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The contribution of GIS in the management of public spaces, case study biskra

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Introduction

Public spaces, such as parks, plazas, streets, and open spaces, play a vital role in the social and economic well-being of cities and communities. They provide opportunities for recreation, social interaction, and civic engagement, and can also serve as important drivers of economic development. They are the places where people can connect with nature, exercise, relax, socialize, and participate in cultural activities. Public spaces are also the places where people go to protest, demonstrate, and express their opinions, which is why they are also considered as a crucial component of democratic societies.

However, the management of public spaces is a complex task that requires a deep understanding of how they are used, the conditions they are in, and the needs of different groups of users. The management of public spaces requires the coordination of various activities such as design, maintenance, programming, and security. Moreover, public spaces are also affected by external factors such as climate change, population growth, and urbanization, which makes their management even more challenging.

Geographic Information Systems (GIS) technology is a powerful tool that can be used to improve the management of public spaces. GIS allows for the collection, storage, analysis, and visualization of spatial data, which can be used to gain a better understanding of the use and condition of public spaces. This information can then be used to make informed decisions about the design, maintenance, and programming of these spaces. GIS allows for the integration of data from different sources, such as demographic data, climate data, and data from social media, which allows for a more holistic understanding of public spaces.

The use of GIS in the management of public spaces is not a new concept, however, its application has been limited in many cities and communities. The use of GIS in the management of public spaces is still in its infancy, and there is a need for more research to understand how GIS can be used to improve the management and use of public spaces. This thesis aims to contribute to the understanding of how GIS can be used to improve the management and use of public spaces.

Research question:

How can GIS be used to improve the management and use of public spaces?

Hypothesis: GIS can provide valuable information and insights that can be used to improve the management and use of public spaces. By analyzing usage patterns, infrastructure conditions, and accessibility, GIS can help identify areas for improvement and inform strategies for enhancing the functionality and livability of public spaces.

Objective:

The objective of this thesis is to strengthen the understanding of how Geographic Information Systems (GIS) can be utilized to improve the administration and usage of public places, specifically focusing on green public spaces.

I. CHAPTER I:Key Terms and Concepts Related to GIS and Green Spaces

1. Key Terms and Concepts Related to GIS and Green Spaces

2. Introduction:

The need to understand and manage green areas is becoming increasingly crucial in today's rapidly urbanizing world. Parks, woods, and gardens, for example, not only provide recreational activities but also play an important role in maintaining biodiversity, reducing climate change, and improving community well-being. Geographic Information Systems (GIS) have evolved as a valuable tool for successfully studying and managing these places.

The first chapter is divided into two sections both establishes the context for delving into the complex link between GIS and green places. This chapter's goal is to acquaint readers with essential vocabulary and concepts connected to both GIS and green areas, laying the groundwork for the next chapters.

2.1. GIS Fundamentals:

The chapter opens by defining GIS as a tool for capturing, analyzing, and visualizing geographical data. It illustrates how GIS uses numerous data sources, such as satellite images, GPS data, and socioeconomic data, to build complete and dynamic maps. Readers will obtain a knowledge of GIS fundamentals such as data layers, characteristics, and spatial connections.

2.2. Green Spaces:

The chapter then goes into the notion of green spaces and its importance in urban contexts. Green spaces are defined as natural or landscaped places that support ecological balance, provide ecosystem services, and give possibilities for enjoyment. Readers will obtain an understanding of the various types of green spaces, their qualities, and the advantages they provide to communities and the environment.

2.3. GIS and Green Spaces Intersection:

Building on the basis of GIS and green spaces, this section investigates how GIS may be used to efficiently analyze and manage green areas. It emphasizes GIS's capability for gathering and interpreting spatial data linked to green spaces, such as land cover, vegetation

density, and ecological connectedness. Readers will grasp how GIS facilitates informed decision-making and planning for green space development and preservation.

2.4. Key Terms and Concepts:

Finally, the chapter provides a comprehensive list of key terms and concepts related to GIS and green spaces. This glossary is a helpful resource throughout the book, ensuring that readers understand the terms used in the area. This part gives a comprehensive comprehension of the vocabulary and ideas key to the subject matter, from essential GIS words like georeferencing and spatial analysis to green space concepts like urban forests and green infrastructure.

By the end of Chapter I, readers will have a basic knowledge of GIS and green areas, as well as how the two interact. Armed with this information, they will be prepared to go further into the next chapters, which will investigate real-world uses of GIS in the management and study of green areas, as well as revealing new solutions to environmental concerns and encouraging sustainable urban living.

The use of geographic information in decision-making tends to go unnoticed, but it is actually present in many of our daily activities. By unconsciously selecting the route to work, the vacation route, going to meet a friend, going to a store using a smartphone and more, decisions are made that involve analyzing geographic information without being aware of it. When this type of analysis or decision making is carried out using computers, it is usually done through what is known as Geographic Information Systems (GIS). According to López Trigal (2015), a GIS is a set of tools made up of hardware, software, data and users, which allows us to capture, store, manage and analyze digital information, as well as make graphs and maps, and represent alphanumeric data. According to Burrough (1994) a GIS can also be seen as a computer model of geographic reality to meet specific information needs, i.e., create, share and apply useful information based on data and maps.[1]

2.5. Introduction :

Geographic Information Systems (GIS) have transformed how we perceive and evaluate spatial data. These systems offer sophisticated capabilities for recording, organizing,

[1] GIS Fundamentals

analyzing, and displaying geographic data, allowing us to obtain useful insights and make sound judgments. In this chapter, we will look at the basics of GIS, looking at its essential components, capabilities, and applications.

2.6. What exactly is GIS?

GIS is a technology that, at its heart, integrates geographic data (location-based information) with attribute data (descriptive information) to generate a comprehensive picture of the actual world. It provides a framework for gathering, storing, manipulating, analyzing, and visualizing geographic data, allowing us to investigate correlations, patterns, and trends that would otherwise be invisible using traditional approaches.

2.7. Defining Geographic Information Systems:

A geographic information system (GIS) is a system that creates, manages, analyzes, and maps all types of data. GIS connects data to a map, integrating location data (where things are) with all types of descriptive information (what things are like there). This provides a foundation for mapping and analysis that is used in science and almost every industry. GIS helps users understand patterns, relationships, and geographic context. The benefits include improved communication and efficiency as well as better management and decision making.[2]

2.8. GIS Components:

In order to completely know GIS, we must first understand its core components. These are some examples:

a. Data:

Geographic information systems (GIS) rely on spatial data, which may be gathered from a variety of sources, including satellite photography, aerial pictures, GPS data, and surveys. Furthermore, attribute data gives extra information about the geographical elements, such as demographics, land use, or infrastructural details.

[2] https://www.esri.com/en-us/what-is-gis/overview

b. Software:

GIS software provides the tools and functionalities necessary for managing and analyzing spatial data. ArcGIS, QGIS, and Google Earth are examples of popular GIS applications.

These systems' capabilities span from simple mapping and visualization to complex spatial analysis and modeling.

b. Hardware:

To process and store huge datasets, GIS systems require specialized hardware such as computers, servers, and storage devices. Computing technology developments have substantially enhanced the speed and efficiency of GIS operations.

d. Methods and Techniques: GIS analyzes and manipulates geographic data using several methods and techniques. Data collection and digitization, geographical analysis, network analysis, geocoding, and cartographic visualization are some examples.

2.9. GIS Applications:

GIS finds applications in diverse fields, ranging from urban planning and environmental management to transportation and public health. Some common GIS applications include:

a. Spatial Analysis: GIS enables the identification of spatial patterns, relationships, and trends within datasets. It allows for spatial queries, proximity analysis, overlay operations, and suitability modeling.

b. Mapping and Visualization: GIS software enables the creation of visually appealing and informative maps, combining various data layers and symbology to represent complex spatial information.

c. Environmental Management: GIS plays a crucial role in assessing and managing natural resources, land use planning, conservation, and monitoring environmental changes.

d. Urban Planning: GIS helps in analyzing population distribution, land use zoning, transportation networks, and infrastructure planning, aiding in the development of sustainable cities.

e. Emergency Management: GIS assists in disaster response and preparedness by providing real-time data on hazards, evacuation routes, and resource allocation.

Conclusion:

Understanding GIS is critical for everyone who works with spatial data and wants to get insights from geographic information. In this chapter, we looked at the fundamental components of GIS, such as data, software, hardware, and procedures. We have also highlighted many GIS applications in other fields. With this foundation in place, readers will be well-equipped to investigate more sophisticated parts of GIS in upcoming chapters, where we will dig into applications and methodologies that use GIS to solve real-world issues.

3. Exploring Green Spaces:

Green areas are an important aspect of our urban and natural settings, providing significant advantages to both humans and the environment. In this chapter, we will look at the notion of green spaces, their qualities, and their importance in constructing sustainable and healthy communities. We will obtain a better knowledge of the value of green spaces and their roles by investigating the many forms and functions of green spaces.

3.1. Understanding Public Spaces: Concepts and definitions

Public spaces are areas within a city or town that are accessible to the public and designed for shared use. These spaces play a crucial role in the urban fabric, serving as places for social interactions, cultural events, and civic engagement. Their importance to the urban environment cannot be overstated as they make cities more livable and contribute to a sense of community and belonging.

Scholarly literature has provided various definitions and interpretations of public spaces. Some describe public spaces as places that are open and accessible to everyone, regardless of their social status, economic background, or cultural background. Others emphasize the

importance of public spaces as spaces for public expression, participatory democracy, and community building.

There are various typologies and classifications of urban public spaces that exist. They can be classified based on their intended use such as parks, plazas, and squares. Parks are typically green spaces intended for recreational activities, whereas plazas and squares are typically hard-surfaced spaces intended for social gatherings. They can also be classified based on their form such as linear, radial, and cluster. Linear public spaces are typically long and narrow, while radial public spaces are organized around a central point, and cluster public spaces consist of a group of interconnected spaces.

In conclusion, public spaces play a critical role in the urban environment. Understanding the concepts and definitions of public spaces is crucial in designing and managing these spaces to meet the needs of the community. The different typologies and classifications of urban public spaces can help designers and planners create spaces that are both functional and accessible for all.

3.2. the role of public spaces in the urban tissue

National and local governments need to recognize the role of good quality public spaces as elements for prosperity in cities. They are key assets for a city's functioning and have a positive impact on its economy, environment, safety, health, integration, and connectivity. They help define the social, cultural, and political functions of a sustainable city. The form, connectivity, distribution, and quality of public spaces are indicators of city's shared prosperity. Public spaces in well planned and adequately functioning cities should make up 45 to 50 per cent of its land area with 30 - 35 per cent of the total allocated to streets and 15 – 20 per cent allocated to other public spaces. This has also been linked to economic growth of such cities as Manhattan. Many cities particularly in the global south are far from achieving these recommendations. Conversely, inadequate, poorly designed, or privatized public spaces increase segregation and generate urban inequality. To achieve such public spaces state intervention through proactive urban polices and local governments legislative actions that support holistic and integrated approach to the planning, design, development, creation, protection, and management of public spaces, is needed. Citywide public space strategies need

to actively align with the national urban policies recommendations related to public space development and enjoyment.[3]

3.3. the importance to the urban environment:

Public space permeates our surroundings, serving as an essential component of our daily urban existence. It encompasses the streets we traverse en route to school or work, the areas where children engage in play, as well as the settings where we come across natural surroundings and wildlife. It includes the nearby parks where we partake in sports, walk our dogs, and find solace during lunch breaks. Essentially, public space functions as our openair living room, an outdoor leisure hub that offers respite from the chaotic pace of everyday life.

The significant increase in hard surfacing and the reduction in green spaces lead to higher temperatures in towns and cities than in the surrounding countryside. This is known as the 'heat island effect'. Vegetation – whether in public spaces or private gardens – can help to redress this imbalance. It brings many important environmental benefits to urban areas, including the cooling of air and the absorption of atmospheric pollutants.

if public spaces are designed intentionally, with consideration of the needs and demands of the community, they can make cities more livable by reducing the likelihood of flooding and air pollution. Creating public spaces that facilitate walking and cycling can also contribute to a reduction in the number of cars on the road, reducing carbon emissions and promoting a more sustainable urban environment. In addition, urban public spaces can offer physical and mental health benefits, community building, and a sense of belonging,

In conclusion, public spaces are vital in urban environments, providing numerous benefits to residents. Intentional design and planning of public spaces, considering community needs, contribute to sustainable and livable cities. Vegetation also provides an opportunity for people to be close to 'nature,' with the associated positive impact that this can bring in terms of mental health and the simple pleasure of experiencing trees, birds, squirrels, ladybirds and other wildlife in an urban situation.[4]

[3] national-urban-policies-driving-public-space-led-urban-development.pdf

[4]

3.4. The Economic Importance of Public Space:

A high-quality public environment can have a significant impact on the economic life of urban centres big or small, and is therefore an essential part of any successful regeneration strategy. As towns increasingly compete with one another to attract investment, the presence of good parks, squares, gardens and other public spaces becomes a vital business and marketing tool: companies are attracted to locations that offer well-designed, well-managed public places and these in turn attract customers, employees and services. In town centres, a pleasant and well-maintained environment increases the number of people visiting retail areas, otherwise known as 'footfall'. A good public landscape also offers very clear benefits to the local economy in terms of stimulating increased house prices, since house-buyers are willing to pay to be near green space.[5]

3.5. The Impact on Physical and Mental Health:

Parks and gardens, for example, have a significant influence on both physical and emotional health. They encourage physical exercise, enhance air quality, and offer sunshine for the creation of vitamin D. Green environments also help to relieve stress, improve relaxation, and improve mood. They provide cognitive advantages, promote social contact, and assist in mental recovery. These advantages are available to people of all ages. We can promote public health and general well-being by preserving and protecting green places.[6]

3.6. various types of public spaces, including parks, plazas, and streets.

Public spaces are important areas that play a significant role in fostering social connection, promoting physical activity and community engagement. Here are some types of public spaces to consider when researching:

1. **Parks:** Parks are green spaces that are designed for outdoor recreational activities such as picnicking, playing sports or playgrounds, taking a walk, or lounging on benches. Parks are ideal for those who appreciate nature and want to spend time relaxing. Some examples of well-known Parks are Central Park in New York City and Hyde Park in London.

[5] The Value of Public Space
[6] The Value of Public Space

2. **Plazas:** Plazas are public spaces that are typically found in cities and characterized by open public areas that are ornamentally designed and usually surrounded by buildings. These public spaces are usually designed for people to come together for social events, such as concerts, rallies, shopping, or to simply relax and enjoy a beautiful view. Plaza de España in Madrid and Red Square in Moscow are some examples of famous plazas.

3. **Streets:** Streets are public spaces that are commonly used for transportation and to connect neighborhoods. Streets are also places where parades, street vendors or social gatherings happen. They can be pedestrianized and designed to be more accessible for people walking and cycling, allowing people to enjoy public spaces while also promoting the use of sustainable modes of transportation. Some examples of famous streets are Champs Elysees in Paris and Fifth Avenue in New York City.

In conclusion, public spaces serve various purposes such as promoting social interaction, encouraging physical activity and community involvement. It is worth noting that each public space type has its unique design, function, and characteristics that reflect its intended purpose. Understanding the different types of public spaces and their various purposes can help to create more efficient public spaces that benefit individuals and communities.

3.7. characteristics, purposes, and functions.

Parks are public spaces that are designed for outdoor recreational activities such as picnicking, playing sports or playgrounds, taking a walk, or lounging on benches. The purpose of parks is to provide a place for people to relax, exercise and connect with nature. Parks also contribute to physical and social well-being of individuals and promote community engagement. Some of the characteristics that contribute to a park's significance include its geography, layout, and diversity. Examples of parks include Central Park in New York City and Hyde Park in London.

Plazas are public spaces that are typically located in cities and characterized by open public areas that are ornamentally designed. Plazas are designed for social events such as concerts, rallies, shopping, or to simply relax and enjoy a beautiful view. Plazas are also designed to foster social interaction and create a sense of community. The characteristics that contribute to a plaza's significance include the arrangement of buildings, the beauty of physical

features, and the presence of entertainment facilities. Examples of famous plazas include Plaza de España in Madrid and Red Square in Moscow.

Streets are public spaces commonly used for transportation and to connect different neighborhoods. They can also be used for parades, street vendors or social gatherings. Pedestrianized streets are designed to be accessible for people walking and cycling. The purpose of streets is to promote the use of sustainable modes of transportation, encourage physical activity, and provide a safe and convenient environment for people to move around. Characteristics that contribute to the significance of streets include the quality of the pavement, the presence of street lights, and accessibility via public transit. Famous streets include Champs Elysees in Paris and Fifth Avenue in New York City.

In conclusion, public spaces such as parks, plazas, and streets play an important role in fostering social connection, promoting physical activity, and community engagement. The characteristics, purposes, and functions of each type of public space are unique.

Understanding the various[7]

3.8. examples of each type of public space:

Parks:

- Phalen Park in St. Paul https://publicspaces.guide/20-types-of-urban-spaces/

- Como Park in St. Paul https://publicspaces.guide/20-types-of-urban-spaces/

- Powderhorn Park in Minneapolis https://publicspaces.guide/20-types-of-urban-spaces/

- Central Park in New York City https://www.nycgovparks.org/parks/central-park

Plazas:

Hyde Park in London https://www.royalparks.org.uk/parks/hyde-park

- Rice Park in St. Paul https://publicspaces.guide/20-types-of-urban-spaces/

- Plaza de España in Madrid https://www.spain.info/en/place/plaza-de-espana

Streets:

Red Square in Moscow https://www.lonelyplanet.com/russia/moscow/attractions/red-square/a/poi-sig/1253408/360547

- Champs Elysees in Paris https://www.parisinfo.com/discovering-paris/walks-in-paris/the-champs-elysees-majestic-andmythical

- Fifth Avenue in New York City https://www.nycgo.com/attractions/fifth-avenue

- Union Depot in St. Paul (transportation hub) https://publicspaces.guide/20-types-of-urban-spaces/

4. GIS and Green Spaces Intersection:

Geographic Information Systems (GIS) and green spaces work together to create a remarkable synergy between technology and environmental management. Green areas provide vital natural resources and recreational activities, while GIS provides a complete framework for gathering, analyzing, and displaying spatial data. In this chapter, we will look at how GIS may be used to research, manage, and improve green areas, resulting in better decision-making and more sustainable environmental practices.

The intersection of GIS and green spaces is becoming increasingly important as the benefits of urban green spaces are being recognized and policymakers focus more on providing equitable access to these spaces. GIS technology can be used to map public urban green spaces with the help of open GIS data and satellite imagery. Even the distribution of distance and the accessibility of green areas throughout the city are closely linked to ensuring recreational needs. Spatial statistics using GIS have made possible the development of correct, coherent explanatory UGS variables such as distance, size, density, connectivity, sight and accessibility. Overall, GIS plays a crucial role in mapping, analyzing, and assessing the distribution and accessibility of public urban green spaces to promote environmental justice and equitable access to these spaces.[7]

[7] Using GIS Analysis to Assess Urban Green Space in Terms of Real Estate Development

4.1. public spaces and GIS applications:

GIS (Geographic Information System) applications have become increasingly important in the management of public spaces. GIS tools and techniques enable urban planners and managers to analyze, visualize, and interpret spatial and non-spatial data related to public spaces. Some of the key GIS tools and techniques used in managing public spaces include land use mapping, spatial analysis, land suitability analysis, crime mapping, and solid waste management.

The benefits of implementing GIS in public space management are numerous. GIS enables managers to take a data-driven approach to decision-making, by providing insights into key issues such as environmental protection, social equity, and economic development. GIS also enables managers to identify and prioritize areas in need of improvement or investment. For example, GIS can be used to identify underserved areas and optimize waste lifting cycles to improve solid waste management.

Urban planners, sometimes known as city planners, design cities and create plans for future improvements and growth. These plans include much of what you see when moving through an urban environment: streets, parks, public spaces, and more. In summary, GIS has become an essential tool in the management of public spaces. Its applications are numerous and include land use mapping, spatial analysis, crime mapping, and solid waste management. While challenges exist in its implementation, the benefits are many and can significantly enhance decision-making in public space management.[8]

4.2. the benefits and challenges of implementing GIS in public space management:

GIS (Geographic Information System) applications have become increasingly important in the management of public spaces due to their ability to provide data-driven insights into key issues such as environmental protection, social equity, and economic development. Using GIS, urban planners and managers can analyze and interpret spatial and non-spatial data that is relevant to public spaces, enabling them to identify areas in need of improvement or investment, prioritize resources, and plan and implement new.

[8] unearth

GIS technology empowers urban planners with enhanced visibility into data. They monitor fluctuations over time, evaluate the feasibility of proposed projects and predict their effects on the environment. GIS software can also show all relevant stakeholders exactly what the changes on the ground will look like to help them make better decisions. For example, GIS software may generate visualizations of an area's current environmental conditions and allow users to draw comparisons between the anticipated results of proposed development plans.[9]

In conclusion, GIS has become an essential tool in the management of public spaces due to its numerous benefits such as improved decision-making, identifying underserved areas and optimizing waste management. Even though it presents some challenges such as a significant investment in both human and technological resources. The use of GIS applications is highly recommended in public space management as it can significantly enhance decision-making and improve the overall quality of urban planning and management.

4.3. Conclusion about the importance of GIS in the management of public spaces:

GIS (Geographic Information System) has become increasingly important in managing public spaces. It utilizes geospatial data from satellite imaging, aerial photography, and remote sensors to provide urban planners and managers with a comprehensive understanding of land and infrastructure. By analyzing and visualizing both spatial and non-spatial data, GIS enhances decision-making, identifies areas for improvement, optimizes resource allocation, and facilitates the planning and execution of new projects.

Key GIS tools and techniques employed in public space management include land use mapping, spatial analysis, crime mapping, and solid waste management. These tools assist urban planners and managers in studying land use patterns, recognizing environmentally sensitive areas, prioritizing development areas, and integrating land use, population, and public transit networks for site suitability and route planning.

Although challenges exist, such as the significant investment required in human and technological resources, as well as potential issues with data inconsistency, redundancy, and

[9] WHAT IS GIS USED FOR IN URBAN PLANNING

security risks, numerous case studies demonstrate the positive impact of GIS in public space management. These studies showcase how GIS supports land-use planning, resource prioritization, observation clarification, and the use of GIS databases in public space design and planning processes. It also aids in analyzing pedestrian and design patterns, as well as evaluating the vitality of waterfront open spaces.

In conclusion, GIS is an indispensable tool for managing public spaces, offering a datadriven approach to decision-making and enhancing urban planning and management. Its applications are wide-ranging, allowing urban planners and managers to identify areas requiring investment, optimize resource allocation, and analyze and interpret spatial and non-spatial data related to public spaces. Despite implementation challenges, the substantial benefits of GIS pave the way for more effective and efficient utilization of public spaces.

5. Key Termes and Concepts:

Finally, the chapter includes a complete list of major words and points connected to GIS and green areas. This dictionary is a helpful resource throughout the work, ensuring that learners understand the terms used in the area. This part gives a comprehensive comprehension of what is key to the subject matter, from essential GIS words like georeferencing and spatial analysis to green space concepts like urban forests and green infrastructure.

5.1. key terms and concepts related to GIS and green spaces:

1. Geospatial data: Refers to any data that has a geographic component to it, such as longitude and latitude coordinates.

2. GIS: Geographic Information System, is a system designed to capture, manipulate, store, analyze, manage, and present all types of spatial and geographic data.

3. Remote sensing: Refers to the use of satellites or aerial platforms to collect information about the environment and the earth's surface.

4. Spatial analysis: Refers to the process of examining and modeling the relationships between different geographic features and data layers.

5. DTM: Digital terrain model, which is a digital representation of the surface features of the land or Earth's surface.

6. Green infrastructure: Something like parks, forests and gardens that provide certain ecosystem services.

7. Landscape ecology: Is the science of studying the structure and function of landscape ecosystems that includes biological, physical, social, and economic systems that affect landscapes.

8. Ecological connectivity: the ability of green spaces to facilitate the movement of fauna and flora species and the related ecological processes.

9. Urban planning: Refers to the process of designing the physical layout of cities and towns, including transportation systems, housing, and green space.

10. Open data: Refers to data that is freely available online, including geospatial data, which can be used for mapping and analysis purposes.

These terms and concepts are critical in understanding the relationship between GIS and green spaces since they provide valuable information about the spatial context and ecological processes that are relevant in the management, conservation, and planning of green spaces. Further analysis, categorizing and grouping these terms and concepts can provide a better understanding of their connections and significance in promoting sustainable development.

5.2. relevant terms and concepts related to GIS and green spaces:

Geospatial data: Information describing the location and attributes of things, including their shapes and representation. Geographic data is the composite of spatial data and attribute data.[10]

Remote sensing: Collecting and interpreting information about the environment and the surface of the earth from a distance, primarily by sensing radiation that is naturally emitted or reflected by the earth's surface or from the atmosphere, or by sensing signals transmitted from

[10] GIS Dictionary

a device and reflected to it. Examples of remote-sensing methods include aerial photography, radar, and satellite imaging.[10]

Spatial analysis: The process of examining the locations, attributes, and relationships of features in spatial data through overlay and other analytical techniques in order to address a question or gain useful knowledge. Spatial analysis extracts or creates new information from spatial data.[11]

DTM (Digital Terrain Model): [none] Acronym for digital terrain model. The representation of continuous elevation values over a topographic surface by an array of zvalues that may be irregularly spaced to incorporate the elevation of significant topographic features, including mass points and breadlines to better characterize the true shape of the bare-earth terrain, and referenced to a common datum. With a DTM, the distinctive terrain features are more clearly defined and precisely located, and contours generated from DTMs more closely approximate the real shape of the terrain.[10]

Landscape ecology: [environmental GIS] The study of spatial patterns, processes, and change across biological and cultural structures within areas encompassing multiple ecosystems.[10]

Vector data: A coordinate-based data model that represents geographic features as points, lines, and polygons. Each point feature is represented as a single coordinate pair, while line and polygon features are represented as ordered lists of vertices. Attributes are associated with each vector feature, as opposed to a raster data model, which associates attributes with grid cells. Ex: .shp .gdb[11]

Raster data: A spatial data model that defines space as an array of equally sized cells arranged in rows and columns, and composed of single or multiple bands. Each cell contains an attribute value and location coordinates. Unlike a vector structure, which stores coordinates explicitly, raster coordinates are contained in the ordering of the matrix. Groups of cells that share the same value represent the same type of geographic feature. Ex: .img .jpg .bmp .map TIN[11]

[11] Get Insight into

Shapefile: Or .shp. A vector data storage format for storing the location, shape, and attributes of geographic features. A shapefile is stored in a set of related files and contains one feature class.[10]

Topography: Topography is the study of the land surface. In particular, it lays the underlying foundation of a landscape. For example, topography refers to mountains, valleys, rivers, or craters on the surface.[12]

SDTS (Spatial Data Transfer Standard): [standards] Acronym for Spatial Data Transfer Standard. A data exchange format for transferring different databases between dissimilar computing systems, preserving meaning and minimizing the amount of external information needed to describe the data. All federal agencies are required to make their digital map data available in SDTS format upon request, and the standard is widely used in other sectors.[10]

Layer: The visual representation of a geographic dataset in any digital map environment. Conceptually, a layer is a slice or stratum of the geographic reality in a particular area, and is more or less equivalent to a legend item on a paper map. On a road map, for example, roads, national parks, political boundaries, and rivers might be considered different layers. View a visual example of this here.[11]

Map document: Or .mxd file In ArcMap, the file that contains one map, its layout, and its associated layers, tables, charts, and reports. Map documents can be printed or embedded in other documents. Map document files have a .mxd extension.[10]

Projection: [map projections] A method by which the curved surface of the earth is portrayed on a flat surface. This generally requires a systematic mathematical transformation of the earth's graticule of lines of longitude and latitude onto a plane. Some projections can be visualized as a transparent globe with a light bulb at its center (though not all projections emanate from the globe's center) casting lines of latitude and longitude onto a sheet of paper. Generally, the paper is either flat and placed tangent to the globe (a planar or azimuthal projection) or formed into a cone or cylinder and placed over the globe (cylindrical and

[12] GISgeography

conical projections). Every map projection distorts distance, area, shape, direction, or some combination thereof.[10]

Coordinate system: A reference system used to locate x, y, and z positions of point, line, and area features in two or three dimensions. A projected coordinate system is defined by a geographic coordinate system, a map projection, any parameters needed by the map projection, and a linear unit of measure.[11]

Thematic layer: [map design] A map designed to convey information about a single topic or theme, such as population density or geology.[10]

Topology: In geodatabases, the arrangement that constrains how point, line, and polygon features share geometry. For example, street centerlines and census blocks share geometry, and adjacent soil polygons share geometry. Topology defines and enforces data integrity rules (for example, there should be no gaps between polygons). It supports topological relationship queries and navigation (for example, navigating feature adjacency or connectivity), supports sophisticated editing tools, and allows feature construction from unstructured geometry (for example, constructing polygons from lines).[11]

Change detection: A process that measures how the attributes of a particular area have changed between two or more time periods. Change detection often involves comparing aerial photographs or satellite imagery of the area taken at different times. The process is most frequently associated with environmental monitoring, natural resource management, or measuring urban development.[11]

Green infrastructure: green infrastructure assets include open spaces such as parks and gardens, allotments, woodlands, fields, hedges, lakes, ponds, playing fields, coastal habitats, as well as footpaths, cycleways or rivers. Assets involving water can also be called 'blue infrastructure,' but these are all included in the overarching term of 'green infrastructure.'

5.1. how these terms and concepts relate to each other:

The terms and concepts related to GIS and green spaces are interrelated and interconnected. GIS, which is an integrated collection of software and data used to manage and analyze geographic information, serves as the foundation for mapping and analysis that is used in science and almost every industry.[13] In the context of green spaces, GIS technology can be used to manage and analyze geospatial data, such as remote sensing imagery, which can provide information about the environment and the Earth's surface.

GIS applications, such as ArcGIS, ArcGIS Online, and ArcGIS Pro, can be used to analyze and model spatial relationships between different geographic features and data layers. Spatial analysis is an important process that can be used to identify patterns, relationships, and geographic context in green spaces, while DTM or digital terrain model can provide a digital representation of the surface features of the land or earth's surface.

Geospatial data, which refers to any data that has a geographic component to it, is linked to coordinate systems, projections, and topology. It is typically represented as either raster data, which defines space as an array of equally sized cells, or vector data, which represents geographic features as points, lines, and polygons[1,2]. GIS can also be used in urban planning to design the physical layout of cities and towns, including transportation systems, housing, and green space.

After analyzing the terms and concepts related to GIS and green spaces, we organized them into the following categories:

1. Geospatial Data: Geospatial data, vector data, raster data, shapefile, topography, DTM, coordinate system, projection, and SDTS.

2. GIS Software: ArcGIS, ArcGIS Pro, ArcGIS Online, QGIS.

3. Spatial Analysis: Spatial analysis, topological analysis, change detection, proximity/buffering, thematic layer, cartogram, and statistical surface.

[13] GIS Overview by Esri

Green Spaces and Ecology: Green infrastructure, landscape ecology, ecological connectivity, parks, forests, and gardens.

4. Data Management: Open data, metadata, ontologies, provenance and lineage, and levels of data quality.

5. GIS Tools and Functions: Selection, classification, dissolve, symbology, and mapping.

These categories enable a more efficient understanding of the relationship between the terms and concepts related to GIS and green spaces, highlighting their importance in various fields such as urban planning, conservation, and scientific research. For example, geospatial data plays a crucial role in capturing and organizing information about the environment. GIS software and spatial analysis tools help in analyzing and modeling spatial relationships between different geographic features and data layers. Green spaces and ecology categories are critical in the management, conservation, and planning of green infrastructure. Finally, data management and GIS tools and functions are essential for creating and analyzing GIS data, making it possible to use it in an efficient and effective manner.

II. Chapter II: Legal Mechanisms

1. Legal Mechanisms for Managing Green Spaces in The Light of Algerian Legislation

2. Green Spaces Classification:

The measures of protection were initially limited to certain sectors following the restoration of national sovereignty, but later extended to other areas, such as green spaces. Since environmental legislation is mandatory, public authorities are responsible for its implementation through the means provided by the legislator. Among these means are licenses, which can be granted as part of exercising the privileges of public authority and control, or exercising regulatory authority through the issuance of administrative decisions, such as classification decrees. Classification is considered a form of administrative regulation practiced by some authorities whose competencies are defined by the legislator. It serves to determine protected areas with their natural characteristics, including plant or animal species, as well as natural phenomena of scientific, cultural, or aesthetic value (Hnouny, 2010/2011, p. 59).

To delve into the process of classifying green spaces:

2.1.Conditions and Procedures for Green Spaces Classification:

Classification is an administrative procedure carried out by the management with the aim of categorizing and dividing green spaces based on their characteristics, functions, and forms. The classification grants legal strength to these spaces, making it impossible to dispose of or take any action on them outside the designated scope and legal framework of their classification (Bougazi, 2018, p. 577).

Regarding the legislative aspect, the process of classifying green spaces is an administrative decision issued by the competent administrative authority, creating a legal effect by placing the concerned green space in one of the legally defined categories. It is not an administrative contract but solely within the jurisdiction of the administration to protect green spaces. The legislator neglected to regulate green spaces and the objective conditions for their implementation, such as determining their primary purpose before their establishment (Dirm Ayda, 2018, p. 13).

Although the Algerian legislator followed the footsteps of foreign legislations and encouraged their implementation by allocating a specific law for them, which was indeed applied through the restoration of existing green spaces and attempts to create new ones, this was insufficient. It was mainly concentrated in upscale neighborhoods adjacent to the city center and main roads, while other neighborhoods were neglected, rendering this method of establishment inadequate (Dirm Ayda, 2018, p. 14).

Referring to Law 07/06 concerning the management, protection, and development of green spaces, we find that the classification process consists of two main stages: the classification and inventory study stage, followed by the issuance of the classification decision, as follows:

2.2.Classification and Inventory Study Stage:

The classification of green spaces is carried out through an administrative decision based on the specific circumstances and the type of green space subject to classification. This is done after studying the files related to the classification request before the competent authority, as stipulated in Law 07/06 concerning the management, protection, and development of green spaces.

The competent authority responsible for studying the classification is determined by Article 10 of the Law No. 07/06. It is entrusted to a joint ministerial committee for green spaces, which is assigned the task of studying the files related to the classification of green spaces, providing its opinion on the proposed classification, and sending the relevant projects to the relevant authorities. The composition and organization of this committee are specified by regulatory texts.

As for the organization of this committee, it is defined by Executive Decree No. 09/115, which determines the organization and work procedures of the joint ministerial committee for green spaces. The committee's headquarters are in the city of Algiers, but it can be relocated to another location within the national territory by a decree based on a proposal from the Minister responsible for the environment, in accordance with Article 02 of the decree.

According to Article 05 of the same decree, the committee is chaired by the Minister responsible for the environment or their representative.

The committee is composed of the following representatives:

- A representative of the Minister of Interior and Local Communities.

- A representative of the Minister responsible for finance.

- A representative of the Minister responsible for water resources.

- A representative of the Minister responsible for agriculture.

- A representative of the Minister responsible for forests.

- A representative of the Minister responsible for public works.

- A representative of the Minister responsible for health.

- A representative of the Minister responsible for culture.

- A representative of the Minister responsible for scientific research.

- A representative of the Minister responsible for urban development.

- Two experts selected based on their qualifications in the field of botany and landscape engineering.

PS; The committee may seek the assistance of any person who can help in its work.

3. Issuance of the classification decision:

In accordance with the provisions of Article 11 of Law No. 07/06, after completing the procedures for studying the classification of green spaces and obtaining the approval of the joint ministerial committee for green spaces, the classification decision for the relevant green spaces is issued through decisions issued by the competent authority.

3.1.For public spaces:

By virtue of a decision issued by the President of the Municipal People's Council, and by virtue of a decision from the Governor for public parks located in the city that serves as the headquarters of the province, in accordance with paragraph 02 of Article 11 of the aforementioned Law No. 07/06.

Here, it can be said that by assigning the authorization for classifying green spaces to the Governor for public parks located in the city that serves as the headquarters of the province, the Algerian legislator has avoided the issue of overlapping jurisdiction between the Governor and the President of the Municipal People's Council of the municipality where the headquarters of the province is located when making classification decisions.

4. Green spaces management plan:

Algeria has shown increasing interest in the environment in recent years, which is reflected in various sectors through directed planning to address environmental problems. However, these plans often do not consider the main causes of environmental deterioration, which hinders the achievement of comprehensive solutions to environmental problems through various types of plans designed to protect the environment (Ben Mansour and A'rabe, 2012, p. 490).

Planning has become widespread today to the extent that the word "planning" has become familiar in workplaces, government agencies, institutions, and media. The absence of justified planning is attributed to all the causes and manifestations of deterioration and environmental problems that we suffer from. The reality is that planning, in all its dimensions and forms, has become a means for countries in our present era to achieve development in all its economic, social, health, and cultural aspects (Hassouna, 2013/2012, p. 136).

Despite the various definitions of planning, they converge in the sense that planning is a method and approach aimed at identifying and studying the available potentials and resources at all levels within an organization, from the village and city to the region and country. It involves determining the methods of utilizing these potentials to achieve the expected goals within a specified timeframe (Maifi, 2014/2013, p. 80).

Since the urban environment is not immune to other environmental domains, the Algerian legislature has established a new plan for managing green spaces. This plan is embodied in the provisions of Law 07/06 concerning the management, protection, and development of green spaces. The topic is divided into three sections: the definition of the plan for managing green spaces in the first section, the content of the plan for managing green spaces in the second section, and finally addressing the procedures for preparing the plan for managing green spaces in the third section.

4.1.Definition of Green Spaces Management Plan:

After completing all the classification procedures as stipulated by law and obtaining the classification decision from the competent authority, a management plan is developed for the classified green spaces. According to Bougazi (2018), the plan is defined as "a technical file that includes a set of administrative, maintenance, and usage measures for the green space, along with all the instructions for its protection and conservation to ensure its sustainability," in accordance with the provisions of Article 26 of Law 07/06.

4.2.Content of the Green Spaces Management Plan:

The content of the Green Spaces Management Plan, its preparation, approval, and implementation methods are determined based on the category to which the green space belongs. This has been achieved through the issuance of Executive Decree No. 09/147, which specifies the content of the Green Spaces Management Plan and the procedures for its preparation, approval, and implementation. (Nandri, 2017, p. 486).

Thus, the Green Spaces Management Plan identifies, in all cases, the following:

First: Study of the existing condition of the green area, which includes the following:

- Identifying the relevant green areas and their legal nature by determining their classification and ownership system through the preparation of a technical card for the project, in accordance with Article 03, Paragraph 01, of Executive Decree No. 09/147, dated May 2, 2009, which specifies the content of the green area management plan and its preparation, approval, and implementation, Official Gazette No. 26, dated May 3, 2009.

- Assessing the physical and biological status of the green area by preparing a quantitative and estimated inventory that clarifies the required budget. This is done in coordination between the Ministry of Finance and the Ministry of Interior, where the project is managed within the framework of the municipal development plan, as stated in Paragraph 02 of the same article.

Second: As for the maintenance plan for the green area, it includes the following steps:

- In addition to the required maintenance measures and works, in accordance with the provisions of Paragraph 03 of the article, the plan specifies the methods used for maintaining

the relevant green area according to its classification, such as fertilization methods and irrigation techniques.

- In accordance with Paragraph 04 of the same article, a short-term and medium-term intervention program is developed, which involves creating a future that can predict the potential establishment of green areas based on the population of the respective area.

- When necessary, a map of the green area is prepared to indicate its locations, boundaries, area, and pathways, as stated in Paragraph 05 of the article.

Regarding the maintenance of green areas, many of them have been neglected and deteriorated without being renewed or properly cared for to prevent damage, especially as they have been subjected to looting or deliberate destruction due to recklessness and lack of awareness. This calls for a serious reconsideration of this aspect, even though the legislator has criminalized such actions (Derme Ayda, 2018, page 17).

4.3.Procedures for preparing the green spaces management plan:

Referring to Decree No. 09/147 mentioned above, we find that the preparation of this plan is assigned to the authority that conducted its classification, based on a ministerial decision according to the situation and the type of green space (wetlands, valorization of green spaces in urban areas in Algeria, 2018, page 579). These plans remain valid for a period of five years, starting from the adoption decisions by the competent authority. The process of preparing them after this period is carried out in the same manner as the initial creation, in accordance with Article 04 of the Executive Decree 09/147.

The issuing authority for the preparation decisions of the green spaces management plans varies depending on the category of the relevant green space, as follows:

1. Public parks: By a joint decision between the ministers responsible for the interior, environment, and urbanism, in accordance with the provisions of paragraph 03 of the same article.
2. Urban farms and those adjacent to the city with a national dimension: By a joint decision between the ministers responsible for the interior, environment, and agriculture, in accordance with paragraph 02 of the same article.

3. Urban farms and those adjacent to the city: By a joint decision between the ministers responsible for the interior and environment, in accordance with the provisions of the first paragraph of Article 02 of the same executive decree.
4. Specialized gardens: According to paragraph 04 of the same article, the authority that established the relevant specialized gardens or the authority assigned to manage them is responsible.
5. Community and/or residential gardens: In accordance with the provisions of paragraph 05 of the same article, by a joint decision between the ministers responsible for the interior and urbanism.
6. Private gardens: The owners of these gardens are responsible for their management according to paragraph 06 of the same article.
7. Urban forests: By a decision from the minister responsible for forests, in accordance with paragraph 07 of the same article.
8. Tree-lined rows and rows located in non-urbanized areas: By a decision from the minister responsible for forests, in accordance with the provisions of paragraph 08 of the same article.
9. Tree-lined rows located in developed areas: According to paragraph 09 of the same article, by a joint decision between the ministers responsible for the interior, environment, agriculture, and urbanism.

III. Chapter III : Study Area Overview

1. Introducing the study area :

2. Geographical coordinats of Biskra:

Latitude: 34°51′01" E; Longitude: 5°43′40" East; Altitude from sea level: 115 m

Biskra is located in southeastern eastern Algeria, on the southern slopes of the Atlas Mountains. With an elevation of roughly 128 meters above sea level, it serves as a natural barrier between the north and south. It is 422 kilometers from the capital city

of Algiers. The province has a land area of approximately 21,675 square kilometers.

Biskra is positioned at an altitude of 34.48 degrees north of the equator and a longitude of 5.44 degrees east of the Greenwich Line. With its position, it plays an essential role in the Algerian desert's northeastern region, serving as a link between the north and south, as well as the east and west.

3. Regional Location:

Biskra became a major center of the province following the administrative division in 1974. The province is divided into 33 municipalities and 12 districts, which are denoted by map number 02. It is bounded to the north by the provinces of Batna and M'Sila.

- Djelfa province is to the west.

- To the south, the provinces of Ouargla and El Oued.

- To the east is the province of Khenchela.

4. Administrative Location:

The administrative division of Biskra province was altered by Law No. 04-84, issued February 4, 1984, and its following changes, as depicted in map number 03. Biskra municipality's limits are as follows:

- To the north, the municipalities of Loutaya and Branis.

- Municipality of El Hachim to the west.

- To the south: the municipality of Oumache.

- Municipalities of Sidi Okba and Shatt Melghigh to the east.

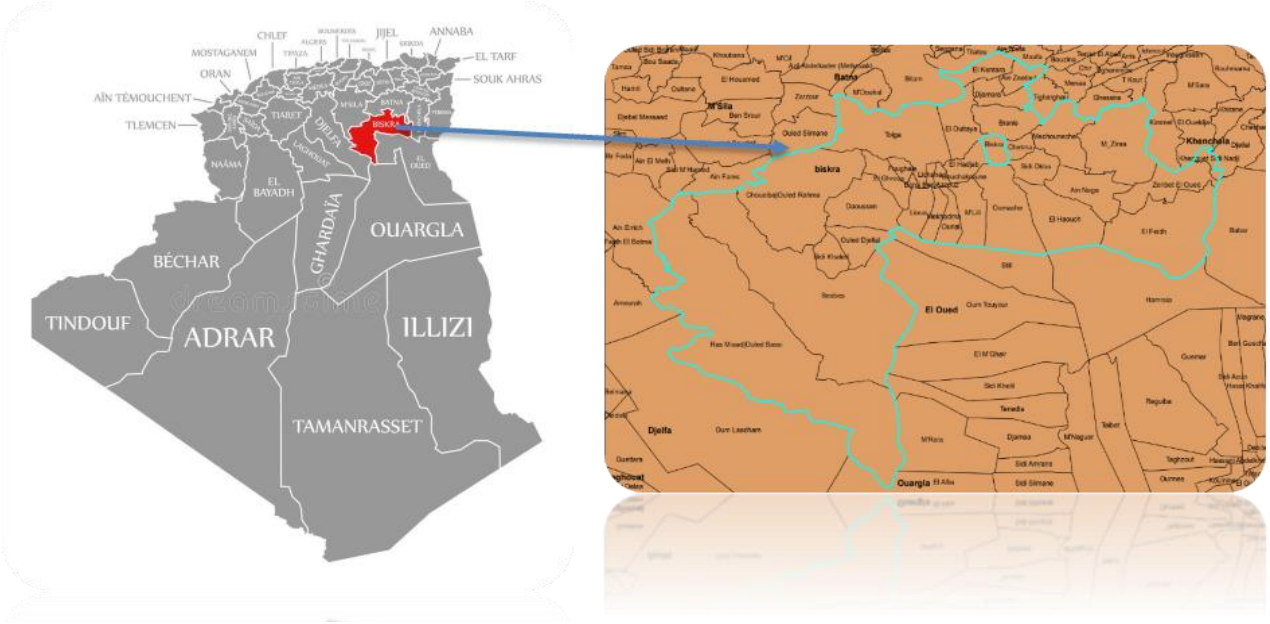


Figure 1 Administrative Location of biskra

5. Natural Study:

1.1. Topography:

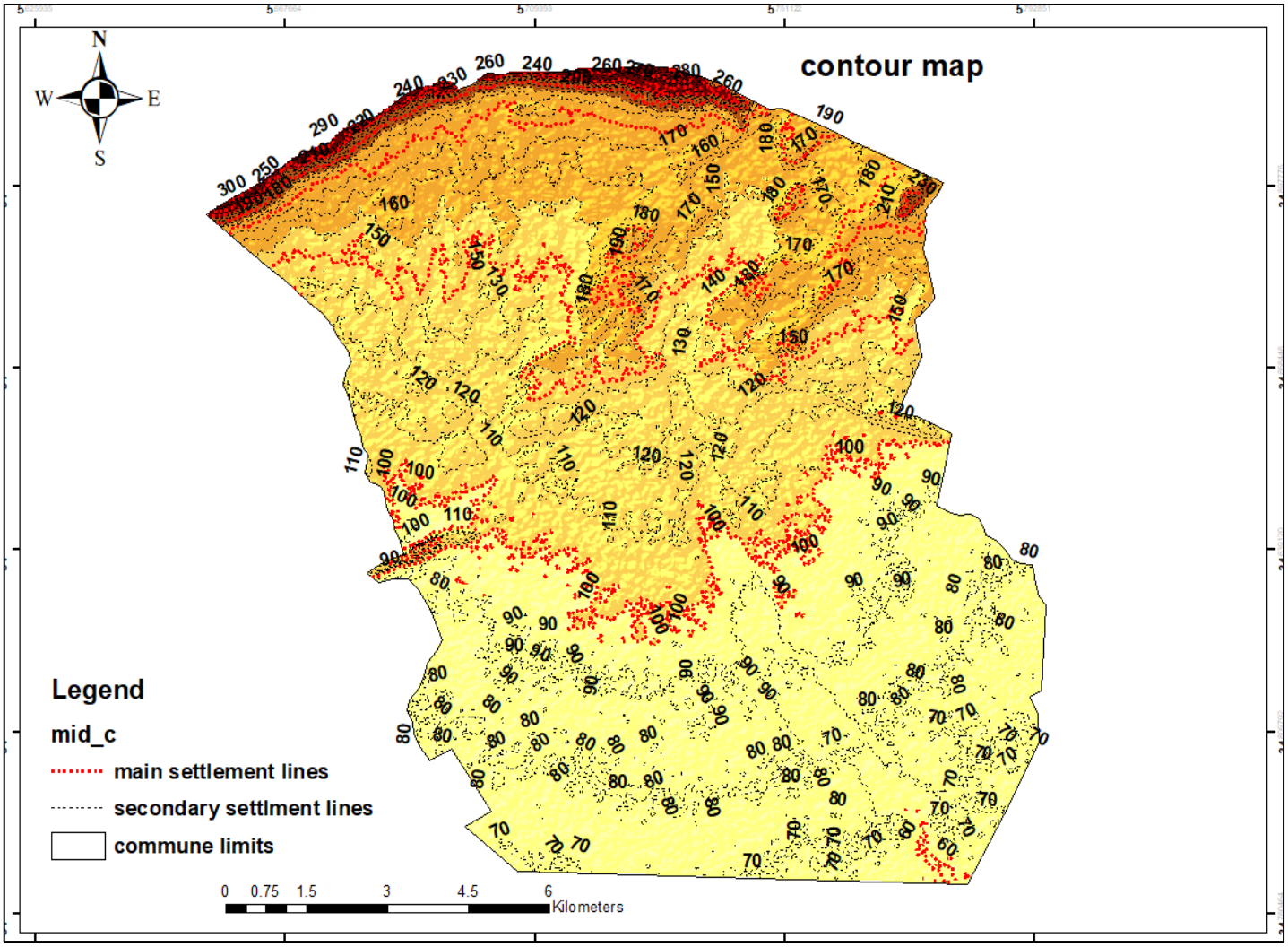
The study area is divided into two regions: the Saharan and the Atlas, which are distinguished by significant topographic characteristics such as:

A. Mountainous Region: This region accounts for a tiny fraction of the province's land area and is mostly centered in the north. Mountains such as Bou Ghzal, El Mellaha, and Thnia Qaiben may be found in the western region. Mountains such as El Tayous, Kammarou, and Kaf El Gouna may be found in the east. Most of these mountains have little vegetation.

B. Plain Region: Extending east-west, the plain region is distinguished by deep and fertile soil.

C. Lowland Region: Located in the southeast, this region is made up of flat, sand-covered plains. It has thin layers of water, which are represented by chotts (salt lakes), and has an average depth of -33 meters below sea level. It is the area's primary natural reservoir for surface water.D. Hydrographic Network: Because of its geographical location and the presence of the Zab and Atlas slopes, Biskra has a rich hydrographic network. Wadi Biskra

(also known as Wadi Sidi Zarzour), Wadi El Djeddi, and Wadi El Zemor are three of the most knowntemporary and short-lived watercourses. These waterways contribute to the region's hydrological system.



Source : student 2023 Figure 2 contoure map of the study area

1.2. The climatology overview of the study area:

1.2.1. Average temperatures and precipitation :

Biskra, a city located in northeastern Algeria, experiences a subtropical desert climate. The climate in Biskra is characterized by mild winters and very hot, sunny summers. As it is situated on the edge of the Sahara Desert, Biskra is influenced by the desert's arid conditions.

During the winter months, Biskra's temperatures remain relatively mild. Daytime temperatures typically range from around 15°C (59°F) to 20°C (68°F), while nighttime temperatures can drop to around 5°C (41°F) to 10°C (50°F). Precipitation is scarce during this season.

Summer in Biskra is characterized by extremely hot and sunny weather. Daytime temperatures often soar to highs of 40°C (104°F) or even higher. The region experiences intense sunlight and minimal cloud cover during this time. Nighttime temperatures in summer are still quite warm, ranging from 20°C (68°F) to 25°C (77°F).

Given Biskra's desert climate, the city receives very little rainfall throughout the year. Most of the precipitation occurs during the winter months, with an average annual rainfall of around 150-200 millimeters (6-8 inches).

Overall, Biskra's climate is arid, with hot and dry conditions prevailing throughout much of the year. The city's location on the edge of the Sahara Desert contributes to its desert climate characteristics.

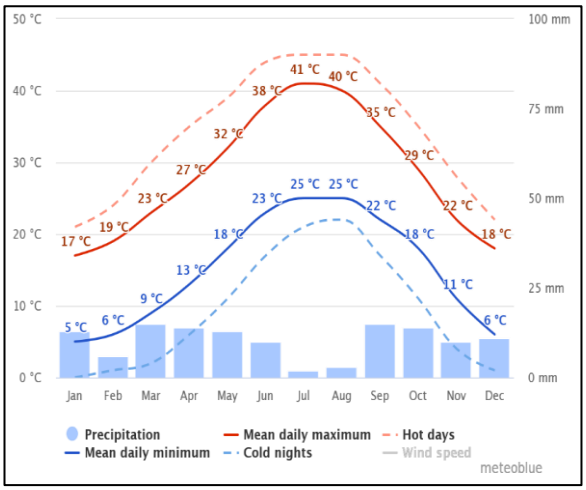
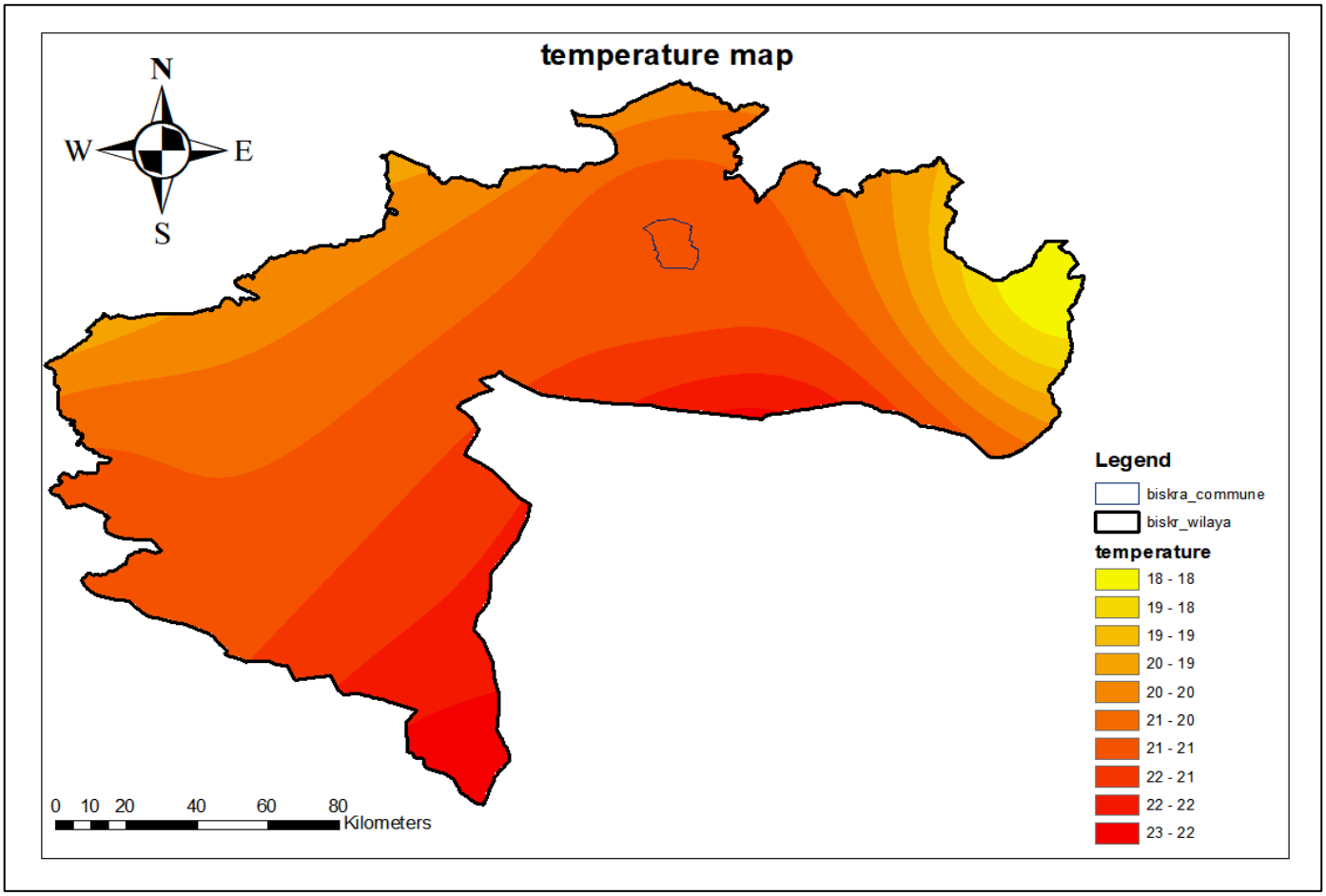


Figure 3 Average temperatures and precipitation

Graph analyses:

The "mean daily maximum" (solid red line) shows the maximum temperature of an average day for every month for Biskra Province. Likewise, "mean daily minimum" (solid blue line) shows the average minimum temperature. Hot days and cold nights (dashed red and blue lines) show the average of the hottest day and coldest nightof each month of the last 30 years.



Source : student 2023 worldclim 2020 **Figure 4 Temperatures map of biskra**

1.3. Cloudy, sunny, and precipitation days:

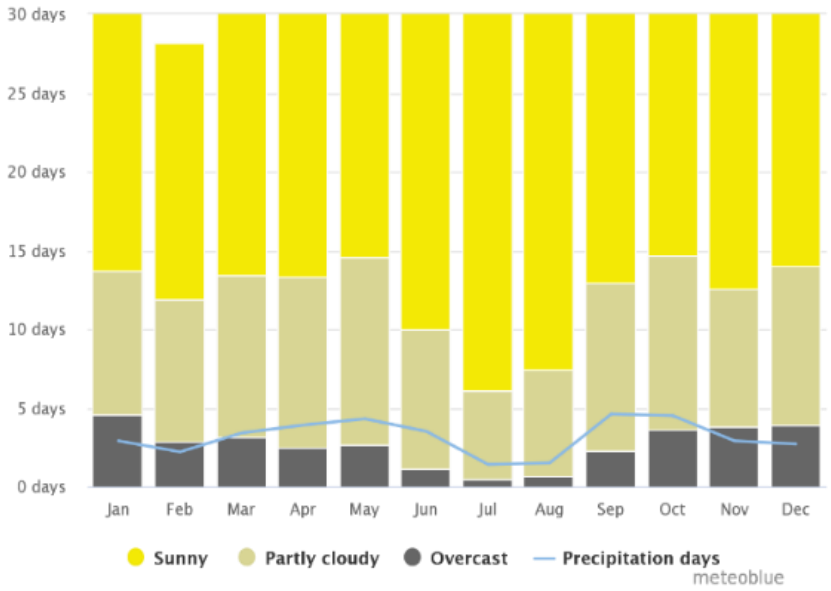


Figure 5 Cloud, sun, and precipitation Diagram

Graph analyse:

The graph shows the monthly number of sunny, partly cloudy, overcast and precipitation days. Days with less than 20% cloud cover are considered as sunny, with 20-80% cloud cover as partly cloudy and with more than 80% as overcast.Maximum

temperatures.

Graph analyses:

The maximum temperature diagram for Biskra Province displays how many days per month reach certain temperatures.Top of Form In this study we chosen Biskra commune to make an analyzable database considering that Biskra is located in a dry and hot area of the country. adding to consideration the data for that last 30 years was provided by **meteoblue**

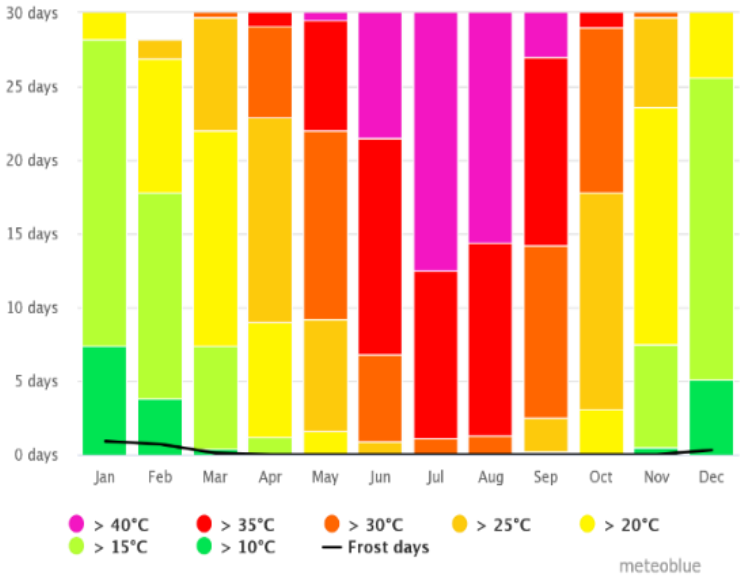


Figure 7 maximum temperature Diagram

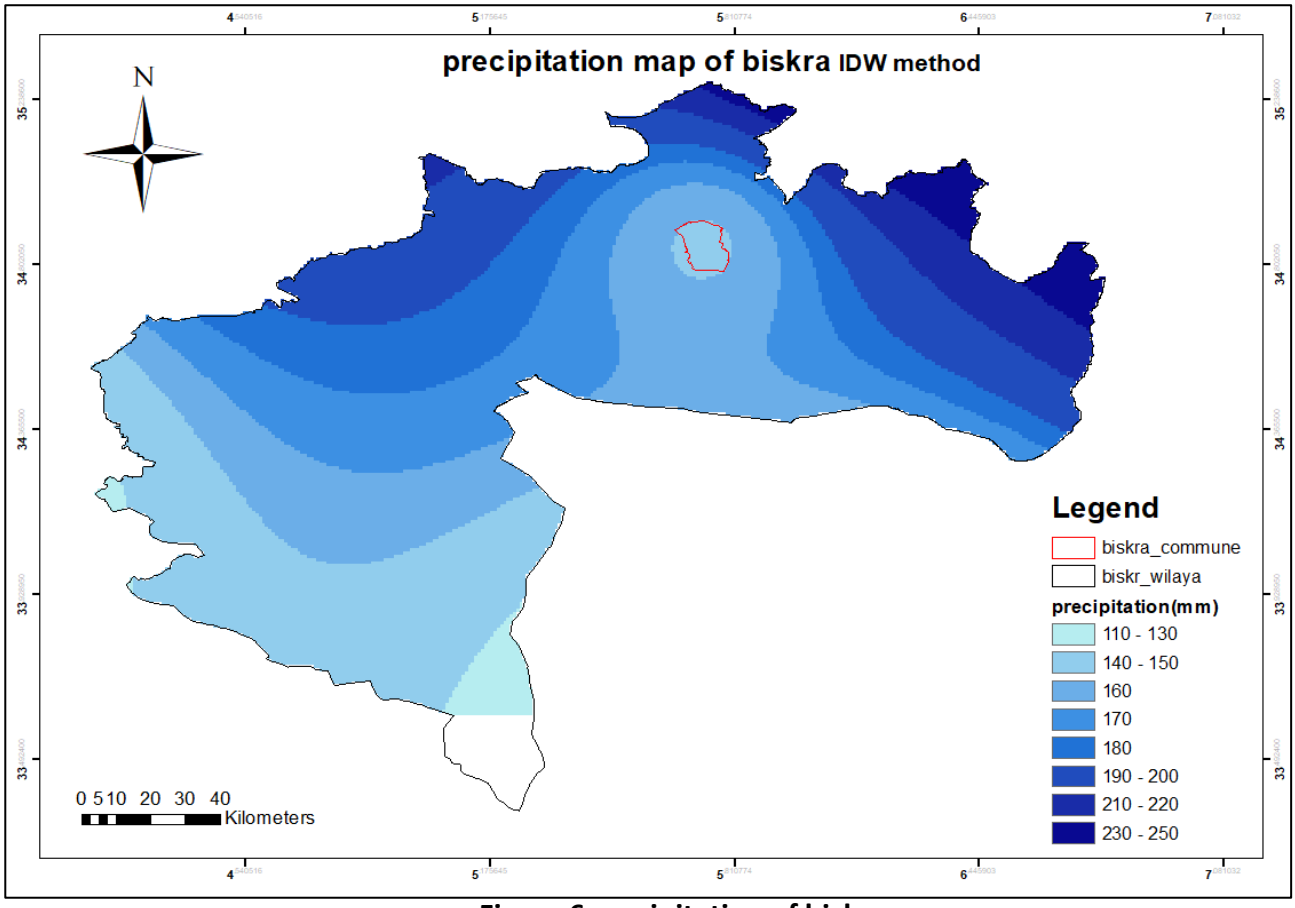


Figure 6 precipitation of biskra

Source : student 2023 utilised

data from CRU 1980

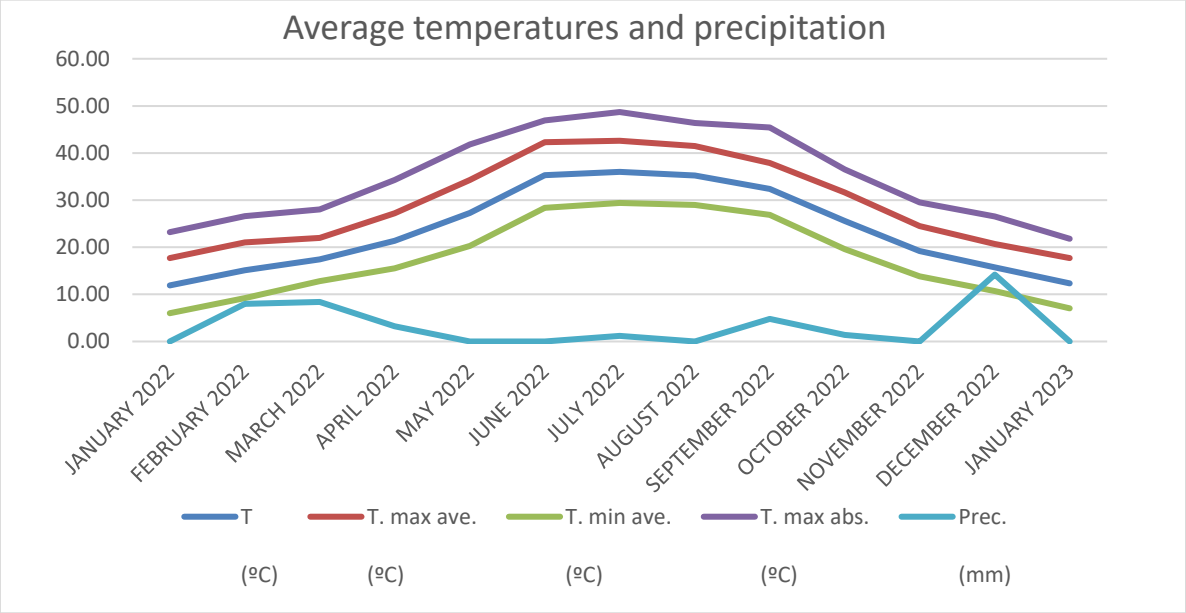
1.4. Temperatures and precipitation of 2022:

After analyzing the data collected from meteoblue, we took a look at the temperatures and precipitation data that we obtained from **meteomanz** of the last year, and to have a better point of view we design a chart to help us analyze it as followed:

Table 1 temperature and precipitation of 2022

Month Δ	T(°C)	T.maxave.(°C)	T. minave.(°C)	T. maxab. (°C	Prec.(mm)
JANUARY 2022	11.9	17.7	6.0	23.2	0.0
FEBRUARY 2022	15.1	21.0	9.2	26.6	8.0
MARCH 2022	17.4	22.0	12.8	28.0	8.4
APRIL 2022	21.4	27.2	15.5	34.3	3.2
MAY 2022	27.3	34.3	20.3	41.8	0.0
JUNE 2022	35.3	42.3	28.4	46.9	0.0
JULY 2022	36.0	42.6	29.4	48.7	1.2
AUGUST 2022	35.2	41.5	29.0	46.4	0.0
SEPTEMBER 2022	32.4	37.9	26.9	45.4	4.8
OCTOBER 2022	25.6	31.6	19.6	36.5	1.4
NOVEMBER 2022	19.2	24.5	13.8	29.5	0.0
DECEMBER 2022	15.7	20.7	10.7	26.5	14.2
JANUARY 2023	12.3	17.7	7.0	21.8	0.0

Source : student 2023



Source : student 2023 Figure 8 Average temperatures and precipitation chart for 2022

As shown in the chart above witch is based on the table temperature and precipitation, Biskra is neither cold or rainy providence it has a long period of hot and dry weather except from December to march.

2 Soil study:

Biskra, Algeria, has a mostly sandy soil texture. Biskra is in the Sahara Desert, which is known for its harsh environment and vast sand dunes. The sandy soil in this area is distinguished by the presence of a high fraction of relatively large sand particles with little water-holding ability. Because of its poor fertility and water retention capacities, the sandy soil texture allows for good drainage but may necessitate additional additives and irrigation for agricultural uses.

In this small part we will define the components of study area soil texture using a map created with ArcGIS, with data provided by FAO.

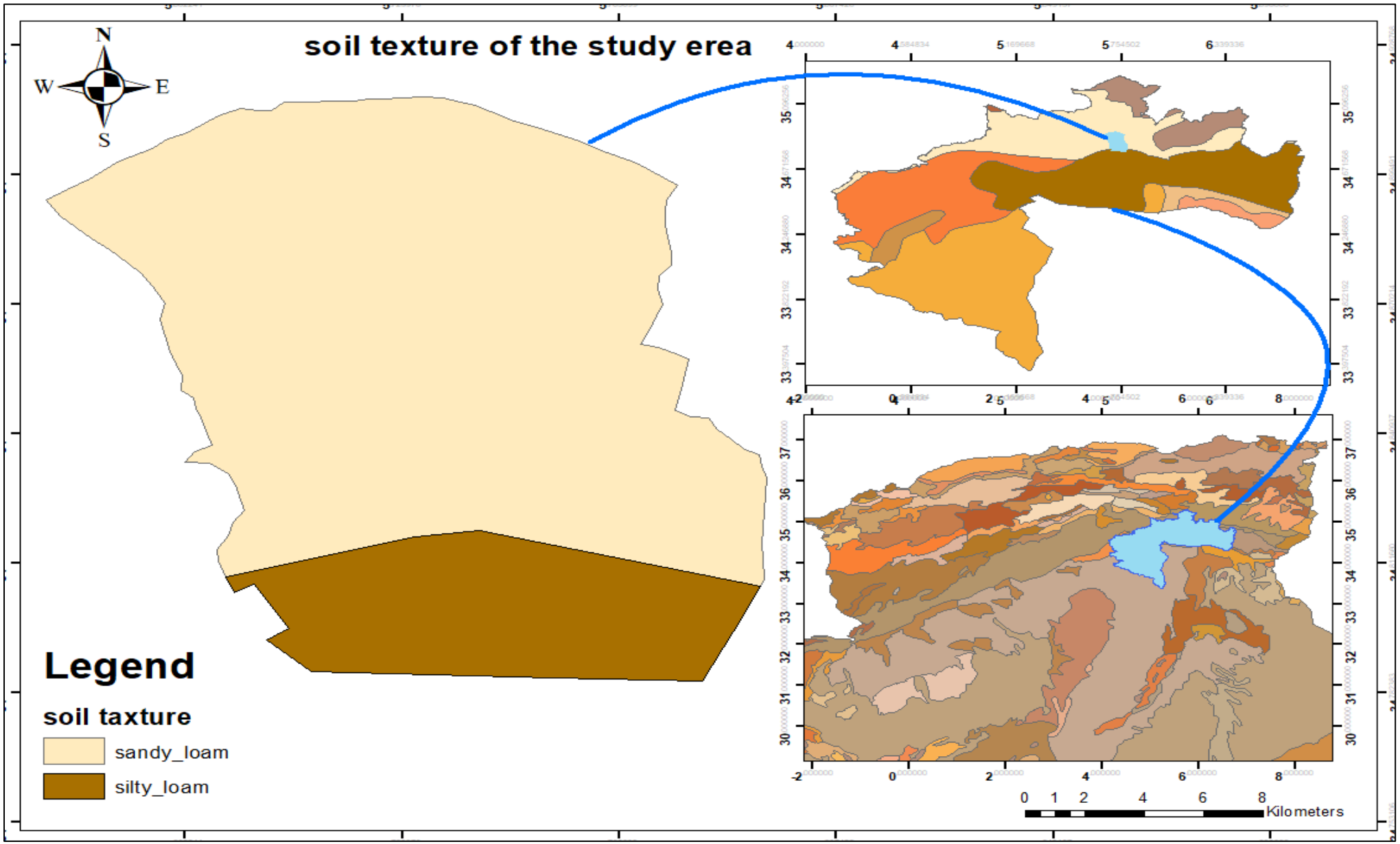
Biskra region is mostly a combination of clay, sand, and silt, where we can discuss their differences below:

Sand is the largest of the mineral particles. Sand particles create large pore spaces that improve aeration. Water flows through the large pore spaces quickly. Soils with a high percentage of sand are generally well-drained. Sandy soils lack the ability to hold nutrients and are not fertile. Sandy soils also feel gritty to the touch.

Silt is a mid-size soil particle. It has good water-holding ability and good fertility characteristics. Silt feels like flour when dry and smooth like velvet when moist.

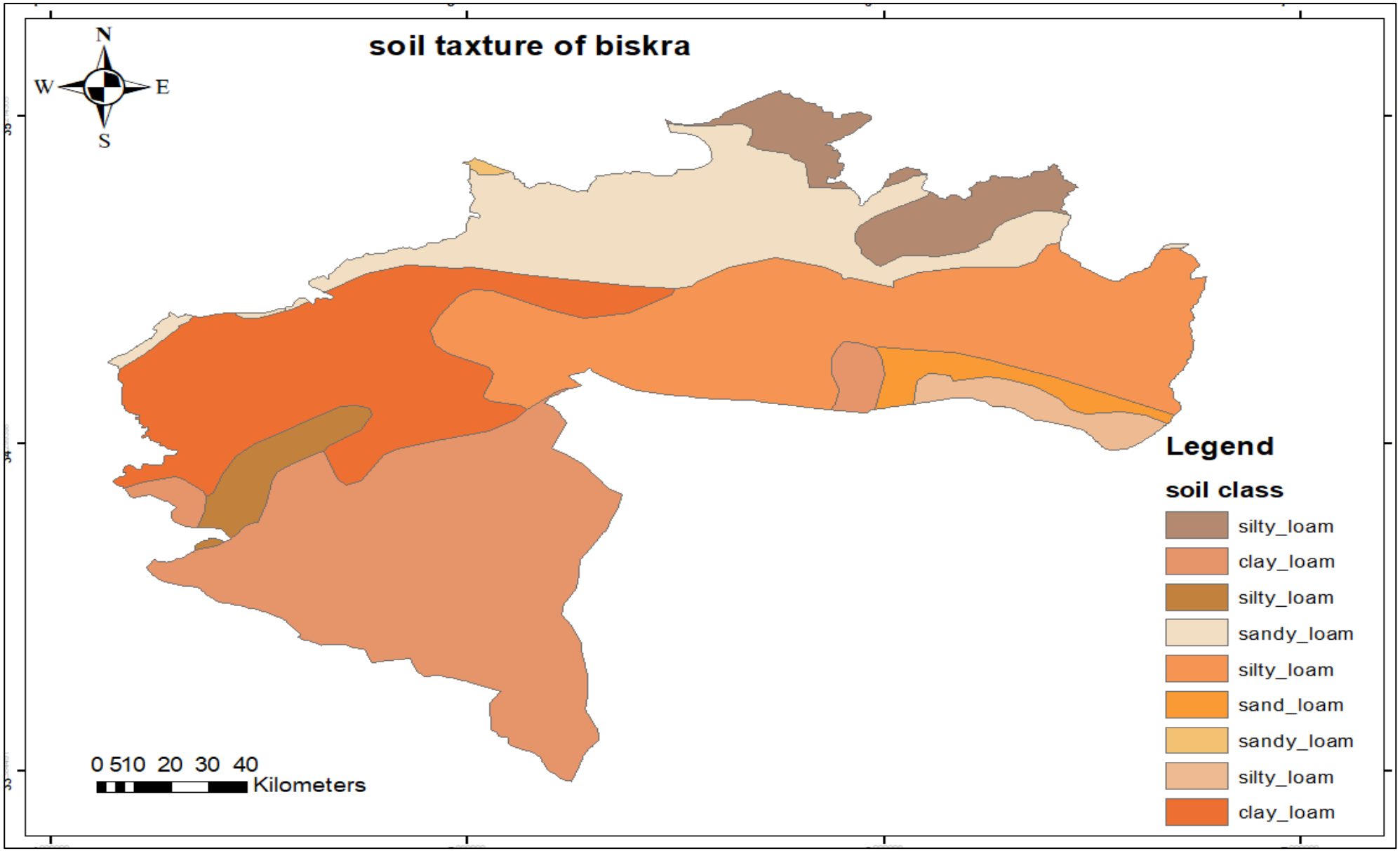
Clay is the smallest size soil particle. Clay can hold both nutrients and water that can be used by plants. It creates very small pore spaces, resulting in poor aeration and poor water drainage. Clay forms hard clumps when dry and is sticky when wet.

Where in figure 1 it shows only two components, we're going to add a soil texture map of Biskra, and explaining the deference between each texture layer there is in the state in this table belo



Source : student 2023 utilised data from FAO 1980

Figure 9 soil texture of the study area



Source : student 2023 utilised data from FAO 1980

Figure 10 soil texture of the stat of biskra

Table 2 Soil classification

Sand	**Dry—Loose and single grained; feels gritty.** **Moist—Will form very easily—crumbled ball** **Sand: 85-100%, Silt: 0-15%, Clay: 0-10%**
Loamy Sand	**Dry—Silt and clay may mask sand; feels loose, gritty.** **Moist—Feels gritty; forms easily—crumbled ball; stains fingers slightly.** **Sand: 70-90%, Silt: 0-30%, Clay: 0-15%**
Sandy Loam	**Dry—Clods easily broken; sand can be seen and felt.** **Moist—Moderately gritty; forms ball that can stand careful handling; definitely stains fingers.** **Sand: 43-85%, Silt: 0-50%, Clay: 0-20%**
Loam	**Dry—Clods moderately difficult to break; somewhat gritty.** **Moist—Neither very gritty nor very smooth; forms a ball; stains fingers.** **Sand: 23-52%, Silt: 28-50%, Clay: 7-27%**
Silt Loam	**Dry—Clods difficult to break; when pulverized feels smooth, soft, and floury, shows fingerprints. Moist—Has smooth or slick buttery feel; stains fingers.** **Sand: 0-50%, Silt: 50-88%, Clay: 0-27%**
Clay Loam	**Dry—Clods very difficult to break with fingers.** **Moist—Has slight gritty feel; stains fingers; ribbons fairly well.** **Sand: 20-45%, Silt: 15-53%, Clay: 27-40%**
Silty Clay Loam	**Same as above, but very smooth.** **Sand: 0-20%, Silt: 40-73%, Clay: 27-40%**
Sandy Clay Loam	**Same as for Clay Loam.** **Sand: 45-80%, Silt: 0-28%, Clay: 20-35%**
Clay	**Dry—Clods cannot be broken with fingers without extreme pressure.** **Moist—Quite plastic and usually sticky when wet; stains fingers. (A silty clay feels smooth, a sandy clay feels gritty.)** **Sand: 0-45%, Silt: 0-40%, Clay: 40-100%**

Sources : E-unit

IV. Chapter IV: Study Area Overview:

1. Materials and Methods:

2. Materials:

2.1. Software:

2.1.1. ArcGIS 10.8:

ArcGIS is a robust GIS software developed by Esri, providing tools for managing, analyzing, and visualizing spatial data. It offers a wide range of features, including data management, spatial analysis, mapping, and geoprocessing. The software supports various data formats and provides access to a vast collection of geospatial data through ArcGIS Online. ArcGIS 10.8 introduces improvements to existing tools, enhancing performance, analysis capabilities, and cartographic options. It also integrates with other software and technologies, allowing users to combine GIS with databases, web services, and real-time data feeds. Widely used across industries, ArcGIS 10.8 serves as a powerful platform for spatial data management, informed decision-making, and solving complex spatial problems.

2.1.2. Excel 2016:

Excel is a spreadsheet program by Microsoft used for organizing and manipulating data. It allows you to enter data, perform calculations with built-in functions and formulas, format data, create charts and graphs, sort and filter data, analyze data using tools like PivotTables, and automate tasks using macros. It is widely used in various fields for data management and analysis.

2.1.3. Google earth pro:

Google Earth Pro is a desktop application that offers satellite imagery, maps, and 3D modeling of the Earth. It allows you to explore locations, view historical imagery, measure distances and areas, and overlay additional data. You can create presentations and tours, and it is used in fields such as geography, urban planning, and education.

2.1.4. Envi 3.5:

ENVI is a software package commonly used in remote sensing and image analysis.

ENVI, short for Environment for Visualizing Images, is a powerful software tool developed by Harris Geospatial Solutions. It is designed for processing, analyzing, and visualizing remote sensing data and imagery. ENVI supports a wide range of image formats and offers numerous tools and techniques for extracting meaningful

information from satellite, airborne, and drone imagery. It includes functionalities such as image preprocessing, spectral analysis, classification, change detection, and vegetation analysis. ENVI is widely used in fields like environmental monitoring, agriculture, forestry, urban planning, and geospatial analysis to gain insights from remote sensing data.

2.1.5. SPSS 25:

SPSS is a popular software package developed by IBM for statistical analysis and data management. It offers a user-friendly interface and supports a wide range of statistical procedures. With SPSS, you can import, clean, and manipulate data from various sources. It provides descriptive statistics to summarize data and hypothesis testing for making inferences. SPSS also offers data visualization tools for creating charts, graphs, and plots. It includes advanced analytics features like data mining and predictive analytics. Customization and automation options are available through syntax and scripts. SPSS generates output for reporting and can export it to different formats. It is widely used in social sciences, marketing research, healthcare, education, and other fields.

2.2. Data :

2.2.1. Thematic maps:

Thematic maps serve an important role in many research areas, giving meaningful visual representations of specific themes or topics within a given geographic environment. In the context of this thesis, a variety of thematic maps were used to evaluate and comprehend various features of the research area. These maps include elevation models, geology maps, NDVI (Normalized Difference Vegetation Index), temperature, precipitation, slope, contour, and soil maps. Each of these thematic maps serves a distinct purpose and helps to a full understanding of the spatial distribution and characteristics of the study area.

2.2.2. Elevation model map:

Elevation models are essential in depicting the topography and relief of the region. They provide a visual representation of the land's altitude, enabling the identification of prominent features such as mountains, valleys, and plateaus. By integrating elevation data into the analysis, researchers can gain insights into the influence of topography on various phenomena, such as hydrological processes or landform development.

2.2.3. Geological map:

Geological maps offer valuable information about the distribution of different rock types, geological structures, and mineral resources within the study area. These maps aid in the identification of geological formations, fault lines, or areas with potential mineral deposits. By incorporating geological data into the analysis, researchers can assess the geological history of the region and its implications for various geoscientific investigations.

2.2.4. NDVI map:

NDVI maps utilize remote sensing data to assess vegetation vigor and health. By measuring the difference in reflectance between near-infrared and red light, NDVI quantifies the vegetation density and can be used to monitor vegetation changes over time. These maps are instrumental in studying vegetation dynamics, land cover changes, and ecosystem health.

2.2.5. Temperature and precipitation maps

Temperature and precipitation maps depict the spatial distribution of temperature and rainfall patterns within the study area. These maps offer insights into regional climate variations, identifying areas with high or low temperatures, as well as regions experiencing different precipitation levels. By examining temperature and precipitation data, researchers can analyze climate patterns, identify climatic zones, and study the impacts of climate change on the study area.

2.2.6. Slope and contour map:

Slope and contour maps provide information on the terrain characteristics and landform morphology. Slope maps show the steepness or gradient of the land, while contour maps present lines connecting points of equal elevation. These maps assist in understanding the landscape's physical features, identifying areas prone to erosion or landslide hazards, and assessing land suitability for various purposes such as agriculture or urban development.

2.2.7. Soil map:

Soil maps depict the spatial distribution of different soil types and properties. They provide information about soil texture, composition, fertility, and drainage characteristics. By incorporating soil data into the analysis, researchers can examine the relationships between soil properties and various environmental factors, such as vegetation patterns or agricultural productivity.

In summary, the utilization of thematic maps, including elevation models, geological maps, NDVI, temperature, precipitation, slope, contour, and soil maps, in this thesis enables a comprehensive understanding of the study area. These maps offer valuable insights into the topography, geology, vegetation dynamics, climate patterns, terrain characteristics, and soil properties of the region. By integrating and analyzing these thematic maps, researchers can unravel the spatial relationships, identify patterns, and draw meaningful conclusions to address the research objectives of the thesis.

2.2.8. Landsat 8:

Landsat 8 is a joint NASA-USGS satellite mission launched in 2013 that plays a vital role in Earth observation and remote sensing. It is equipped with the Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS), providing comprehensive coverage of the Earth's surface in various spectral bands. The OLI captures imagery at a spatial resolution of 30 meters, enabling detailed analysis of land cover, vegetation health, urban development, and natural resources. The TIRS records thermal infrared data for monitoring temperature variations. The data from Landsat 8 is widely used in environmental science, agriculture, and water resource management. It helps monitor land use changes, deforestation, habitat fragmentation, crop health, and water bodies. An advantage of Landsat 8 is its publicly accessible data, which promotes scientific research, informed decision-making, and innovation in remote sensing applications. Overall, Landsat 8 contributes to our understanding and sustainable management of the Earth.

2.2.9. Satellite images:

Satellite images are photographs or digital recordings of the Earth taken from satellites. They provide detailed views of different regions and are used for mapping, environmental monitoring, disaster management, and more. They offer valuable visual information for analyzing the Earth's surface and making informed decisions.

2.2.10. Band Designations for Landsat:

Band Number	Description	Wavelength	Resolution
Band 1	Coastal / Aerosol	0.433 to 0.453 µm	30 meters
Band 2	Visible blue	0.450 to 0.515 µm	30 meters
Band 3	Visible green	0.525 to 0.600 µm	30 meters
Band 4	Visible red	0.630 to 0.680 µm	30 meters
Band 5	Near-infrared	0.845 to 0.885 µm	30 meters
Band 6	Short wavelength infrared	1.56 to 1.66 µm	30 meters

Band 7	Short wavelength infrared	2.10 to 2.30 µm	60 meters
Band 8	Panchromatic	0.50 to 0.68 µm	15 meters
Band 9	Cirrus	1.36 to 1.39 µm	30 meters
Band 10	Long wavelength infrared	10.3 to 11.3 µm	100 meters
Band 11	Long wavelength infrared	11.5 to 12.5 µm	100 meters

Table 1 landsat 8 band designation

Source: Gis geography

The characteristics of the satellite image chosen in this study:

IMAGE	PATH	ROW	CAPTURE	DATE	BANDS	resolution
LC08 L2SP	194	36	Landsat 8	5/9/2023	1-2-3-4-5-6-7	30m

Table 2 satellite image characteristics

2.2.11. Survy :

Through conducting a survey, I collected valuable information directly from visitors and stakeholders about the "5th of July Garden" park. This included insights on visitor satisfaction, park sage patterns, preferences for amenities, and other specific topics. The gathered data deepened my understanding of how people interacted with and perceived the park, facilitating informed decisions for park management and improvements.

Integrating the survey results with digitized information and the associated database enhanced my analytical capabilities. By combining multiple data sources, I gained a comprehensive perspective on the park and its attributes. Leveraging this combined information provided valuable insights that contributed to an improved understanding of the park and influenced my decision-making processes in the past.

3. Method:

3.1. Preprocessing of satellite images:

Correcting satellite images typically involves several steps to enhance their quality and ensure accurate representation of the captured data. Here are some common corrections applied to satellite images:

3.2. Geometric Correction:

Geometric distortions caused by satellite motion, sensor characteristics, and Earth's topography need to be corrected. This involves aligning the image with a reference coordinate system, removing distortions, and ensuring accurate spatial representation.

3.3. Atmospheric Correction:

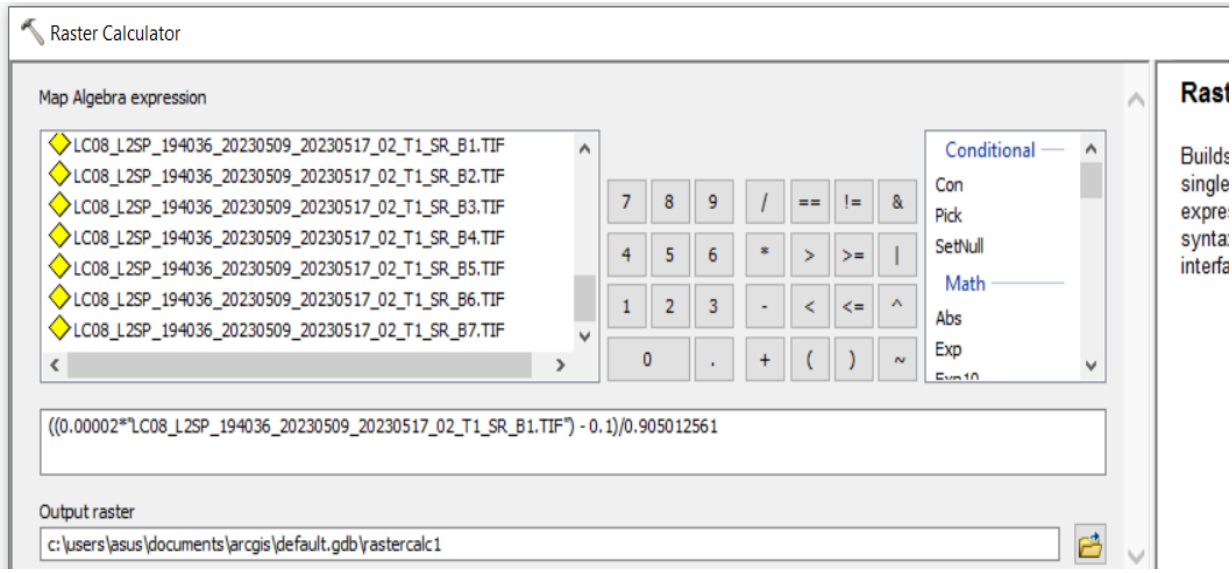
Satellite images can be affected by atmospheric interference such as haze, aerosols, and water vapor. Atmospheric correction techniques are applied to remove or minimize these effects, improving image clarity and accuracy.

3.4. Radiometric Correction:

This correction compensates for variations in sensor sensitivity, atmospheric conditions, and sun angle. It involves converting the raw pixel values to calibrated radiance or reflectance values, which allows for accurate analysis and comparison of different images.

The processing of satellite images is carried out using ArcGIS software version 10.8. Image preprocessing plays a crucial role in remote sensing as it aims to obtain accurate values of reflected or emitted energy from any given point on the Earth's surface.

Using the software ArcGIS 10.8 and raster calculator tool we were able to perform the processing for radiometric correction using the formula below:



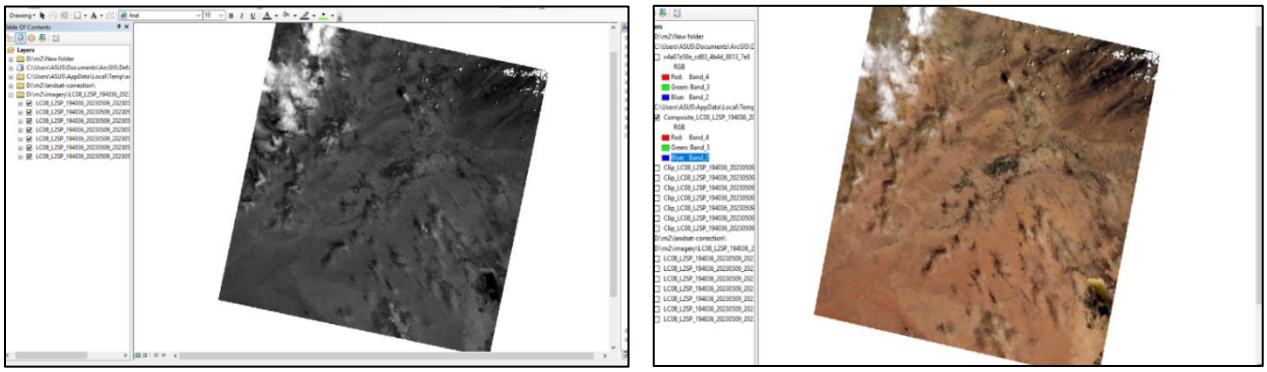
Sourec : student 2023 **Figure 11 calculating Correction**

Where:

(LC08_L2SP_194036_20230509_20230517_02_T1_SR_B1.TIF) is the image band.

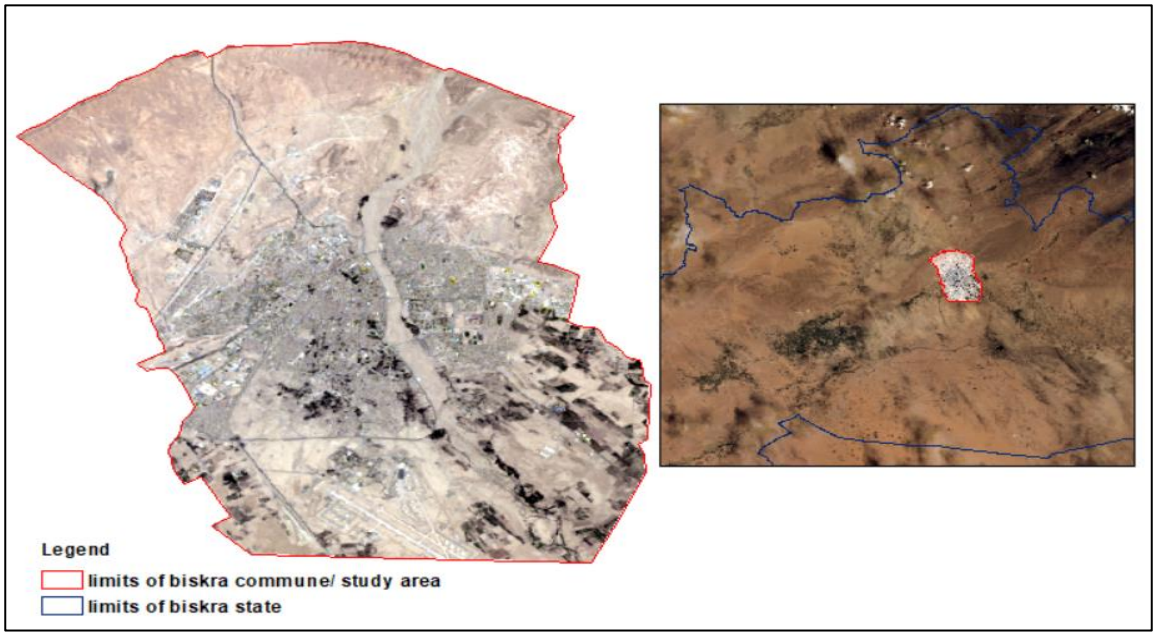
And the digits are:

(0.00002) is: REFLECTANCE_MULT



Sorce : 2023

Figure 12 correction resulte



Sorce : 2023

Figure 13 study area map

is: REFLECTANCE_ADD

(0.905012561) is: tha value of sin SUN_ELEVATION

And this values r provided with in the image files, (MTL.txt) file to be specific.

Bellow we can see the results of the processing before and after applying the correction and adjusting the bands to the natural color.

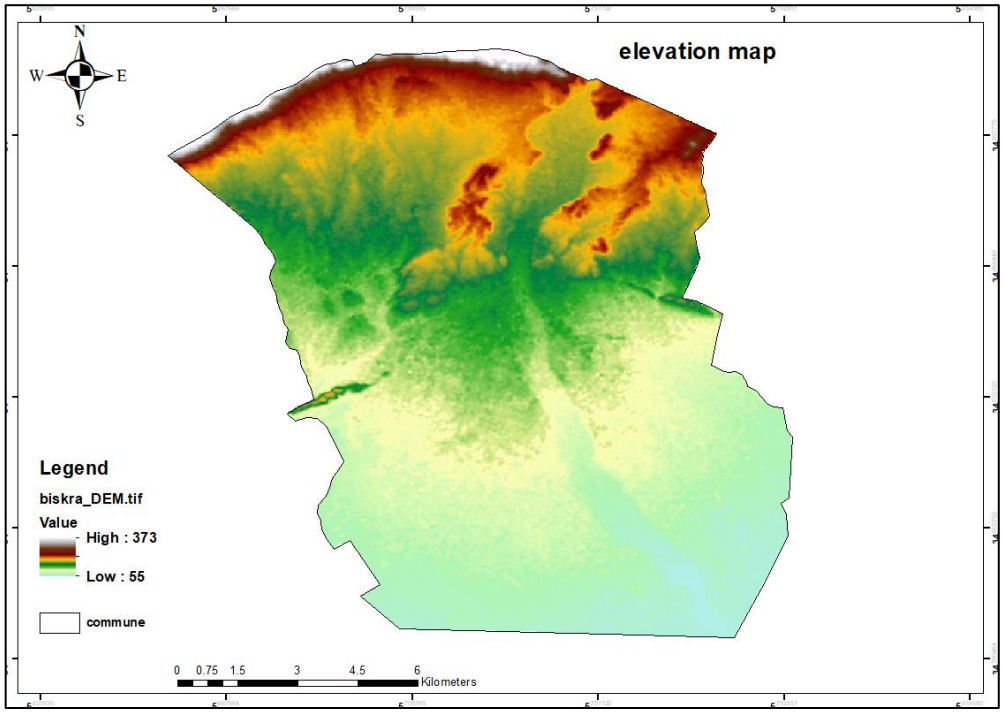
Extracting the area we're about to study using the clip tool with the study area shapfile.

3.5. Thematic mpas

The effective management of public spaces plays a crucial role in enhancing the quality of life for communities. GIS technology have become effective tools for managing and organizing public places. Through the incorporation and analysis of diverse thematic maps, this thesis seeks to investigate the role played by GIS in the administration of public areas. The Elevation Model Map, Geological Map, NDVI Map, Temperature and Precipitation Maps, Slope and Contour Map, and Soil Map are the theme maps that were chosen for this study. This introduction will describe the sequence in which these maps will be displayed and explain why that arrangement was selected.

3.6. Elevation Model Map:

To begin, the Elevation Model Map will be introduced as it forms the foundation for



understanding the topographical characteristics of the study area. This map will illustrate the varying altitudes and landforms, which are important considerations for managing public spaces, particularly in relation to drainage, accessibility, and landscape design.

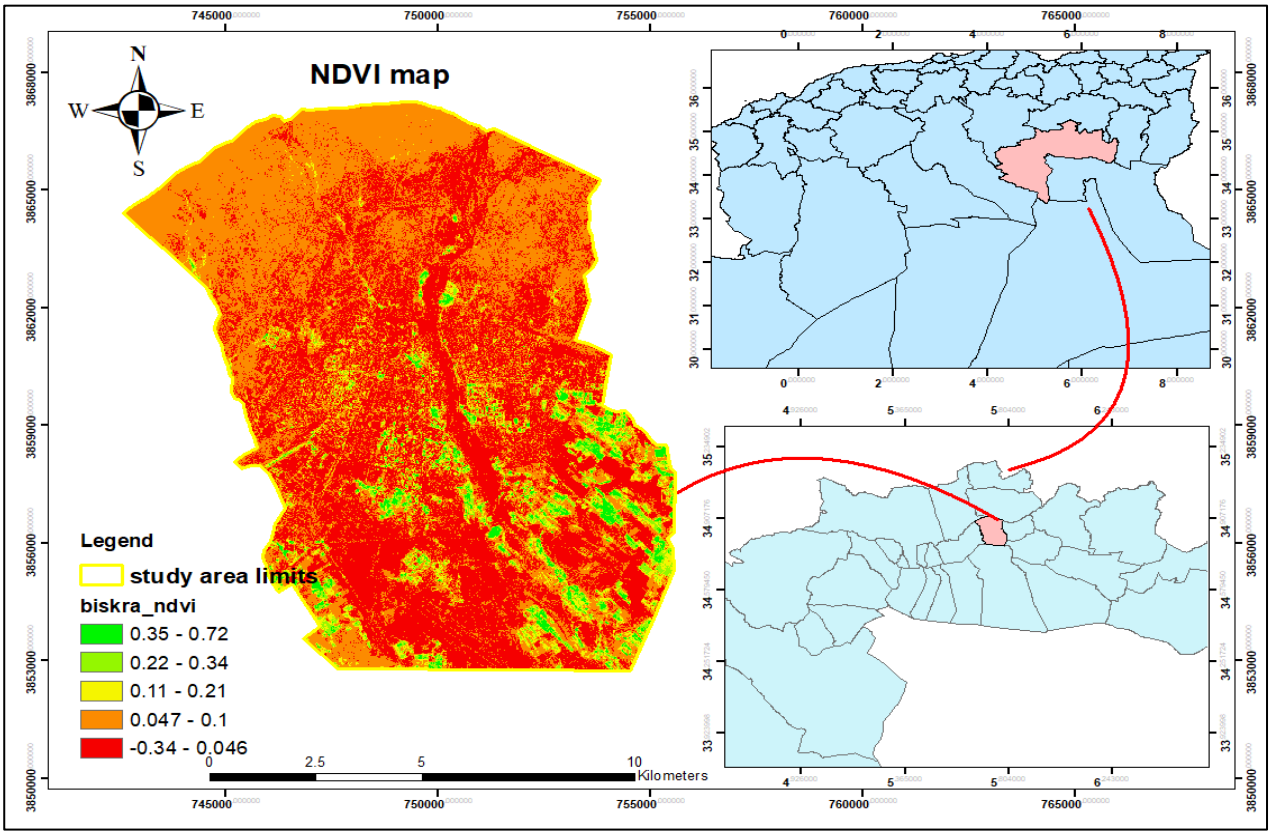
NDVI Map:

Moving forward, the NDVI Map will be presented to examine the vegetation density and health within the study area. This map is instrumental in assessing green spaces, identifying areas with high or low vegetation cover, and evaluating the overall environmental quality of public spaces. It will provide valuable information for enhancing biodiversity, promoting urban greening initiatives, and improving the recreational value of public spaces.

Applying NDVI calculate:

NDVI

stands for Normalized Difference Vegetation Index. It is a commonly used remote sensing index that quantifies the presence and health of vegetation in a given area. NDVI is calculated using satellite imagery or aerial photographs that capture both visible and near-infrared (NIR) light.



Source : student 2023 **Figure 15 NDVI MAP**

The formula to calculate NDVI is as follows:

NDVI = (NIR - Red) / (NIR + Red)

Normalization by the sum of the two bands reduces illuminance effects. NDVI maintains a constant value regardless of the overall illuminance, unlike the simple difference which is very sensitive to variations in illuminance. NDVI values are theoretically between -1 and +1, with negative values corresponding to surfaces other than vegetation cover, such as snow, water or clouds, for which the red reflectance is higher than that of the near-infrared. For bare soils, with reflectances being about the same order of magnitude in red and near infrared.

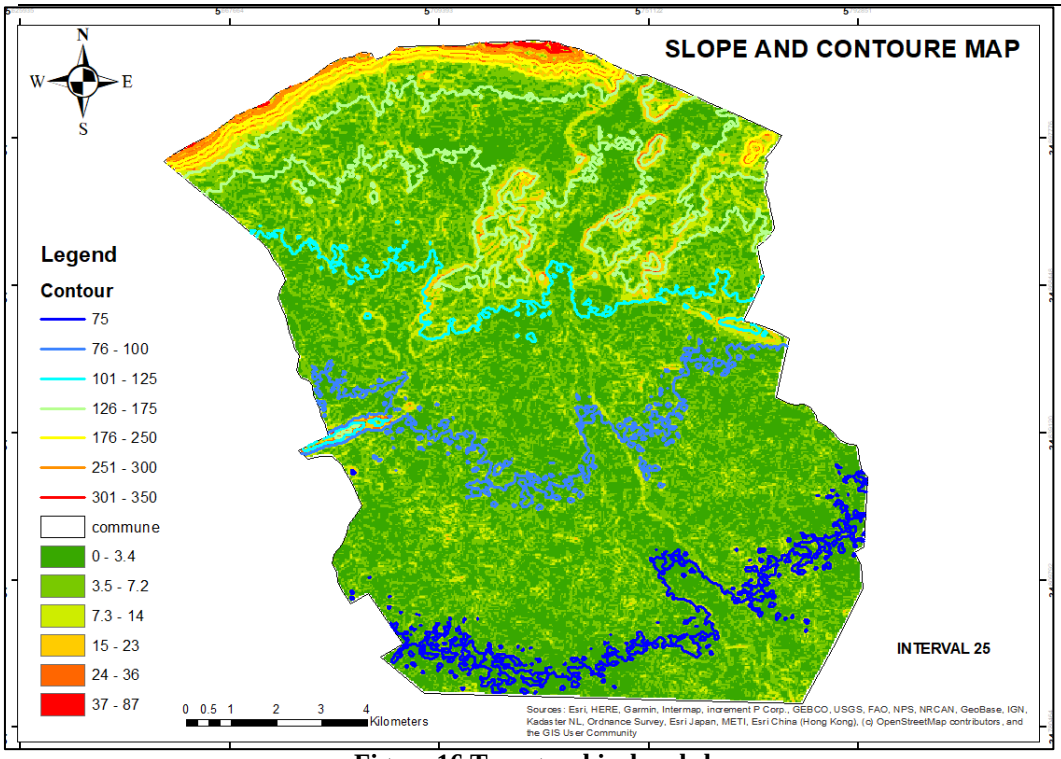
NDVI has values close to 0. Plant formations, on the other hand, have positive NDVI values, generally between 0.1 and 0.7 - the highest values corresponding to the densest covers.[14]

Applying ndvi index will show us if the public space's plants health, the greener they appear the healthier they are.

Slope and Contour Maps:

The Slope and Contour Map will then be discussed to provide insights into the terrain characteristics of the study area. Managing public spaces often involves considering the slope and landform configuration to ensure accessibility, prevent erosion, and optimize land use. This map will aid in identifying suitable areas for recreational activities, accommodating infrastructure, and optimizing land development strategies.

[14] ENVCAL - REMOTE SENSING ENVIRONMENTAL MONITORING



Source : student 2023 **Figure 16 Topographical and slope map**

Conclusion:

The integration of these thematic maps within a GIS framework significantly contributes to the management of public spaces. The Elevation Model Map provides insights into the topography, enabling informed decisions related to drainage, accessibility, and landscape design. The Geological Map enhances our understanding of potential hazards and influences land-use planning. The NDVI Map helps in assessing vegetation health, promoting biodiversity, and improving the recreational value of public spaces. The Temperature and Precipitation Maps aid in designing climate-resilient public spaces. The Slope and Contour Map assists in optimizing land use and ensuring accessibility. The Soil Map facilitates landscape planning and stormwater management. By leveraging these thematic maps, decision-makers can make evidence-based choices, enhancing the functionality, sustainability, and aesthetic appeal of public spaces.

V. Collecting data about the study area and its green public spaces:

In this step it was required to move out into the field and collect what was available to me, the data that was needed to be obtained was the Species of the plants in the public spaces and to obtain a structural plan for it.

Additionally, after doing some researches on the websites, articles, books, I was able to collect more useful data, and these data includes the characteristics of the public green spaces in our study area.

1. Listing public green spaces in the study area:

Biskra has five large green public parks that constitute a city attraction. These well-kept parks and gardens provide a tranquil and refreshing getaway for both inhabitants and tourists. These public spaces, with their lush foliage, meticulously groomed landscapes, and serene ambience, provide a great backdrop for relaxation, leisure activities, and communing with nature.

1.1.London Park

1.1.1. Historical Overview of London Park:

London Park was established in 1872 by Count London Longueville. It was influenced by the acquisition efforts made by Mrs. Jean Albritton, the widow of Jack Andre de Ghana, to secure properties in Algeria following the administrative work issued on 14/05/1937, which aimed to protect mortgages in Batna. On 10/07/1937, the park was sold for free to the municipality of Biskra. This park was classified on 13/01/1992 by the National Agency for Nature Conservation and the Ministry of Agriculture as a protected botanical garden site.

1.1.2. London Park Location

London Park is located in the western part of the city of Biskra, on the banks of Wadi Sidi Zerzour, at a distance of 200 meters. Specifically, it is situated in the Shatouni neighborhood and is surrounded by educational facilities to the east, the residence of the governor to the south, and collective HLM buildings.

This park is 1 kilometer away from the Al-Mahatta neighborhood. It covers an area of 4.10 hectares and has an irregular shape resulting from its boundaries with palm forests in the past. It is bordered by secondary roads on the eastern and northern sides.

1.1.3. Report on the London Park Visit:

Continuing my research and, as usual, enriching it with facts through field trips, I went to London Park. When I arrived, I was greeted by a security guard who escorted me to the park manager. I had a private meeting with the park manager after having some chat with him, and he presented me with a lot of information, including:

The first question concerned the park's regular timetable:

- Cleanliness is maintained on a constant basis, with pedestrian walkways cleaned on a regular basis.

- Tree cutting and reshaping are done on a regular basis, no more than once a week.

- Watering is done every day using conventional methods.

- Visitors are welcome on a daily basis.

Second, in terms of the quantity of workers, their jobs are assigned in accordance with the following program:

There are four security guards on duty throughout the day and night.

There are 5 personnel in charge of cleanliness and maintenance.

Watering and tree trimming are done on a rotating basis.

When it comes to the workers, there is some overlap in their task organization because they rotate roles among themselves.

Third, look into the park's components.

The park has many different components, such as facilities, amenities, and furnishings, as well as some birds and a great number of tree species.

Fourth, there was a discussion about the park's visiting hours and peak periods when the visitation rate is high, as well as the park's positive and negative elements.

Furthermore, the park provides a variety of activities, such as:

- Cultural events such as exhibitions and a painting hall.

- Raising awareness through programs such as rubbish collection and disposal.

- Recreational and open activities.

-Scientific activities, such as guided nursery visits and practical work for various educational levels.

1.1.4. Furniture and Facilities within the Park:

The park currently includes various functional areas and buildings, a plant nursery, a duck lake, a library, and areas equipped with artistic elements dating back to the colonial era. Additionally, there is an administration office and a kiosk, which are still closed to this day.

Table 1 londen park Furniture

Condition	Appearance	Type	Furniture
Good condition	Wooden	Benches	Wooden benches
Good condition	| Wooden	Bridges	Wooden bridges
Fair condition		Water pumps	Water pumps
Good condition	With lamps	Light poles	Light poles
Good condition	Wooden	Garbage containers	Garbage containers

Source : student 2023

1.1.5. Facilities available in London Park :

The Municipal Library is in good shape and has a façade study that makes use of symmetry and repetition. The volumetric analysis depicts a composite shape made up of rectangular parallelograms and a dome. The library is 200m2 in size and is located near the park's main entrance in its northern section. However, the small and insufficient holes limit natural light penetration and visual connection to the surrounding area.

The Hotel, which is likewise in good condition, exhibits a façade study based on repetition with identical opening shapes. The architecture is based on alignment, and the hotel has two facades facing the park's nearby highways. It has a total area of 250m2 and is created by L-shaped rectangular parallelograms. The hotel is located in the park's northern section.

The Art Gallery, which is also in fine condition, features Ottoman-style façade and stresses symmetry. Throughout the gallery, similar opening shapes are repeated. It has an area of 80m2 and is made up of rectangular parallelograms. The art gallery is next to the park, making it easy for tourists to get there.

The Administration building is in good condition, and its façade study combines repetition and symmetry. It has a surface area of 150m2 and a volumetric study consisting of a composite shape resembling a T-shaped arrangement of rectangular parallelograms. The building, which is located within the park, provides administrative duties.

Lastly, the Storage facility, also in good condition, relies on repetition and symmetry in its design. The small-sized openings in the building, spanning an area of 60m², restrict the amount of natural light entering the space. The storage facility takes the shape of rectangular parallelograms and is located within the park.

1.1.6. Botanical Species in London Garden:

In the London Garden, a wide variety of botanical species from different countries can be found. There are a total of 35 species representing 18 different countries. Here is a breakdown of the species by country of origin:

Australia: Acacia cynophylia, Suariaa torulosa, Eucalyptus camaldulensis, Myoporum serratum.

Brazil: Bougainvillea glabra.

Canada: Prosopis glandulosa.

Ceylon: Phoenix zeylanica.

India: Acacia farnesiana, Bambusa thouarsii, Ficus religiosa, Ricinus commuais.

Louisiana: Maclura aurantiaca.

Mediterranean: Artemisia absiathiu, Ceratonia siliqua, Pinus pinea, Olea europaea.

Mexico-Antilles: Burrata plumieri.

Myanmar: Ficus glomerata.

North Africa: Chamaerops humilis, Nerium oleander, Phoenix dactylifera.

Persia (Iran): Cupressus sempervirens.

Reunion: Latania borbonica.

Southern Europe: Arundo donax.

South America: Schinus terebinthifolius.

Tropical America: Lantana camara, Leucaena glauca, Schius molle.

Baja California: Washingtonia robusta.

California: Washingtonia filifira.

Asia Minor: Rosa damascena.

These diverse botanical species from around the world add beauty and richness to the London Garden, creating a vibrant and international atmosphere.

1.2.Zidane Ibrahim Park:

1.2.1. introduction :

Zidane Ibrahim Park, popularly known as "Rodari," was established in 1996 and is overseen by the Forest Administration. It is 1.28 hectares in size and was formally registered on February 26, 1994. The park is located in the city center, next to the Martyrs' Directorate in the Adl'a neighborhood. It begins at the intersection of three major thoroughfares: Rue des Frères Saouli, Boussatah Mohamed, and Bouhil Hussein. Buildings of diverse sizes and uses may be found in the surrounding region, including residential and institutional facilities such as the Directorate of Martyrs and

the Music Center. The built environment of the park is denser than the individual dwellings, resulting in a distinct urban landscape in the heart of Biskra.

1.2.2. Report on Zaidan Ibrahim Garden Visit:

I conducted a scientific research visit to Zaidan Ibrahim Garden as part of our ongoing efforts to enhance our knowledge through field trips. Upon arrival, I met with the security officer who directed me to the garden manager. After a fruitful discussion, I had a personal meeting with Mr. Bouzid Nobel, the garden manager, who provided me with valuable information. Here are the key findings from my visit:

Firstly, I inquired about the daily schedule of the garden. The garden follows a daily routine that includes the cleaning of pedestrian pathways, regular irrigation for watering, feeding of birds and animals, and daily reception of visitors.

Secondly, in terms of workforce, the garden has a total of 7 workers who are assigned specific tasks. There are 4 workers responsible for guarding duties during both day and night shifts. Additionally, there is 1 worker dedicated to cleanliness and maintenance, 1 worker for bird and animal care, and 1 worker responsible for watering and tree trimming. It's worth noting that the workers occasionally switch roles to ensure flexibility in their assignments.

Thirdly, Zaidan Ibrahim Garden comprises a wide range of components, including various facilities, amenities, and furnishings. The garden is home to diverse species of birds and animals, as well as different types of fruit-bearing and forest trees.

During my visit, I discussed the visiting hours and peak times when the garden experiences high visitation rates. We also addressed both the positive aspects and the challenges the garden faces. Moreover, I inquired about the workers' salaries and the entity responsible for remunerating them.

In addition to these insights, I discovered that Zaidan Ibrahim Garden organizes a variety of activities. These include cultural events such as exhibitions and scouting, awareness campaigns focusing on cleanliness, open days for national celebrations and religious occasions, and scientific activities such as guided visits for nurseries and practical projects across different educational levels.

Overall, my visit to Zaidan Ibrahim Garden was informative and allowed me to gather significant knowledge about the garden's operations, workforce, facilities, and activities.

1.2.3. Visiting hours:

In the morning, from 7:30 to 8:30, there is no specified movement, indicating a relatively calm period. However, from 8:30 to 11:30, there is a moderate movement, which suggests an increase in activity or busyness during that time frame. This could be a result of people starting their work or daily routines.

A notable shift occurs from 11:30 to 12:30, where a strong movement is indicated. This suggests a significant surge in activity during this specific hour, possibly due to lunchtime or specific events taking place.

Moving into the afternoon, from 12:30 to 13:30 and 13:30 to 14:30, there is no specified movement. This could indicate a lull or a relatively quieter period during the early afternoon.

However, from 14:30 to 16:00, a weak movement is recorded, signifying a slight increase in activity compared to the earlier hours. This could be attributed to the resumption of work or various engagements during the later part of the afternoon. From 16:00 to 17:30, a strong movement is indicated, suggesting a peak period of activity and productivity. This time frame likely corresponds to the end of the workday for many individuals, resulting in increased movement and urgency.

Continuing into the evening, from 17:30 to 18:30, another strong movement is observed. This might indicate the transition from work to leisure activities or rush hour traffic as people commute home.

Finally, from 18:30 to 20:00, there is no specified movement, suggesting a gradual decrease in activity as the day progresses towards evening.

1.2.4. Zidan Ibrahim Park holds equipment:

Zaidan Ibrahim Park offers a variety of facilities for visitors to enjoy. The park features a well-maintained mobile library with a rectangular shape, providing access to books and serving as the administrative hub. However, the restroom facility is in poor condition and needs improvement. Children can enjoy the medium-condition

play areas, while a security station ensures safety throughout the park. Bird cages provide a designated space for observing different bird species. Zaidan Ibrahim Park strives to cater to the needs and enjoyment of its visitors with its diverse range of facilities.

1.3.Bouchair Ben Nasser Park:

This park, which opened in 199has been neglected in terms of administration and preparedness. It is encircled by a concrete wall and has two entrances. The park is in terrible condition and used to draw primarily homeless or mentally ill persons from the surrounding areas. However, it was just officially launched by the government, and it is already attracting substantial interest from the populace and from all sections of the city.

1.4.November 1st Park :

The park is located west of Biskra city. It was established in 1972 by the municipality of Biskra. Later, it was handed over to Bouzaher Noureddine through a tender process on July 5th, 2008. The park is situated in an urban area, surrounded by residential buildings on the western side and public facilities on the other sides, with a slightly irregular shape. It is characterized by the presence of two main axes, one being the national road No. 03, and the other being a secondary road that connects the city center to the Amal neighborhood.

1.4.1. Park Features:

• The park has multiple functions and diverse sections, offering recreational and leisure activities, green spaces, and animals.

• It has a diverse and dense vegetative cover.

• The park features an old low-height wall with gaps, while the new wall surrounding the park has a height of 2.5 meters, with a 2-meter distance between the old and new walls.

• There are four entrances to the park, two of which are developed, with one being the main entrance and the other being secondary, while the remaining two entrances are not developed.

1.5.5th July 1962 Park (Jnan Bélik):

Biskra has five large green public parks that constitute a city attraction. These well-kept parks and gardens provide a tranquil and refreshing getaway for both inhabitants and tourists. These public spaces, with their lush foliage, meticulously groomed landscapes, and serene ambience, provide a great backdrop for relaxation, leisure activities, and communing with nature.

Source : google maps Figure 17 5th July 1962 Park

1.5.1. The park's location:

The 5th July 1962 Park is located in the heart of Biskra, precisely in the colonial fabric. It is bounded to the northeast by a military barracks and a railway station, to the north by the Mahatta neighborhood and various administrative buildings, and to the east by the Sisters Orphanage School. The park has a total size of 4.02 hectares.

1.5.2. Report on the Park Visit:

I went on a field trip to the 5th July Park, also known as Jnan Bélik, as part of my scientific study. When I arrived, I went straight to the park's nursery, which acts as the principal hub for planting, harvesting, trimming, and caring for the park's vegetation.

I had the honor of having an exclusive talk with the head of the nursery employees while engaging in conversations with some of the security people and nursery staff. He freely imparted a wealth of knowledge that vastly improved my understanding of the park's horticulture techniques. The following are the important findings:

There is no set work schedule in place for the nursery workers. The procedure of establishing miniature trees or "fossils" on the ground takes around two and a half to three months.

Once the ready-to-plant fossils are pulled from the earth, they are moved to specified places where they are carefully cultivated for about 10 days before being planted.

To reduce losses, the planting operation is carried out on a big scale. For example, around 85 to 70 of every 100 plantings are effective.

It is crucial to highlight that all of the plants grown in the park are primarily for decorative purposes, with no fruit trees or other sorts of vegetation present.

"La Tourbe," a black earth substance made of dirt and chemicals, is used to highlight the veins of the plants, making cutting and transplanting easier. This method is very common in the manufacture of fossils.

"La Tourbe" is only used in the summer or spring because it is ineffectual in the other seasons. Its maximum effectiveness lasts for a total of 20 days.

Pruning operations are performed during the winter season, when the plants are dormant. The nursery personnel might pick two consecutive months throughout the winter for this trimming operation. Planting, on the other hand, occurs throughout the spring season, whereas other seasons, particularly summer, are avoided owing to high temperatures.

In terms of irrigation, plants are watered every 6 or 5 days during the winter season, and every 2 days during the other seasons.

To save water and time, the nursery uses a contemporary watering system known as "Al-Sakiyah" rather than the old approach known as "Al-Qutaqut." This decision is mostly inspired by the park's vast size, which demands large amounts of water.

The jobs allocated to the personnel are separated correspondingly inside the park. Some are in charge of caring for the park, including planting, cleanliness, and upkeep, while others are concerned with park security and tourist safety.

Finally, my visit to 5th July Park and interactions with nursery employees gave me with significant insights into the park's planting, nurturing, and care techniques. The thorough knowledge I acquired will surely help my current scientific studies.

1.5.3. Furnishing inside 5th of July Garden :

There are several furniture types throughout the park, all in varying states of repair. 50 benches made of wood are in good shape compared to 65 concrete benches that are in poor condition. In addition, 50 dual-lamp lighting fixtures are in average condition. Additionally, there are 20 well-maintained wooden trash cans throughout the park. Last but not least, there are six bridges made of concrete and iron that are all in good shape. These amenities offer the park with seating, lighting, waste disposal, and easy access.

1.5.4. Plant species in the 5th of July garden:

1. **Anacardiaceae:** This family includes plants like cashews, mangoes, and poison ivy. They are flowering plants with diverse characteristics and some species are known for their edible fruits.

2. **Mimosaceae:** Mimosaceae is a family of leguminous plants known for their distinctive mimosa flowers and sensitive leaves. They often have a feathery or fern-like appearance.

3. **Arecaceae:** Arecaceae, commonly known as palm trees, is a family of plants characterized by their large, compound leaves and tall, slender trunks. They are often associated with tropical environments.

4. **Punicaceae:** Punicaceae is a family of trees and shrubs, with pomegranates being a well-known example. They bear fruits with leathery rinds and juicy, edible seeds.

5. **Poaceae:** Poaceae, also known as the grass family, includes various species of grasses. They are important for their role as major cereal crops such as wheat, rice, and corn.

6. **Pinaceae:** Pinaceae is a family of coniferous trees, including pines, firs, and spruces. They are characterized by their needle-like leaves, cones, and often being evergreen.

7. **Bignoniaceae:** Bignoniaceae consists of flowering plants known for their showy blossoms. They include species like trumpet vines and jacarandas, which are often cultivated for their vibrant flowers.

8. **Tamaricaceae:** Tamaricaceae is a family of shrubs and small trees adapted to arid environments. They are often found in saline soils and have feathery foliage.

9. **Pittosporaceae:** Pittosporaceae is a family of flowering plants, typically evergreen shrubs or trees. They are known for their fragrant flowers and often have glossy leaves.

1.5.5. both the advantages and disadvantages of the 5th of July 1962 Park

1.5.5.1. Positive aspects

Beautiful scenery: The 5th July 1962 Park offers tourists a relaxing and pleasant setting with its picturesque terrain and well-kept flora.

Recreational Facilities: The park provides a variety of options for outdoor activities and exercise, including walking routes, playgrounds, and sports fields.

Cultural Significance: The park has historical and cultural significance as a symbol of Algeria's battle for independence because it was named after the Algerian Independence Day.

Accessibility: The park is easily accessible to the public, making it convenient for families, tourists, and individuals to visit and enjoy its amenities.

Wildlife and Biodiversity: The park is likely to support a diverse range of flora and fauna, providing a habitat for various plant species and possibly attracting wildlife, enhancing the ecological value of the park.

1.5.5.2. Negative Points:

Maintenance Issues: There might be some maintenance issues in certain areas of the park, such as broken benches, littering, or lack of proper upkeep, which can impact the overall visitor experience.

Limited Shade: In some sections of the park, there may be a limited number of shaded areas, which could be inconvenient during hot weather or for visitors seeking shelter from the sun.

Crowded During Peak Hours: The park may get congested during peak hours, on weekends, or on holidays, which may disrupt the peace and make it difficult to find room for activities.

Lack of Interpretive Signage: The educational experience for visitors may be limited by a lack of interpretive signage or displays that offer insights on the park's features, history, or advice.

Lack of Parking: Due to the park's location and popularity, there may not be enough parking places, making it difficult for visitors to locate convenient parking spaces close by.

Conclusion:

In conclusion, this thesis has provided substantial evidence for the crucial role of Geographic Information Systems (GIS) in revolutionizing the management and maintenance of green public spaces. By focusing on the specific case of the "5th July 1962" park and employing advanced software tools such as ArcMap, ERDAS, ENVI, and SPSS, a comprehensive understanding of the park's attributes and its broader implications for urban green spaces has been achieved.

The integration of GIS technology has showcased its exceptional potential in several key areas. Firstly, GIS has facilitated efficient data collection, enabling comprehensive attribute mapping of the park's flora, furniture, and other essential elements. This detailed inventory empowers park managers and urban planners with accurate and up-to-date information necessary for informed decision-making.

Secondly, GIS has proven invaluable in data analysis and visualization. By utilizing spatial analysis techniques, patterns and trends within the park's ecosystem and usage can be identified. This allows for evidence-based planning and effective resource

allocation, ensuring optimal utilization of available space and promoting sustainability.

Furthermore, GIS has demonstrated its capacity to enhance public engagement and participation in green space management. The incorporation of survey data and the ability to overlay community feedback onto the spatial data layers foster a sense of ownership and involvement among park users. This participatory approach encourages collaboration between stakeholders and facilitates the implementation of inclusive and user-centric management strategies.

Ultimately, the successful integration of GIS technology in the management of green public spaces holds immense potential for improving the quality of urban environments. It offers a data-driven approach that can inform decision-making, optimize resource allocation, and enhance community engagement. As cities continue to grapple with the challenges of urbanization and environmental sustainability, GIS emerges as a powerful tool to create and maintain green spaces that promote ecological balance, social well-being, and a high quality of life.

By shedding light on the transformative capabilities of GIS, this thesis contributes to the body of knowledge in urban planning, landscape management, and environmental conservation. It serves as a catalyst for further research, encouraging the exploration and adoption of GIS technologies in diverse contexts. Ultimately, the effective implementation of GIS in managing green public spaces has the potential to create vibrant, sustainable, and livable cities for present and future generations.

Appendix:

In this study I used a survey to really understand what to do next with the data base I created, the survey had multiple questions aiming to see the opinion of those who uses 5th July park most of the time, the survey goes as follows:

Survey :

Introduction:

Thank you for participating in this survey about public gardens. Your answers will help us understand how people use and benefit from public gardens in our community. Please answer the following questions to the best of your knowledge and experience. Your responses will remain confidential and anonymous.

Part 1: Personal Information

.1Gender:

- Male
- Female

.2Age:

- Under 18 years old

24-18 - years old

34-25 - years old

44-35 - years old

54-45 - years old

64-55 - years old

65 - years old or older

.3Do you live near a public garden?

- Yes
- No

.4How often do you visit public gardens?

- Several times a week
- Once a week

3-2 - times a month

- Once a month
- Less than once a month
- I have never visited a public garden before

Part 2: Reasons for Visiting

.5What are the main reasons for your visits to public gardens? (Select all that apply)

- Relaxation and stress relief
- Enjoying nature and the outdoors
- Walking, jogging, or exercising

- Outdoor socializing
- Photography or drawing
- Educational purposes
- Other (please specify)_____

.6How much time do you usually spend during each visit to public gardens?

- Less than 30 minutes
- 30 minutes to 1 hour
- 1 to 2hours
- 2 to 3hours
- More than 3 hours
- Part 4: Security and Cleanliness

.8Do you feel safe when visiting public gardens in our community?

- Yes, I feel completely safe
- Yes, but it could be improved slightly
- No, I feel somewhat concerned
- No, I feel very unsafe

.9How satisfied are you with the maintenance and cleanliness of public gardens in our community currently?

- Very satisfied
- Somewhat satisfied
- Neutral
- Somewhat dissatisfied
- Very dissatisfied 9

10.Would you recommend visiting public gardens in our community to others?

- Yes, definitely
- Yes, probably
- Not sure
- No, probably not
- No, definitely not

Thank you for your time in completing this survey!.

Survy result are bellow:

-for analyzing the answers that was filled in the survey with I used SPSS software.

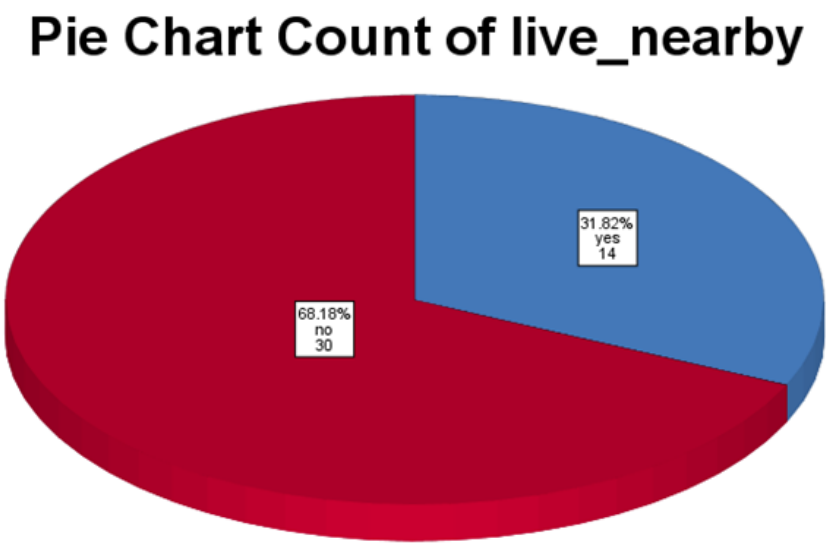
Figure 18 spss tabl

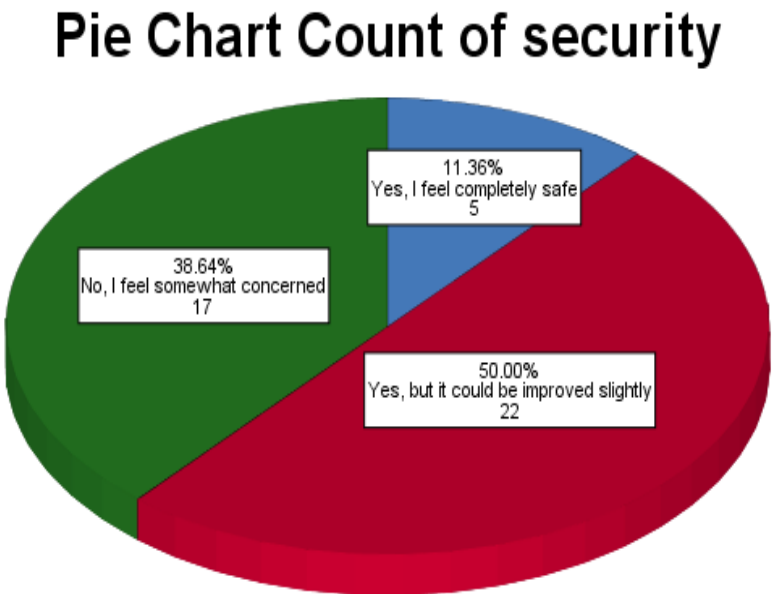
thesis survey.sav [DataSet1] - IBM SPSS Statistics Data Editor

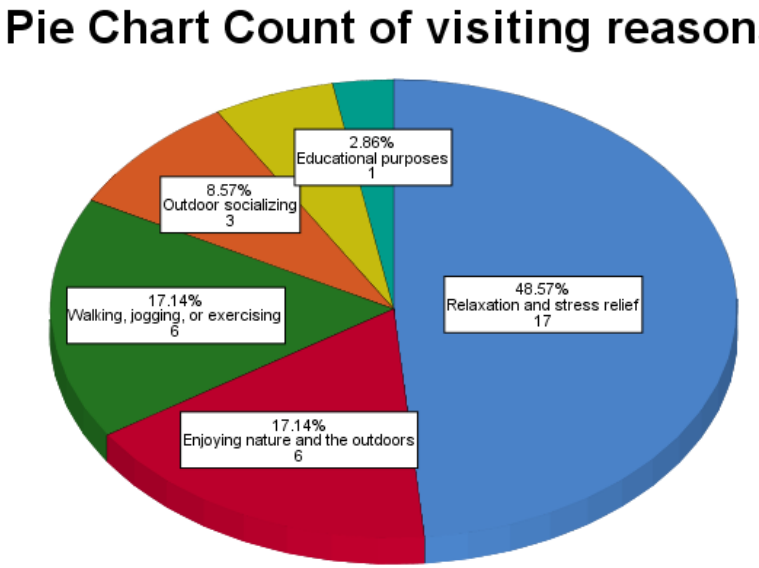
File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

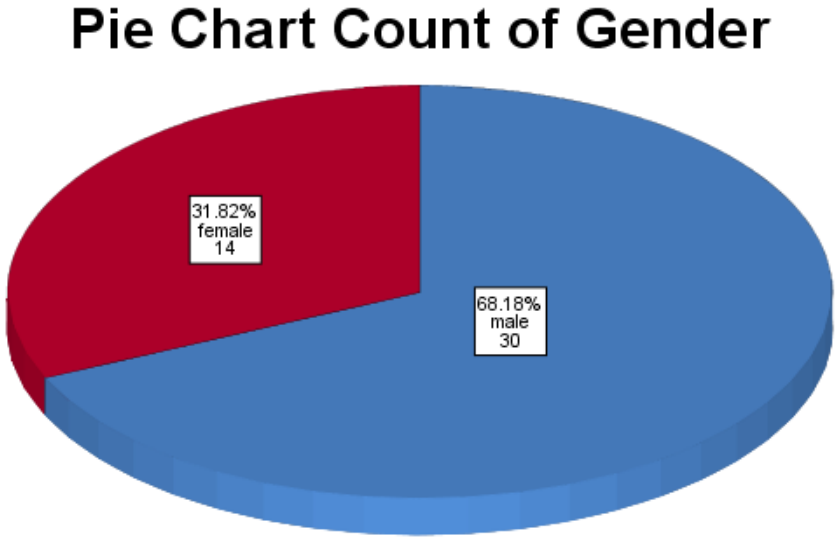
	Gender	age	live_nearby	visiting	visiting_reasons	other_reasons	time_spent	security
7	male	55-64 yo	yes	Once a week	Relaxation and stress relief		Less than 30 minutes	Yes, but it could be improv
8	male	55-64 yo	yes	Once a week	Relaxation and stress relief		Less than 30 minutes	Yes, but it could be improv
9	male	45-54 yo	yes	Once a week	Relaxation and stress relief		Less than 30 minutes	Yes, but it could be improv
10	male	45-54 yo	yes	2-3 times a month	Relaxation and stress relief		Less than 30 minutes	Yes, but it could be improv
11	male	45-54 yo	yes	2-3 times a month	Relaxation and stress relief		Less than 30 minutes	Yes, but it could be improv
12	male	45-54 yo	yes	2-3 times a month	Relaxation and stress relief		Less than 30 minutes	Yes, but it could be improv
13	male	45-54 yo	yes	2-3 times a month	Relaxation and stress relief		Less than 30 minutes	Yes, but it could be improv
14	male	45-54 yo	yes	2-3 times a month	Relaxation and stress relief		Less than 30 minutes	Yes, but it could be improv
15	male	45-54 yo	no	2-3 times a month	Relaxation and stress relief		Less than 30 minutes	Yes, but it could be improv
16	female	45-54 yo	no	2-3 times a month	Relaxation and stress relief		30 minutes to 1 hour	Yes, but it could be improv
17	female	45-54 yo	no	Once a month	Relaxation and stress relief		30 minutes to 1 hour	Yes, but it could be improv
18	female	45-54 yo	no	Once a month	Enjoying nature and the outdoors		30 minutes to 1 hour	Yes, but it could be improv
19	male	35-44 yo	no	Once a month	Enjoying nature and the outdoors		30 minutes to 1 hour	Yes, but it could be improv
20	male	35-44 yo	no	Once a month	Enjoying nature and the outdoors		30 minutes to 1 hour	Yes, but it could be improv
21	male	35-44 yo	no	Once a month	Enjoying nature and the outdoors		30 minutes to 1 hour	Yes, but it could be improv
22	male	35-44 yo	no	Once a month	Enjoying nature and the outdoors		30 minutes to 1 hour	Yes, but it could be improv
23	male	35-44 yo	no	Once a month	Enjoying nature and the outdoors		30 minutes to 1 hour	Yes, but it could be improv
24	female	35-44 yo	no	Once a month	Walking, jogging, or exercising		30 minutes to 1 hour	Yes, but it could be improv
25	female	35-44 yo	no	Once a month	Walking, jogging, or exercising		30 minutes to 1 hour	Yes, but it could be improv
26	female	25-34 yo	no	Once a month	Walking, jogging, or exercising		30 minutes to 1 hour	Yes, but it could be improv

the analyze result aws presented as percentage

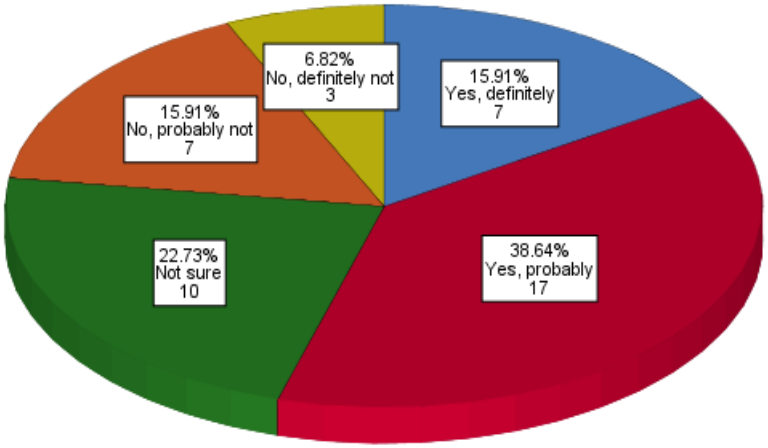








Pie Chart Count of recommending



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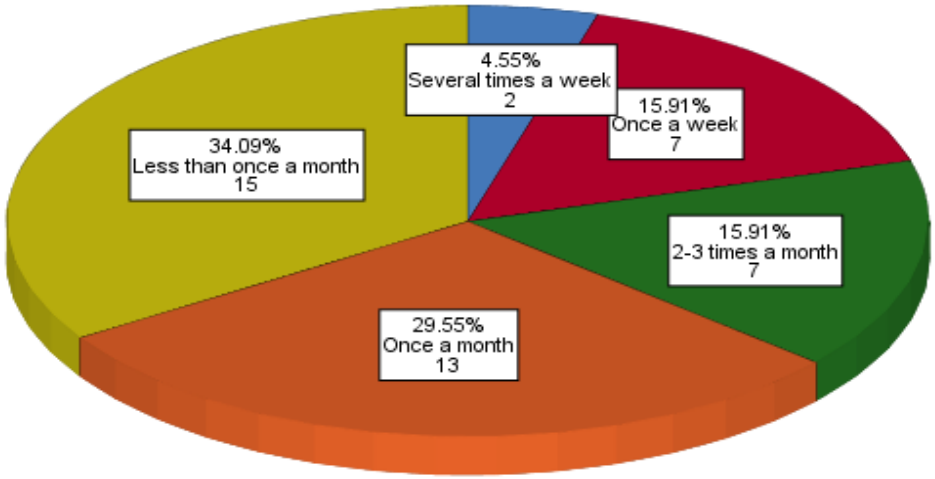
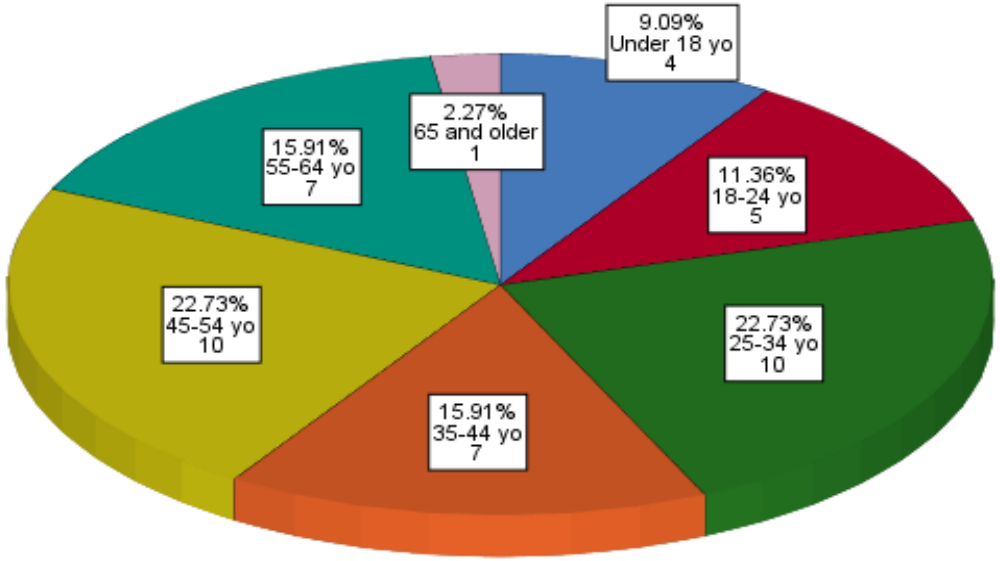
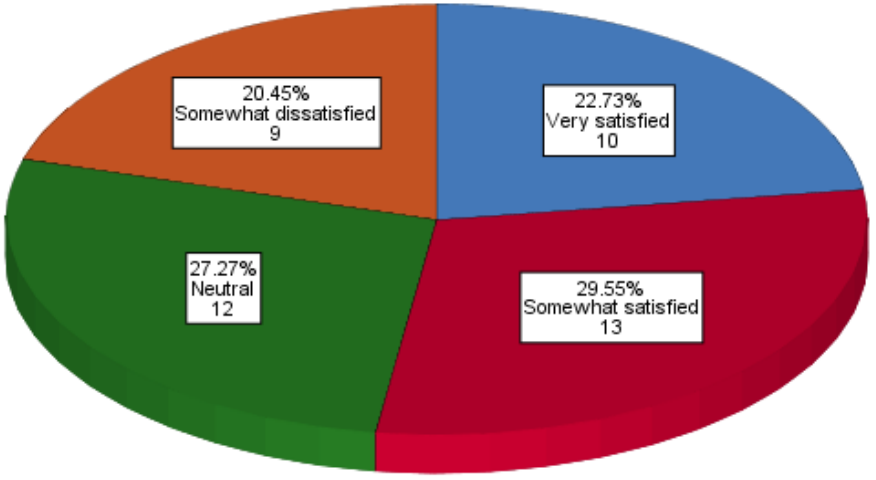


Pie Chart Count of age



Pie Chart Count of satisfaction



Pie Chart Count of time spent

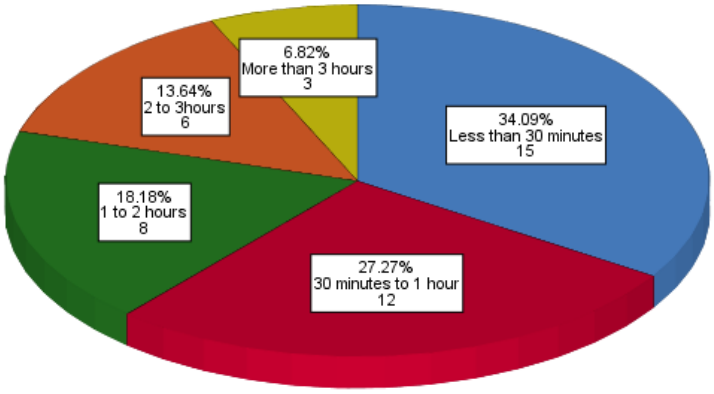


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Table of Contents

Summery:

"The Role of GIS in the Management of Green Public Spaces" thesis centered around investigating how GIS can enhance the management of green public spaces, with a particular focus on the "5th July 1962" park. Through the utilization of software tools like ArcMap, ERDAS, ENVI, and SPSS, the research aimed to create a comprehensive understanding of the park's attributes, including plant species and furniture. A survey was also conducted to gather valuable insights. The integration of GIS technology demonstrated its effectiveness in facilitating data collection, analysis, visualization, and decision-making processes, thereby enhancing the overall management of green public spaces. Overall, this thesis contributes to the broader understanding of the benefits and applications of GIS in the context of managing and maintaining green public spaces.

ملخص:

تركز أطروحة "دور نظم المعلومات الجغرافية في إدارة المساحات العامة الخضراء" على التحقيق في كيفية قيام نظم المعلومات الجغرافية بتعزيز إدارة المساحات العامة الخضراء ، مع التركيز بشكل خاص على حديقة "5 يوليو 1962". من خلال استخدام أدوات برمجية مثل ArcMap و ERDAS و ENVI و SPSS ، يهدف البحث إلى خلق فهم شامل لخصائص المنتزه ، بما في ذلك أنواع النباتات والأثاث. كما تم إجراء مسح لجمع رؤى قيمة. أظهر تكامل تكنولوجيا نظم المعلومات الجغرافية فعاليتها في تسهيل جمع البيانات وتحليلها ، التصور وعمليات صنع القرار ، وبالتالي تعزيز الإدارة العامة للمساحات العامة الخضراء بشكل عام ، تساهم هذه الأطروحة في فهم أوسع لفوائد وتطبيقات نظم المعلومات الجغرافية في سياق إدارة وصيانة المساحات العامة الخضراء.

Résumé :

Le rôle des SIG dans la gestion des espaces verts publics - Cette thèse se concentre sur l'étude de la façon dont les SIG peuvent améliorer la gestion des espaces verts publics, en mettant l'accent particulièrement sur le parc "5th July 1962". Grâce à l'utilisation d'outils logiciels tels que ArcMap, ERDAS, ENVI et SPSS, la recherche visait à créer une compréhension complète des attributs du parc, y compris les espèces végétales et le mobilier. Une enquête a également été réalisée pour recueillir des informations précieuses. L'intégration de la technologie SIG a démontré son efficacité dans la collecte, l'analyse, la visualisation des données et les processus de prise de décision, améliorant ainsi la gestion globale des espaces verts publics. Dans l'ensemble, cette thèse contribue à une compréhension plus large des avantages et des applications des SIG dans le contexte de la gestion et de l'entretien des espaces verts publics.