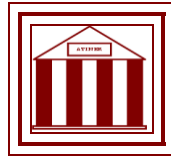


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**ATINER's Conference Paper Series
GEL2015-1654**

**Managing the Impacts of Planned
Urbanization on Sustainable Agriculture in
the Kurdistan Region, Iraq**

**Serwan Baban
Professor & Vice Chancellor
Cihan University
Iraq**

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Managing the Impacts of Planned Urbanization on Sustainable Agriculture in the Kurdistan Region, Iraq

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Abstract

The Kurdistan region is capable of producing a wide range of agricultural produce since it possesses a suitable climate as well as significant areas of arable land and fertile soil. However, the Kurdistan Region is undergoing significant urbanization and development since gaining autonomy. The unfortunate reality in developing regions like Kurdistan is that the farmland is often regarded as a reserve for future urban expansion. This is mainly due to the land being relatively cheap; farming seen as hard work for town dwellers and lucrative development schemes.

Research indicates that cities as well other main settlements have historically evolved on the most suitable soils for agriculture due to the society being agricultural in nature. However, the paradox is, that as the population grows, the need for urban expansion grows and the latter can only be carried out through squandering productive agricultural land, therefore endangering sufficient food production for the current as well as the growing population. Clearly, there is a critical need to protect the remaining finite amount of good agricultural land. More specifically, it is important that government laws and regulations underline the resource value of good agricultural land and the public obligation to protect it for agricultural use for future generations.

This paper examines the impacts of urbanization and in particular the Master plans on squandering agricultural land as well as endangering sustainable agricultural production in the Kurdistan region. Furthermore, the paper presents a practical science based management approach for managing the issue by proposing guidelines to preserve productive agricultural land and to manage urbanization.

Keywords: Iraq, Kurdistan Region, Protecting Agricultural Land, Urbanisation

Introduction

The Kurdistan region (Figure 1) is capable of producing a wide range of agricultural produce as it possesses a suitable climate as well as significant areas of arable land and fertile soil. The varied geography represented by wide-ranging topography and accompanied by rainfall regimes has produced three basic micro-climatic zones (Figure 2); high rainfall (700-1100 mm), medium rainfall (400-700 mm), and low rainfall (under 400 mm). Examining the distribution of agricultural produce within the region will show general alliances with micro-climatic zones. The high-rainfall zone contains mainly fruit orchards, wheat occupies most of the medium-rainfall zone, and barley is the main crop in the low-rainfall zone. Winter wheat and barley are planted in autumn (October-November) and harvested in late spring (April-June) in accordance with the rainfall pattern (MOA, 2009; Mahdi, 2000).

Historical Archives show that the Kurdistan Region (Figure 1) in the 1960's supplied the rest of Iraq with wheat, chick-peas, apples, peaches, grapes, and other products (MOA, 2009; MOAWR, 2012; Baban, 2012b). Hence, the Region is agricultural fundamentally in nature and tradition, the agricultural sector is a deeply rooted aspect of the society and economy in the Kurdistan Region (MOAWR, 2012; Baban, 2005, 2014). Evidently, agriculture is an important sector for the economy and it could become an important public revenue stabilizer at a time when the oil revenue is particularly volatile putting the government and its programs at risk (Baban, 2013).

The Kurdistan Region has developed significantly since gaining autonomy despite the extremely challenging geopolitics, national trauma and harsh economical circumstances (Baban, 2005). However, agriculture is lagging behind and poor performance in the local agricultural production systems makes it incapable of competing in a free market with cheap mass produced food from well-established and funded agricultural producers in the neighboring countries (Baban, 2014). In fact, current agricultural production is not able to meet the actual requirements for the nation. This fact is expressed in (Figure 3), which represents a comparison between real production and the actual needs of the region for crops during 2012 (Baban, 2012a; Baban, 2012b; Baban, 2014).

Figure 1. Location Map



Figure 2. Rainfall Map (Aziz, 2014)

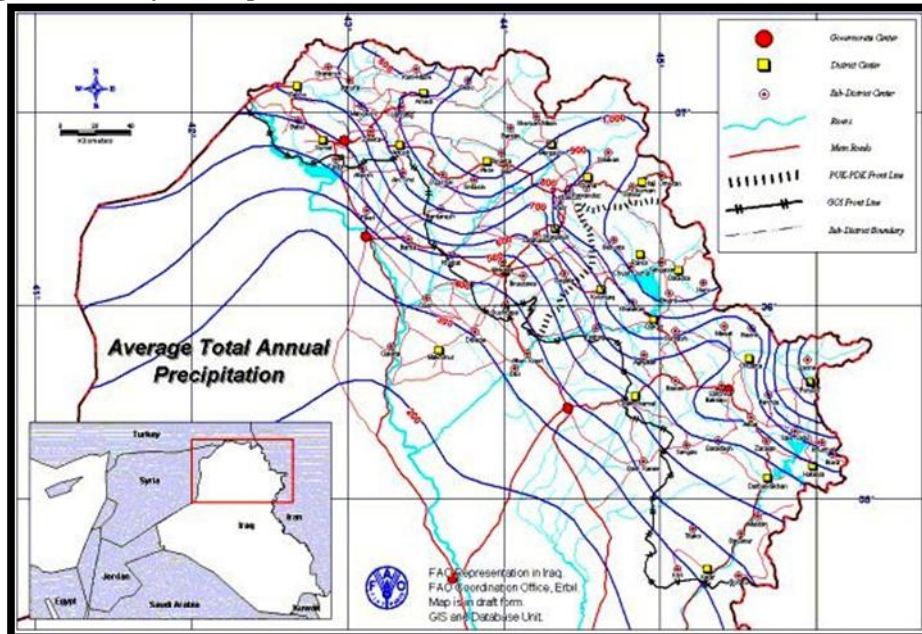
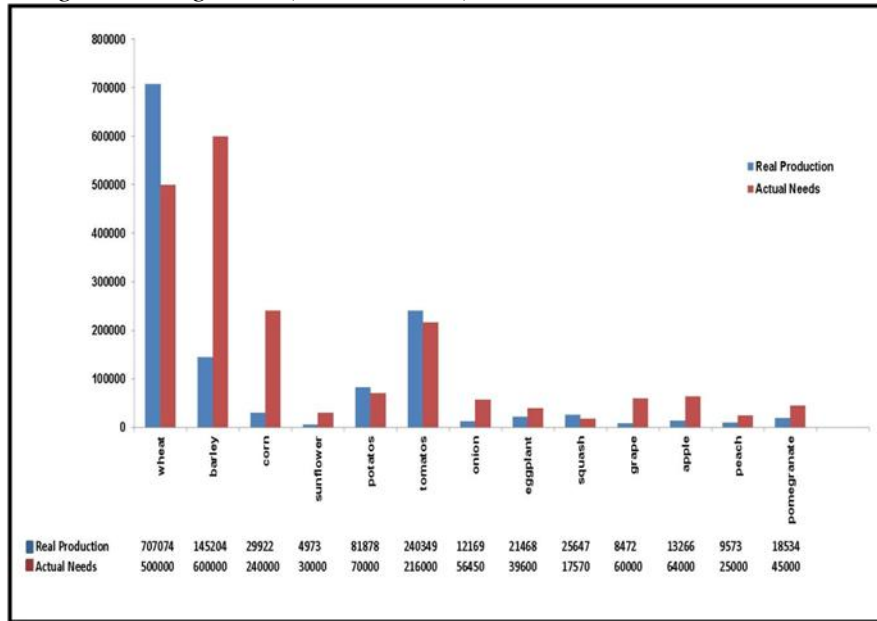


Figure 3. A Comparison between Real Production and Actual Needs for Crops in the Region during 2012 (Baban, 2014)



There are a number of factors that affect the integrity and security of agricultural lands. Primarily there is the loss of land to urbanization: farmland being used for development of housing, office/industrial parks, commercial buildings, etc. Sprawling cities and towns consume vast amounts of land and since most human settlements tend to be located in close proximity to agricultural lands, it is these fertile soils that are most at risk of being lost to urban enlargement (Handel, 1998). Given that fertile soil takes thousands of years to develop and requires the exact combination of climate, geology and biology. Consequently, land suited to food production is a finite and valuable resource as well as public property. Therefore, Agricultural land preservation must be viewed as protecting commercially viable farms and productive agricultural land.

The unfortunate reality is, that, during the initial phases of development, urban expansion, tends to take precedence over food production and farming, hence, agricultural land is often regarded as a set aside for future urban expansion (Baban, 2014). This is the case in the Kurdistan region as it was, for example, in Canada during the early 1970s when it was losing up to 6,000 hectares (15,000 acres) of agricultural land each year. In order to manage this problem, between 1974 -76, the Canadian government established the Agricultural Land Reserve (ALR): a provincially regulated zone in which agriculture is the priority use, farming is encouraged and non-farm uses are restricted. At its inception the ALR protected approximately 4.7 million hectares of agricultural land (Smart Growth, 2005).

In Kurdistan, the loss of farmland continues at a pace, as does the demand from a growing population for more adequate food supplies. Meanwhile, the geopolitical situation and the rising import costs make dependence on food

imports less desirable, unreliable and unsecure. Hence, it is a critical need to protect the remaining finite amount of good agricultural land. More specifically, it is important that government laws and regulations underline the resource value of good agricultural land and the public obligation to protect it for agricultural use for future generations.

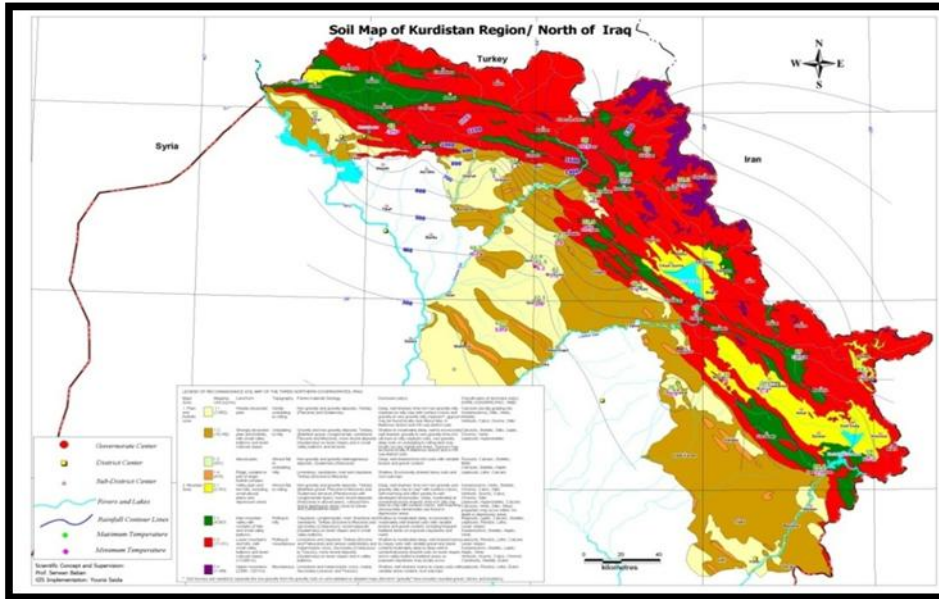
This paper examines the impacts of urban expansion, based on a series of developed Master plans, on squandering prime agricultural land and the ultimate consequence on sustainable agricultural production in the Kurdistan region. Furthermore, the paper presents a practical approach for preserving productive agricultural land and managing urbanization in the region.

Data Preparations

The following datasets were prepared and developed;

1. The Digital Elevation Model (DEM) was obtained from the United States Geological Survey (USGS) website (<http://gdex.cr.usgs.gov/gdex/>). The DEM has a 30 m resolution. The format of the data is raster data. The datum of the data is WGS-84.
2. Climate data were provided by the Ministry of agriculture and water resources of the Kurdistan Region Government, Iraq. The monthly rainfall data for 2012- 2014, as tabular data has been pre-processed using an Excel program, and then it has been post-processed using a Surfer program creating rainfall contour lines with an interval of 100 mm.
3. The soil map of the region was obtained from the Ministry of Agriculture and Water resources of the Kurdistan Region Government, Iraq. The soil map was prepared by the FAO coordinate office in Erbil city, 2001 (Figure 4). The soil map describes the texture, depth and colour of the soil in the region. The data type of this map is in raster format JPG. The scale of the original paper map is 1:1,000,000.
4. Satellite Imagery (Landsat 7 ETM+) was obtained from the Earth Science Data Interface (ESDI) (<http://glcfapp.glcf.umd.edu:8080/esdi/index.jsp>). The image was taken by the satellite on May 19th, 2006. The resolution of the six bands, including bands number 1 to 5 and band number 7, since the raster layer is 30 m. These data are used to describe the land use of the study area. The geo-reference of the satellite image is WGS_84 Datum project 38N.

Figure 4. *The Soil Map Developed by Digitising a Map Prepared by the FAO Coordinate the Office in Erbil City (MoAWR, 2013)*



Examining the Impacts of Master Plans on Squandering Productive Agricultural Land

In order to identify and map potentially suitable land for agriculture in the Kurdistan Region, an earlier GIS based study, mapped the soils based on a land capability classification scheme for agriculture using available information from the Soil Survey Geographic Database (SSURGO) (Baban, in Preparation).

This was fundamentally a mapping approach to present the inherent physical capacity of the land to sustain a range of land uses and management practices without deteriorating any resources over a long period of time (Dent and Young, 1981; Emery, 1986; Sonter and Lawrie, 2007). Hence, the outcome maps represent an assessment of the biophysical characteristics of the land, to the extent that this will limit a particular type of land use, and the current technology that is available for the management of the land (Emery 1986).

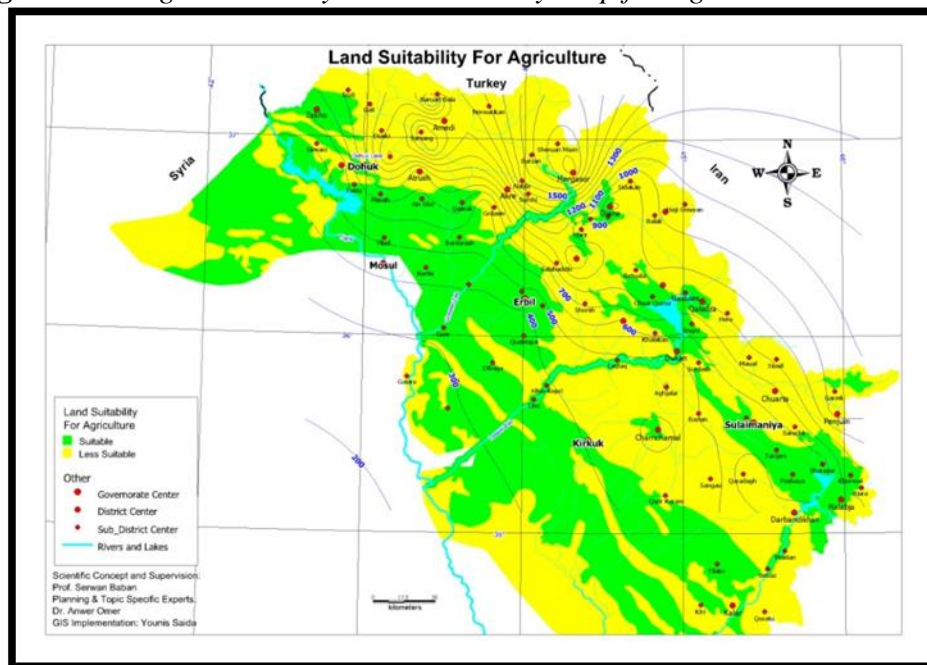
In practical terms, the land capability classification identifies the potential for agriculture by mapping out land using seven classes. The best lands (prime farmland) are rated Class 1, 2 & 3, which support the widest range of crops and the longest growing seasons. Class 7 is considered non-arable, with no potential for soil-bound agriculture (Emery, 1986).

This concept was implemented and produced final binary maps based on reclassifying the 8 classes of land capability into two classes. The first soil classes ranked from 1-4, these are considered as "Suitable", while the other classes (5-8) were considered to be "Less Suitable" (Baban, 2014).

The outputs were four GIS based Land capability maps. One produced for the region as whole (Figure 5) and three maps representing the main governorates in the region. The maps showed clearly that cities, as well other main settlements throughout the region, are located on the most suitable soils for agriculture. This is a confirmation and a reflection of the reality that historically, the society has evolved based on agriculture; hence, the cities and urban centres developed and have been evolving rapidly at the expense of agricultural land (Baban, In Preparation).

Recently a series of Master plans were developed for guiding the expansion of the main cities and settlements in the region. Below are some approximate calculations for the three main governorates, showing the spatial distribution of proposed urbanization, based on the developed Master Plans, for the main cities as well as for Districts and Sub-Districts within each Governorate. The calculations were implemented using GIS technology.

Figure 5. *A Regional Binary Land Suitability Map for Agriculture*



Erbil Governorate

No. of Districts = 5

No. of Sub-Districts =13

Area of Master Plan for Erbil City = 2700 Km²

Area of Master Plan for Districts = 550 Km²

Area of Master Plan for Sub-Districts = 565.7 Km²

The estimated impact on squandering agricultural land as a result of implementing the Master plan for Erbil Governorate is about 1514 Km².

Sulamaniya Governorate

No. of Districts = 9

No. of Sub-Districts =26

Area of Master Plan for Sulamaniya City = 147 Km²

Area of Master Plan for Districts = 785.7 Km²

Area of Master Plan for Sub-Districts =791.8 Km²

The estimated impact on squandering agricultural land as a result of implementing the Master plan for Sulamaniya Governorate is about 4354 Km².

Duhok Governorate

No. of Districts = 5

No. of Sub-Districts =14

Area of Master Plan for Duhok City = 147 Km²

Area of Master Plan for Districts = 471.4 Km²

Area of Master Plan for Sub-Districts = 395.9 Km²

The estimated impact on squandering agricultural land as a result of implementing the Master plan for Duhok Governorate is about 1470 Km².

Using this information, GIS based maps were produced for the region (Figure 6) three further three maps showing the geographical extent of the Master plans within three main governorates of Erbil (Figure 7), Duhok and Sulamaniya (Figure 8).

Figure 6. A Regional Binary Land Suitability Map for Agriculture Showing the Geographical Extent of Developed and Proposed Master Plans throughout the Region

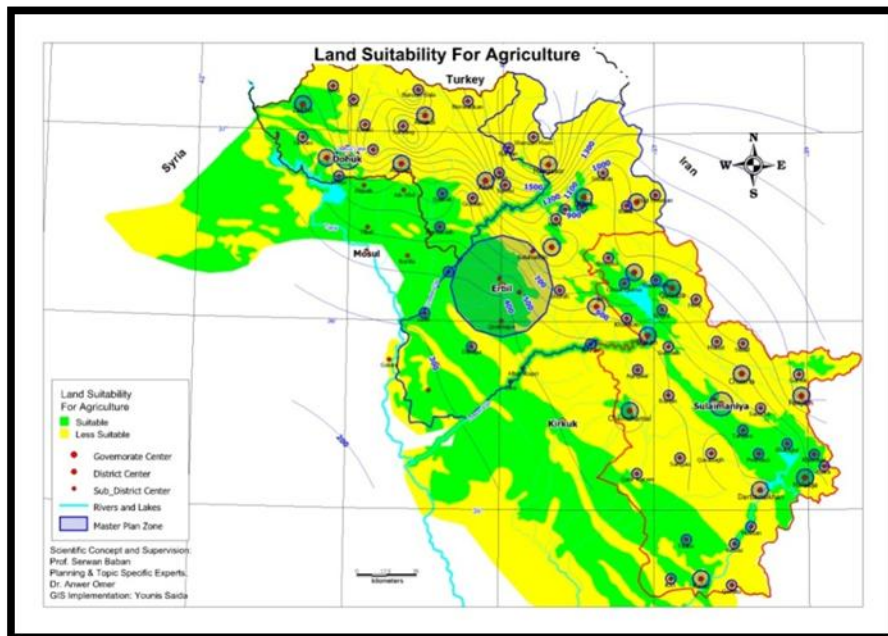


Figure 7. A Binary Land Suitability Map for Agriculture in Erbil Governorate Showing the Geographical Extent of the Developed Master Plan for the City of Erbil

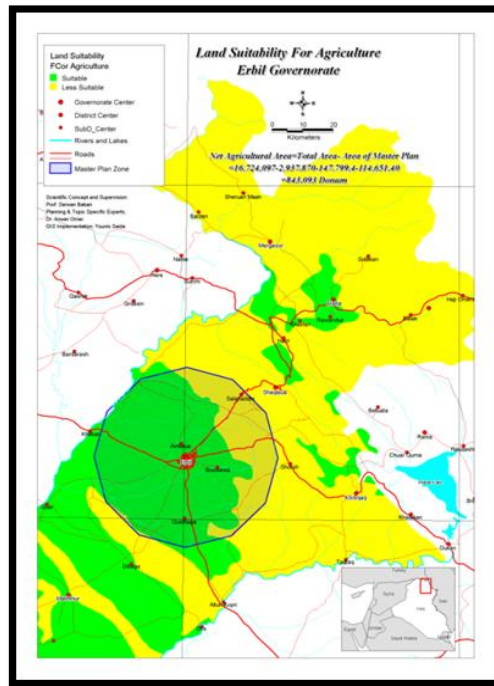
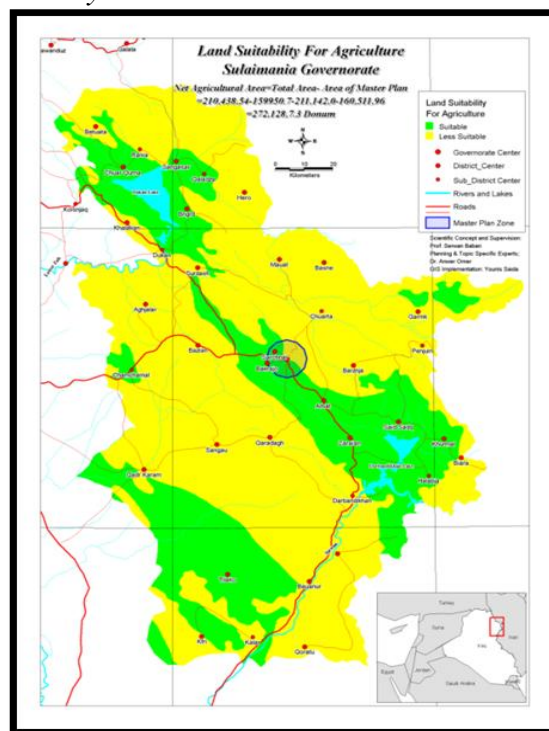


Figure 8. A Binary Land Suitability Map for Agriculture in Sulamaniya Governorate Showing the Geographical Extent of the Developed Master Plan for the City of Sulamaniya



The results show that the main cities and settlements are geographically located on the most suitable soils for agriculture in the local area consequently urban expansion can only be carried out through squandering productive agricultural land. More specifically, the outcomes (Figures 6, 7 and 8) show the loss in productive agricultural land in every governorate when the current Master plans are implemented, making the estimated loss in Erbil, Sulamaniya and Duhok governorates to be around 1514Km², 4354Km² and 1470Km² respectively. Overall this represents 27% of prime land for agriculture in the Region.

Managing the Impacts of Urbanisation on Agricultural Land in Kurdistan Region: A Way Forward

A simple projection indicates that the population in the Region will increase to some 6.2 million by 2018. Given the potential squandering of the agricultural land and the current level of productivity, the Region will not be able to realise the declared strategic objective of realizing sufficient food production for the current as well as the growing population.

It is evident that a significant squandering of prime agricultural land can take place, the developed Master plans have ignored the true impact of urban expansion on squandering agricultural land and could not foresee the paradox that is: the population grows, the need for urban expansion grows and the latter can only be carried out through squandering productive agricultural land. Hence, the need for revising the Master plans and for specific planning schemes, policies and guidelines to protect and preserve agricultural land and to sustainably manage the urbanization process in Kurdistan region.

Protecting and Preserving Agricultural Land in Kurdistan Region

Planning schemes are particularly important in establishing an appropriate framework for the protection of good quality agricultural land. When considering how future development should be represented in schemes, settlement patterns that minimise the squandering of productive farming areas, both directly and indirectly, should be adopted (Handel, 1997; Sanders, 2006; Baban, 2014). Hence, in terms of planning, local governments are required to develop and enforce provisions to protect good quality agricultural land when preparing, amending or reviewing planning schemes. Applications for material change of use, buildings, works or subdivision should be assessed in the context of such provisions. This objective can be realised through (Handel, 1997; Smart Growth, 2005; Sanders, 2006; Baban, 2013, Baban, 2014):

1. Recognising the importance of productive agricultural land as a critical finite national natural resource that all levels of government should preserve for food production for current as well as future generations.
2. Government funding for all infrastructure facilities should be conditional not squandering agricultural land and not having any

negative impacts on food production and security. The impact of the facilities should be determined based on scientifically correct and acceptable Environmental Impact Assessment (EIA).

3. Explicit authorization of municipal governments to adopt agricultural zoning ordinances as an appropriate technique for protecting agricultural land. Such agricultural zones would limit nonagricultural development to densities and development patterns that are consistent with the development of agriculture.
4. Agricultural land should be protected and preserved. Hence, agricultural land should not be divided into smaller parcels but kept in large contiguous blocks in order to maintain a "critical mass" of farms and agricultural land.
5. Subdivision provisions and policies should be devised in a way that encourages amalgamation of titles where this would enhance farm viability.
6. Legislation and financial strategies should be developed to discourage the conversion of agricultural land to other uses.
7. When preparing, reviewing or amending planning schemes, local governments should include provisions for protecting and preserving productive agricultural land, regardless of the effect of market fluctuations on its viability.
8. Where a planning scheme does not contain adequate provisions for protecting agricultural land, the Government will be informed by the guiding principles set out here when considering whether or not a proposed planning scheme would adversely affect public interests.
9. The fact that existing farm units and smallholdings are not agriculturally viable does not in itself justify their further subdivision or rezoning for non-agricultural purposes.
10. Local government planning schemes should aim to minimise cases where incompatible uses are located adjacent to agricultural operations in a manner that inhibits normal farming practice.
11. The preparation of planning schemes should include an evaluation of alternative forms of development, and significant weight should be given to those strategies which minimise the impacts on good quality agricultural land.
12. Environmental stewardship should be integral with effective agricultural land preservation programs, plans and policies (i.e. erosion and flood management, ground water protection and buffering).

Conclusions

The Kurdistan Region is fundamentally agricultural in nature and tradition, the agricultural sector is a deeply rooted aspect of the society and economy in the Kurdistan Region.

The Region has developed significantly since gaining autonomy, the urbanization expansion has mainly occurred through a significant squandering of productive agricultural land.

This paper examined the impacts and potential impacts of the urbanization process which was guided by a series of developed Master plans on sustainable agricultural production in the Kurdistan Region. The results show that the main cities and settlements are geographically located on the most suitable soils for agriculture in the local area and that the potential squandering of the productive agricultural land in the governorates of Erbil, Sulamaniya and Duhok governorates is estimated to be around 1514Km², 4354 Km² and 1470 Km² respectively. Overall this represents 27% of the prime land for agriculture in the Region.

Evidently implementing the developed Master plans will cause a significant squandering of productive agricultural land as the developed Master Plans seem to be misinformed and have disregarded the impact of urban expansion on squandering agricultural land and, given the local circumstances, could not foresee the paradox that as the population grows, the need for urban expansion grows and the latter can only be carried out through wasting productive agricultural land. This in turn will endanger the declared strategic aims of achieving food sufficiency and realizing food security for the region both currently and in the future.

Clearly, there is a critical need for revising the developed Master plans and for protecting and preserving the remaining finite amount of good agricultural land through planning policies, guidelines and regulations underlining the resource value of good agricultural land and the public obligation to protect it for agricultural use for future generations. This paper developed and presented a practical science based management approach for managing the issue by proposing guidelines to preserve productive agricultural land and to manage urbanization in the Kurdistan region.

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