

Eco-City Analysis in The Framework of Sustainable Planning Case Study in Jordan

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Abstract:

Background: Sustainability is an ever-evolving innovative concept in architecture, landscape architecture and environmental engineering. It is known that some countries are completely dependent on fossil fuels and their consumption is high, while some countries have harsh climatic conditions and need a special design suitable for environmental and climatic conditions to help their inhabitants adapt to their limited resources. Today, the success of a design is generally associated with the awareness of environmental problems affecting the world, and a solution proposal that will raise awareness within the scope of the country and region.

Materials and Methods: Jordan is one of the countries with limited resources and limited climate. Some areas of Jordan tend to have desert diversity, and some areas contain incredible natural and botanical diversity. For years, Jordan has been trying to implement the concept of sustainability, to protect what is left of its resources and to improve and develop them, and to benefit from the surrounding climate and environmental conditions without harming people and the environment. In this study, Jordan's location was analyzed in terms of geography, climate and environmental aspects, solar radiation rate, precipitation rate, population density and plant species found there. And with the analysis of all these factors, the appropriate location for the eco city was selected.

Results: As a result of the study, after using approved maps and determining the appropriate factors for the eco-city, the maps were placed in layers and the common areas with the features suitable for the eco-cities were selected. Two regions, northeast of Jordan and southwest of Jordan, emerged as suitable regions to embrace and implement the idea of eco-friendly cities and eco-city.

Key Word: Sustainability, Eco-Friendly Cities, Jordan Geography, Site Analysis.

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I. Introduction

As global warming and environmental pollution increase, the resources provided by nature rapidly decrease, causing life difficulties for living things. In order to prevent these problems experienced in every field day by day, the idea of environmentalism has begun to be considered in every field in order to use building resources correctly. Sustainable means not "despite everything", but "taking into account everything", maintaining a healthy life in the natural environment despite the population and construction.

Sustainable energy is a concern that unites the future, developed and developing countries. Our global reliance on fossil fuels may still remain, but the desire to apply a more sustainable, resource efficient approach has taken shape and is rapidly gathering momentum. In this context, countries and trading blocs around the world are developing energy efficient mechanisms across particular sectors, one of which is the buildings and construction sector.

Data on the building sector reveals an intense and often wasteful use of scarce resources. Buildings account for 40 % of global energy use, 40 % of waste products, 12 % of potable water and 38 % of all global GHG emissions. As buildings are physical structures with long life spans, the potential for savings in this sector is enormous. Improvements in both new and existing buildings are needed to tackle pressure on resources (Royal Scientific Society of Jordan, 2013). The phenomenon of urban sustainability is one of the most challenging and urgent issues facing humanity today.

The future of our sustainable energy supply is a concern that unites developed and developing countries. Although the political focus has largely been fixed on the issue of energy security, rather than on sustainability and the environment, science and public opinion are having an impact on longer term thinking.

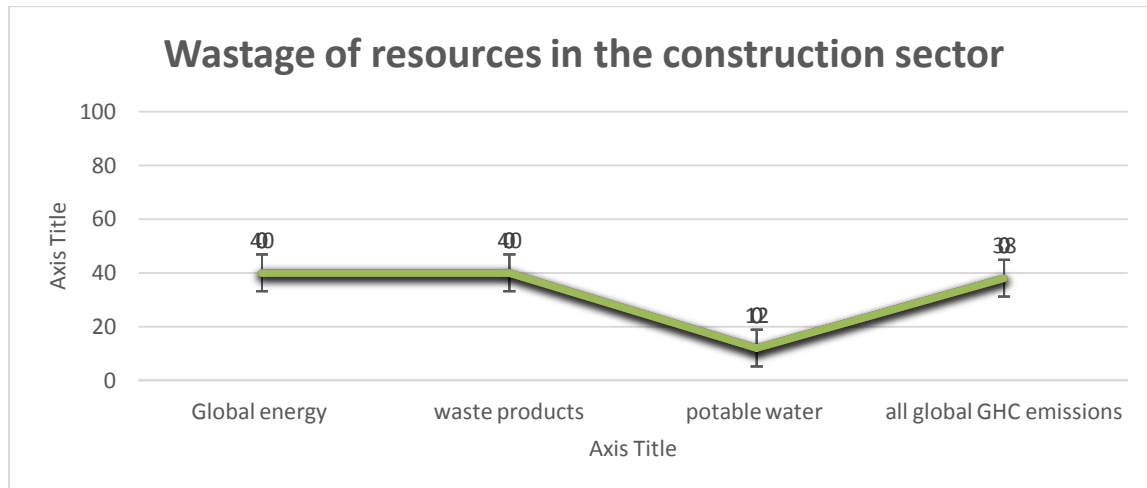


Figure . 1 . the Wastage of resources in the construction sector , Source: UNEP, 2012.

The concept of green, eco-construction and sustainable buildings emerged as a response to the global environmental crisis manifested through climate change and the water and energy crisis. Although the concept of green building is relatively new to Jordan, the concept has received significant attention and acceptance at the global and regional level. Statistics show that the operating costs of buildings and urban transport account for more than half of the total energy consumption in the city (UNEP, 2011).

Half a century ago, economic development in Jordan was achieved at the expense of the depletion of groundwater, the disappearance of ecosystems (in the Dead Sea, the Azraq Oasis, of which only 10% of its area remains, and pastures that were overexploited), and accelerated pollution of water and air. The first environmental protection policies were announced in 1991. Nature reserves were established, and environmental reserves were established within them, managed by the Royal Society for the Conservation of Nature, with varying coordination in effectiveness with local communities (Ajloun, Dibbin, Azraq, Wadi Mujib, Dana, Wadi Faynan, and Wadi Rum) Since the beginning of this century, a real environmental awareness has developed among citizens, in line with the directions of international conferences in the fields of environment and water, and better-designed programs have been formulated to combat desertification. Soil use plans were developed for each governorate in order to reduce urban sprawl and to develop agricultural land in the highlands. But these programs are not effective enough to stop the erosion of agricultural land in southern Amman, due to the massive real estate speculation on the Airport Road since 2002. A charter for the protection of biodiversity has been passed, and measures have been taken to protect animal species. The first environmental protection law (Law 1) was promulgated in 2003. At the same time, a royal botanical garden was designed with the aim of re-cultivating the national species from the last remaining living specimens available in it, and preserving the inherited knowledge of medicinal herbs that exist in the Jordanian rural and Bedouin communities (Atlas of Jordan,2013).

Due to the global urban population growth which is estimated to increase nearly to 70% in 2050, therefore the following impacts of this growth as energy sources shortage and carbon dioxide emission which reached 75% (Griffithsa, 2019). Hence, the interest in new urban settlements increased and oriented towards sustainable efficient solutions as a reaction to the aggravating ecological problems. The term "eco-city" is currently used to a wide variety of urban projects, from minor renovations to new large cities, to state this diversity in definition, eco-city is an ecological healthy human settlement structured on the self-sustaining and energy efficiency principles to run the natural ecosystems and living organisms to live in a sustainable city context socially, economically, and environmentally (kadi,2021).

The idea of the eco-city is widely varied in conceptualization and operationalization. In other words, there are multiple definitions of the eco-city, depending on the context where it is embedded in the form of urban projects and initiatives in terms of the practices and strategies adopted to achieve its goals. Broadly, an eco-city is a human settlement which emphasizes the self-sustaining resilient structure and function of natural environment and ecosystems. It seeks to provide a healthy and livable human environment without consuming more renewable resources than it replaces (Bibri,2020).

Jabareen (2006) describes the eco-city as an umbrella metaphor which 'encompasses a wide range of urban-ecological proposals that aim to achieve urban sustainability. These approaches propose a wide range of environmental, social, and institutional policies that are directed to managing urban spaces to achieve sustainability.

Rapoport and Vernay (2011), who have looked at several eco-city initiatives from across the world, there is no single solution for making urban living more sustainable, so in this sense, it is better to think of the eco-city as an objective that can be achieved in multiple ways.

These ways lead us to several strategies which eco-cities are based on it .

The key dimensions of the eco-city, which have been enacted in many cities across the world, include a variety of strategies and solutions for achieving the goals of sustainability (Bibri 2018a, 2019a, 2020; Bibri and Krogstie 2017b, 2020; Farr 2008; Jabareen 2006; Kenworthy 2006, 2019; Lynn et al. 2003), especially in relation to its environmental dimension. Table 1, presents the key strategies and solutions of the eco-city as distilled based on a recent interdisciplinary case study conducted by Bibri (2020).

Table no 1 : Shows Key strategies and solutions of the eco-city , Bibri (2020)

Sustainable energy systems	Locally renewable energy—sun, wind, and water
	Bio-fueled Combined Hear Power (CHP) system
	Passive solar houses
Sustainable waste management	Smart waste collecting system
	Vacuum waste chutes system
	Food waste disposers
	Wastewater and sewage treatment system
High performance infrastructure	Component and multifunctional optimization
	Integrated design
High performance buildings	Energy efficiency technology and renewable energy resources
	Improved indoor environment
	Pollution prevention, material reduction, and recycling
Sustainable transportation	Cycling and walking
	Public transport (metro, buses, tram, etc.)
	Car pools (biogas and electric)
	Mobility management
Greening and ecological diversity	Multi-functional green structure for ecosystem services
	Green factor planning tools

Long time ago the rise of urban settlements, architects, landscape architects, planners urban theorists and historians have sought methods of combine nature into the built environment. The evolution of ecological planning can be traced back to the early works of many architects and planners (Olmsted,2013).

The environmental movement emerged into a broader context In the 1980s. Great technical advances were made in the harnessing of solar and wind energies as renewable sources of power, and many environmentally friendly projects were undertaken. These ideas were extended in the 1990s and resulted in the emergence of the eco-city concept, which aims to create livable and walkable communities. By the beginning of the twenty first century, ecological planning emerged as an expression of a sustainability world-view, which seeks to integrate the human and natural ecosystems. All of the abovementioned theories laid the foundation of the ecological planning theory and they additionally contributed to shaping many other important planning concepts (Shu-Yang,2004,Ahern,2013). As stated by Steiner, (2000), planning is “a process that uses scientific and technical information to build consensus among a group of choices”. Ecology is the study of interaction between living organisms and their environments. Ecological planning then is defined as the use of biophysical and socio-cultural information derived from this interaction as decision- making opportunities and constraints in the management of ecological systems. Ecological planning is a broad concept based on strategies and methods to create green, safe, vibrant and healthy urban environments (Steiner,2000). It is an important planning tool in the establishment of sustainable cities. As stated by Ndubisi, (2002), “ecological planning is more than a tool: it is a way of mediating the dialogue between human actions and natural processes based on the knowledge of the reciprocal relationship between people and the land. It is a view of the world, a process and a domain of professional practice and research within the profession of planning”(Shu-Yang,2004.Steiner,2000).

Urbanization considered as a result of industrialization and technological progress. However, within the industrialization development and technology advance, the billow in urban population and the growing extension of the scale of city will necessarily rise, too. Although the urban areas records for only 2% of the Earth's land surface, but they generate greenhouse gases 78 percent of the total greenhouse gas emissions. Therefore, the development of urban has a greater effect on climate and environmental change (Grimm,2000). This effect is mainly from two aspects. The first one, the city's development is bound to occupy a lot of land and consumption other natural resources, and this will undoubtedly cause a certain degree impact on natural ecosystem. The second, the development of city will have a greater effect on the biochemical cycle on the Earth, and this will cause a confirmed extent adverse impact on natural ecosystem, particularly biodiversity, but moreover its impact goes far beyond the range of the city itself (Grimm,2000).

II. Material And Methods

The aim of this study is to take advantage of all the environmental, climatic and geographical factors that characterize Jordan. The study is based on analyzing Jordan's location and geographical, climatic, demographic and environmental characteristics and the plant species found in it by the maps, and analyzing environmental problems that Jordan is exposed to, such as gas and carbon emissions, high electrical energy consumption and scarcity of water resources.

After mentioning all the data obtained from the geographical nature, climate, precipitation rate, population gathering places and environmental conditions in Jordan, it is possible to predict and extract suitable places for Eco-City according to sustainability principles and conditions.

This study gives an overall expectation of the locations of Eco-Cities in Jordan to derive the highest percentage of benefits from the existing environmental factors by using GIS Maps from Atlas of Jordan as a source for map borders and locations, then analyzing maps in layers form. In order to protect Jordan's limited resources and take advantage of its distinctive desert climate as much as possible, a genuine sustainability plan must be drawn up, based on environmentally friendly natural resources, to protect the remaining ecological systems and not harm them in the future. And to solve the problem of water scarcity and drought and rely on water-saving systems in buildings, such as the Eco-City Strategies

Analysis and Working Steps:

- 1- Determination of suitable factors and conditions for eco-cities.
- 2- Choosing a case study that is "Jordan" and examining the general condition of climate, region, geography, precipitation, population centers and vegetation.
- 3- Relying on certified and documented maps of approved sources for Jordan.
- 4- Layering the maps in order to obtain common areas that meet the eco-cities requirements.
- 5- Obtaining a high-yielding public space proposal for the eco-city, which can be examined and provide further details for future research.

THE LOCATION” STUDY AREA”

The Hashemite Kingdom of Jordan is located in Western Asia between latitudes 29° and 34° North and longitudes 34° and 40° East. The geographical coverage of the country is approximately 89,287 square kilometers, covering a large area of climate and ecoregion where the country's population (about 8 million, of which 1.3 million Syrians) is concentrated mainly in the west (CIA World Factbook).

Jordan is divided into four main geographical and climatic regions (Fig. 2)(Atlas of Jordan, 2013):

- Jordan Valley,
- Mountain Hills Plateau,
- eastern desert or Badia region
- The steppe region between Badia and the Highlands.

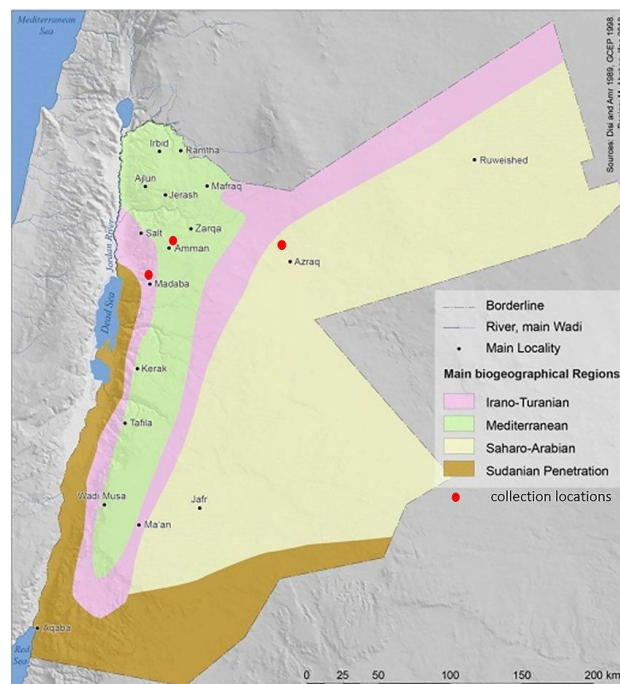


Figure. 2. Map of Jordan showing the biogeographical regions, source: Atlas of Jordan, 2013.

Jordan is a resource-constrained country that is struggling more with desertification, drought and land degradation. 75 % of the country is arid and less than 5% of the total land area is arable. Jordan experiences periodic droughts and is considered the third most unsafe country in the world. Population growth, unsustainable land use, urbanization, industrialization and additional pressures from climate change continue to increase their vulnerability in the areas of agriculture, livelihoods, nutrition and food security, and environmental sustainability (FAO, 2019).

CLIMATE AND WATER CONDITION

The climate in Jordan is highly variable. Western Jordan has a Mediterranean climate with hot and dry summers, cool and rainy winters, and two short transitional seasons. About 75% of the country can be described as having a desert climate with less than 200 mm of precipitation annually (Jordanian Ministry of Agriculture,2018). Four major bioclimatic or biogeographic regions are recognized in Jordan: Mediterranean, Irano-Turanian, Sahara-Arabic, and Sudanese (representing tropical penetration) (Kasapligil 1956; Jordan Country Study 2000a, 2000b; Long 1957; Al-Eisawi 1985, 1996). Mediterranean bioclimate region dominates the mountainous regions of Jordan, from Irbid in the north to Ras al-Naqb in the south. It is usually associated with altitudes above 700 m, but is found at lower altitudes in the north, where precipitation is higher. The soil type is predominantly Terra Rossa and yellow Mediterranean soil (Rendzina). It has the best land and highest tree cover for rain fed arable farming and horticulture. 90% of the modern human population lives in this region (Atlas of Jordan, 2013).

Therefore, the Mediterranean climate region, which is the most suitable in terms of climate and vegetation and rainfall suitability, was considered as the ideal region for the existence of eco-cities. Although other areas are less suitable.

For centuries, the settling of communities in modern Jordan was concentrated in the highlands and in the Jordan Valley (in the north-west of the country) leaving arid regions unpopulated. From the twentieth century, natural population growth and migration as well as improved irrigation techniques and road networks led to the settling of more than a hundred communities beyond the Ma'mura, in areas with less than 250 mm annual rainfall as shown in (Figure 3) . During the twentieth century, the implantation of communities spread considerably in the Jordan Valley with the arrival of Palestinian refugees and improved irrigation techniques. The (Figure 4) shown Settlements which spread towards the east, with the proliferation of well drilling in the areas of Mafraq and Azraq, and along the road to Iraq. So although most communities still settled in areas with sufficient rainfall, this was no longer always the case (Atlas of Jordan,2013).

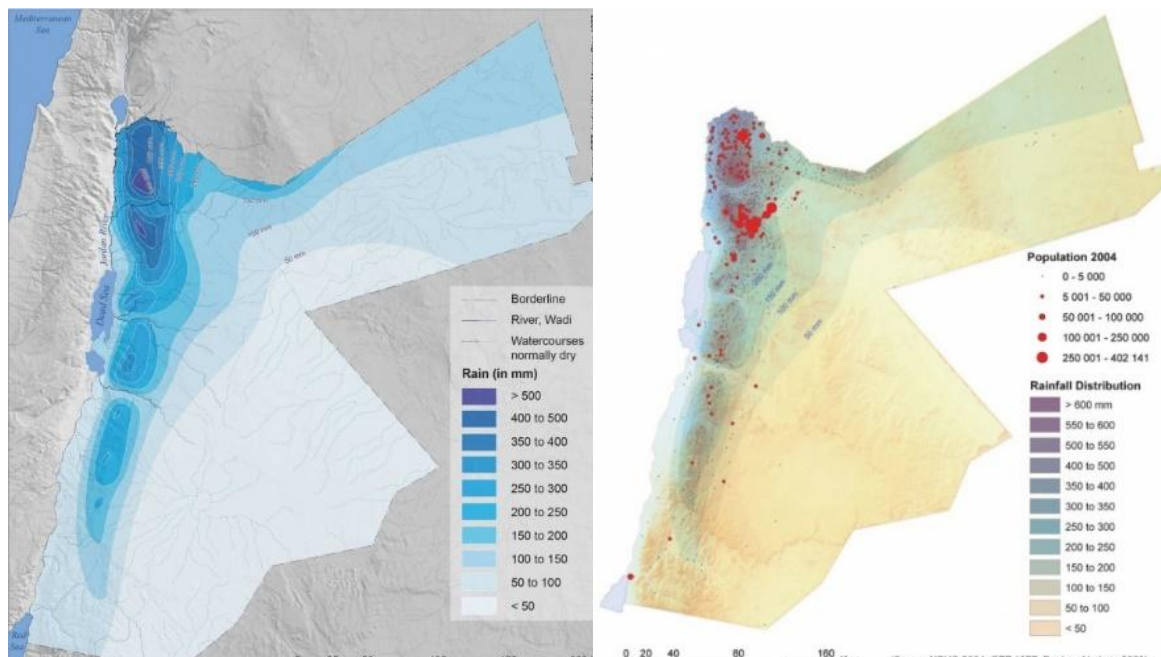


Figure 3. Map of Jordan with Average Rainfall , source Atlas of Jordan, 2013.

Figure .4. map of Correlation between rainfall and population distribution, source Atlas of Jordan,2013.

Jordan is shown as one of the ten most water-stressed countries in the world (Figure6). Jordan struggles with water pressure as a result of the country's drought, recurrent droughts and rapidly increasing population

demands (Drought conditions and management strategies in Jordan, 2014). The country relies heavily on groundwater to meet the demands of its population.

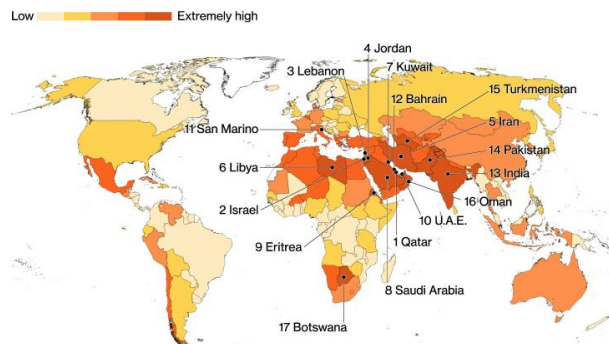
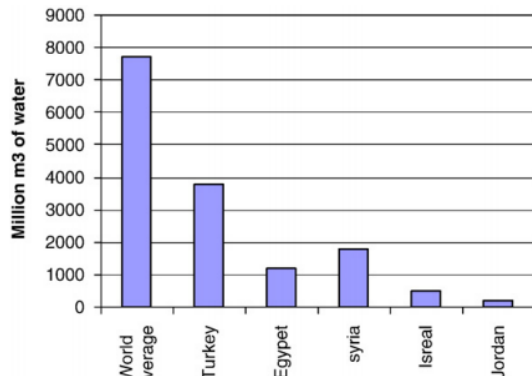


Figure 5. Comparison of annual water share between Jordan and some of Jordan's neighbors, source: Hadadin et al.,2010.

Figure.6. map of the Most at Risk From a Water Crisis, Jordan number “4”, source: World Resources Institute’s Aqueduct Water Risk Atlas ,2019.

Jordan is prone to periodic droughts. The most recent and worst drought period the country faced was from 1998 to 2000, which caused severe economic and environmental losses. According to the Aligned Action Plan to Combat Desertification in Jordan, climate change is likely to increase the country’s exposure to drought and may adversely influence vulnerable ecosystems like forests and fresh water communities (The Aligned Action Plan to Combat Desertification in Jordan 2015 – 2020.)

ENERGY AND CO2 EMISSIONS STATUS

Jordan consumption of primary energy is mainly composed of crude oil and imported electricity. But Jordan is blessed with an abundance of solar energy which is evident from the annual daily average solar irradiance (average insolation intensity on a horizontal surface) ranges between 4-8 kWh/m², which is one of the highest in the world. This corresponds to a total annual of 1400-2300 kWh/m²; with the average sunshine duration is more than 300 days per year (Alrwashdeh,2018). Jordan's suitable location to exploit solar energy enables it to generate electricity and use alternative energy that is environmentally friendly well using solar panels.

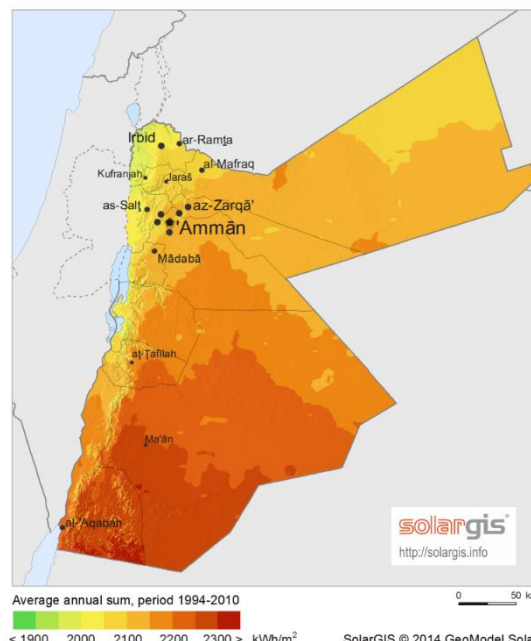


Figure.8.map of The rate of solar radiation in Jordan, source : GHI Solar Map ,2014 .

Because of fossil fuel and different resources, in 2020, CO2 emissions for Jordan was 26.5 million tonnes. CO2 emissions of Jordan increased from 2.8 million tonnes in 1971 to 26.5 million tonnes in 2020 growing at an average annual rate of 5.04%. (WORLD DATA ATLAS ,2021).

PRESENCE OF VEGETATION

Jordan encompasses a large number of plants commensurate with the diversity of its climate. These plants are suitable for mountainous nature or desert areas that do not need large amounts of irrigation water. In order to be suitable for projects in accordance with the green building concept, it is recommended to plant plants that are suitable for the nature of the area and do not require high water or soil. Examples of plants recommended to be grown in Jordan in (Table 2) are:

Table no 2 : Types of plants and vegetation that suit Jordan's climate and annual rainfall , source: The Plants Of Jordan An annotated checklist,2016.

The Biogeography	The location	The vegetation
Irano-Turanian regional centre of endemism	Turkey, most of Syria, parts of Lebanon, Israel, Palestine, N Sinai, N Jordan, N Iraq	<i>Alysum marginatum, Cardaria draba, Heterocaryum subsessile, Hyocyamus pusillus, Ixioliron tataricum, Ziziphora tenuior, Scorzonera pusilla, Anchusa strigosa, Artemisia sieberi, Ducrosia anethifolia, Gundelia tournefortii, Linum album, Minuartia picta, Pistacia khinjuk.</i>
Saharo-Sindian regional zone	Saharo-Sindian , Arabian regional subzone , Nubo-Sindian local centre of endemism	<i>Anastatica hierochuntica, Gymnarrhena micrantha, Neurada procumbens, Notoceras bicorne, Savigna parviflora</i>
Arabian regional subzone + Nubo-Sindian local center of endemism		<i>Anisosciadium isosciadium, A. lanatum, Haloxylon salicornicum, Zygophyllum propinquum, Paronychia Arabica, Trigonella glabra.</i>
Mediterranean regional center of endemism	Occupies most of western Jordan, mountains and Jordan valley	coniferous forests of Aleppo pine (<i>Pinus halepensis</i>) and Callabrian pine (<i>Pinus brutia</i> — not in Jordan); and dry oak (<i>Quercus</i> spp.) woodlands and shrubland formations. Olive (<i>Olea europea</i>), carob (<i>Ceratonia siliqua</i>), oak (<i>Quercus coccifera</i> — most widespread), pistachio (<i>Pistacia palaestina, P. lentiscus</i>), and <i>Arbutus andrachne</i> are the principal species. In addition, <i>Phillyrea latifolia, Pistacia terebinthus, Calicotome villosa, Genista acantha, Rhamnus oleoides, Myrtus communis, Laurus nobilis, Styrax officinalis, and Spartium junceum</i> also occur.

III. Result

The proposed area is part of the southwestern region and northeastern region of Jordan, located in the provinces of Tafileh, Ma'an and Karak city, these results include collecting specialized maps, analyzing the information on them, working in layers and common areas suitable for green building and eco-urban conditions.

In Terms Of Rainfall Average :

As the first layer appears (The Number 1), The Average precipitation in the proposed area ranges from 200 to 350 mm, which is considered good for the rest of Jordan. Special wells can be built to collect rainwater in winter and use it in summer.

In Terms Of Solar Radiation:

As the second layer appears (The Number 2) ,The layer that appears in the map is the best area for solar radiation, and in which the efficiency of benefiting from solar radiation is high, so:

- 1- The area is suitable for utilizing solar radiation to generate electricity using solar panels.
- 2- Use daylight in the morning and save energy used for lighting.

In Terms Of Geography And Climate:

As the Third layer appears (The Number 3), It is a Mediterranean regional climate and suitable for the cultivation of various plant species mentioned in the previous table. In addition, it is possible to plant various plant species suitable for the region in home gardens that do not need abundant irrigation water.

The soil type is moderately developed, mostly red, clay-rich, B-horizon, usually primary or secondary calcium carbonate-rich soil in Jordan.

In Terms Of Population Centers:

As the Fourth layer appears (The Number 4), the population density in these areas is low, which makes it possible to build or house a large area as open gardens to grow crops and reduce carbon emissions and harmful gases.

Therefore, when collecting the characteristics of the areas studied by means of maps and geographical elements, rain, population and solar radiation, which are essential components in reliable sustainability, renewable energy

generation and reducing pollution emissions, and as shown in the model Shown in (Figure 8), it has been found that there are common areas in which we can combine these elements together in specific areas to obtain the highest efficiency achieved for the establishment of eco-cities.

The proposed model also shows that the appropriate area is an area with a small population density, which helps to establish regions and cities from the beginning and according to the environmentally and planning appropriate terms and proposals.

As (Figure 9) is the result of collecting these areas and extracting the investigator for the conditions and what is appropriate from an environmental and planning point of view in general.

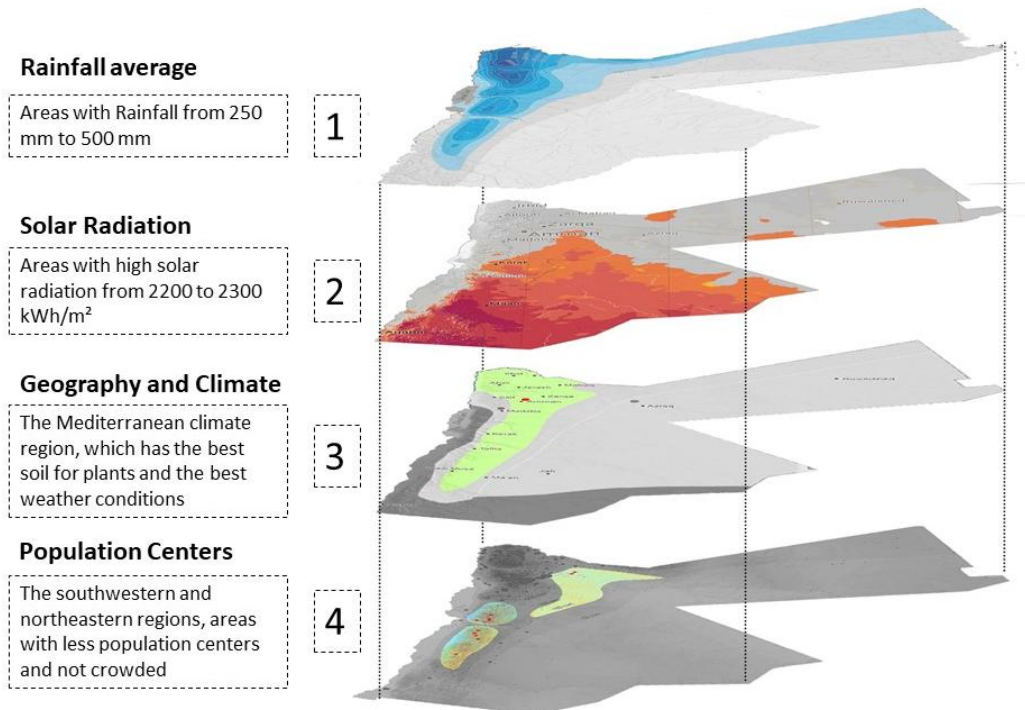


Figure .8. select the Eco-City Location and Analysis by layering the maps, Editing and Modeling by Researchers.

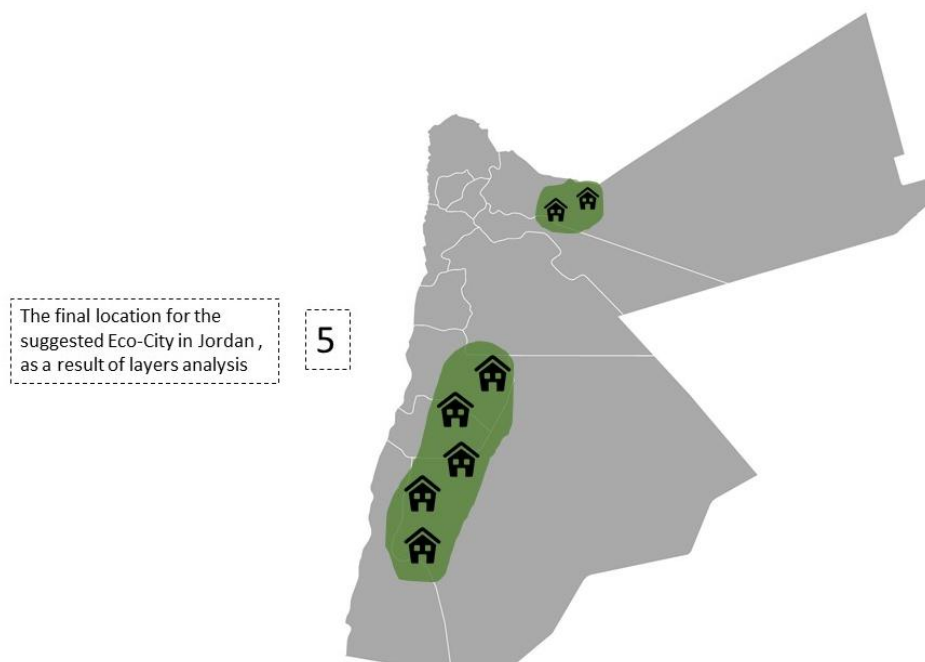


Figure .9. map of The final location for the suggested Eco-City in Jordan , as a result of layers analysis , source: Researchers.

IV. Conclusion

Today, eco-cities are multiplying by many countries with application examples in various parts of the world. Among these; Germany-Freiburg, Australia-Moreland Eco-city, China-Tianjin Eco-city, Denmark-Kalundborg Industrial Park, Germany-Vauban, India-Karakal Eco-city, Hong Kong-Hung Shui Kiu Eco-city, Cleveland -USA, Curitiba-Brazil, Toronto-Canada, Vaxjo-Sweden, Sydney-Australia, Kampala-Uganda, Puerto Princesa-Philippines, Masdar Eco-City-Abu Dhabi eco-cities can be given as examples.

In order for ecological planning to be implemented, the existence of a region that has not yet been settled is required. While making land use decisions in these regions, it is necessary to determine the most suitable places and to plan a physical structuring for all systems in nature within the framework of order and harmony, and this process should be strictly controlled. Although it is not possible to provide an ecologically based life altogether in existing cities, mechanisms that will provide order and harmony between the natural system and human needs can be partially implemented in various regions of the city. Achieving an ecologically based urban structure in these cities will be possible with policies and practices that will be shaped over time.

If we rely on Tunçer's (1994) approach in evaluating the proposed Eco- city in Jordan, we found several common points that can be summarized as follows:

Table no 3 : A Result of comparative study between the approach of the Tunçer and the proposed study for the location of eco-cities in Jordan .

The Main Principles That Determine A Sustainable City Center , Tunçer (1994)		The Proposed Eco-city In Jordan	
The Most Effective Use of Microclimatic Data	Sunbathing, wind directions, heat, radiation etc. The effective use of energy saving in planning, urban design and architecture.	The energy of solar radiation and heat has also been exploited, and the wind intensity in the proposed area is suitable for generating clean energy	Highly Suitable
Energy and Material Conservation	Making arrangements to ensure minimum use of energy in reaching the central business area, in its internal circulation, in designing the lighting/heating/ventilation, etc. microclimatic environment (environmental/building scales) of the central business areas.	The appropriate climate was taken into account	Highly Suitable
Energy and Waste Recovery	Electricity, solar, natural gas etc. used in central business areas. technologies related to energy recycling, on-site separation of wastes (solid/liquid garbage, solid liquid biological wastes, etc.), use of recycling technologies.	Some environmental determinants have been addressed. As for recycling and the ways to apply it, they are planning treatments.	Suitable But Needs Development
Development of Energy and Material Resources	Use of solar energy in heating and lighting in buildings; the use of bio-mass energy, electricity, and alcohol-powered environmentally friendly vehicles in central business areas; use of waste as heating/fuel; recycling of recyclable wastes (paper, glass, metals, chemicals, etc.) by establishing a separation facility, using the existing building stock in the area until the end of its economic life as much as possible, then making maximum use of the material, etc.	Exploitation of solar radiation in the processes of generating renewable energy and reducing dependence on fuel, as the energy resulting from radiation can be used for lighting, water heating and daily work	Highly Suitable
Using Topographic Data	Minimizing the infrastructure and superstructure problems arising from the land. Evaluation of geological structure and soil capability.	An appropriate geological area has been selected, which is the Mediterranean region, as the type of soil in it is the best soil for agricultural work and is suitable for the basic environment.	Highly Suitable
The Most Effective Use of Natural Resources	Today, the existing vegetation, stream, flora, fauna, etc. Evaluation and development of natural resources. Increasing the green standards for central business areas per capita as much as possible, keeping the green ratio in squares/areas/buildings high.	They are the most suitable places for plants due to the excellent soil type available in them, and the high rainfall, which provides an economic and natural irrigation method.	Highly Suitable

Evaluation of Vegetation	It is the development and use of the existing vegetation in planning, the research of plant species native to the region. The ecological planning system is the primary planning action that should be used in the realization of all these principles that determine a sustainable city center, in the prevention of environmental problems and in the protection of resources.	Suitable for plants	Highly Suitable
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The best recommended location for an Eco-city in Jordan depends on several factors such as solar energy, precipitation, soil type, vegetation and population density.

Adopting the eco-city idea throughout a site works to reduce environmental damage and, as we mentioned earlier, the ever-increasing harmful gases and carbon emissions in Jordan. The possible solution is therefore to reduce the emissions of the building sector and transform the ordinary building into a green building that can adapt to the environment and protect the health of users and residents. The idea of eco-cities is a sustainable idea that needs to be reconsidered, and the seriousness of its implementation and the selection of the appropriate area with high efficiency are the basis and essence of sustainability. For Jordan, sustainability and reducing environmental and economic public costs are among the priorities of life, as it is a country with limited resources and suffers from water scarcity.

This study gives a general idea about the areas where we can use and benefit from the environmental elements for the benefit of the users, and are general recommendations that can be strengthened and studied in detail in the future.

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