

Uncontrolled Urban Expansion of Amman City and the Disintegration of the Rainfed Lands

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Abstract Jordan is one of the arid and semi-arid regions with about 10 million inhabitants in the year 2016. Rainfed land which represents a major source of crops and vegetable, is facing a critical reduction due to the unexpected increase in the population, unexpected urban expansion and economic growth. The issue of rainfed lands exploitation in the Middle East and North Africa (MENA) region and particularly in Jordan is of prime importance for the development of the region in the future, considering the political instability in the region. In this article, the current problems are reviewed and research efforts is conducted to describe and to tackle this issue.

Keywords Rainfed land, Land use, Water Scarcity, Urban development, Urban agriculture, Jordan

1. Introduction

The scarcity of freshwater in Jordan and the continuous increase in demand plays a major role in the development of Jordan. The water resources in Jordan consist of groundwater and fossil water which extends in aquifers at different depths through the country. The groundwater in Jordan represents the major source of drinking water. The water resources in Jordan mainly depend on rainfall, which is subjected to great variability. Meanwhile, there is an observed population growth, so there is high demand for water [1, 2]. Jordan is marked by sharp seasonal variation in both temperature and precipitation [3, 4]. Jordan is one of the arid and semi-arid regions where 90% of the country receives less than 200 mm of annual rainfall (Figure 1). The Area of Jordan is about 90,000 km², were the agricultural land represent about 10% of the total land area. Twelve percent of this area have been over taken by urban expansion over the last few years. Whereas, 13% represents forest and woody areas, leaving only 63% for actual plantation. However due to the sever scarcity of water and limited annual rainfall quantity, only half of this land is used for agricultural activities. Only 5% of the total area is used for planting cereal and other crops, fructiferous and variable vegetables, covering 9%, 26% and 32% respectively. Whereas, 33% are bare lands not used for any other agricultural activities. Such areas are subjected to various climate conditions and misuse of civilians and habitants through dumping waste materials effecting the quality of soil

and groundwater and surface water. The area is of major concern to the World Bank in terms of enhancing sustainable development in all regions [5].

One of the characteristics of the Mediterranean region and therefore Jordan is the presence of a wide use rainfed plantation which reduces the high demand of water usage for agricultural activities. However, the current scenario shows a rapid drop in the quantity of such lands for the favor of uncontrolled urban expansion. For example, lands used for rainfed plantation have been minimized to a great extent in the last century. Figure 2 shows the drastic change in such areas in Amman, when comparison is made between the third decade of the last century with the present time.

2. Discussion

Any successful regional planning should take into account both urban development as well as maintaining the agricultural lands including forests, woods and natural reserves. Such balanced control and limitations on the light of the limited water resources will be an extra asset for the overall sustainable development. However, the concept of urban agriculture arose in the last few years creating a wide scope of production for self consumption and maintaining agricultural lands side by side with the urban development [7, 8].

The term rainfed agriculture is used to describe farming practises that rely on rainfall for water. It provides much of the food consumed by poor communities in developing countries. For example, rainfed agriculture accounts for more than 95% of farmed land in sub-Saharan Africa, 90% in Latin America, 75% in the Middle East and North Africa; 65% in East Asia and 60% in South Asia.

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Published online at <http://journal.sapub.org/arch>

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Middle East and North Africa (MENA) region with Land area about 15.5 million Km², is considered to be the most water scarce region in the world, with the highest levels of water deficit (Fig. 3). Desert land prevails over 85% of the

region land area with annual rainfall is less than 25 cm. MENA hosts about 5% of world population with only 1% of the world's renewable water resources. The MENA region falls far below the global average of 8000 m³ per year).

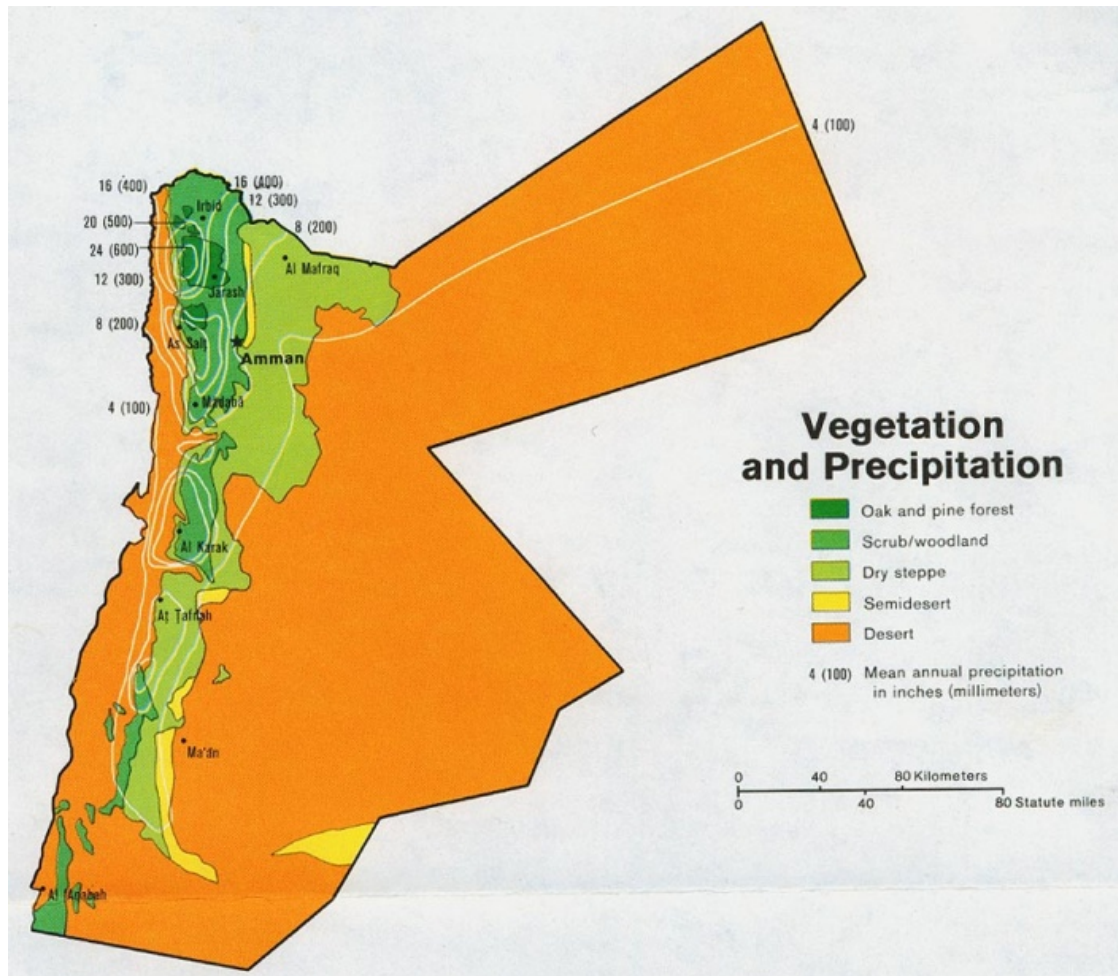


Figure 1. A Vegetation and annual rainfall in Jordan [6]

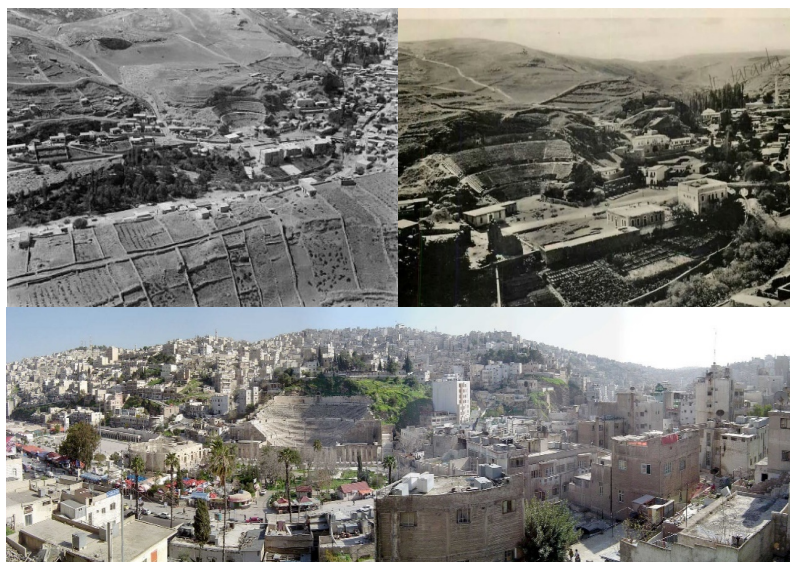


Figure 2. Land use drastic change: Amman between the present and the past

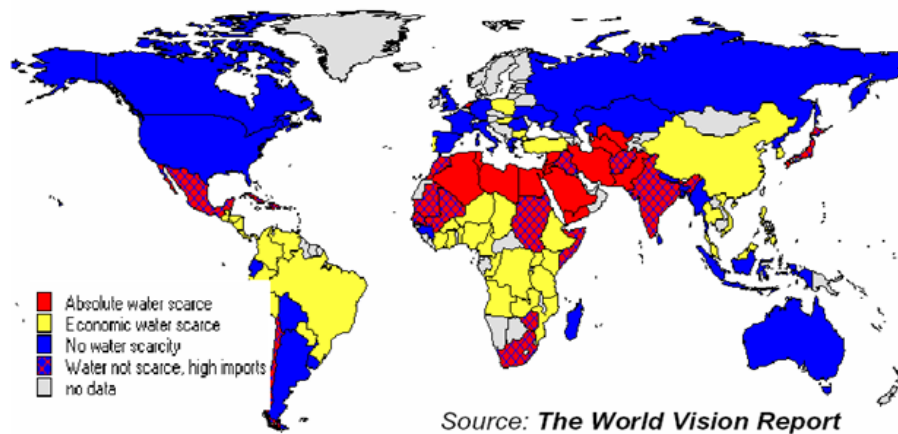


Figure 3. Absolute Water Scarcity by 2025 [9]

The fertile lands decreased by 86 km², which represents 23% of loss [10]. The urban/built-up area class increased from 9% in 1987 to 13% in 1999, and then to 20% in 2005. Agricultural land class, however, decreased significantly from 11% in 1987 to 6% in 1999 and remained with slight changes in 2005 [11].

The results as indicated by Rawashdah and Saleh [10], show that the urban/built up areas increased from 174 km² in 1987 to 260 km² in 1999, and then to 394 km² in 2005, showing an expansion of urban/built up areas of 220 km² from 1987 to 2005. In contrast, agricultural land occupied about 205 km² in 1987, decreased to 115 km² in 1999 and then to 106 km² in 2005, indicating a decrease of 99 km² from 1987 to 2005. On the other hand, bare land slightly increased from 1394 km² in 1987 to 1411 km² in 1999 and then decreased to 1292 km² in 2005, a record loss of 102 km² during the 18 years (Table 1).

Table 1. Results of land use/cover classification statistics for 1987, 1999 and 2005, after [11]

Class Name	1987		1999		2005	
	km ²	%	km ²	%	km ²	%
Urban/ built up areas	174.2	9.0	259.9	13.4	394.3	20.4
Natural vegetation	118.1	6.1	115.8	6.0	109.4	5.7
Water	2.75	0.14	3.57	0.18	4.21	0.22
Bare land	1393.6	71.9	1410.9	72.8	1292.2	66.7
Forest land	44.0	2.3	31.8	1.6	31.3	1.6
Agricultural land	204.6	10.6	115.1	5.9	105.7	5.5
Total	1937.2	100	1937.1	100	1937.1	100

Seasonal rainfall is the main source of water in the Kingdom which is highly variable. It only occurs in the mountainous range in the north-west with annual variability affects rain fed agriculture, ranges, livestock, groundwater recharge and surface water storage.

Agricultural land use in Jordan confronts three main issues;

(1): land use legislations which allow the fragmentation of agricultural land into smaller parcels facilitating changing the land use nature; (2): on the one hand, unjustified cities and villages horizontal expansion disintegrating the agricultural lands, and on the other hand, integration of nearby municipalities which facilitates the disintegration of the agricultural lands. This is implemented under the concept of land use development and utilization instead of formulating a strategic plan for development, and (3): excluding the Ministry of Agriculture from the participation in the decision regarding the land use and reuse amendment [12].

3. Conclusions and Remarks

Water scarcity is the most important natural constraint to Jordan's economic growth and development. Unprecedented demands on water resources with the rapid increases in population and the accelerated industrial development make the total annual demand approaching one billion cubic meters which approximately represents the limit of Jordan's renewable and economically developable water resources.

In order to highlight the severity of changing the agricultural land use, it is worth mentioning that the overall urban spaces in Amman and around areas is about 837 km² theoretically enough to accommodate 16 million inhabitants. At present these areas accommodate 3.3 million inhabitants and expected to touch 4.5 million by 2020. In addition, the land use and reuse is highly effected by several legal references (more than seven) controverting each other in terms of responsibilities and legal authority creating a huge gap in establishing integrated cooperation between different entities [12].

In the last two decades, the urban planning consumed large area of lands traditionally used for rain fed (non-irrigated) cultivation. This pattern created more stress in the limited water resources and reduced the quantity of vegetables, fruits sessional crops and cereal available for local people. The farmer became more dependent on the

underground water resources in the light of low rainfall rates and drastic climate change.

Observing Jordan natural map showing land use (Figure 4) and annual rainfall distribution (Figure 1), it is advised to shift the urban planning expansion to the east and south east of the kingdom (Fig. 3). Three main factors should be considered in order to control the urban, population expansion such as refugees' camps and selection of utilities location, such as waste landfills and wastewater treatment plants. These factors should include detailed investigation on the soil type, topography and amount of the annual rain fall. This probably will limit the miss use of lands using non-irrigated techniques which again, will substitute other irrigated lands with extra water. Such rainfed land may be considered as controlled conservation land by law.

The eastern and south eastern regions in Jordan shall have great opportunity to best use renewable energy generated

from wind and solar. Such areas should depend on wastewater treatment in irrigating a wide range of plants. Major policy reforms are needed to keep and maintain the rainfed land in Jordan, particularly in Central and Western Hill. The policy should consist of the followings:

1. Adopt an integrated approach to land use management;
2. Promote policy reforms to encourage farmers to shift to non-irrigated crops;
3. Adopt a sustainable land use strategy;
4. Encourage vertical building expansion instead of horizontal, particularly in the rural areas;
5. Centralize land use management responsibility;
6. Promote cooperation for sustainable management of land use;
7. Adopt urban agriculture concept.

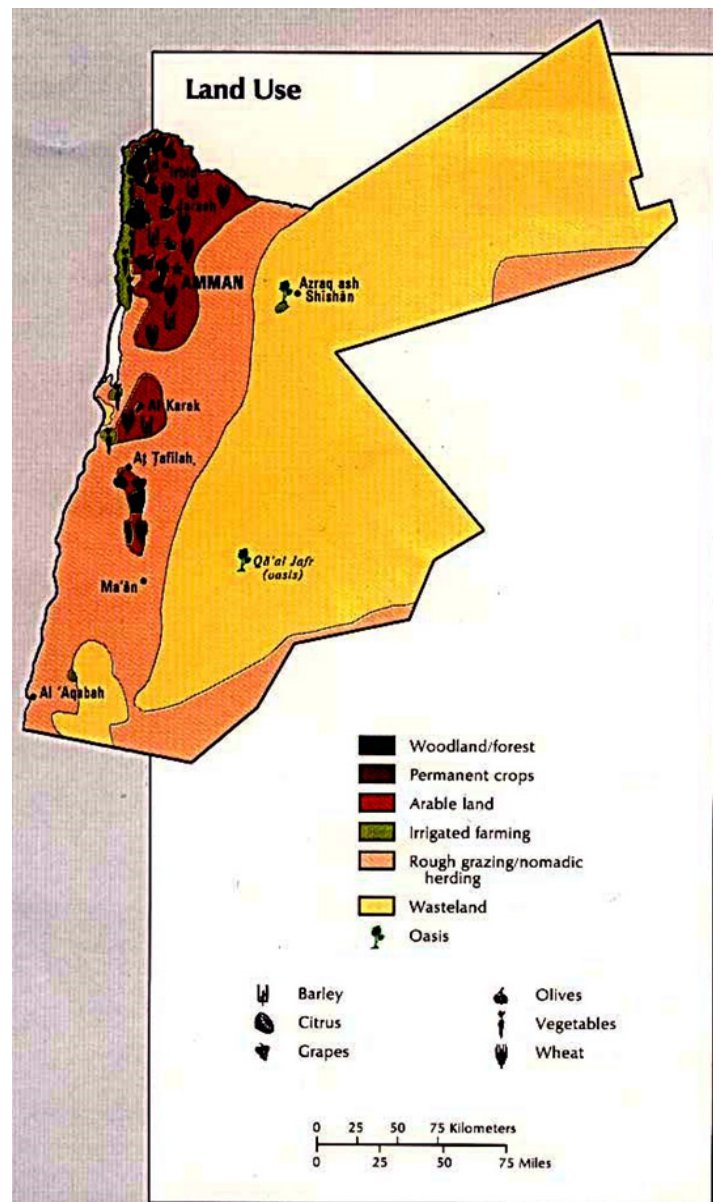


Figure 4. Land Use in Jordan, [13]

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