



Sustainable Land-Use Planning Using GIS

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تخطيط استخدامات الأراضي المستدام باستخدام نظم المعلومات

الجغرافية

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ABSTRACT:

This study concerns with the urban expansion due to population growth which influence changing in the land use and land cover that effect natural resources and

environment by changing the open lands or agricultural lands to urban areas. The study aims to understand the land use and land cover in Bethlehem district, in order to achieve a framework for formulating a regional land use plan for Bethlehem district. Bethlehem district affected deeply by the existing urban areas and especially the environment. These urban areas appear as a result of many factors, such as social, economical, environmental, and political, however, the study aims to understand the existing urban areas and to locate the suitable future urban areas within regional land use plan that take into consideration the socio-economic and environmental factors.

The analysis of the study heeded under the assumption of the sustainable development aspects which consider a deep influence for socio-economic and environmental aspects. The method to understand the problem depends on analyzing the available data acquired from the Palestinian Central Bureau of Statistics (PCBS) and the Ministry of Planning. The research passes through three main parts; firstly; understanding the theories and model used in sustainable land use planning, secondly; analyzing of socio-economic and environmental data of Bethlehem district, finally; Establishing future land use allocations and locations within Bethlehem district, based on sustainable land use model using multi criteria evaluation and the GIS for integrating the socio-economic spatial data layers and the physical infrastructure and environmental layers, with a full spectrum of urban and regional planning factors in a spatial modeling.

The different levels of analysis led to formulate a sustainable land use plan for Bethlehem district that shows the importance of environmental considerations in the planning for future urban growth. The land use plan shows the most suitable

areas for urban development, and the areas that must be prevented from urban development.

ملخص البحث:

يقوم هذا البحث بدراسة التوسع العمراني الناتج عن النمو السكاني والذي يؤدي الى تغير في استخدامات الأراضي والغطاء الأرضي حيث تتأثر البيئة والموارد الطبيعية وذلك بتحوّل الأراضي المفتوحة أو الزراعية الى— أراضي عمرانية. يهدف هذا البحث الى فهم الغطاء الأرضي وإستخدامات الأراضي في محافظة بيت لحم وذلك ضمن مفهوم شامل لعمل مخطط إقليمي لإستخدامات الأراضي في المحافظة. تأثرت محافظة بيت لحم وبعث من النسيج العمراني المحود حالياً، حيث أن المناطق العمرانية في المحافظة هي نتاج عوامل عديدة منها الإقتصادية والإنسانية والبيئية والسياسية. وبالتالي فإن هدف الدراسة هو فهم هذا النسيج العمراني وتحديد أكثر الأراضي ملائمتا للتوسع العمراني المستقبلي ضمن مخطط إقليمي شامل يأخذ بعين الإعتبار العوامل الإقتصادية والإنسانية والبيئية.

إن تحليل المعلومات في هذه الدراسة وفقاً لمبادئ التنمية المستدامة والتي بدورها تأخذ بعين الإعتبار تأثير العوامل البيئية والإنسانية والإقتصادية. وإن فهم المتغيرات إعتد بشكل أساسي على المعلومات المتوفرة في— مركز الإحصاء الفلسطيني ووزارة التخطيط الفلسطينية والوزارات المختصة الأخرى. لقد تم تقسيم هذا البحث الى ثلاث مراحل أساسية هي: فهم ودراسة النظريات والنماذج المستخدمة في التخطيط المستدام لإستخدامات الأراضي. أما المرحلة الثانية فتتمثل في تحليل المعلومات الإنسانية والإقتصادية والبيئية لمحافظة بيت لحم. وأخيراً تتمثل المرحلة الثالثة في توزيع إستخدامات الأراضي المستقبلي في محافظة بيت لحم بناء على نموذج إستخدامات الأراضي المستدام والذي بدوره يستخدم طريقة التقييم متعدد المتغيرات من خلال نظم المعلومات الجغرافية لضمان دمج المعلومات الإنسانية والإقتصادية مع المعلومات البيئية والفيزيائية.

إن المراحل المختلفة في التحليل أدت الى إنتاج مخطط مستدام لإستخدامات الأراضي في محافظة بيت لحم والذي يظهر أهمية الإعتبارات البيئية في التخطيط للنمو العمراني المستقبلي، كما ويظهر أفضل الأراضي للتوسع العمراني والمناطق الواجب حمايتها من النمو العمراني.

Chapter One

INTRODUCTION

1.1 Background:

Spatial Planning system in Palestinian areas controlled by the Israelis within their vision and their strategic plans that satisfy their needs and the minimum requirement of the Palestinian people, until the Palestinian Authority established in 1993 after Oslo agreement.

The urban Growth areas in the Palestinian cities and villages depended on the master plans that done by the Israelis; these plans were done to enforce the Palestinian development within its borders and to catch more lands from the Palestinians outside these borders. Nowadays some Palestinian municipalities and Local Authorities start developing their master plans, without a regional land use plan that can control the population growth and point this growth towards suitable lands that can be used as urban land.

Land use allocation plan for Bethlehem district will be based on the suitable urban lands which can be located by applying sustainable land use model based on the multi criteria evaluation method and using the GIS as an analysis tool to facilitate the integration between the exiting urban lands, the natural recourses and the socioeconomic needs. Socioeconomic factors such as population projection, political classification of land due to peace agreements, aridity, tourism, and agricultural lands where used in the sustainable land use model in addition to the environmental and physical factors such as the agricultural lands, water sensitivity lands, slope, and soil types,

1.2 RESEARCH PROBLEM

Urban expansion due to population growth causes changing in the land use and land cover of the surrounding lands of the urban areas and the other lands of Bethlehem district. This change of land cover and land use will affect natural resources and environment by changing the open or agricultural lands for example to urban lands. Lack of regional land use plan causes a loss in natural resources.

1.3 RESEARCH STATEMENT AND OBJECTIVES

1.3.1 RESEARCH STATEMENT

The thesis has focused on addressing the research statement: which is "develops an efficiently regional land use plan for integrating aggregated (socio-economic data) and disaggregated (environmental, and physical datasets) within sustainable land use planning model GIS in order to formulate and evaluate urban growth in Bethlehem district."

1.3.2 RESEARCH OBJECTIVE

The main objective of this thesis is to find regional land use plan and policies for Bethlehem district that compliment with sustainable Development (S.D.) criteria. As a note of caution Evans (1997) has said that: "It has become common place to assert that one purpose of planning is to secure sustainable cities, or perhaps a sustainable pattern of land use." Evans (1997, p.8)

1.3.3 TO ACHIEVE THIS OBJECTIVE:

- Review existing planning methodologies, and the underlying theories and models used to formulate sustainable land use planning;
- Formulate a spatial planning framework that integrates both socio-economic and environmental indicators used in modeling variables;

- Investigate factors influencing growth in the study area;
- Develop suitability map for the suitable urban lands; and
- Allocate and verify the regional land use plan and attached policies;

1.4 CONTEXT OF THE RESEARCH

The growth or decline of an area can thus be considered a dynamic process consisting of numerous interrelated phenomena, such as migration, economic performance, and land availability. Historical socio-economic data from 1995-2000 acquired from the Palestinian Central Bureau of Statistics (PCBS), are used to measure the extent of regional growth and decline experienced within Bethlehem district. Projected population figures from 2006 to 2010 acquired from the Population Information and Forecasting in Palestinian Central Bureau of Statistics (PCBS) based on data in PCBS 1997 and the forecasting to 2025 population was by using Equation 5.1. Environmental and physical data acquire from the ministry of Planning.

Through formulation of sustainable land use modeling framework it will be shown how both aggregated data (socio-economic data such as population projection) and disaggregated data layers (environmental and physical data such as agricultural lands layer) can be combined in order to formulate future potential land use.

Aggregated socioeconomic analysis is undertaken at the national level (West Bank), because this is the most detailed level at which many socio-economic modeling processes can produce meaningful results. Socio-economic modeling processes include Regional profiling and Population projections were used.

Disaggregated land use spatial analysis is undertaken at the district level because datasets, such as cadastral land information, are readily available and spatial modeling processes permit analysis at the land use level.

Using Multi Criteria Evaluation (MCE) within the GIS, socio-economic spatial data layers can be integrated with existing physical infrastructure and environmental data layers, with a full spectrum of urban and regional planning factors in a spatial modeling (See Pullar & McDonald 1999).

1.5 RESEARCH DESIGN

The goal of research design is to provide a logical framework for conducting research. Bethlehem district is the case study because it comprises both coastal and rural centers, experiencing varying degrees of socio-economic growth and decline. Initial scoping and general understanding of the social, economic, and environmental factors influencing the district were achieved via:

- Meetings with state and local government planning authorities;
- Review of regional planning documentation; and
- Collection of spatial and non-spatial datasets.

The completion of the initial scoping exercise led to the development of the research design. The research design involves three Parts:

1.5.1 PART I – LITERATURE REVIEW

Research Issue: Theories and model used in sustainable land use planning?

1.5.2 PART II – REGIONAL AND DISTRICT ANALYSIS

Research Issue: What areas are experiencing socio-economic growth or decline within Bethlehem district?

Key Scio-Economic Variables

- Population Projections
- Exiting Urban Areas
- Industry Sector Employment trends

Demographic and socio-economic analysis for the statistical data obtained from the PCBS. The socio-economic results are key inputs to meet the needs of projected population growth and socio-economic change. This phase concentrates on the analysis of an area experiencing significant urban growth. Various spatial data layers obtained from the Ministry of planning provide the key inputs into the urban analysis.

1.5.3 PART III – SUSTAINABLE LAND USE MODEL

Research Issue: Establishing future land use allocations and locations within Bethlehem district.

Key Sustainable land use Variables

- Social (population Projection and Urban areas)
- Economical (cultural heritage map (tourist), Regional Roads)
- Environmental (agricultural lands, water sensitivity map, and soil map)
- Physical (slope map)

Planning Instruments that will be used in the model:

- Multi Criteria Evaluation (MCE)
- Geographic Information System (GIS)

1.6 ASSUMPTIONS AND LIMITATIONS OF THE STUDY

The assumption underlying both the regional (West Bank) and District (Bethlehem) planning models developed relies on the caveat that the statistical and spatial data layers obtained for analysis from various government agencies

maintain a significant degree of accuracy in order for future land use model.

1.6.1 ASSUMPTIONS

The principal assumption underpinning the use of socio-economic and land use information for efficient planning of future urban growth is that if an area experiences a change in population then the existing urban landscape will be subsequently altered. This premise is supported by the argument that land use change is strongly correlated to population growth (Theobald & Hobbs 1998).

In the context of Bethlehem district the main assumptions will be:

- 1- Political assumption: this thesis considers the fixed rights of the Palestinians as a main aspect, so this thesis will ignore any Israeli existence within the district borders. While it took into consideration the existing political conditions on land.
- 2- Environmental assumption: due to sustainable development, the preservation of natural resources took an essential place in this thesis (especially agricultural lands).
- 3- Socioeconomic assumption: this thesis assumed that the development near to historical site will enhance the economical situation.
- 4- Land use allocation: this thesis gives the opportunity for a new urban areas, expansion for existing urban areas, and may stop urban development in some areas that conflict with the above assumptions.

1.6.2 LIMITATIONS

Generally, the most recent socio-economic demographic data available for input into the regional planning model is 1997 data. Political situation updating of these data during 2002-2005. Existing updated data by the Palestinian

Central Bureau of Statistics based on the data survey done in 1997.

1.7 STRUCTURE OF THE THESIS

This chapter provides a brief introduction to the thesis. It outlines the research problem, contribution and context, along with the aim and supporting objectives. Chapter-(1) also contains the research design, methodology, and the underlying assumptions and limitations of the research.

Chapter-(2) comprises a literature review of S.D., sustainable land use planning, urban and regional planning, and the different planning approaches.

Chapter-(3) includes the methodology which comprises a comprehensive appraisal of regional and urban planning models. The integration of planning policy and plan formulation is also investigated, along with how this can be achieved through the use of spatial analyst undertaken within a GIS and the MCE.

Chapter-(4) discusses the Planning system in Palestine and examines the existing planning policies and strategies that shape the past, present and future direction of Palestinian planning system.

Chapter-(5) contains socio-economic influences driving Bethlehem district. Various regional modeling tools are used including such as demographic analysis. Also this chapter examines the existing planning policies and strategies that shape the past, present and future direction of Bethlehem district.

Chapters-(6) focus on the formulation of sustainable land use planning model that help the 'S.D.'. This model is formulated using a MCE model and GIS.

Chapter-(7) presents the discussion and results drawn from the research. The limitations of the research are further examined. Finally, recommendations are made with respect to where future research initiatives could be directed.

Chapter Two

LITERATURE REVIEW

2.1 INTRODUCTION

Literature review is an important part in any research; this chapter will discuss the literature review behind land use planning and its implementation within the concept of sustainable development. This chapter looks at several theoretical issues including: Sustainable development, land use planning, relation socio economic and environmental sustainability and land use, and the advantages from urban and regional planning. The aim of this review of the literature is to develop a better understanding of the criteria of sustainable land use.

2.2 SUSTAINABLE DEVELOPMENT:

Brundtland report defined Sustainable development as "the capacity to meet the needs of the present without compromising the ability of future generations to meet their own needs", (WCED, 1987). The International Council for Local Environmental Initiatives (1994) provide a practical and local understanding of sustainable development, "Sustainable development is development that delivers basic environmental, social and economic services to all residents of a community without threatening the viability of the natural, built and social systems upon which the delivery of these services depends."

Sustainable planning is a comprehensive study of the current socioeconomic needs and the available resources, and plan to fulfill socioeconomic needs using the available recourses without forgetting the future need for these resources.

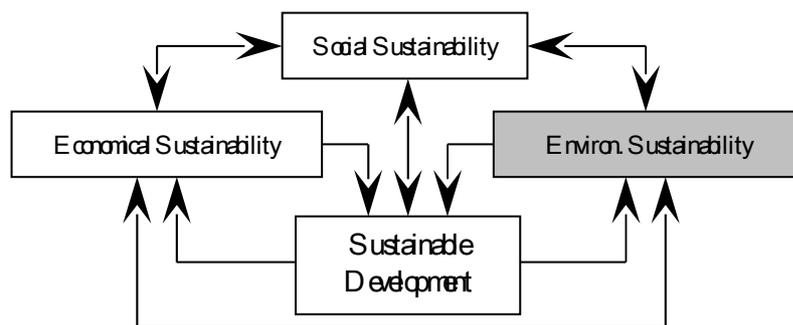


Figure 2.1: Sus. Planning (derived from Principles of Sustainable development)

Protection of environment within the socio-economical needs and understanding that the land is a finite resource leads to study the required urban growth and the ways that can manage that growth. Managed urban growth and sustainable cities can be achieved by studying the land use and land allocation form within the concept of sustainability. Evans (1997) said that: "It has become common place to assert that one purpose of planning is to secure sustainable cities, or perhaps a sustainable pattern of land use."

Agenda 21 is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations, governments, and major groups in every area in which humans' impact on the environment (United Nations 1992). Under the United Nation's umbrella, Agenda 21 is one of the key sustainable development Programme (United Nations 2001). A number of action Programme and related objectives are comprised in the Agenda 21. The actions Programme most applicable to land use planning are outlined in Table 2.1.

Consequently, the final result from the sustainability that there are three categories of indicators (social, economic and environment) must be used in sustainable planning, while the most important category is the environmental category. The next section will discuss the Land use planning, which will provide

a better understand of the relation between the main sustainability categories and land use planning.

Chapter	Programme Actions in (Agenda 21)
5.1.a	Developing and disseminating knowledge concerning the links between demographic trends and factors and sustainable development.
5.1.c	Implementing integrated, environment and development Programme at the local level, taking into account demographic trends and factors.
7.5.c	Promoting sustainable land use planning and management.
8.1.a	Integrating environment and development at the policy, planning and management levels.
8.1.d	Establishing systems for integrated environmental and economic account.
10.1	Integrated approach to the planning and management of land resources.

Table 2.1: Relevant Agenda 21 Sustainable Programme Actions

2.3 LAND USE PLANNING

Briefly, land-use "denotes the human employment of land" (Turner and Meyer 1994, P5). Skole (1994) expands further and states that "Land use itself is the human employment of a land-cover type, the means by which human activity appropriates the results of net primary production as determined by a complex of socio-economic factors" (Skole 1994, P438). Land use and land cover are not equivalent although they may overlap, "land cover is the biophysical state of the earth's surface and immediate subsurface" (Turner et al. 1995, P20).

Land use planning is the employment of lands by human activities on the employed land, land employment also needed in different planning levels (national, regional, and local), the larger the scale the less detailed and this

definitely not mean that there are any conflicts of interest between each level. At regional level land use planning is used to classify the lands into urban use lands, rural use lands, protection lands (agricultural protection land, water sensitivity protection), and transportation use, (See Ruiter and Sanders 1998, P199).

Many countries such as Denmark, Netherlands, Spain, France, Japan, and USA “have set up long rang urban development programs by introducing a classification scheme for different parts of the country according to the expected land use in the future. This system differentiates between the existing urban land use, future urban land use (reserves for development), recreation areas, and agricultural land”, (H.Darin, 1977; P190).

In the context of this thesis the result of land use planning will be land use plan which “contains two basic, but contradictory objectives; urban development and urban protection” (H.Darin, 1977; P190). Bethlehem district regional land use plan consist of all of these land classification (urbanized areas, rural areas, and protected areas) and will be attached by the required policies.

2.3.1 URBANIZED AREAS

Catanese ET El (1979) explains that there are three major old theories of urban development. The first theory is the concentric ring theory; the second theory is the multiple theory. The third theory is the Sector theory which proposed by Homer Hoyt in 1939, it suggest that cities grow in sectors of similar types of development that is, residential areas might expand outward along existing transportation links, topographic features, natural amenities, or the like, (See Catanese ET El, 1979:239-241)

The sector theory shows that the urban development enhanced by

physical feature such as transportation links, which shows that regional roads in Bethlehem district will enhance the urban development nearer to these roads, and increase the “density of economic activities and population on a local and a regional scale that characterize urbanized areas”, (See Hilligart 1998). Finally urbanized areas are, in comparison to rural areas, better equipped with social infrastructure such as health services education and training facilities and cultural life, (See Hilligart 1998).

2.3.2 RURAL AREAS:

Rural areas formerly were characterized by agricultural and forest use of land in order to receive income. Rural areas are characterized by low population density, low density of settlements, tendencies of emigration, rural or village life style and a high share of free space. The high share of free land allows the provision of ecological potentials such as adequate living conditions for high biodiversity, landscapes and other natural resources such as water and fresh air. But the increasing intensification of the remaining agriculture led to high emissions with the consequence of endangering the ecological of rural areas (SRU 1996, Bantle 1998). Change of use of undeveloped areas for purpose other than agriculture and forestry requires permission.

2.3.3 PROTECTION AREAS:

Urbanized areas consume more natural resources than provided on the land of their territory apart from raw materials, food, environmental goods, (Bantle 1998). To prevent natural resource from unplanned urban use, the

lands that comprise these natural resources such as (agricultural lands, and water sensitivity lands) must be prevented from urban development.

Agricultural lands is important for food production and for the environment, Technological change can become a major vehicle in agricultural development reaching far beyond the more immediate goals of increasing production and satisfying food and nutritional needs (Birowo & Qasem, 1987a). Agricultural lands can be also helping the commerce by what Apies called commercial agriculture, (Apies, 1987).

2.3.4 REGIONAL LAND USE PLAN

Regional Land use plan is a result of the above land classification and the attached policies. Regional Land use plan is an expression of the intent of the actor as to what the future pattern of land use will be. Land use plan describes to what extend lands should developed or protect. Land use planning also consist of a map or a series of maps, plus an explanatory text which describes and objectives and the reasons for the use land categories, the densities, and the principles and standards to be used within each land category. Land use plan also fixes the protection of a group's rights to own and use his property, while it also protects scare resources from wrong use. (See Ruiter and Sanders, 1998: P197-198)

2.4 SUSTAINABLE LAND USE;

"Sustainable Land use planning deals with an active planning of land to be used in the (near) future by people to provide for their needs. These needs are diverse: from food products to places to live; from industrial production sites to

places to relax and to enjoy beautiful landscapes; from human uses to places where natural plants and animals can live and survive; and many more" (Van Lier, 1994). The term sustainable land use planning embraces several aspects, as given in Figure 2.2. The Figure illustrates the two dimensions of both land use planning (physical planning and improvement plans) and sustainability (environmental and socio / economic sustainability).

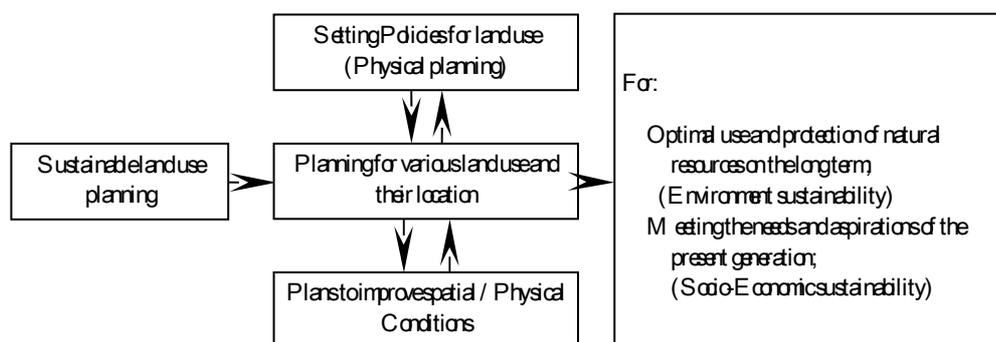


Figure 2.2: Sustainable land use planning and embracing aspects (Van Lier, 1994)

Due to environmental change, land use changes, climate change and loss of biodiversity; sustainable land use has become an important analytical and policy issue (see Finco and Nijkamp 1997). The increasing demand for space and for natural resources determine changes in the land allocation but also in the way the land is managed. In addition, the availability of natural resources per capita will decrease, implying a further pressure on land. Poor agricultural practices and an increased pace of natural resources depletion will necessarily lead to an increasing environmental load and to an impoverishment of the natural resources capital.

There are many intricate and complex linkages between the economy and the environment, in which land use and space are usually acting as the vehicles for transmitting externalities. The World Bank Development Report (World Bank, 1992) states: "Degradation and destruction of environmental systems and natural

resources are now assuming massive proportions in some developing countries, threatening continued, sustainable development. It is now generally recognized that economic development itself can be an important contributing factor to growing environmental problems in the absence of appropriate safeguards. A greatly improved understanding of the natural resource base and environment systems that support national economies is needed if patterns of development that are sustainable can be determined and recommended to governments.”

Bryden (1994) distinguishes two major dimensions, which characterize sustainable land use:

1- The husbandry dimension, which relates to the durability, exploitability, and continuity of natural resources over a long time horizon. The use of crop-rotating systems, the careful use of scarce natural resources and the rehabilitation of degraded land can be seen as actions oriented towards the husbandry dimension. Keeping the amount and quality of the natural resources stock is at the core of this dimension.

Land is classified as natural resources which comprise the agricultural lands, water sensitivity lands, and other land cover classifications. Due to this husbandry dimension these types of lands has to be prevented as possible from any use against its nature, while within this thesis these lands prevented from urban development and were placed as high level of protection.

2- The interdependence dimension, which focuses on aspects like fragmentation, segmentation and relations between different types of land use. Traditional farming offers examples of interdependence, in which the

farm and the surrounding natural areas achieve an equilibrium based on interaction and mutual system resilience. Maintaining the type and quality of the natural-human system interactions is at the basis of the interdependence dimension.

The relation between human and the nature has to be developed by directing the human for using of lands that don't affect the natural resources, also directing the human to use the lands that can help in direct income (such as lands nearer to the tourist areas, and agricultural lands into agricultural economic activities). In this thesis and especially for Bethlehem district regional land use plan enhance the development nearer the tourist areas which enhance the economic while the agricultural lands will be prevented which enhance the economic, and prevent the natural resources.

From the above dimensions sustainable Land use planning and management is an activity which seeks for the "assessment of land potential and suitable land exploitation" (FAO 1993). This means; to achieve sustainable land use planning it is important to classify the lands due to its suitability to urban use, while the unsuitable lands for urban development means that it affects the natural resources. Figure 2.3 Show the need for sustainable land use planning.

Sustainable Land-use design and management develops along some fundamental spatial concepts, which are the conceptual tools for addressing the relationship between environmental assets and the economic and social systems. Lier and Taylor (1988) consider three main spatial concepts; framework and dynamics concept, ecological network concept, and integration / segregation

concept.

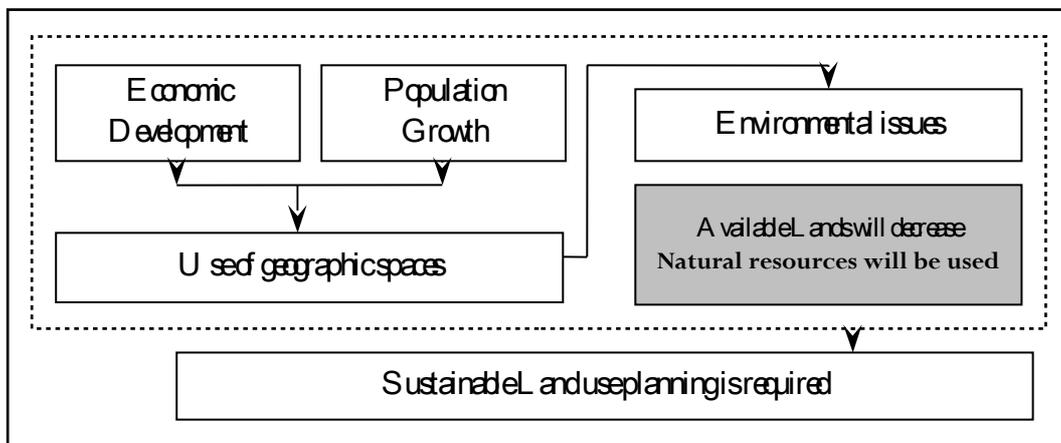


Figure 2.3: Need for sustainable land use

The integration / segregation concept stresses on the need of multiple coherent land uses, which implies different degrees of restrictions and expansion for different types of land uses. While in the recent past spatial segregation and assigning functions of the land have often been pursued for efficiency reasons, integration is based on the recognition of the importance of the links between multiple land uses, (Lier and Taylor, 1988). This concept opens the door for some development functions in the protected areas to achieve some existing conditions.

In the context of Bethlehem district most of the existing urban areas are located within the agricultural lands. This means that in the future regional land use plan for Bethlehem district there will be large urban areas lay on agricultural lands. This is an existing situation, and these urban areas will be under special policies that will help in preventing the remaining agricultural lands within the borders of these urban areas, while the lands outside the borders of these urban areas will be prevented from urban uses.

2.5 THEMES OF SUSTAINABLE LAND USE:

After the explanations of the concept of sustainable development and sustainable land use planning, more specifically, sustainable land use planning can be influenced by three overlapping circles representing environmental, social and economic sustainability (see Figure 2.4).

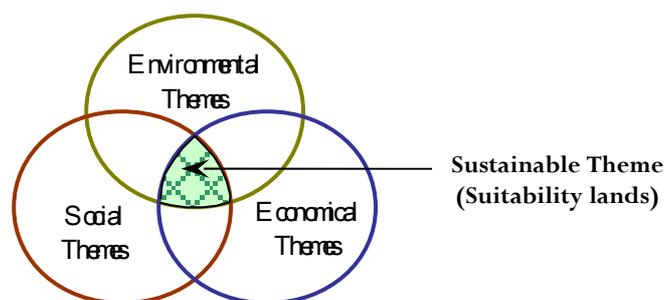


Figure 2.4: Three Basic Themes of Sustainable Land use (derived from Khalfan, 2002)

2.5.1 SOCIAL THEMES:

Social sustainability is concerned about “conservation of social and cultural diversity” (Munasinghe et al., 1995). Furthermore, social sustainability is concentrated on how to promote social development and cultural enrichment. The following issues are central and important to this notion: Growth of community, and development near areas with cultural and history interests. Social sustainability cannot be achieved at the cost of damage to the natural environment.

2.5.2 ECONOMIC THEMES:

Economic sustainability is the maintenance of the stocks of capital or assets in order to produce a non-declining set of benefits (Munasinghe et al., 1995). Specifically, this means a situation whereby an investment produces non-declining or constant benefits over-time (Munasinghe et al., 1995). The main component of this theme is the tourist achievement layer by

development near to tourist areas, urban development nearer to the regional roads which can give the benefit from the travelers on these roads, and the use of agricultural land for food production.

2.5.3 ENVIRONMENTAL THEMES:

Environmental sustainability Themes refers to “a process of maintaining or improving the integrity of the life support system of the earth” (Fuwa, 1995). This theme includes indicators that classify soil, agricultural lands and water sensitivity lands due to its suitability for urban development. All types of lands with high values must be prevented as H. Darin explains “there is a growing understanding that land must be treated as natural resources”. (H. Darin, 1977; P 189)

Fertility soils were considered from the main types of soil that must be preserved, as Bonn (1996) mentioned that “the preservation of soils and their fertility as well as a stable balance of natural processes within them are essential prerequisites for the food security of a growing population”, (Blume,1998; P-II)

2.6 SPATIAL DIMENSIONS INFLUENCE SUSTAINABLE LAND USE:

Land has to be preserved from uncontrolled use, which mean that the urban expansion has to be as minimum as possible spread on land; to achieve this concept, and to help in finding the best solution for regional land use planning, it is necessary to study the required expansion area based on the population needs and according to the population density that will control the amount of needed land to be used as urban areas.

Sustainable Land use is the result of the interplay between economic, ecological, social, and cultural systems. The most important spatial dimension (that can help in allocating the land uses and to specify the required urban lands) is the density. Most emerging in the respect of land use and occupation is the settlement structure measured by the population density as one can assume that the population density is strongly connected with the intensity of land use. Seiwert (1997) distinguished 6 structural types of settlement based on the population density in cities and the surrounding areas. See table 2.2

Agglomerations		Urbanized areas		Rural areas	
Pop. density > 150 cap./km ²		Pop. density 150 <100 EW/km ²		Pop. density < 100 EW/km ²	
High density With big centre	High density With centre	mid density With bigger centre	mid density with mid centre	Low density with small centre	Low density without centre

Table 2.2: Possible delineation of areas types based on density, (Seiwert, 1997)

Mike Jenks et al (1996) showed that the net residential densities can reach 250 people per hectare without any sense of over crowding as long as proper balance is achieved between land use and built form in order to provide adequate space, so there is a considerable potential population within each walking distance radius. (See Mike Jenks et al, 1996, P.56)

While low-density (Urban Sprawl) are more often criticized, since the former supposedly wastes the land resource, the latter raises the cost of development by requiring a spread of highways and utilities as well as increasing travel time energy consumption. (Catanese et el, 1979:241).

After it became clear that land use planning would be central to the promotion of sustainable development. Breheny et al (1993) described five scenarios for accommodating growth: urban infill, urban extensions, key villages, multiple

village extensions and new settlements see figure 2.6.

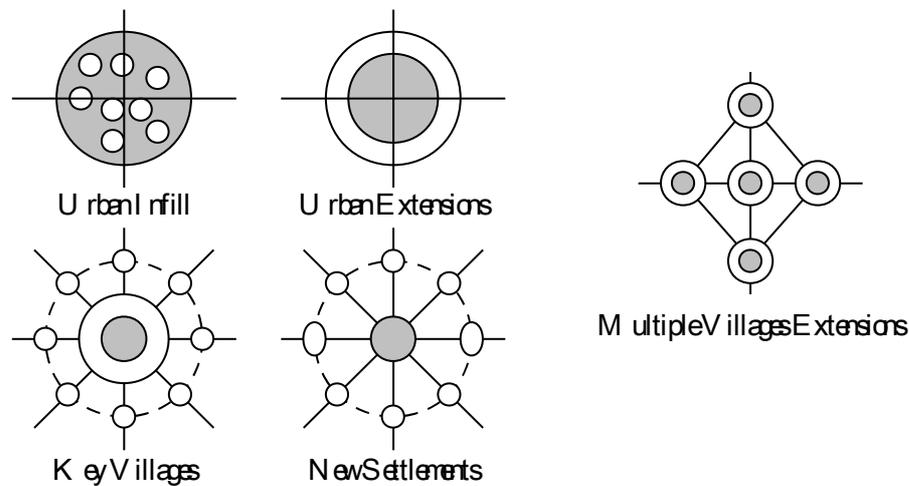


Figure 2.6: Development Growth Scenarios; (Mike Jenks et al, 1996, P.55)

With urban infill there is the further distinction between urban intensification and reclamation of Brownfield (no value) sites (Aldous, 1992; Llewelyn-Davies, 1994), while who also explain that these types rests not just on strictly environmental criteria of energy consumption and emissions, but also a quality of life grounds (Breheny, 1992b, P.139). (See Mike Jenks et al, 1996, P.54-55)

2.7 ACHIEVING SUSTAINABLE LAND USE

Land use planning is known as urban and regional planning fields. Batey (1984) explained that the results of planning take the form of a policy and/or plan. Urban and regional planning is viewed as a “set of evolving techniques humans have developed in order to shape the environmental, social and economic landscape in which we live” (Webster 1993).

As a conclusion urban growth can be controlled by suitable planning mechanism such as legislation, policies, and land use plans; uncontrolled urban growth causes negative consequences on both the built and natural landscapes. Therefore the need for urban and regional planning comes to control and regulate

urban growth and where it should be occurred without forgetting the needs of the community, and the pressures on the existing natural environment.

Policies Documents in general contain information that concerns attributes, expressing goal variables such as necessary population development and environmental qualities to be achieved, or constraint factors like budgets that have to be met (See; Clercq 1990).

Sui (1998) argues that whilst we need new frameworks, models, and concepts, we must strive to translate these new structures and models into meaningful policies and languages that society can appreciate and understand and thus help us to build a more human urban society. Planning policies has to provide an important input in the land use planning process and strategy plans.

H. Darin (1977) studied the land use policies in most of the developed and developing countries and he conclude “that the most important new policy of land use planning employed recently by different countries were the long term national and regional land-use planning (including environmental conservation), with special land use controls in the areas of development”, (See H. Darin, 1977;P 189). While this “national or regional long term planning must cover all possible features of urban life for a period of 20-30 years”, (See H. Darin, 1977; P 189).

Many countries have the experience in implementing land use policies with urban plans. For example, work that done in the Netherlands for a project on regional planning for new housing in Randstad Holland involved the use of GIS (ArcInfo) to translate general policy statements into concrete location decisions (Geertman & Toppen 1990).

2.8 SUMMARY

This chapter provided literature review of the main components of Sustainability, regional land use planning, and special concepts resulting in showing the importance of land use planning in managing urban growth and where it should be occurred. This chapter also discussed many factors that influence required sustainable land use planning.

As a result; land use plan for Bethlehem district has to take into consideration; preserve high value lands due to environmental aspects, and direct the urban growth to enhance the economic and to fit the social needs. This can be achieved by a concentrate city and dispersed communities around this city.

Chapter Three

RESEARCH METHODOLOGY

3.1 INTRODUCTION

Sustainable Land use Planning is considered a very complex issue. In general, Sustainable land use planning indicates the consideration of political, social, socio-economic, economic, and environmental issues. There are three principal land use modeling components used in formulating the ‘sustainable development’ for Bethlehem District:

1. Land Suitability Analysis: provides a spatial range of land least to most suitable for urban land use based on the socioeconomic and environmental data layers;
2. Projecting land use demands: calculate the future demand of land required for particular land uses; and
3. Allocating projected land use demands: combines the projected land use growth with the final urban land suitability map.

This chapter will focus on discussing the research methodology which is divided into four main phases. Phase one discusses the problem, phase two is the analysis phase which contains the regional and urban analysis techniques used in analyzing the socio-economic and environmental data, phase three will discuss the multi-criteria evaluation method as an approach using GIS in producing the suitability land mapping in Bethlehem district for the suitability land model, while

GIS-based analysis of spatial data has been a new specialized process, capable of analyzing complex problem of evaluating and allocating different data layers for targeting urban expansion areas for sustainable land use, and the final phase which explains the verification of the model and land use allocation map.

3.2 FORMULATION OF A SUITABLE RESEARCH FRAMEWORK.

During the 60's and 70's hundreds of approaches were developed (Sypson 1985), some of these planning approaches: the incrementalist approach (Lindblom 1965); the mixed scanning approach (Etzioni 1967); the systems view approach (Chadwick 1966; 1978); and the spatial scenario planning approach (Stillwell et al, 1999a). It can be argued that there can never be the one true-all embracing planning approach. Instead of one planning approach that we can all agree on which based on rational decision theory (also known as rational planning approach).

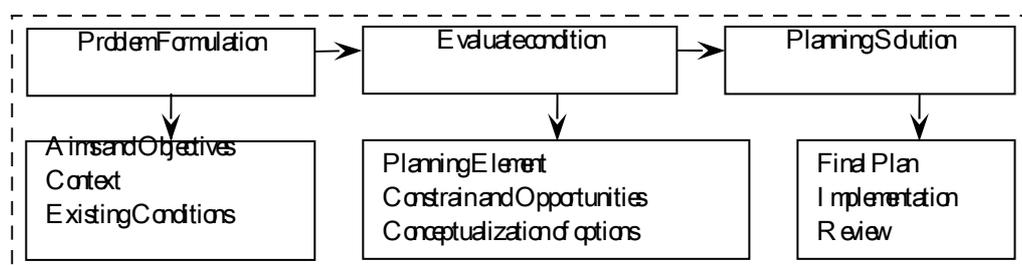


Figure 3.1: The Rational Planning Approach

It is argued that the rational approach is one of the most suitable planning approaches when integrated within a GIS (Batty 1993; McGuigan & Downey 1999). Decision rules that can be logically expressed can be translated into quantitative rules that GIS can easily interpret. The generic rational planning approach is depicted in Figure 3.1 and consists of three key phases: problem formulation; evaluation of conditions; and the planning solution.

3.3 RESEARCH METHODOLOGY AND FRAMEWORK

The research methodology that derived from the rational approach was divided into four phases: see figure 3.2

1. Phase one: (Problem Formulation and data needed) in this phase the problem will be shown and discussed. The required data will be collected.

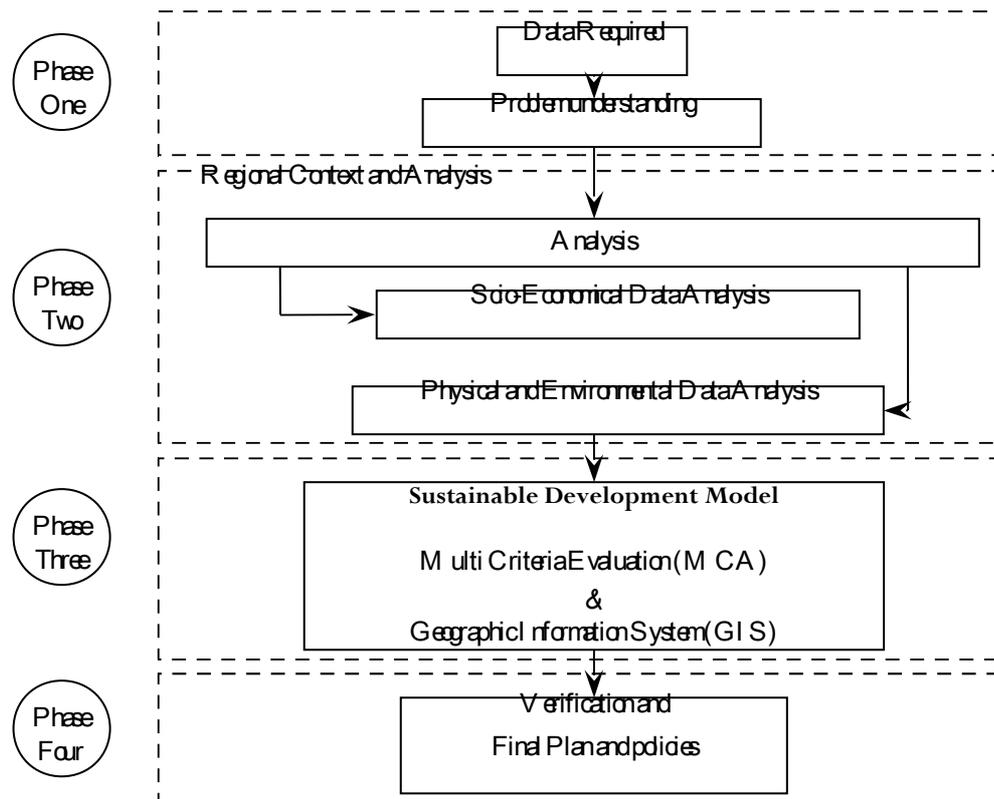


Figure 3.2: Research framework

2. Phase two: (Analysis Phase), socioeconomic and environmental data will be analyzed using the regional planning analysis techniques.
3. Phase three: (Suitability urban land model), socioeconomic and environmental layers will be analyzed using GIS by applying the multi-criteria evaluation to produce the suitability land map.
4. Phase four, verification allocation of final land use map based on the

suitability map and the required urban projection.

The next sections will discuss the main phases and the techniques used in each phase and will show a detailed framework for each phase.

3.4 PHASE ONE: (Problem Formulation and Data Needed):

Formulation of the suitable lands for urban development and urban expansion without influence the natural resources and with achieving the economical growth is required socioeconomic and environmental data needed to influence the decision for urban locations. These data was divided into two types:

3.4.1 SOCIO-ECONOMIC DATA;

To get an overview of the existing urban areas, general spatial statistics and socioeconomic data can be found in the Palestinian Central Bureau of Statistics (PCBS). Population projections, unemployment data, and projected urban lands will be based on the data collected from the PCBS. In addition to the general statistics, a basic spatial indicator was calculated using GIS for Bethlehem district, showing the land use changes of the two main classes (urban lands and agricultural lands) over a 15-year period.

3.4.2 PHYSICAL AND ENVIRONMENTAL DATA;

To get an overview of the environmental and physical features of the existing urban areas, layers data sets were obtained from the ministry of planning. The main environmental and physical data are the agricultural land layer, water sensitivity land layer, soil data layer, and existing regional Land use and Land Cover.

- Agricultural lands; this layer contains the classification

of lands due to its agricultural activities value.

- Water Sensitive areas for Ground Water; this layer shows the lands that has a good water infiltration rate to the underground water.
- Soil data layer; this layer shows the soil types in the district.
- Slope layer; this layer shows the slopes within the district.
- Current urban settlements based on satellite image in the year 2005.
- Existing land use / cover;

3.5 PHASE TWO: (Analysis Phase);

Number of analytic techniques and modeling approaches were discussed by Stimson (1998) such as Regional profiling, Population projection, social capital, and environmental impacts of potential land use. Each of these modeling approaches and tools are used in understanding the research problem and formulating land use modeling approaches based on Sustainable development. Some of these analytical techniques used in the analysis for Bethlehem district and examined as follows:

3.5.1 REGIONAL PROFILING

Regional profiling involves the analysis of a region using a number of key socio-economic variables or indicators. These variables are commonly obtained from census data and are analyzed and reported through the use of

frequency distribution tables and/or graphs, (Fenton & Coakes 1998).

Profiling a region examine such indicators as employment figures, population figures and distribution.

Cauaye (1999) states that, Measurements of variables such as unemployment can be analyzed dichotomously. For example, a region experiencing high unemployment rates can be analyzed socially in that the high unemployment rates could be contributing to a lower level of social capital and quality of life. The analysis of the affect of high unemployment rates from an economic perspective could lead to the conclusion that the high unemployment rates could be contributing to economic destabilization of the region and a possible recession.

3.5.2 POPULATION PROJECTIONS

Population forecasting is important in the monitoring of regional growth and typically forms a basis for planning future urban growth (Ward et al 2001). There are many techniques used for formulating population projections. Ruitter and Sanders (2000) categorize these as linear trend-extrapolation, non-linear trend-extrapolation, moving average, and forecasting using simple equation. For this thesis the equation 3.1 used in future population growth:

$$B(t) = B(0) (1+ GR)^t \text{ -----(EQ 3.1)}$$

Where: B(t) = Population size at time t
 B(0) = Population size at time Zero
 GR = Growth Rate
 t = Projected period

As stated by Theobald and Hobbs (1998, p68): "Population growth is

strongly correlated with land use change and is a principal ‘driving force’ of global land use change.” Therefore, the analysis of future population levels within Bethlehem district provides an essential component of the research. Insights into future population levels can lead to the development of possible urban growth.

3.5.3 URBAN GROWTH

Multiple Growth Scenarios allows simulating different urban growth process, even with aspatial data, growth scenarios can be expressed implicitly or explicitly as policy constraints, growth rules, growth rates, and urban sizes. In this thesis growth ration is used in determining the future urban sizes. Growth ration is defined as a ratio of urban area growth to urban population growth measured as a percentage, it can be calculated uses these equations:

$$r = ((A_1 - A_0) / A_0) / ((P_1 - P_0) / P_0) \text{ -----(EQ 3.2)}$$

$$A_1 = r A_0 (P_1 - P_0) / P_0 + A_0 \text{ -----(EQ 3.3)}$$

Where: r = Growth Ratio

$A_{2,1,0}$ = Urban Size (2= Projected, 1= Current, 0= Past record)

$P_{2,1,0}$ = Population (2= Projected, 1= Current, 0= Past record)

3.6 PHASE THREE: (Urban lands Suitability Land Model)

One of the important components of Bethlehem district development plan is to identify land that is suitable for urban development and the others that have to be protected or still as current use. In developing the urban expansion plan for Bethlehem district there are two levels of focusing:

Firstly, at the broad strategic level, the suitability lands for development

location must be placed and will be discussed in this section.

Secondly, at a district level; exiting urban areas can be merged, new urban area can be found and existing urban area can be expand within the suitable urban lands and due to the need for expected urban expansion.

The model identifies ranges of suitability for urban development across the district as well as areas with poor suitability for urban development that would impact the environment if development were preceded in these areas. Broad criteria that have been considered in the urban lands suitability model are:

Environmental Conservation:

Agricultural Land (high value agricultural lands not suitable for urban land)

Water sensitivity Lands (water sensitive land isn't suitable for urban land)

Soil Types (each soil type will be classified in the analysis)

Socioeconomic Conservation:

Distance from Cultural Places (near distance more suitable for tourist)

Distance from Regional Road Connecting main districts (nearest is better)

Existing Urban Areas (near distance more suitable for urban expansion)

Aridity

Agricultural Land

Physical Development Factors:

Slope

The main question is how these lands can be measured to find the best area for urban lands? It is preferable to locate these lands using the lands that will not effecting the environment (agricultural areas, water sensitivity areas, and soil types), also use the effective physical properties (slope layer), and socioeconomic aspects (Aridity, distance from cultural places and regional roads). The process of

creating the suitability maps is demonstrated in Figure 3.3.

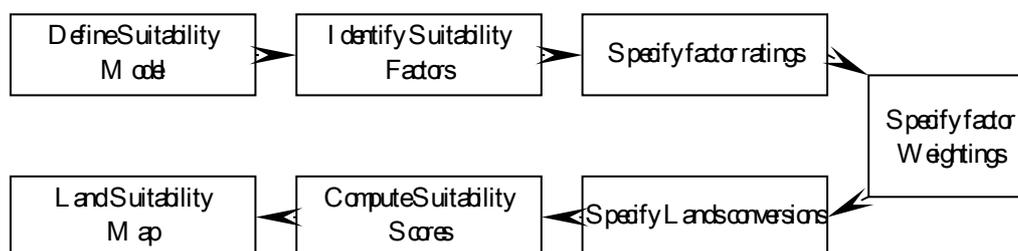


Figure 3.3: Land Suitability Analysis Procedure

A number of urban modeling techniques can be used to assist in the planning and decision-making processes concerned with the zoning, approval, and the location-allocation of particular land uses. In order to develop an appropriate methodology for sustainable land use planning at the local or regional level, a set of Optimization models are commonly used. Examples are: dynamic systems analysis (cf. Nijkamp and Reggiani 1993); impact analysis (cf. Wathem 1988); scenario analysis (cf. Heijden 1996); geographic information systems (GIS) analysis; multi-criteria decision support analysis (see for details Giaoutzi and Nijkamp 1994). In this research the methods that will be used for Bethlehem district sustainable land use model are:

1. Geographic information system (GIS).
2. Multiple Criteria Evaluation (MCE).

GIS and MCE Overlaying approach used in creating suitability maps rating and weighting for each environmental, physical, social data layers, the results depict areas that most suitable, least suitable and non-suitable for urban use. GIS and MCE overlaying approach can be briefly discussed in this section to clarify how to formulate suitability map and outlines each of the land suitability factors incorporated into the model. Also, the process of assigning the ‘weightings of importance’ and the final suitability map are examined.

3.6.1 GEOGRAPHIC INFORMATION SYSTEM (GIS)

GIS can be used for collecting, analyzing, and presenting spatial data. Planning data can be collected and stored within the GIS database. Once collected a large range of spatial analysis functions can be performed to create new information layers. These spatial information layers can be presented in the forms of maps (plans), reports, and charts. GIS can be used to explain: events; visualize trends; protect outcomes; and strategize long-term planning goals (Kostreva & Orgyczak 1999; EPA 2000b).

Consequently, modeling GIS can be used to undertake spatial analysis of multiple land use data layers based upon sieve mapping overlay techniques such as MCE. Subsequent chapters of the thesis will incorporate the use of GIS in the fore-mentioned modeling tasks, in linking the results of both urban and regional analysis, and consequently bridging the gap between planning policy and land use modeling.

3.6.2 MULTIPLE CRITERIA EVALUATION (MCE)

MCE model used in formulating the ‘sustainable development’ Model and to obtain the most suitable lands for urban use. In this thesis, application of the MCE sieve mapping overlay approach and the MCE weighted linear combination (WLC), driven MCE model in Bethlehem district.

3.6.2.1 MCE SIEVE MAPPING OVERLAY APPROACH;

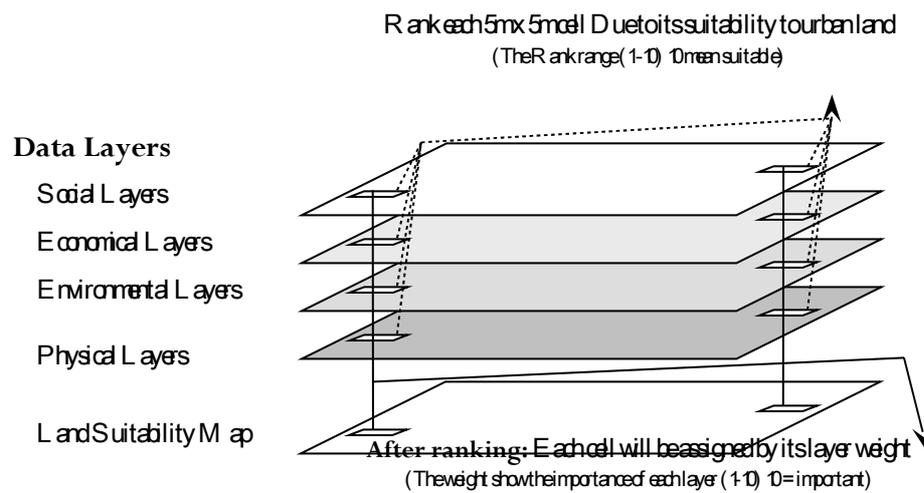


Figure 3.4: Sieve Mapping Overlay Approach

The land use suitability maps are formulated based on the sieve mapping overlay technique advocated by McHarg (1969). The sieve mapping technique involves the overlay of a number of spatial data sets in order to formulate a final suitability map. See Figure 3.4.

3.6.2.2 MCE WEIGHTED LINEAR COMBINATION;

The overlay approach underlying the layers component by the weighted linear combination (WLC) of MCE technique, as expressed by Eastman et al. (1995) in equation 3.4. The WLC technique also constitutes the mathematical foundations for some IDRISI decision support module functionality (Eastman et al. 1995) and also the MCE Planning Arc View extension (Pettit 1999a; Pettit & Pullar 1999). WLC as shown in equation 3.4 is based on a simple mathematical formula which multiplies each suitability factor's rating for each cell by the overall weighting of importance for each layer. Rates and weights assigned using the Arc-View Software and its spatial analyst extension after this operation a final potential cost surface can be derived. The final cost map will represent the

suitability map each cell will has a cost; the higher cost will be as the most suitable land for urban development.

$$S = \sum (w_i \cdot x_j) \cdot C_k \text{ -----Equation 3.4}$$

Where: S = Urban land suitability (higher value mean most suitable)
 w_i = weight such that a value of 1
 x_j = criterion score of factor j
 C_k = the criterion score = $1 / \sum w_i$

Defining the rates and weight can be obtained from decision-makers, planners, community groups and private citizens. The ranking range is from (1-10) while 10 means most suitable for urban land and 1 is not suitable, and weighting range will be from (1-10) while 1 means not important layer while 10 mean very important layer.

3.7 PHASE FOUR: (Model Verification and Land Allocation):

The allocation of land for the ‘sustainable development’ model uses both the results obtain in the land suitability component, and projecting land use demands component as primary inputs, as shown in Figure 3.5. Other inputs include types of expansions, and open spaces items used in formulation the final land use suitable allocation. The expected output is to locate land that is suitable for new urban areas and to locate the existing urban areas that must be protected from urban development or still as current use, or assigned as small development activities within its border.

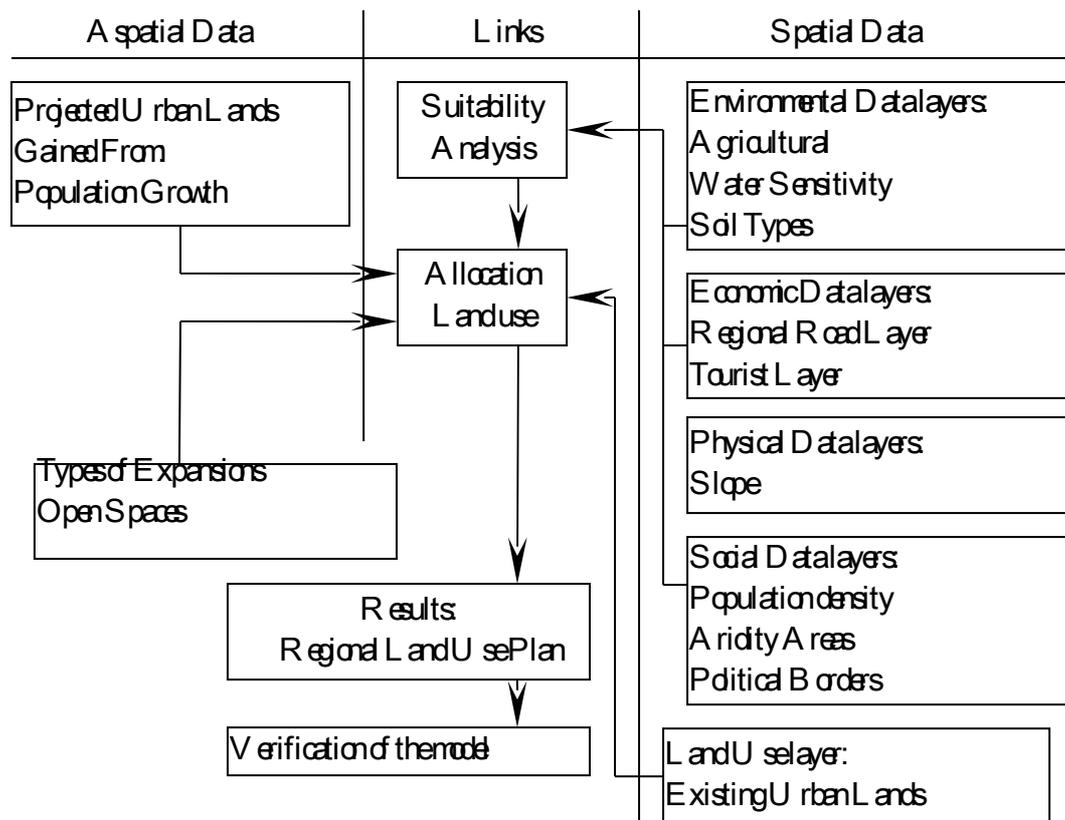


Figure 3.5: Land Allocation Procedure

Verifying the results obtained from sustainable model and the use of MCE by apply spatial analysis, a site visit for the resulted lands, and applying of these results on the satellite image and digital photos can verify the results obtained from spatial analysis. Figure 3.5 shows the detailed final framework that will be use in the thesis.

3.8 SUMMARY

This chapter has explained the methodology used to reach the sustainable land use model for Bethlehem area, and provided a literature review of the main components of regional planning models, and suitable framework, resulting in the development of a framework shown in Figure 3.6. This chapter also shows the main spatial and aspatial datasets needed for applying this model. This chapter also investigates the main steps that will be used in this model.

Chapter Four

REGIONAL CONTEXTUAL

4.1 INTRODUCTION

This chapter focuses on formulation of contextual information of the West-Bank. Data and results from regional analysis help in formulation of sustainable land use model prepared for Bethlehem District. National, and local discussion includes; Relation between Districts in the West-Bank, sustainable development, the dominant paradigms of urban and regional change, and planning system in Palestine. Finding and understanding the issues that influencing the district helps in providing a suitable allocation of future district urban land.

The tools of regional planning as explained in CH3 are used to examine the socio-economic indicators within the West-Bank. These tools utilized include regional profiling, population projections. Using these tools, socio-economic data inputs were provided into the sustainable land use model. These socio-economic inputs include population projections, industry sector employment projections. The environmental indicators will be discussed at the next chapter

4.2 Historical Framework

Palestine is the crossroads of the ancient world. The Canaanites were the earliest known inhabitants of Palestine. In 636 AD Palestine was under the Muslims Authority. Caliph Omar (638AD) made Jerusalem the capital of Palestine. After that Palestine was under different mandate such as British Mandate which supports a Jewish homeland in Palestine. On 1917, British Foreign Secretary Balfour signed Balfour Declaration, which stated that “His

Majesty's Government views with favor the establishment in Palestine of a national home for the Jewish people.”

Israeli occupation is still control Palestinian lands until these days. The Israelis used the opportunity offered by the 1948 war to take an additional 20% of Palestinian territory, including half of Jerusalem. The remainder of the land, on the West Bank of Jordan River (including the eastern half of Jerusalem), was annexed by the renamed Hashemite Kingdom of Jordan until 1967. In 1967, Israel occupied the remainder of Palestine (the West Bank including East Jerusalem, the Gaza Strip). During the occupation process in 1948 and 1967 many Palestinian villages were destroyed and a total of 950,000 Palestinians driven out from their homelands to became as refugees in the West-Bank, Gaza, and world wide, See Table 4.1.

Country	Number	Percent %
Palestinian Territory	3,737,895	38.7
Lands occupied year 48	1,068,885	11.1
Jordan	2,797,674	29.0
Lebanon	415,066	4.3
Syria	436,157	4.5
Egypt	61,917	0.6
Sudi-Arabia	309,582	3.2
Kuwait	39,402	0.4
Other Golf countries	124,230	1.3
Iraq and Libya	115,542	1.2
Other Arab countries	6,523	0.1
U.S.A.	236,357	2.5
Other Foreigon Countries	300,977	3.1
Total	9,650,207	100

Table 4.1: Living location of Palestinians, end year 2003, based on (PCBS, 1997)

As a conclusion All Palestinian lands were occupied by Israelis, and the Palestinians who still in their lands are living under Israeli occupation and within

the Israeli rules until 1993 when the Palestinians and Israelis signed a peace agreement named by Oslo Accord. Among its provisions, the accord called for a five-year interim period of Palestinian Autonomy in the West Bank and Gaza at the end of which the final status of the occupied territories will be decided.

Nowadays, after 12 years of establishing of the Palestinian national authority, many strategic visions and policies put to enhance the planning system in the Palestinian National Authorities at different levels of planning (national, regional and local level). Next sections will study the planning system in the Palestinian National Authority which will help to understand the last and current policies.

4.3 Palestinian national Authority Context:

4.3.1 Location Overview:

West-Bank is a part from the Palestinian Authority and its area is 5845 km². Its east border is Jordan River, and from the north, west, and south is Israel, See map 4.1. At the end of year 2004, the total population in the West Bank including East Jerusalem was 2.123 million, (PCBS, 2004). West Bank comprise eleven Districts; Jenin, Tubas, Tulkarem, Nablus, Qalqiya, Salfet, Ramallah, Jericho, Jerusalem, Bethlehem, and Hebrew.

4.3.2 SOCIO-POLITICAL OVERVIEW:

The West-Bank was controlled by the Israelis until the Palestinian National Authority (PNA) was established due to the Oslo Accord, 1993. After this agreement the Palestinians incrementally share the Israelis in their decisions, while the Palestinian planning system still depend on the Israelis and there vision, due to the political division for the West Bank lands.

Three political zones due the political agreements (see Table 4.2);

- 1- Zone-A; it Includes All the large cities and some of the Palestinian villages, these areas totally controlled by the Palestinians.

Zone	2 nd 09/13/04 Agreement	1 st Wye River Agreement 1998	Wye River Agreement 2 nd & 3 rd	1999 AI-Shekh 1 st Sharm	2000 AI-Shekh 2 nd Sharm	2000 AI-Shekh 3 rd Sharm
Zone-C	73.0%	71.0%	60.3%	64.0%	61.0%	60.0%
Zone-B	24.0%	18.9%	21.8%	25.9%	26.9%	21.8%
Zone-A	03.0%	10.1%	18.2%	10.1%	12.1%	18.2%

Table 4.2: Zones percentage in each existing Agreements; (MOPIC, 2002)

- 2- Zone-B; It includes most of the Palestinian villages. Palestinians have a civil control on these areas and Israeli security control.
- 3- Zone-C; it includes all the reset lands of the west bank. It includes all the Palestinian lands that are unused or rural lands, and also include the lands used by the Israelis Colonies.

The Palestinians fixed rights due to the security counsel decision 242 that give the Palestinians a total control on all the lands of the West-Bank with a total area of 5845 km². However, in real and due to the incremental agreements that showed in (Table 4.2), the Palestinians has the total Control on 1064 km² (18.2%) from the West-Bank lands as Zone-A, and civil control on 1274 km² (21.8%) as Zone-B. As a conclusion; the Palestinian Planners can work in Zone-A and Zone-B with a total area of 2338 km² and the Israelis has the totally Control on Zone-C. (See Map 4.1)

Figure 4.1: Political zones; (MOPIC, 2002)

4.3.3 URBAN SETTLEMENTS OVERVIEW:

In the west bank 666 or 453 urban settlements were expanded on 358,930 Donam, in addition to, 20 refuge camps that include 103.022 Palestinian people, (PCBS, 1997). The division of the west bank into three Zones make the Palestinian built-up area separated from each others, and because the Israelis control on the zone-C it put many regulation that conclude to a higher density in the Palestinian main urban areas.

The form type of the Palestinian settlements and land use planning is a result from schematic unplanned years in all levels of planning (national, regional and local). The Israelis did not care about the Palestinian strategic needs, didn't take into account the proper distribution of the urban settlement and the population growth and the needed lands for the development. Israelis only insure their vision, and to prevent the Palestinian settlements from expansion. Most of Palestinian settlements master plans done between the years (1990-1994). Due to these plans borders of Palestinian settlements was fixed and couldn't be changed without negotiations with the Israelis, especially in Zone-B and Zone-C. (Ministry of Local Government)

4.4 REGIONAL ANALSYS

This section examines the contextual planning issues that influence the regional analysis in this research.

4.4.1 DISTRICTS RELATIONS IN THE WEST-BANK

West-Bank Comprise eleven districts, Jerusalem is a regional area

considered as key global region in Palestine due its religious importance for the three main religious (Islam, Christian, Jewish), also its place as a capital of Palestine. However, Ramallah considered as a main city also due to its economical and political situation. Globally and historically Bethlehem city are considered the oldest religious city for Christian world which comprise the place where the profit of Christian Jesus was born (Nativity Church).

However; Bethlehem district comprise the city of Beit-Jala which known as the best olive oil production in Palestine. Bethlehem district due to its geographical location is also important because it is the nearest region to Jerusalem and Jericho districts. Jericho district comprises the first and oldest city in the world. The main industrial region in Palestine is considered to be Hebron; this district is located directly to the south side of Bethlehem district. See Figure 4.2.

The Ministry of planning in their National Policies for urban development finds out the Regional settlement Structure: the settlement centers were ordered in three levels according to functional content relating to services. Thus the centers belonging to regional order Nablus, Ramallah-Jerusalem-Bethlehem, and Hebron each serve one third of the entire West Bank with functions of upper order, such as hospitals, universities, cultural institutions, shopping centers, hotels, administration, etc. However, Jerusalem will be the future capital for the Palestinian Authority, (NPUD, 2002, P40).

This settlement structure enhances the population growth in Bethlehem due to its nearest location from Jerusalem. As a conclusion Bethlehem region due to its historical, religious place and its middle location between Jerusalem,

Jericho and Hebron districts is considered an important globally district.

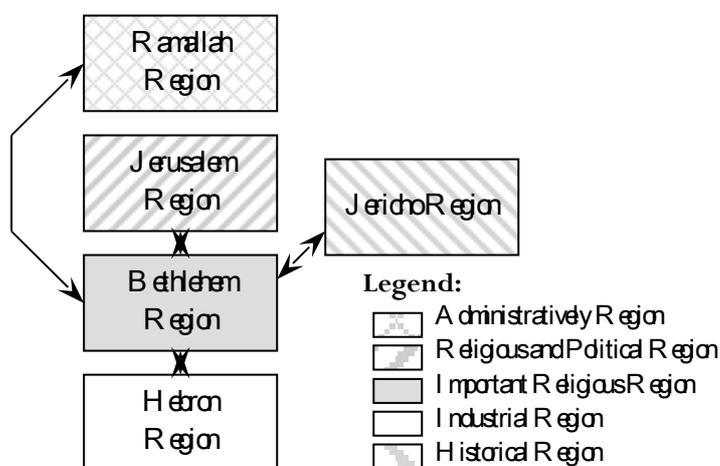


Figure 4.2: Bethlehem Region in the Context of the West-Bank

Physically there is a regional road that connects the Southern part of the West-Bank with the Northern Part, which across Bethlehem district. This road already constructed by the Israelis and used by the Palestinians. The location of this road located in the eastern part of the district which will enhance the development in this part.

4.4.2 Demographics and Societal Change

In general, demographic and societal change is a main influence impacting upon the social and economic structure of both urban and regional areas. In the context of Palestine, the social factor is more complicated. The Israeli occupation causes a Palestinian immigration to various countries. As shown in Table 4.1. From 9.65 million Palestinians only 3.73 millions live in West-Bank and Gaza-Strip, and 1 millions live in the lands that occupied by the Israelis in 1948. So difficulties in knowing the part of the Palestinians may return back to Palestine in the future which make the population projection in the West-Bank is difficult and unclear. In this thesis; the populations currently

live in Bethlehem district are only comprised in the population Projection.

4.4.3 Sustainable Development in Palestine

The Palestinian Authority was formulated an environmental strategy, action plan and environmental impact assessment policy. The Applied research institute in Jerusalem (ARIJ) did the first step in localization of local Agenda 21 Process in Palestine. This first step includes the identification of issues, status, needs, difficulties, opportunities and action plans, which include the principal document outlining Palestinians strategy for implementing sustainable development practices. The strategy's goal, objectives and guiding principles for the Palestinian Authority are contained in Table 4.2.

Type	Strategy statement
Goal	Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. (NPUD, 2002: P16)
Core Objectives	To enhance individual and community well-being and welfare by following a path of economic development that protects the welfare of future generations.
	To protect biological diversity and maintain essential ecological processes and life-support systems.
Guiding Principles	Use and develop the natural resources in a sustainable way for providing necessary needs for the future generation of the Palestinian inhabitation
	Prevent the resources from unplanned development
	Control and monitor the population growth
	The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognized

Table 4.4: Palestinian National S.D. Strategy, derived from (NPUD 2002:P52-64);

As a result the Palestinian policies took into consideration that the

socioeconomic needs must be reached with preventing the natural resources.

Next section will discuss the main policies formulated and how these policies affect the regional land use planning in Palestine.

4.5 Planning system In the West Bank

Urban and regional planning in the West Bank was, since the beginning of the century subject to quite a number of different planning laws and systems: first, the Ottoman system, then the British Ordinance as from 1936 and, starting in 1966, the Jordanian Town and Villages Planning and Building Law No 79. The Israeli military orders followed during the occupation and finally as from 1996, Palestinian rules and regulations for building, permits, and land division have been approved.

Coon (1992) concludes that before the establishment of the Palestinian authority that there is a need for planning especially because the rapid rate of natural increase of the population, and for the squalid and unhealthy conditions especially in the refugee camps (ex; open sewage channels between houses). Coon (1992) also said "despite the rapid rise of population and educational standards, industry has stagnated during the last 20 years. The need now is for an economic strategy to provide a massive boost to the scale, diversity and technological sophistication of manufacturing industry in the West Bank. This will require sites for individual plants to be identified, as well as industrial estates. There is a need to plan for the renewal of the town centers and for modern commercial areas." (Anthony Coon, 1992:P34)

He also mentioned that "all of these developments could of course take place without planning, but it would probably be socially divisive, economically

inefficient and environmentally destructive. The Palestinian population is deeply attached to their home villages, all of which have growth potential, and each which is unique units historical, social, economic and topographical characteristics. Development opportunities should be allocated to each village and town in the light of local needs, opportunities and aspirations. Development strategies will need to take complex land ownership patterns into account, and where appropriate land may need to be bought by public authorities to facilitate development", (Anthony Coon, 1992:P34).

The agencies responsible for planning in the West Bank after 1967 can be set into two periods, the first during the total Israeli control on planning and the second from 1993 after Oslo agreement.

4.5.1 Planning authorities during the Israeli military period

The agencies responsible for planning in the West Bank till 1992 as Coon mentioned were almost all appointed by the Israeli authorities. Local village planning commissions and district planning commissions have been abolished and their responsibilities taken over by the high Planning Council, who are a group of Jewish soldiers appointed by Israeli military commander. All plans must be approved by the High Planning Council, however almost all the plans were approved for new Jewish settlements. The Central Planning Department of the Israeli government is responsible for all planning outside the municipalities; majority of its staff are engaged in organization the demolition of Palestinian development. Municipalities retain some of their powers of preparing plans and granting permits, but most council are Israeli-appointed, they are all very short-staffed and under-funded, their areas have not been

adequately increased, and no new municipalities have been created since the Israeli occupation. (See: Anthony Coon, 1992:P62)

In 1981 a civil administration was established by the Israeli and the head of the civil administration was appointed by the Israeli army commander. Peretz (1986) mentioned that the civil administration was "not an administration operated by civilians but an administration dealing with the affairs of civilians" (Peretz, 1986:83). There are four divisions in the civil administration; Administration, Interior, infrastructure and health, each headed by a military officer, the department of Central Planning is apart of many departments below these divisions. "Twenty-five municipalities had been established in the west bank (excluding east Jerusalem)" as well as "87 villages' council". All the services in these municipalities and local councils had to have the agreement from the Israelis, "Palestinians are not permitted to participate in significant public policy decisions concerning land and resource use and planning" (US State Department, 1987). Coon (1992) shows that during the last 23 years of the occupation there has been no attempt by the Central Planning Department (or indeed any other department concerned with matters of development) to consult representative Palestinian Groups on planning Policies or procedures" (Anthony Coon, 1992:P39).

Development plans in Palestine during this period were of four types during the Israeli period; regional plans, outline plans and detailed plans. These plans were required for building regulations. These would be concerned mainly with defining permitted land uses in each zone, and specify size and form of building, mainly with a view to limiting maximum density. Roads are

included in all plans, preservation of landscape and building is to be covered in regional and outline plans – as is infrastructure. (See: Anthony Coon, 1992:P45) these plans can be summarized:

- Regional Plans: (location of new towns) two plans were of fundamental significance to planning practice in the West Bank.
- Outline Plans: (location of public project)
- Detailed Plans: (location of shops)
- Parcellation Schemes: (layout of plot and roads)

4.5.2 Planning authorities after the Israeli military period

After the Palestinian Authority, The Palestinian planners face in their planning many control problems especially that related to Jerusalem and the Israeli colonies. Moreover the Palestinian plans for their land in Zone C were always stopped by the Israelis. (See, National Policies for Urban Development, 2002:P20)

Instead of these problems the Palestinian decision making is formulated in a hierarchical way, with each level of government determining policies that set the framework for policy and decision making at the next lower level, in a top-down style. There exist three levels of decision making governments in the West-Bank include; local government in the forms of city councils; the ministry of local governments; and the ministry of planning. Each of these authorities maintains separate powers and obligations in the management of the built and natural environment. For example, each city or village council is responsible for land under freehold tenure and the approval of permissible uses for this land under their relevant town planning schemes. The ministry of

local Government is responsible for duties such as locating regional offices and maintaining and updating regional planning schemes. The ministry of planning formulates the national strategies and plans.

The next sub-sections will discuss the main spatial outputs of the ministry of planning which steer the urban planning at the national level from its establishment in 1994. One of the main concerns was preparing the urban development Plans in the West Bank which named regional plan that translate into sets of policies. In 2002 MOPIC formulate the draft copy of the national policies for urban development which were submitted and wait the Palestinian legislation council to vote on it. (See, NPUD, 2002:P2)

4.5.2.1 The Regional Plan

The Palestinian National Authority in 1995 with no basic data and planning capacity has had to take charge and create a "physical planning system from nothing". "The technical and administrative gap created a grossly inadequate capacity level among current local government and ministries in the filed of urban (including physical and strategic, socio-economic, and environmental planning. The generation of these capacities is very important for the promotion of a balance and resource-efficient development in Palestine. MOPIC currently serves as the co-ordinating administrative unit for these activities." MOPIC, Regional Plan, 1998:0)

The main Goals of MOPIC is to "develop its capacity in physical planning to enhance Co-ordination administrative unit process in the West-Bank and Gaza Strip". The physical planning activities at MOPIC focused on the development of land and land use on regional (regions;

Gaza Strip and West Bank) and national levels". The objectives of land use planning were, (MOPIC, Regional Plan, 1998:0).

- Prepare environmental emergency protection plans for selected topic;
- Prepare urban structure plans for selected areas;
- Prepare regional plans for Gaza and the west Bank;
- Develop land use policies at the regional and national level;
- Develop guidelines for planning at the local level;
- Develop policies, programs, and sector plans at the national level;
- Provide background information to be used in negotiations with Israel.

The goal structure of the regional plan is connected to three overall visions for development of the Palestinian society, as listed below; (MOPIC, Regional Plan, 1998:10).

- The system of production will be enhanced to create economic growth in the society, heighten levels of income, and cover human needs.
- Natural resources and environmental will be safeguarded in order to direct the future development into sustainable tracks through monitoring, rehabilitation, protection, and preservation.
- Economic growth and development under guidance of sustainability should be allocated and distributed to achieve balanced regional development, a well-functioning utilization of resources over time.

4.5.2.2 National Policies for Urban Development (NPUD, 2002:15)

The main goals of the National Policies for Urban development;

- Formulate a general understanding for the urban development in Palestine (especially because of the Geopolitical issues) is very

important and have to deal with every transition stage.

- Clarify the main issues that preventing the development process and the Urban Planning.
- Support the regional plans for final approval.
- Prepare the necessary polices for the Urban development which created for the regional planning.
- Suggest more than one Urban development, spatially that related to the creating the national independence Palestinian nation.
- Suggest Implementation and monitoring tools for the proposed polices.

4.5.2.3 Local Level of planning (NPUD, 2002)

Local authority independence in Palestine is limited and is exerted mainly in the understanding of national planning policy at the local level, through its decisions on applications that are submitted to the authority for planning permission. However, even local authority planning decisions can be challenged through the appeal system, which allows the applicant to seek a decision from Palestinian Ministers that can override the local authority's decision. The preparation of actual development plans is however the responsibility of local government. Development plans in Palestine are of two types: structure plans and local plans.

The two types of development plan are prepared through a similar process. The essential elements of the preparation of structure plans can be summarized as follows:

- the planning authority notifies the Palestinian Ministers, neighboring planning authorities and other interested parties by advertising its

intention to prepare the plan;

- a Report of Survey is prepared that identifies key issues, analyses significant trends and reviews previous policies;
- a draft consultative plan is prepared and published;
- there is a formal consultation period during which the public can submit written representations commenting on the draft plan;
- the planning authority considers the comments and modifies the plan;
- the plan is submitted to the Palestinian Ministers;
- an Examination in Public may be held (very rare) under the guidance of an independent panel appointed by the Palestinian Executive, who then makes recommendations;
- Palestinian Ministers modify the plan and approve it to modifications;
- The local planning authority publishes the approved plan.

The procedure for the preparation of local plans is basically as follows:

- Planning authority advises the public, statutory consul-tees and other interested parties of its intention to prepare a plan;
- Planning authority invites opinion on what issues plan should address;
- Draft consultative plan is prepared and published;
- there is a formal consultation period during which the public can submit written representations commenting on the draft plan;
- the planning authority considers the comments and modifies the plan;
- if the objections from the public are settled, the local authority adopts the plan and sends a copy to the Palestinian Ministers (though it does not require approval from them);

- if objections from the public are maintained, the Council appoints a Reporter who chairs a Local Plan Inquiry and informs the local authority of his/her recommendations;
- the local authority either accepts or rejects the Reporter's decision;
- The Palestinian Executive can still intervene in the case of rejection.

In summary, in Palestine the overall responsibility for planning rests with Palestinian Executive, but the detailed formulation and implementation of policy is delegated to local government. The system of planning policy making in Palestine shows that policies are substantially driven from the top. Local authority autonomy is mainly exerted through the interpretation of planning policy at the local level, in decisions on applications that are submitted to the authority for planning permission.

4.5.2.4 Legal Public participation in planning

Palestinian mechanisms that exist for representation through elected representatives include the Palestinian Parliament, composed of Members who are elected every four years, and the members of the local councils, who are also elected every four years. Those people represent the general public in formulating planning legislation, and delegate in the Palestinian Executive the function of issuing planning advice. The local councilors represent the general public in the examination of development plans, as well as in reaching decisions on planning applications. These latter decisions are usually delegated to a committee of elected councilors, or in some limited cases to the Joint Services Council for planning and development, which comprise a number of local authorities and

municipalities, (MOPIC, NPUD, 2002:P67 - P69).

4.6 SUMMARY

This chapter focused on formulation of contextual information of the West-Bank. In general this chapter shows in more detail the Israeli control period and how it affect and direct the planning on the Palestinian lands within their vision. I also explain in more detail the Palestinian Authority control on planning and the main regional policies. It was shown that sustainable development took a good place in the regional plan done by the ministry on planning, but these plans couldn't be fully applied on land due to the political situation.

Finally in the regional analysis it was clearly shown that Bethlehem district occupied a historical place because it comprise the City of Bethlehem (the place where Jesus the Profit of Christians was born) and a central geographic place between three Four important Districts (Jerusalem, Jericho, Hebron and Ramallah).

Chapter Five

DATA COLLECTION

5.1 INTRODUCTION

This chapter is to provide a contextual overview of Bethlehem district which help in formulate and examines Land use model. This chapter also examines the socio-economic factors, which affect future development of urban areas located within the district. These socio-economic inputs include population projections, industry sector employment projections, and agricultural activities.

The environmental and physical layers inputs used in formulation of the sustainable land use model derived by the Ministry on planning. These datasets can be easily disaggregated from the national level to the urban level using GIS which cut from the appropriate Palestinian spatial databases.

5.2 BETHLEHEM REGIONAL OVERVIEW

This section provides an overview of Bethlehem district including a description of the district, its comprising cities and villages, physical features, and a brief history. This section also contains the main planning document for the region, an examination of regional growth and settlement patterns, and the pressures and challenges facing the region. The analysis tools used in this section includes population projections, and demographic profiling.

5.2.1 Description of District

The West Bank comprises Eleven Statistical Divisions including the Bethlehem District. The importance of this district comes from the city of

Bethlehem. The city's name originated from "the house of Lahma", in Aramaic meaning "the house of bread" resounding the name "Lahama". The City of Bethlehem developed international fame as the birthplace of Jesus. Jesus is also known in Islam as the prophet Issa, making the city holy to Christians as well as to Moslems.

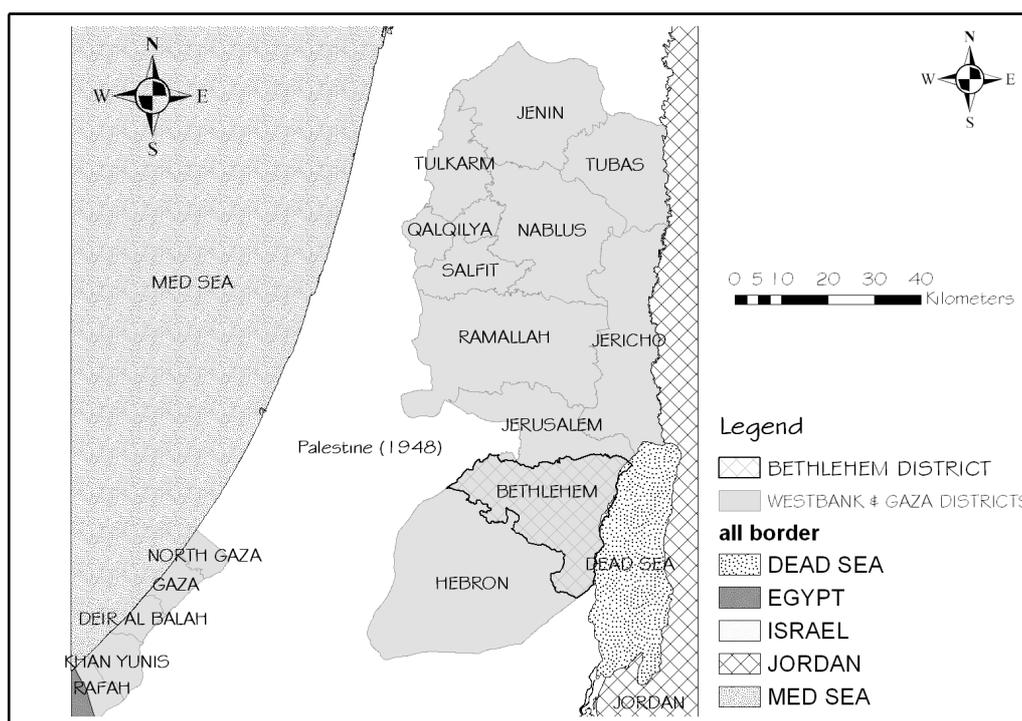


Figure 5.1: Bethlehem District Locality Map

As shown in the locality map Figure 5.1, Bethlehem District is located eight kilometers south of Jerusalem city, along the South coast of the West-Bank. The District extends from Jerusalem district in the north to the Hebron district in the south and from the “year 67 borders” in the west to the Dead Sea in the east. The district occupies an area of 593 square kilometers, which is approximately 10.6 % of the total area of the west bank. Approximately 7.5% of the Bethlehem District is classified as a built-up area (5.8% Palestinian Settlements and 1.7% Israeli Colonies), which includes within its boundaries

39 Palestinian cities, towns, villages and refugee camps, and 20 Israeli colonies, (ARIJ, 2002).

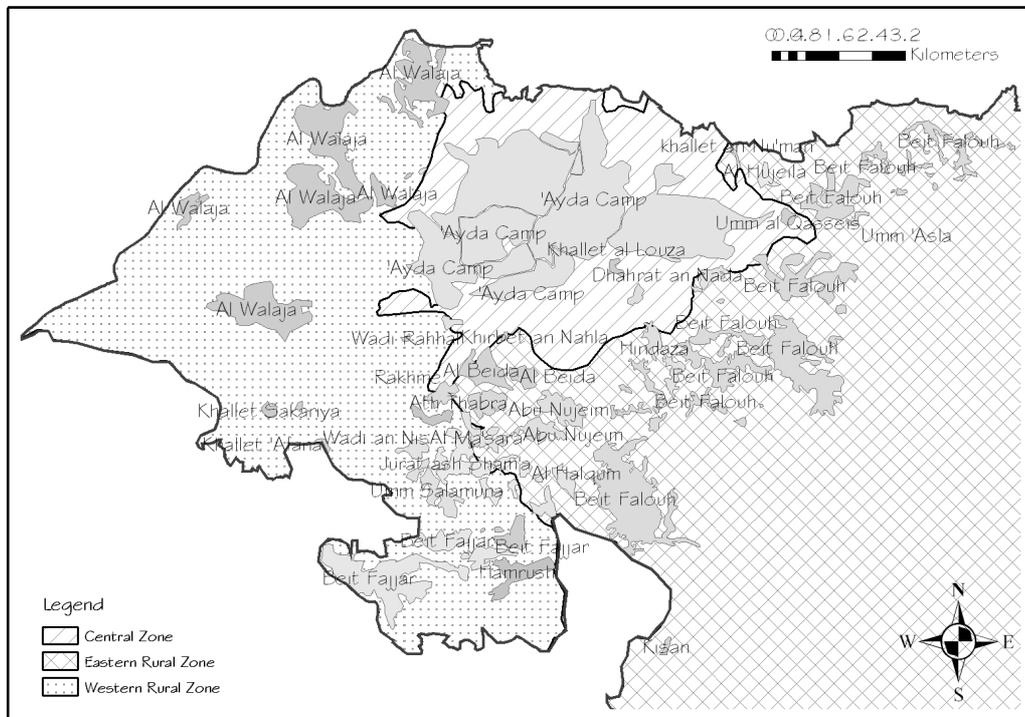


Figure 5.2: Cities and villages Comprising Bethlehem Region

Bethlehem district also divided into three main Services Councils for Planning and Development, as shown in figure 5.2. The middle is the central council which comprises three cities (Bethlehem, Beit Jala, and Beit Sahour), two towns (Al-Duha and Al-Kader), and the three refugee camps ('Aida, El-Daheisha, and Al-Aza) with a total population of 93,520 inhabitants; the eastern rural council which comprises four towns (El-'Ubadiyah, Teqo'a, Gennata, and Za'tara) and ten villages (Dar Salah, El-Rashayda, Hindaza-Berede'a, Beit-Ta'mar, Ashawawreh, Al-Menya, Kesan, Goub-Etheeb, Al-Khase Wel-Nuaman and Khalayel El-Louaz) with a total population of 45,770 inhabitants; the western rural council which comprises 1 town (Beit Fajjar) and 16 villages (El-Walagi, Battir, Housan, Wadi Fukin, Nahaleen, Artas, El-

Ga'a, Goret El-Shamah, El-Masara, Umm Salamuna, Marah Rabah, Wadi El-Neas, Wadi Rahal, Mrah Meala, El-Mansheya and Khalet El-Hadad) with a total population of 35,370 inhabitants, see table 5.2, (SCPD, 2005).

5.2.2 Existing Population and Settlement Pattern

The district's total population is estimated at 174,654 Palestinians (PCBS, 2005), representing 4.6% of the total population of the Palestinian Territory. This number includes 8% living in the 3 refugee camps, 81,959 people 47% are living in rural areas and 45% in urban communities (PCBS, 2005). Demographic change in Bethlehem district is a result of Christian immigration to other countries and Moslems emigration from nearby districts like Hebron and Jerusalem (Soudah, 1990).

The Palestinian Territory population is being distinguished as a young. The youth under age 15 represent 45% of the Palestinian population, the overall age population distribution within the region, which compares the age structure for the shown time intervals, is shown in Table 5.2. The age population distribution will be a steady increase in persons until the age of 40, with a jump in residents aged 65 years and older (PCBS, 2005).

Locality Name	Population Total 2005
Al Walaja	1,644
Battir	4,092
Husan	5,535
Wadi Fukin	1,165
Nahhalin	6,215
Wadi Rahhal (Khallet al Balluta)	718
Jurat ash Sham'a (Wadi an Nis) (Marah Ma'alla) (Al Ma'sara)	3,539

Locality Name	Population Total 2005
Beit Fajjar (Marah Rabah) (Umm Salamuna)	12,463
Beit Jala & ('Ayda Camp)	19,344
Bethlehem (Al 'Aza Camp)	30,710
Beit Sahur	14,921
Ad Doha (Ad Duheisha Camp)	15,988
Al Khadr	9,003
Artas	3,552
Al 'Ubeidiya	8,300
Dar Salah (Juhdum) (Umm 'Asla) (Wadi al 'Arayis)	4,577
Ash Shawawra (Fakht AJul) (Khallet an Nu'man) (Elkhas) (Umm Elqasseis)	3,689
Za'tara (Ras al Wad) (Al Fureidis) (Beit Ta'mir) (Al 'Iqab)	8,659
Tuqu' (Al Manshiya) (Al Halqum) (Al Maniya) (Kisan) (Khirbet ad Deir)	9,652
Hindaza (Dhahrat an Nada) (Bureid'a) (Wadi Umm Qal'a) (Khallet al Louza) (Khallet Hamad) Beit Falouh	4,440
Harmala (Al 'Asakira) (Khallet al Qaranin)	1,840
(Rakhme) (Abu Nujeim) (Khallet al Haddad) (Ath Thabra) (Al Beida)	2,641
'Arab Ar Rashayida (Ar Raw'a'in)	1,189
Other Localities	780
Bethlehem District	174,656

Table 5.1: Bethlehem Cities and Villages Population; (PCBS, 2005).

Age Distribution	Percentage
Age 0 - 4	17.5
4 - 15	27.5
15 - 25	21
25 - 64	30.1
65+	3.8
Total	100

Table 5.2: Regional Age Population Distribution; (PCBS, 2005).

5.2.3 Urban and regional planning in Bethlehem.

As mentioned in (Section 4.5, Planning system in the West Bank). Urban and regional planning in Palestine was, since the beginning of the century subject to quite a number of different powers. Palestinian power over Bethlehem district land comes after by the Second Oslo Accord in 1995 and still on the populated areas of the district, hampering full scale planning. These lands is within Zone A (7.9% of Bethlehem District area) and Zone B (6.7% of Bethlehem District area), See Figure 5.3.

In fact, the existing plans for the main urban centers only represent "outline plans". The outline plan for Bethlehem was approved in 1960 and then covered an area of about 3.9 sq. km. Today, with an increased surface of 5.6 sq. km, the municipality still lacks an adequate planning tool to guide and control the urban development. For Beit Jala, a first Master Plan was approved in 1987, covering an area of about 3.2 sq. km. It does, however, not consider environmental, conservation and various development issues because most of its lands is from high agricultural value lands. Beit-Sahour is currently preparing a "Master Plan for an area of about 7.6 sq. km. This plan, which includes development programs is more comprehensive and could become an urban management plan. It should shortly be approved by the HPC. While the other towns try to do their master plans within the Israeli limitation and within Zone A and Zone B, as the municipality of Al-Ubeidyia is doing.

Up to now, urban development patterns rather depend on land private ownership and topography than on a politically inspired development plan. Consequently, illegal and spontaneous urban developments represent a serious

danger, since they normally lead to undesirable land-use changes, to higher building densities, to conflicting situations where residential areas are endangered by industrial activities and to a degradation of the urban form and, more generally speaking, of the physical as well as natural environment. (Bethlehem Municipality)

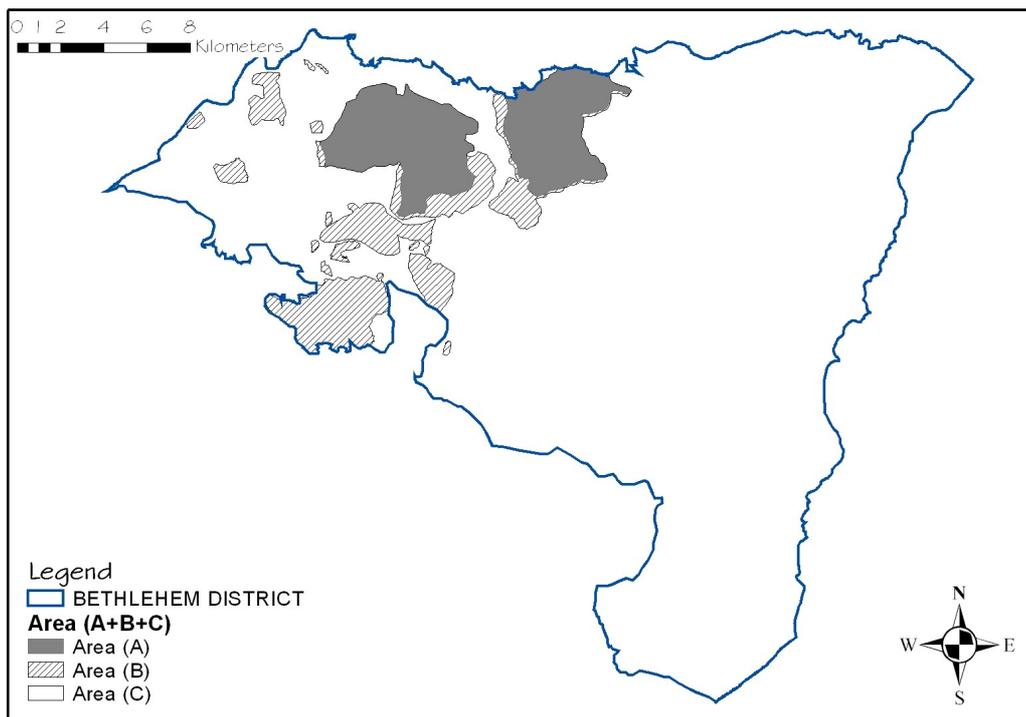


Figure 5.3: Bethlehem political zones; Ministry of planning

Urban and regional development plans are designed to become official documents providing directions and the framework for actions to be taken in the future. They have to be conceived according to the targets and purposes of the expected development, and allow for monitoring and evaluation. Institutional structures and resources, financial and human, should correspond to the targets of the plan and be in a position to identify and implement projects and programs foreseen by the plan. (Ministry of Local Government)

A smooth and future oriented urban development in the Bethlehem area

and beyond its boundaries cannot, for the time being, be expected due to the absence of adequate plans at the regional and local levels, but also due to the lack of planning policies and guidelines. Furthermore, the municipalities do not have sufficient and qualified staff to undertake comprehensive processes and to collect all the necessary data and documentation for that purpose. The strong and increasing demand, particularly with regard to infrastructures, networks, services and management has neither led to the improvement of the administrative structures nor to an increase in human resources. (Bethlehem Municipality)

5.2.4 Pressures Facing the District and Challenges.

Most of Bethlehem built-up areas are concentrated in fertile lands used for either rain fed or irrigated agriculture. For example, Bethlehem and Beit-Sahour and Beit-Jala, the largest Palestinian communities in the district, are located on flat and deep brown rendzinas soil that is valuable in terms of agriculture. In contrast, shallow depth and steep areas with brown rendzinas soil, which is mostly suitable for the building foundations, are currently left. For the last few years, there has been an intensive wave of building constructions. Most of the expansion has been at the expense of the agricultural areas. Many trees have been cut and several roads were constructed on agricultural lands.

A number of social, economic, environmental, and political pressures are impacting on the district, these include:

- Protecting the region's natural and cultural heritage resources from unnecessary encroachments by urban development and for these to be

managed in an ecologically sustainable manner to ensure their special value and economic potential are retained for future generations.

- Efficient planning for future water needs, and the sustainable management and allocation of water resources in the region on catchment basis is of the highest importance due to the district water supply, a major constraint to economic development and urban growth.
- Creating new wealth generating initiatives building on the region's economic strengths and complementary population-led employment growth is urgently required to combat the growing gap between population growth and the generation of jobs.
- Israeli activities on land such as Israeli colonies and segregation wall.
- Population growth rates and unemployment rates are often seen as important indicators of socio-economic performance within a region (Newton et al. 1998). Analysis of population data for the region shows that over the decade 1997– 2005, Bethlehem district increased its population by 4.3 growth rate.
- Hence, despite population growth, the region has been experiencing deteriorating rates of employment.

5.3 SOCIO-ECONOMIC DATASETS OF BETHLEHEM DISTRICT:

This section provides a socio-economic analysis of Bethlehem district based on Palestinian Central Bureau of Statistics census data. However, the aim of this section is to examine number of socio-economic parameters; these parameters include population projections, expected urban lands, industry sector employment

projections. Each of these parameters is discussed in the context of Bethlehem.

5.3.1 Population projections;

Population figures that obtained from the Palestinian Central Bureau of Statistics (PCBS) shows that the population of Bethlehem district has grown from 132,090 persons in 1997 to 174,654 persons in 2005 (PCBS 2005). That means; that the total population between 1997 and 2005 increased by approximately 42,000 persons, with growth rates shown in table 5.3.

PCBS also prepared a population projection for all the Palestinian districts until 2010, while PCBS estimate the population growth rate until 2015. In this research the Growth rate in table 5.3 is used for 2025 projection. Population projections indicate that the population of Bethlehem district is expected to increase to around 29,309 people in the year 2010 and by 140,000 new residents in the year 2025. Equation 3.1 is used to find the population projection in 2025 which is expected to grow to around 314,687 persons. Table 5.4 shows the past, present and projected population figures for Bethlehem district between “1997-2025”.

Year	GROWTH RATE (%)
1997	4.0
2000	4.3
2005	3.3
2007	3.2
2010	3.0
2015	2.8

Table 5.3: Population Growth Rate 2005-2015, (PCBS, 2005).

Year	Population
1997	132,090
2001	152,848
2002	158,280
2003	163,729
2005	174,654
2006	180,116
2007	185,572
2010	203,963
2015	238,753
2025	314,687

Table 5.4: Past, Present, and Future Population Figures (PCBS, 2005).

5.3.3 Economical situation and industries

5.3.3.1 General Overview

Before the year 1993, there are no studies concerning with the per capita Gross National Product (GNP) or Gross Domestic Profit (GDP) for the Bethlehem District. While the overall economy in Palestine is characterized by a per capita GNP of US\$ 1,715 and a GDP of US\$ 1,275 for 1991 (World Bank., 1993). According to a 1994 study of the Bethlehem District working force, approximately 91% have permanent employment, 1% has seasonal jobs, and 8% have part-time jobs (PARC & Arab Thought Forum, 1994). The unemployment rate is estimated at 40.5%. In the agricultural sector, 45% of the male workers are between the age of 21-40 (PARC & Arab Thought Forum, 1994).

The economics of the Palestinian Territories are mainly service-

oriented with agriculture accounting for about 20%, and services 50% of GDP in 1991. Private sector activity dominates the economy of the Palestinian Territories, accounting for about 85% of GDP in 1991. An important characteristic of the economy in both the Gaza Strip and the West Bank is the heavy dependence on the Israeli economy: in 1992 Israel received 85% of all exports from the Palestinian Territories and sold nearly 90% of all imports to the Palestinian Territories.

Before 1992 most inhabitants were working in the agricultural sector, especially who live in the western part of the district and in the south part of Bethlehem district stone industries and quarries is dominant, (PARC & Arab Thought Forum, 1994). While according to a 1996 study on the state of economy in the Palestinian territories, that the GNP per capita was estimated for 1996 to be 1,310\$, while the estimated unemployment for 1996 was 21.8%. This means decreasing of the employment rate, this decrease due to the infrastructural development after the Palestinian National Authority.

During the years 2000-2004 and after Intefadet Al-Aqsa the Israeli measures and policies have adversely affected the economies of the West Bank and Gaza by the hard economic blockade and the segregation wall. As a result, Bethlehem district has become isolated from both Palestinian economics as well from Israeli economy, while security measures and closures have prevented the markets' of Bethlehem district from integrating with other Palestinian cities, like Ramallah, Nablus and Gaza, as they remained isolated from Israel. (UN, 2004)

Overall, the Gross Domestic Product (GDP) of Bethlehem district accounts around 12% of the total GDP of the Palestinian Territories, being the output of manufacturing industries (Stone Cutting, Textile, Plastic, handicrafts). Wholesales and retail trade, real estates and business services, construction, public services and transportation and communication approximate 85% of the GDP. However, output of electricity and water supply, hotels and restaurants, education and health services, agriculture account only 15% of the total GDP.

Bethlehem district seems to enjoy a better situation than other Palestinian cities. This is due to its central historic, cultural, religious, and social role. Tourism forms a major industry in Bethlehem district. More than 28% of the working population is employed directly or indirectly in tourism.

The World Bank shows the effect of the Intifadet Al-Aqsa on the Palestinian economy. Aggregate income losses (using GNI) by the end of 2002 are estimated at US\$ 5.2 billion—nearly equal to the total income generated in 1999—the last full year before the onset of the crisis. Per capita income is estimated to have declined by 46 percent during the first 27 months of the crisis, e.g. September 2000—December 2002, and unemployment to have increased from 10 percent in September 2000 to 37 percent of the workforce, after peaking at 45 percent in the third quarter of 2002 (using the relaxed definition of unemployment). See World Bank *Twenty-Seven Months—Intifada, Closures and Palestinian Economic Crisis, An Assessment*, May 2003, pp. 7-8, 11-15, 31.

Direct physical damage to existing public and private assets reached an estimated US\$ 930 million by end-2002 with an additional US\$ 800 million in wear and tear to existing equipment and infrastructure—over and above normal depreciation caused. Thus, on a replacement cost basis, a physical capital deficit of some US\$ 1.7 billion had been created by end-2002. Forgone investment—the difference between new investment flows before and during the crisis—were estimated at some US\$ 3.2 billion. See World Bank Twenty-Seven Months, May 2003, pp. 17-19.

5.3.3.2 INDUSTRIES AND EMPLOYMENTS

452,230 dollars has been invested by private and public sectors within the Bethlehem district between “2004-2005”, (PCBS, 2005). Table 5.5 shows the total industry investment in the Bethlehem district for projects such as manufacturing, agriculture, construction, etc.

The main industries in Bethlehem district is tourism which may be defined as the business providing access to places and sites that are attractive for reasons of history, religion, leisure, pleasure, shopping, climate, etc. This includes the arrangements of tours, transport, accommodation and hotels, restaurants, leisure areas. Bethlehem advantage in tourism rests mainly with its unique religious sites, particularly for the Christian world, for which there is no substitute. Any attractions based purely on providing leisure will have to compete on price and distance with the rest of the world. Tourism can be a great economic asset with spin off to many associated industries and services, both public and private. Bethlehem district a responsible and economically viable local

tourist industry, it can contribute to a positive district development as well as to the political stability in the district.

Economic Activity	Output	% in comparison to the GDP
Manufacturing	75	16.5
Agriculture	10.5	2.3
Electricity and Water Supply	1.35	0.2
Construction	38.8	8.5
Wholesale and Retail Trade	50.7	11.2
Services	101	22.3
Transport and Communications	26	5.7
Real Estate and Business Services	83	18.3
Hotels and Restaurants	9.2	2
Education and Health	8.37	1.8
Public Services	48.3	10.6
Total Gross Domestic Product	452.23	100%

Table 5.5: Beth. District Industry Investment (\$1000) 2005 ;(PCBS, 2005)

The Bethlehem area is specialized and well known for handicraft industries. Production includes a wide range of hand fashioned articles made of olive wood, mother of pearl and copper. Most of these products are manufactured locally in small workshops.

Tourism development as an economical asset for the Bethlehem area will involve the development of many fields such as infrastructures, transportation facilities, accommodation, information and training, cultural activities and entertainment etc.

Bethlehem district suffered an increasing drop in income during the last few years. It is estimated that for the period 2000-2005 real GNP per capita per year dropped by 39.4% for the West Bank and approximately registered to be (US\$ 2,140) and unemployment rate during the last ten years is shown in table 5.6 (PCBS, 2005). While in Bethlehem district the percentage of unemployment is 9.8% in the year of 2005.

Year	Unemployment rate
1995	18.2
1996	23.8
1997	20.3
1998	14.4
1999	11.8
2000	14.1
2001	25.2
2002	31.3
2003	25.6
2004	26.8
2005	26.5

Table 5.6: Unemployment Percentage 1995-2004, (PCBS, 2005).

The projected number of employees is also an important socio-economic data input required to formulate the sustainable land use models. However, industry sector employment during the years 1999 - 2003. Based on these data shown in Table 5.7 the services industries is the main dominant industry in the district which depend on tourist due to its historical place, the second dominant industry is the agricultural industry, while the mining industry is also important industry in the district.

From the above discussion there is a need to enhance the development nearer to the tourist areas to enhance the tourism industries and to prevent the agricultural lands to increase the employment in the agricultural industry, which enhances the district economy and sustainability.

Year	Fishing, Agriculture, Forestry, and	Mining, Quarrying, & Manufacturing	Construction	Commerce, Hotel	Transportation, communications	Services
1995	12.7	18.0	19.2	19.6	4.9	25.6
1996	14.2	16.8	16.8	18.2	4.8	29.2
1997	13.1	16.4	18.4	19.1	4.8	28.2
1998	12.1	15.9	22.0	18.2	4.7	27.1
1999	12.6	15.5	22.1	17.0	4.7	28.1
2000	13.7	14.3	19.7	17.5	4.9	29.9
2001	12.0	14.0	14.6	19.4	5.5	34.5
2002	14.8	12.9	10.9	20.0	5.5	35.9
2003	15.7	12.5	13.1	20.0	5.8	32.9

Table 5.7: Employment Percentage in industrial fields, (PCBS, 2005).

5.4 ENVIRONMENTAL, POLITICAL AND PHYSICAL DATASETS:

A number of environmental and physical spatial data layers required to formulate sustainable land use model. These Data include: land information (i.e. existing land uses) and areas of environmental significance.

5.4.1 Land Information

The analysis of land data through the use of GIS enables “better understand in the location and spatial characteristics of a land area, along with its social, economic, and environmental dimensions”, (Hubner 2000). Land is

an important input data source in formulating future urban growth. Table 5.5 showed that 83% of land in Bethlehem district is open lands (not used), 5.7% urban areas, and 8.7% agricultural lands, and 2.6 % are Israeli colonies. The existing land uses in Bethlehem district is visually represented in Figure 5.4.

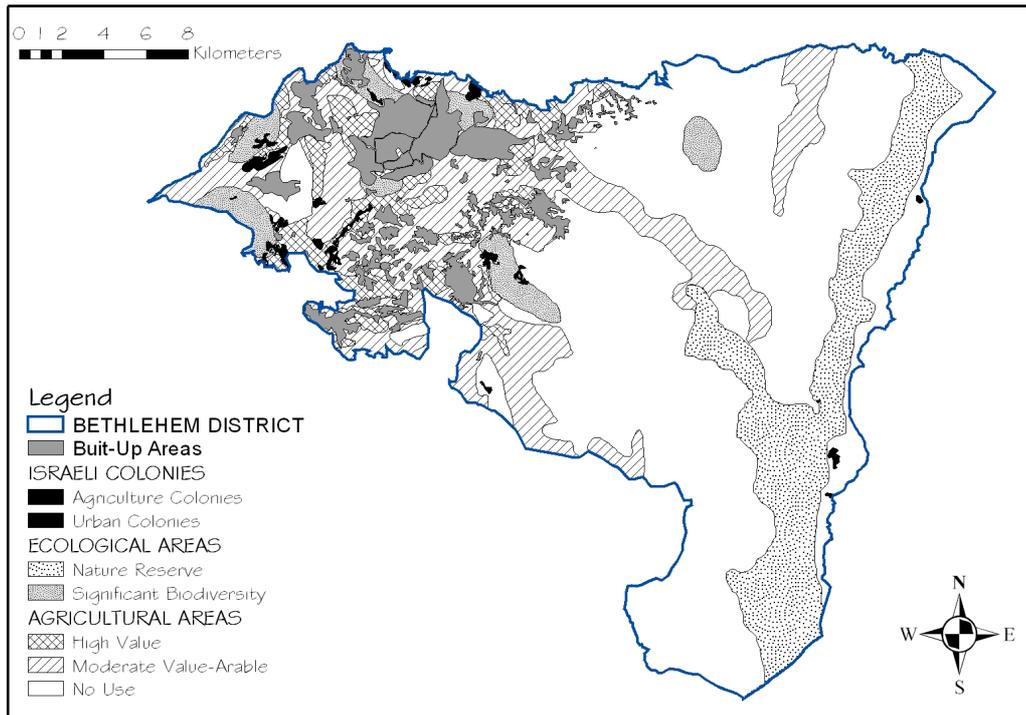


Figure 5.4: Land Use Map – Bethlehem District (MOPIC, 2002)

5.3.2 Urban Area Projection;

Table 5.8 shows the main land uses in Bethlehem district within “1995-2005.” It can be seen that over 23,542 donams of lands used during these years as urban lands over the whole Bethlehem district. 96 % of these were issued as residential lands, which would indicate important growth in the existing residential population. The largest new urban land use in Bethlehem is in the central region especially in Al-Doha town, which was attributed with 14.9% of the total new urban lands.

	1990	1996	2005

	Area	%	Area	%	Area	%
Agricultural	191530	10.3	182050	9.7	166350	8.7
Urban areas	8010	1.3	17478	2.9	31552	5.7
Israeli Colonies	8920	1.5	11432	1.9	15699	2.6
Open Lands	384601	86.9	382101	85.5	379460	83.0
Total Area (Donam)	593061	100	593061	100	593061	100

Table 5.8: Existing Land Use Categories in Bethlehem district.

80% of the Palestinian households live in homes they own. Nearly 98% of homes have access to tap water and electricity. While electricity cuts are common, water cuts present a more serious problem in the area of Bethlehem. Most homes have private sewage disposal with about 29% of households connected to the main lines and placed in main cities. Solid waste management system disposes of 85 % of solid waste in the cities and 65% of the rest of the district, (PCBS, 2005)

As shown in table 5.8 that the urban developments affect the natural resources and especially the agricultural lands. The lost agricultural lands between “1990-2005” are estimated by 25180 donams, all of these lands transferred to urban lands (are 79.8 % of the existing urban lands). While only 5141 donams from the open lands (no value) is used for urban development in the same period. This change shows the importance of preventing the natural resources and especially the agricultural lands.

The total projected of new urban lands is an elementary data input required to formulate sustainable land use models. Urban lands projection figures for Bethlehem district up until 2016 have been derived from the urban

development during the last 15 years (from 1990 to 2005). Table 5.8 shows the increasing in the urban lands during the years 1990, 1996, and 2005.

5.4.3 CURRENT POLITICAL SITUATION:

The Current political situation is complicated, due to the conflicts between the Palestinians and the Israelis. As explained before (in section 5.2) that the Israelis still control 85% of the West Bank. Due to this fact Israelis construct on land what Palestinian call segregation wall, which separate lands between Israelis and the Palestinians.

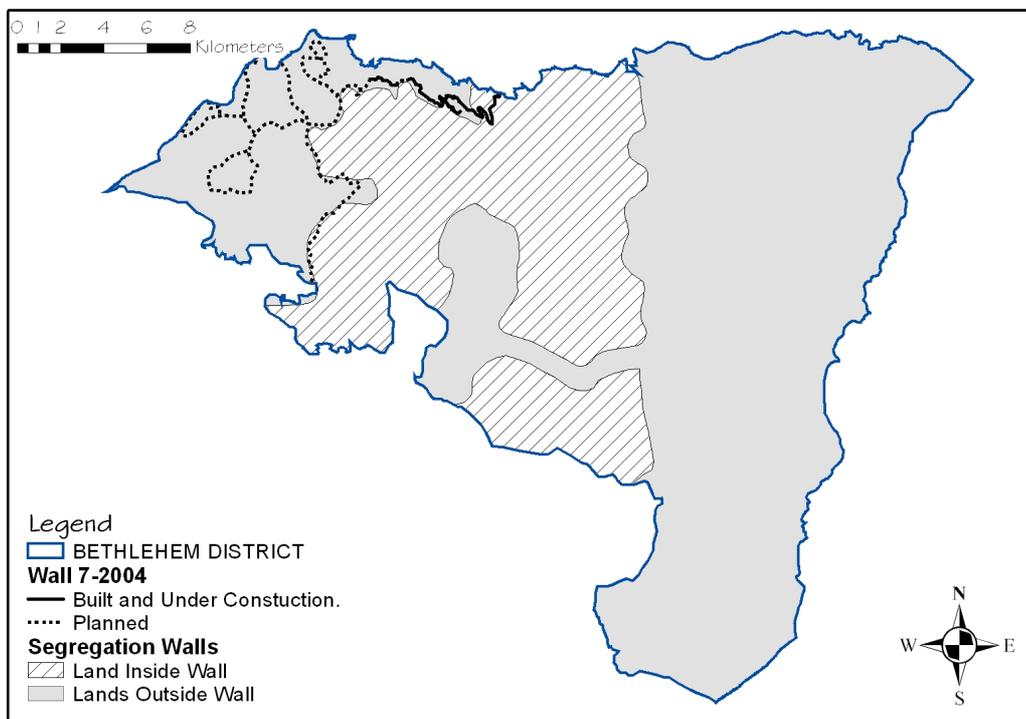


Figure 5.5: Israeli Plans (MOPIC, 2005)

The main problem that this wall built in the West Bank not on the Green line that separate the 1967 lands and the Palestinian lands that occupied by the Israelis in 1948, this wall cuts near 70% of the Palestinian occupied lands in 1967, Figure 5.15 shows the segregation wall within Bethlehem district.

5.5 SUMMARY

This chapter has provided a comprehensive overview of Bethlehem district. This chapter also has examined a number of socio-economic datasets and spatial physical and environment datasets required to formulate the land use model. Population data is known as a primary socio-economic data input used in land use modeling. The projected population increase in Bethlehem district is expected to nearly double between 2000 and 2025. This will result for a rapid urbanization in Bethlehem district.

The urban growth acquired during the last 15 years in Bethlehem district shows the need for regional land use model which minimize environmental degradation within the district. The contextual information and the socio-economic, physical and environmental datasets derived in Chapters 4 and 5 are combined to formulate the sustainable land use model in the next chapter which controls the urban growth in Bethlehem district, using the framework outlined in Chapter 3.

Chapter Six

DATA ANALYSIS

6.1 INTRODUCTION

This chapter concentrates on the third phase of this thesis which is about urban suitability model with the sustainability aspects. This chapter explains in more detailed the main socioeconomic and environmental indicators layers that used in the model. Eight data layers which contain different type of land classification (agricultural layer for example comprise; high value, moderate value, no value agricultural lands). All of these layers were filled in the ArcGIS software and the MCE model applied on them. Finally by using the spatial analyst and raster calculator extensions in the ArcGIS the final suitability map can be developed.

This chapter also analysis results achieved from the socio-economic inputs include population projections, urban lands required and the results achieved from the suitability model to allocate the land use in the district, this allocation verified also by site visits for each land type in the final land use plan. The environmental and physical data inputs used in formulation of the sustainable land use model derived by the Ministry on planning in the Palestinian Authority.

6.2 Model Components;

The main components of the model which discussed in Chapter three for Bethlehem district are:

- 1- Land suitability map
- 2- Projected urban land demand

3- Allocation of land uses

These three components can be implemented by:

- 1- Define, rank and weight each data layer.
- 2- Assign the ranks and weights for each data layer using GIS.
- 3- Develop suitability land layer using GIS.
- 4- Find the required urban expansion in 2025.
- 5- Allocation the final land uses
- 6- Verification of model

6.3 Define, Rank and weight data layers:

A number of land type's layers are utilized in the formulation of the suitability maps. Create a suitability map enables by obtaining a suitability value for every location on the map. After creating the necessary layers, each layer can be ranked of potential areas for urban lands that mean in this thesis, assigning a value to each class in each layer on a scale of 1–10, with 10 being the best (suitable for urban lands). The model is initially constructed in this way; then, while testing sustainable lands which prevent natural resources and enhance the economy, weight factors can be applied to the layers to further explore the data and its relationships. These weights also on a scale of 1–10, with 10 being the best (very important in model)

In Bethlehem district eight land type layers have been derived and used in formulating the 'sustainable development' model and they are:

Environmental Layers:

- Agricultural Land;
- Water sensitivity Lands;

- Soil Types;

Socioeconomic Conservation:

- Distance from Cultural Places (tourist)
- Distance from Regional Road Connecting main districts
- Existing Urban Areas
- Aridity
- Agricultural Land

Physical Development Factors:

- Slope

6.3.1. Agricultural lands (environmental and economical layer);

Forested areas in the district comprise approximately 380 hectares; most of these are located in the northwestern part of the district. The dry areas in the district comprise approximately 450 hectare; most of these are located in the eastern part of the district between the end of urban areas and the Dead Sea.

The agricultural industry is one of the most predominant industry sectors within Bethlehem district. Nearly 35 percent of the total area of the district classified as agricultural lands. The percentage of land useful for agricultural in the eastern part is low, while the central and western part lands are suitable for agricultural production, the problem that the most urban land is located within these two part of the district.

The main aspect of sustainable development is to protect natural resources, agricultural lands one of these natural resources, while the agricultural lands in very important part of land due to its environmental and economical issues. Figure 6.1 shows the main agricultural land classification (High Value,

Moderate Value, and No value). Due to sustainability aspects the most suitable lands for the urban areas are the lands that have no agricultural value, while lands with high and moderate value must be protected from urban development. See table 6.1

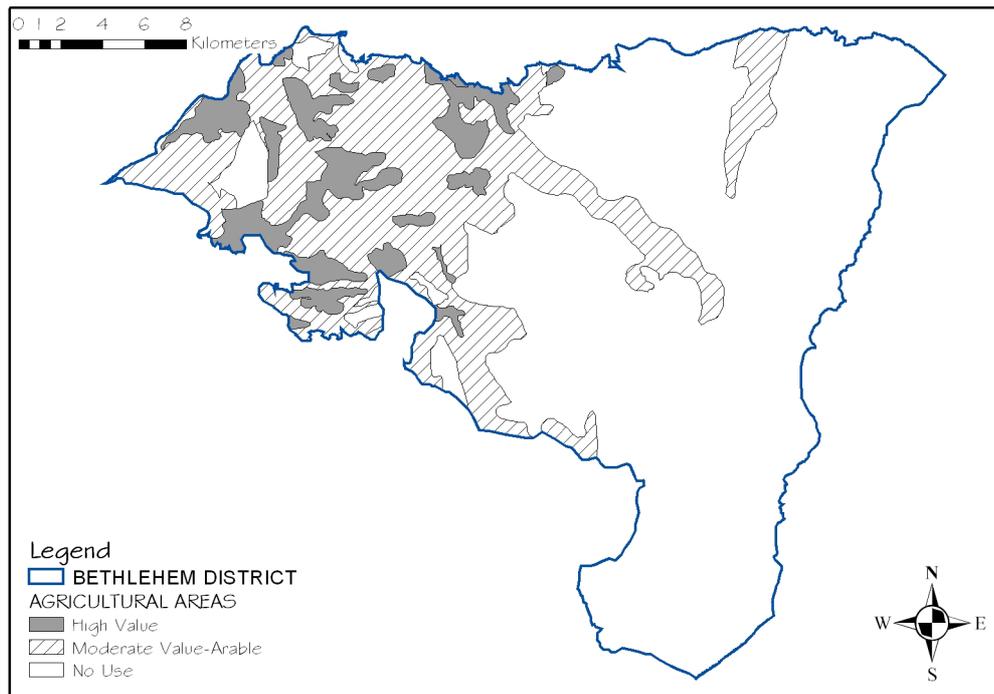


Figure 6.1: Agricultural Production (MOPIC, 2002)

Agricultural layer Weight = 10	
Land Type	Rank
High Value	1
Moderate Value-Arable	3
No use	10

Table 6.1: Agricultural Layer (Weights and Ranks)

The high value agricultural lands is ranked by the value (1), while the moderate value lands is ranked by (3) and finally the no value lands take the rank (10) which mean it is the most suitable for urban land, see table 6.1. The whole layer is classified in this thesis as an important layer in the model, and it took a high importance weight (10), which mean a highly protection for these

high value lands (total score $10 \times 1 = 10$) while a highly recommended for the no value lands for urban development (total score for this layer $10 \times 10 = 100$).

6.3.2 Water sensitivity lands; (environmental layer)

The Important dataset input in land use planning is the land which is classified as water sensitive lands. These lands classified due to its ability in transferring surface water to the ground water, See Figure 6.2. The sensitive lands must be prevented from any urban development, these lands where assigned by a lower rank due to its suitability for urban land. The high sensitive lands is ranked by the value (1), while the sensitive lands is ranks by the value 4, in addition the moderate sensitive lands is ranked by 7 and finally the not sensitive lands take the rank 10 which mean it is the most suitable for urban land, see table 6.2.

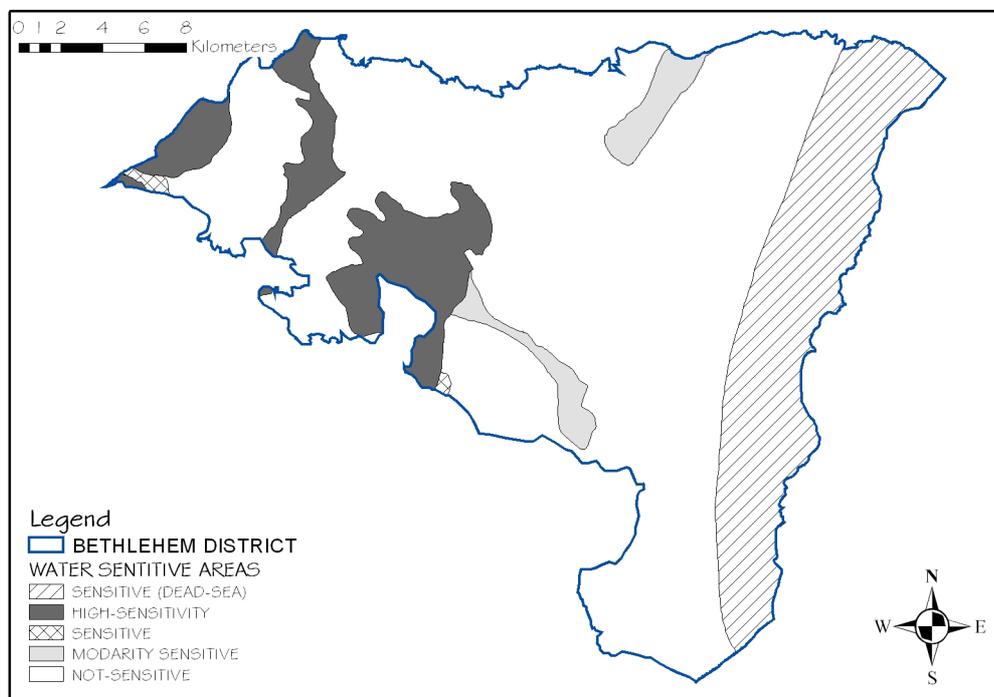


Figure 6.2: Water Sensitive Areas (2005)

The water sensitivity layer is classified in this thesis as an important layer

in the model, and it took a high importance weight (8), which mean a highly protection for these sensitive lands (total score $8 \times 1 = 8$) while a highly recommended not sensitive lands for urban development (total score for this layer $8 \times 10 = 80$).

Water sensitivity lands Weight = 8	
Land Type	Rank
Highly Sensitive	1
Sensitive	4
Sensitive Dead Sea	4
Moderate Sensitive	7
Not Sensitive	10

Table 6.2: Water sensitivity layer (Weights and Ranks)

6.3.3 Soil Types Lands;

Another fundamental data layer used in delineating areas of environmental significance is the remnant soil data layer. Major soil associations found in the Bethlehem District: see figure 6.3 and table 6.3

- 1- **Alluvial Soil:** A general term for those soils developed on a fairly recent alluvium. Alluvium deposited by streams and varying widely in particle size. Some of the most fertile soils are derived from alluvium of medium or fine texture, that is why these lands due to its fertility is classified as important land to be protected and has a rank 2 .
- 2- **Brown forest soil** these are fertile, often deep soils that are used for agricultural purposes. Due to its complete fertility it is classified as important land to be protected and has a rank 1.
- 3- **Desert Skeletal Soils:** these types of soil are concentrated in the eastern parts of the district. Such soils suffer from extensive erosion

due to runoff. The second layer are originally formed from hard limestone, which mean that is suitable for engineering development, and classified as good soil for urban development and has a rank 10.

- 4- **Desert stony soils;** these types of soil are concentrated in the far eastern parts of the district. They are generally characterized by bare rocks and slight soil depths. These soils are originally formed from hard limestone and chalks rocks, which mean that is suitable for engineering development, and classified as good soil for urban development and has a rank 9.
- 5- **Rendzina soils** are defined as shallow (Max. 30cm deep) calcareous soils with only topsoil over hard stony layer. This types of soil can be classified a good soil for buildings, and in some areas it used for some agricultural activities, which mean that these soil is ranked by 5.
- 6- **Terra Rosa** is a red soil containing iron and from a basaltic origin. It was classified as the most fertile lands in the district, and most of its use for agricultural lands. These lands must be full prevented from urban development, which mean that these soils are ranked by 1.

Soil Types layer Weight = 8	
Land Type	Rank
Alluvial Soil	2
Brown forest soil	1
Desert Skeletal Soils	10
Desert stony soils	9
Rendzina soils	5
Terra Rosa soils	1

Table 6.3: Soil Types layer (Weights and Ranks)

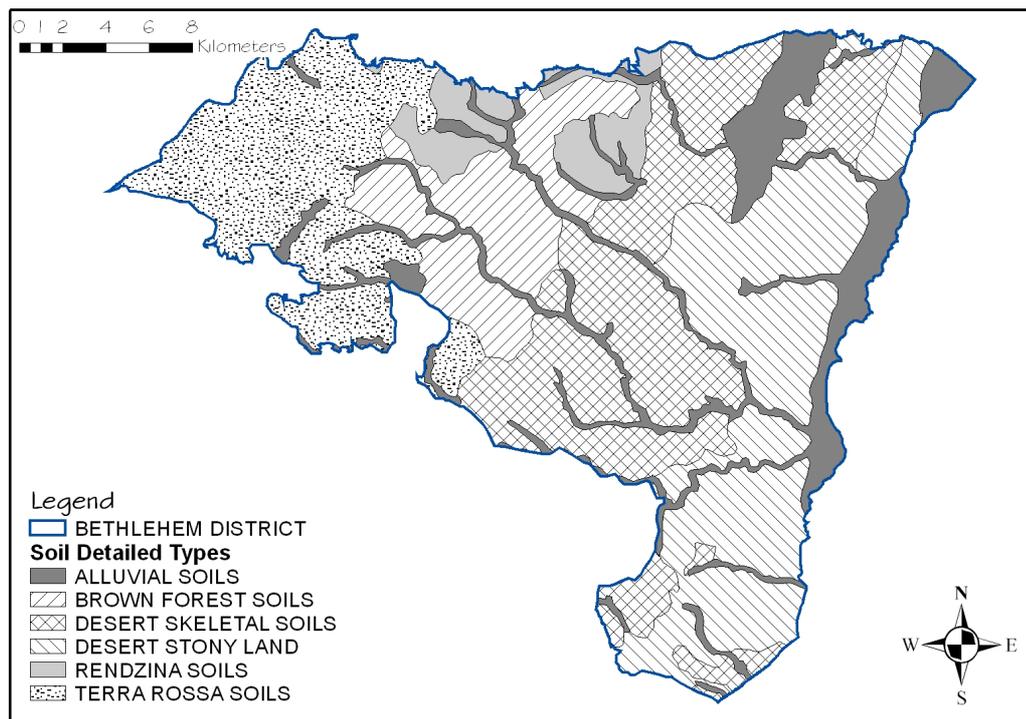


Figure 6.3: Soil Types (MOPIC, 2005)

6.3.4 Existing Urban Areas; (social layers)

Development growth scenarios as shown in Section 2.6 and figure 2.6 can be into several ways; Urban infill, urban extensions, etc. these scenarios direct the high ranks for this layer towards the existing urban areas. In this layer the existing urban areas ranked as 10 which is the suitable for urban infill and extensions for each urban area, while the lands outside urban areas and nearer to its borders took a low rank 4, however the far lands more than 2500m is ranked as 1. See figure 6.4 and see table 6.4.

Existing urban areas Layer Weight = 4	
Land Type	Rank
Existing Areas	10
Near to urban areas and not far than 2500m	4
Far than 2500m	1

Table 6.4: Existing urban areas layer (Weights and Ranks)

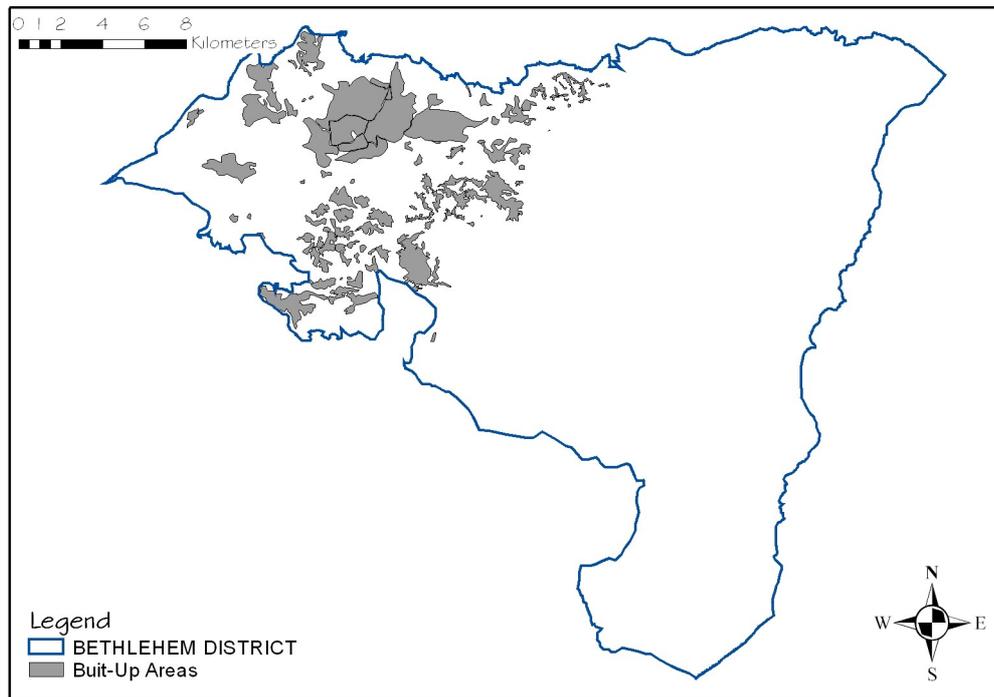


Figure 6.4: Existing urban areas; (MOPIC)

5.3.5 Climate

Bethlehem district Climate ranges from arid to semi-arid, with an increase in aridity towards the eastern direction across the district. While the western parts receive an average of 700mm of rainfall annually, the eastern proximity receives less than 100mm. The average annual temperature in the high grounds of Bethlehem District is 17-19°C. At lower elevations, close to Dead Sea, the average annual temperature reaches 21-23°C, (Benvenisti, 1986).

That mean from the eastern part to the western part of the district is can be seen that the lands became more socially accepted for living, while the eastern part were suggested as desert land. This is clearly appearing in the current distribution of urban areas. The rating for this layer will be the best rate for urban land suitability in the western part while the lowest rates will be in the eastern part. Lands classified as Sub-Humidity is ranked by 10, lands

classified by Semi-Arid is ranked by 7, while the arid lands ranked by 4 and the Hyper Arid is ranked by 1. This layer in general weighted by 4 due to the small difference in its lands types. See figure 6.5 and table 6.5

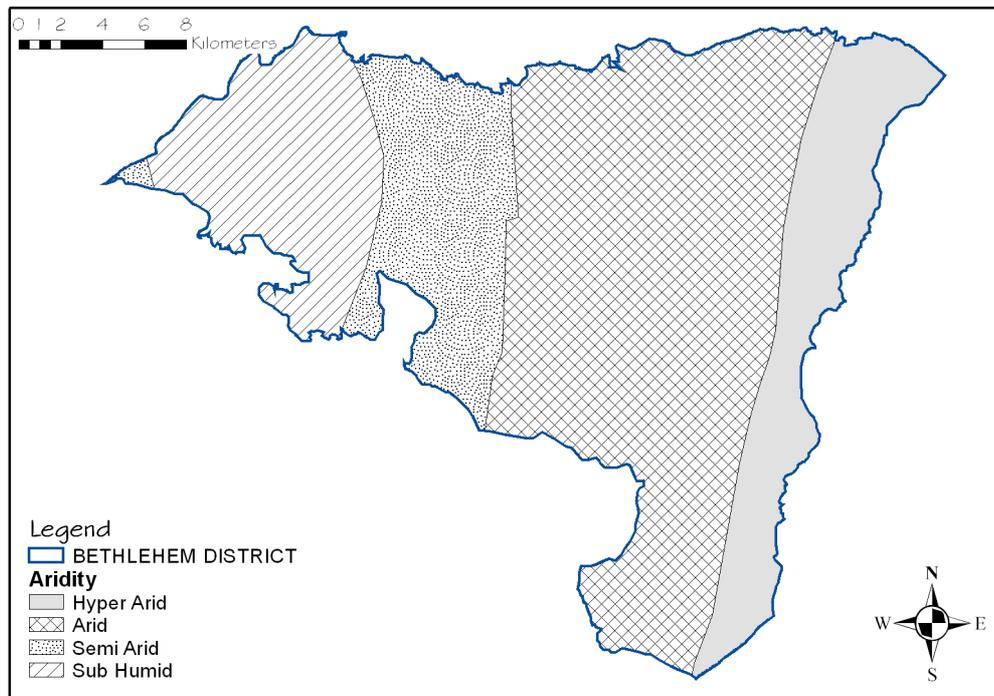


Figure 6.5: Climate (MOPIC, 2005)

Aridity layer Weight = 4	
Land Type	Rank
Hyper Aridity	1
Arid	4
Semi Arid	7
Sub Humid	10

Table 6.5: Aridity layer (Weights and Ranks)

6.3.6 Cultural Places lands;

The importance of sustainability is to study the importance of creating symbiotic relationships between tourism and the environment through the implementation of a visitor management system that takes into account key environmental, cultural and social values, (Roberts, 1996). See figure 6.6.

Cultural Places layer Weight = 3	
Distance from cultural places	Rank
Less than 250	10
Between 250 - 1000	8
Between 1000 - 1750	5
Between 1750 - 2250	3
Grater than 2250	1

Table 6.6: Cultural Places layer (Weights and Ranks)

As shown in table 6.6 this layer showed the cultural and historical places in Bethlehem district, the development near these places will enhance the tourist industry which will enhance the local economy and will decrease the unemployment rate. The lands nearer to these places ranked by 10 as suitable lands for urban development, while the far lands and more than 2250m ranked by 1 which mean not suitable for this kind of urban development. This layer in general is important in economy while in the sustainability the environmental issues is more important that is why this layer took a weight of 6.

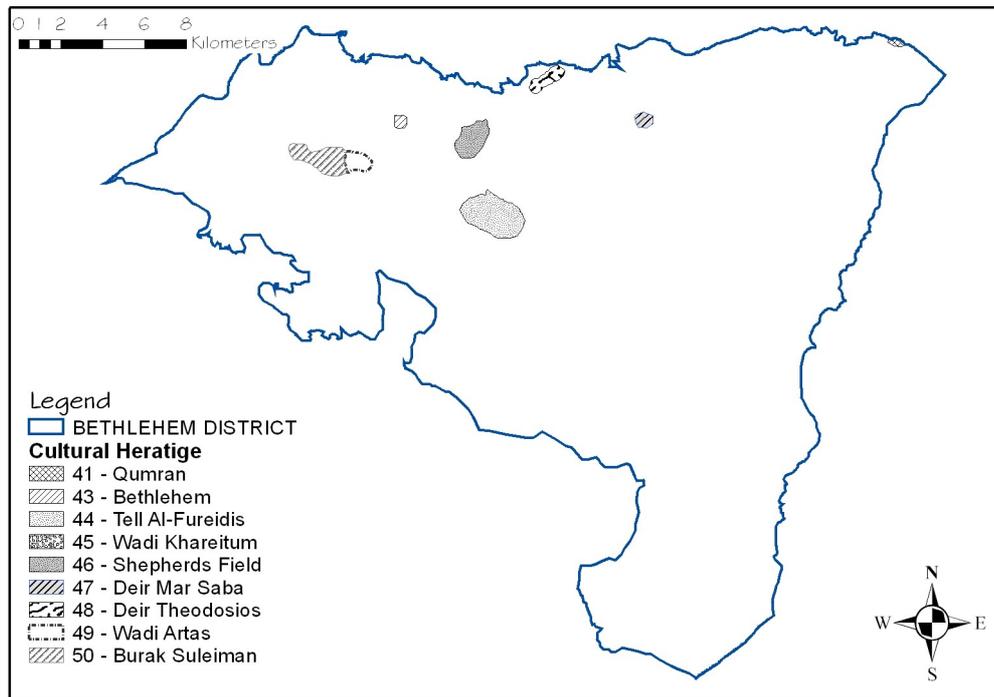


Figure 6.6: Cultural Heritage Places (MOPIC, 2005)

6.3.7 Slope;

Bethlehem District is characterized by great variation in its topography and altitude. The central mountain range of the West Bank crosses the area from south to north in the western portion of the district. The eastern parts of the district are characterized by sharp slopes, where elevation drops from 900 m above to 395m below seal level in the Dead Sea area within a short horizontal distance of 25 km. see figure 6.7

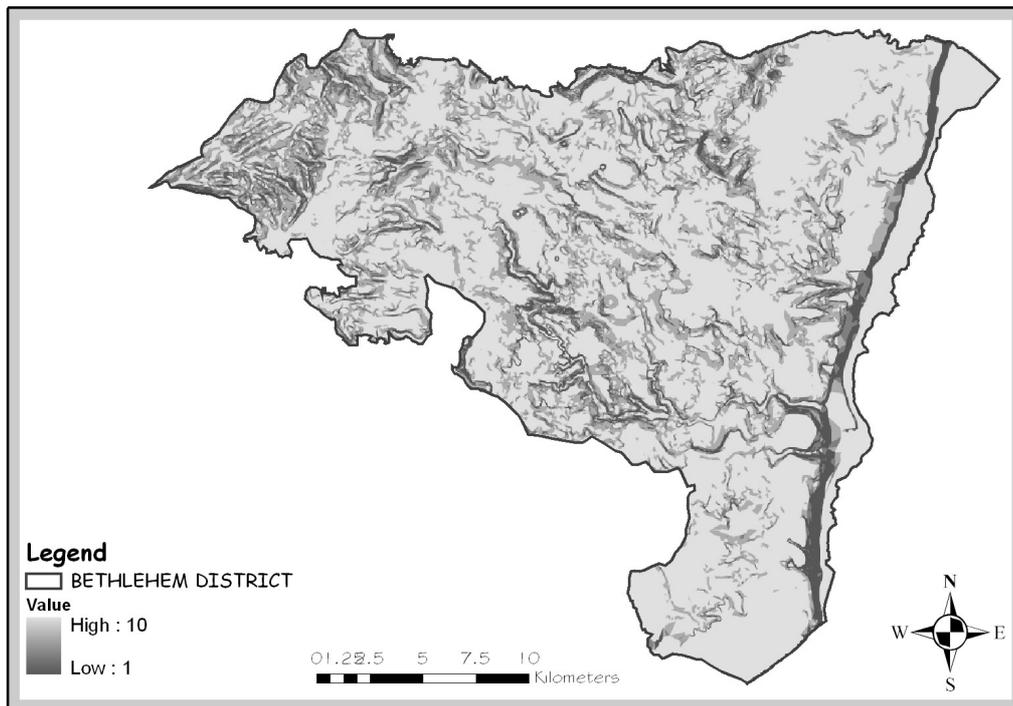


Figure 6.7: Slope (MOPIC, 2005)

This layer showed the slope ranges and its suitability for urban development, the lower slopes is better for engineering development, while the high slopes lands isn't good for engineering development due to road slopes, cut and fill. The next table shows the slopes ranges and their ranks. The most suitable lands for urban development are lands with slope less than 9 degree. While the lands with slopes higher than 42 degree is classified as non-suitable urban lands. The whole layer has an important place in the model and it took a low weight 3. See table 6.7

Slopes layer Weight = 3	
Slope angle (degree)	Rank
Less than 9 deg.	10
Between 9 deg. – 15 deg.	8
Between 15 deg. – 27 deg.	5
Between 27 deg. – 39 deg.	3
Grater than 39 deg	1

Table 6.7: Slope layer (Weights and Ranks)**6.3.8 Distance from regional road;**

The main regional road in Bethlehem district connects Hebron district with Ramallah, Jerusalem, and Jericho districts, See figure 6.8. As shown in table 6.8 this layer showed the road that cross Bethlehem district, the development near this road will enhance the local economy and will decrease the unemployment rate. The lands nearer to these places ranked by 10 as suitable lands for urban development, while the far lands and more than 2250m ranked by 1 which mean not suitable for this kind of urban development. This layer in general is important in economy while in the sustainability the environmental issues is more important that is why this layer took a weight of 5.

Regional road layer Weight = 5	
Distance from regional road places	Rank
Less than 250	10
Between 250 - 1000	8
Between 1000 - 1750	5
Between 1750 - 2250	3
Grater than 2250	1

Table 6.8: regional road layer (Weights and Ranks)

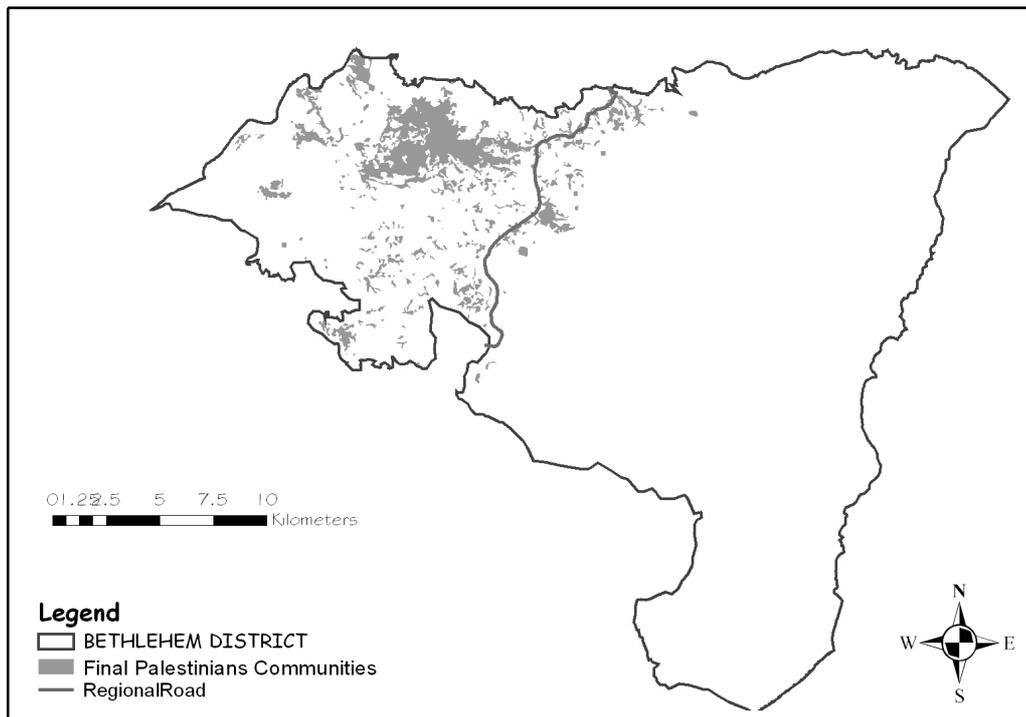


Figure 6.8: regional road (MOPIC, 2005)

6.4 Assignment of Weightings and Ratings Using GIS interface.

The process of assigning weightings and ratings has been undertaken from the indicators and their importance. Final set of weightings and ratings in tables (6.1 to 6.11) which based upon expert knowledge and opinion (see Appendix G) were in filled into the ArcGIS Software.

ArcGIS provides a graphic user interface which allows planners, and decision-makers to easily enter rates and weights and run a model. Rates assigned by using spatial analyst (classify graphic user interface) shown in figure 6.9 with in this interface the following steps are shown:

- 1- Select the layer that will be reclassified (Ex: agricultural Final layer).
- 2- Select the data field that will be reclassified (Value field).
- 3- Enter new value (rate) for each type of lands in this layer; the software will assign this rate for each cell has the same property. (Ex Agricultural land).

4- Click on classify.

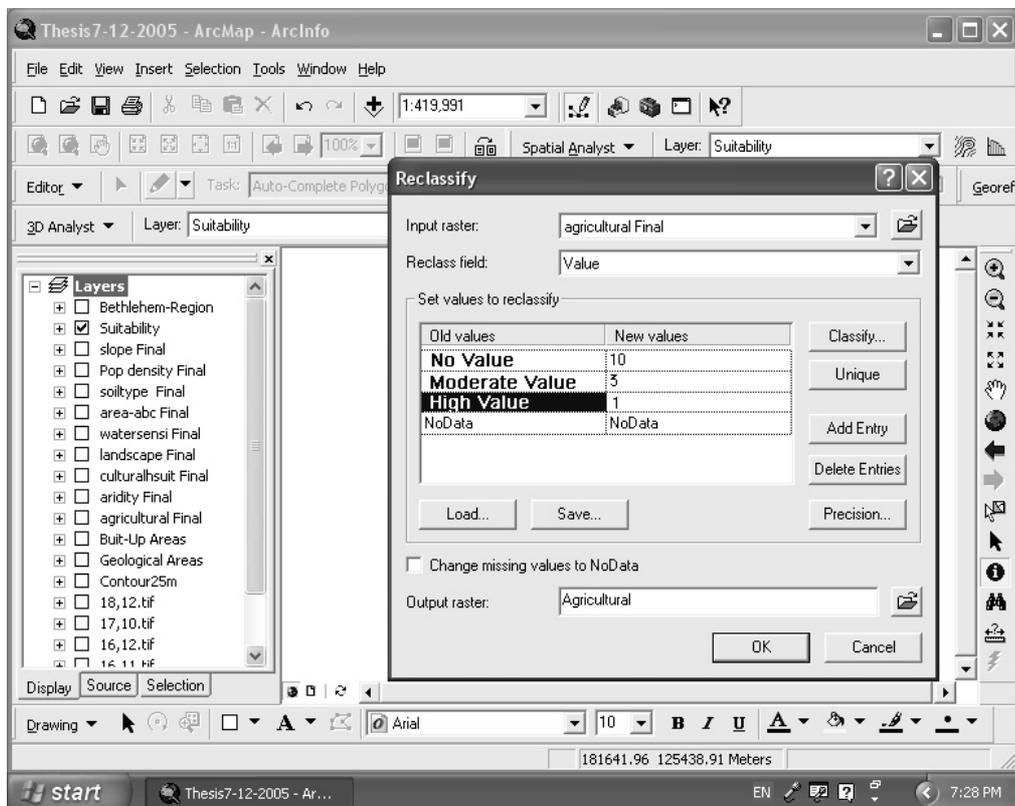


Figure 6.9: Suitability Definition (Reclassify Graphic User Interface)

- 5- The result will be a new raster data layer which includes the new rating for each type of land.
- 6- Repeat these steps for each data layer.

Old Value	New Value	Note
No Value	10	Very suitable for urban lands
Moderate Value	3	Can be used in some urban lands
High Value	1	Not suitable for urban lands

Table 6.9: Agricultural Layer Ranks

6.5 Develop Land Suitability Maps using GIS:

The final suitability map is produced by combining all the data maps (layers) together. Each cell in each data layer has its rate which will multiply by the

weighting values for the layer showed in tables (6.1-6.8). Weights can be assigned by using spatial analyst (Raster Calculator graphic user interface), the assigning of weights were by using the equation of MCE model $S = \sum(w_i \cdot x_j) \cdot C_k$ - Equation 3.4. This equation applied for each cell in each layer and by the summation of all the layers cells. See fig 6.10.

$$S = \sum(w_i \cdot x_j) \cdot C_k \text{ (For 8 layers)}$$

$$S = (W_1 \times R_1 + W_2 \times R_2 + W_3 \times R_3 + W_4 \times R_4 + W_5 \times R_5 + W_6 \times R_6 + W_7 \times R_7 + W_8 \times R_8) \times C_k$$

$$C_k = 1 / (W_1 + W_2 + W_3 + W_4 + W_5 + W_6 + W_7 + W_8)$$

$$\begin{aligned} \text{[Suitability Lands]} = & (10 * [\text{agricultural Final}] + 4 * [\text{ExistUrbanArea Final}] + \\ & 4 * [\text{aridity Final}] + 2 * [\text{culturalhsuit Final}] + 3 * [\text{landscape Final}] + \\ & 5 * [\text{Regional Road}] + [\text{soiltype Final}] + 10 * [\text{watersensi Final}] / 42 \end{aligned}$$

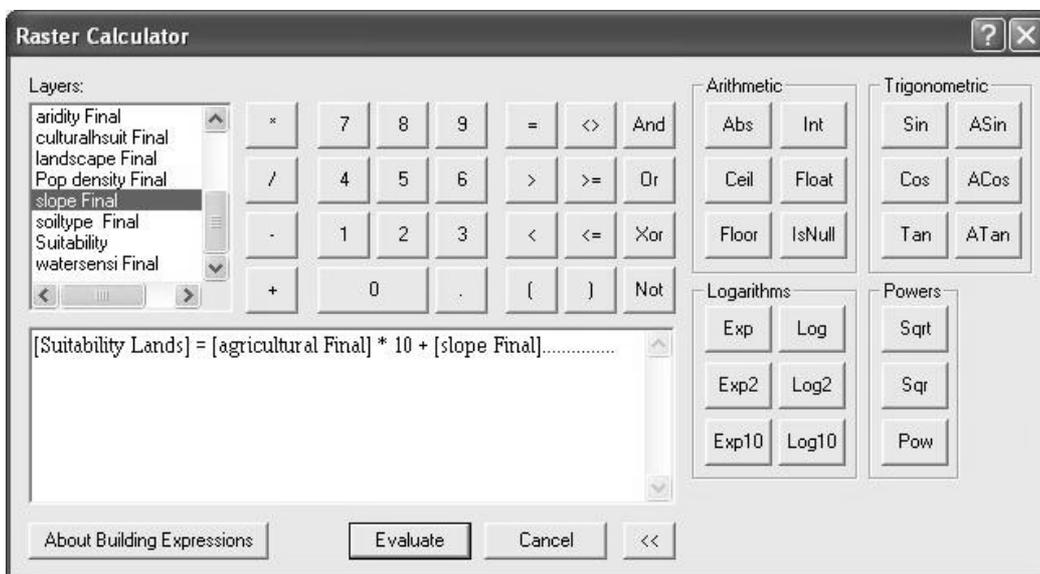


Figure 6.10: Suitability Map Production (Raster Calculator Graphic Interface)

The result will be a suitability map displaying the best locations for urban lands. Higher values indicate more suitable locations for urban use. See fig 6.10 that shows lands from least suitable to most suitable and not suitable urban lands.

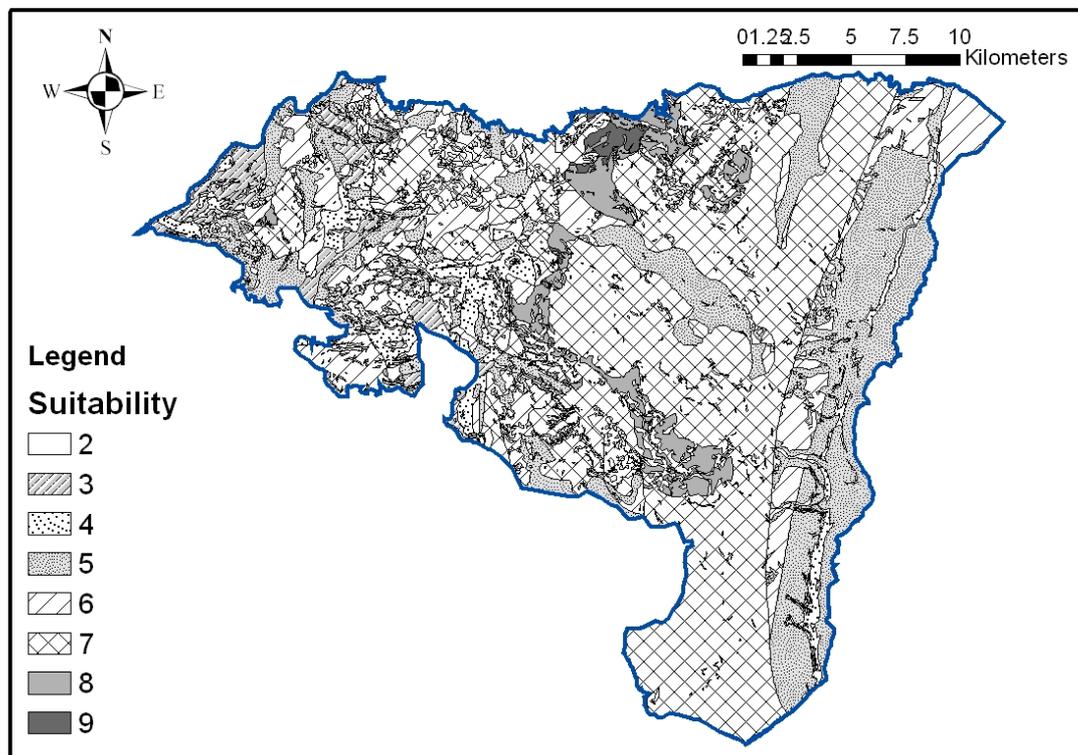


Figure 6.11: Suitability land layer

6.6 Projecting Land Use Demands

The second component of the land use model is to calculate projected urban lands demands based upon thesis assumptions. The demand assumptions for residential, regional commercial, industrial, preservation and different defined land uses are used to find the urban land use demand. This section of this chapter applies the input parameters, underlying equations, and the results in projecting of the future land use demands in Bethlehem district up to 2025.

The complete list of land use categories used in the formulation of the ‘sustainable development’ model; the land use types (urban lands) assumptions can be based on the data in section 5.3.2 and Section 2.4.4; the urban lands projection figures extend until 2025 using linear extrapolation of the used urban lands by using equation 3.2 and 3.3 is 82086 donam.

$$r = ((31552 - 17478) / 17478) / ((174654 - 124441) / 124441) = 2$$

$$A_1 = 2 \times 31552 (314520 - 174654) / 174654 + 31552 = 82086 \text{ Donams}$$

6.7 Allocating Projected Land Use Demands

The allocation of land for the ‘sustainable development’ model uses both the results obtain in the land suitability component (see fig 6.14), and projecting land use demands component as primary inputs (see section 6.6), and other inputs include development growth scenarios (showed in fig 2.6). Each of these data items used in formulation the final land use suitable allocation.

While constructing a suitability scale, work with experts to find the best scenario (see table 6.10). Experts were knowledgeable about the objective being studied. They also classified the range of resulted rates gained from the thesis for each regional land type in the final land use allocation, (see Appendix G).

Land Use Type	Ranges
Highly recommended Urban Areas	7-10 (Most Values 8-9)
Rural use areas	4-6
Protected Areas (Open Lands)	1-3
Freeze Areas (Existing Urban Areas)	1-3
Suitable for urban land	7-10 (Most Values 7-8)

Table 6.10: Suitability ranks for land use types

The final allocation map for regional land use shown in figure 6.11. The results of the ‘sustainable development’ model can be represented both numerically in tables and visually. Numerically, the regional land allocation requirements for each of the land uses comprising Bethlehem district are shown in Table 6.11. This table shows that the final amount of urban lands within the regional land use plan equal to 84008 donam which is satisfy the required urban areas as shown in section 6.6. While visual representation of the ‘sustainable

development’ model has been undertaken using Arc View GIS and AutoCAD in finalizing the regional map. The second principal results of the ‘sustainable development’ model are land use maps comprising the regional land use categories relocated to Bethlehem District. Figure 6.11 illustrates the differences in the existing and projected urban growth patterns, depicting where exactly growth is expected to occur.

Land Types	Area (Donam)	Used (Donam)	Final New (Donam)
Recommended Urban Areas	54398	13726	54398
Ex. Urban areas with some restrictions	15597	3813	15597
Highly Restricted Exist. Urban Areas	12585	3204	3204
Restricted Open Areas	269316	0	0
Freeze Areas	10809	10809	10809
Suitable for urban land	230356	0	0
Total	593061	31552	84008

Table 6.11: Land Use Allocation Results

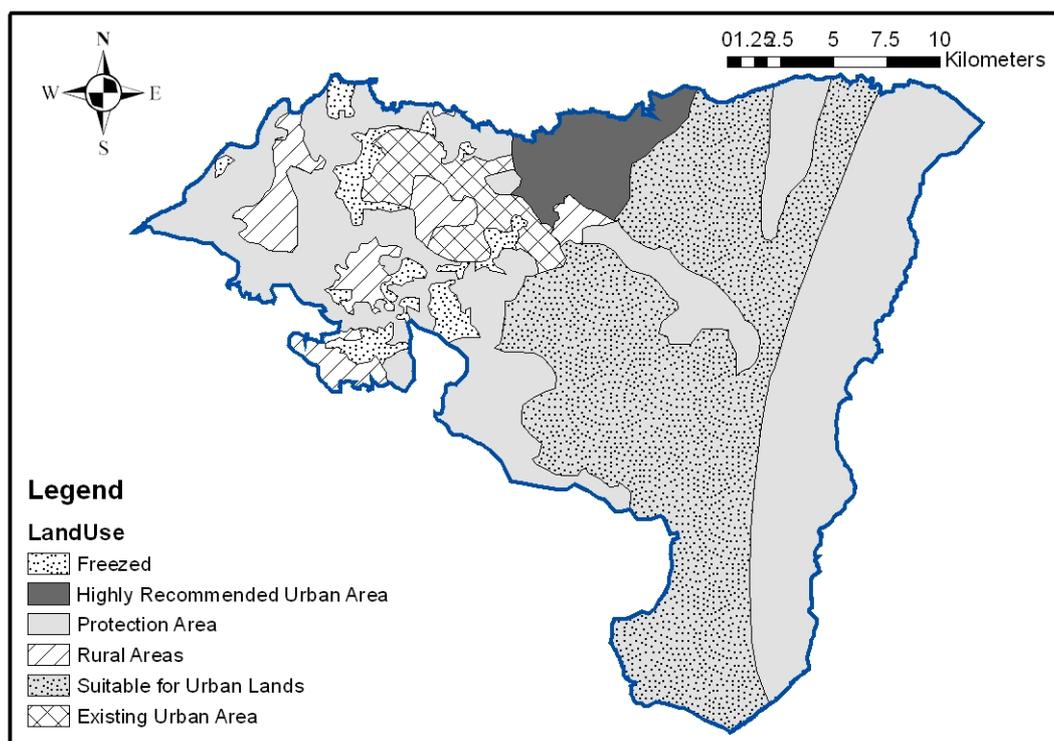


Figure 6.11: Final Regional Land Use Plan**6.8 Verifying the model's result**

Verifying the results obtained from sustainable model and the use of MCE by apply spatial analyst in ArcGIS, a site visit for the resulted lands, and digital photos can verify the results obtained. See Figure 6.12

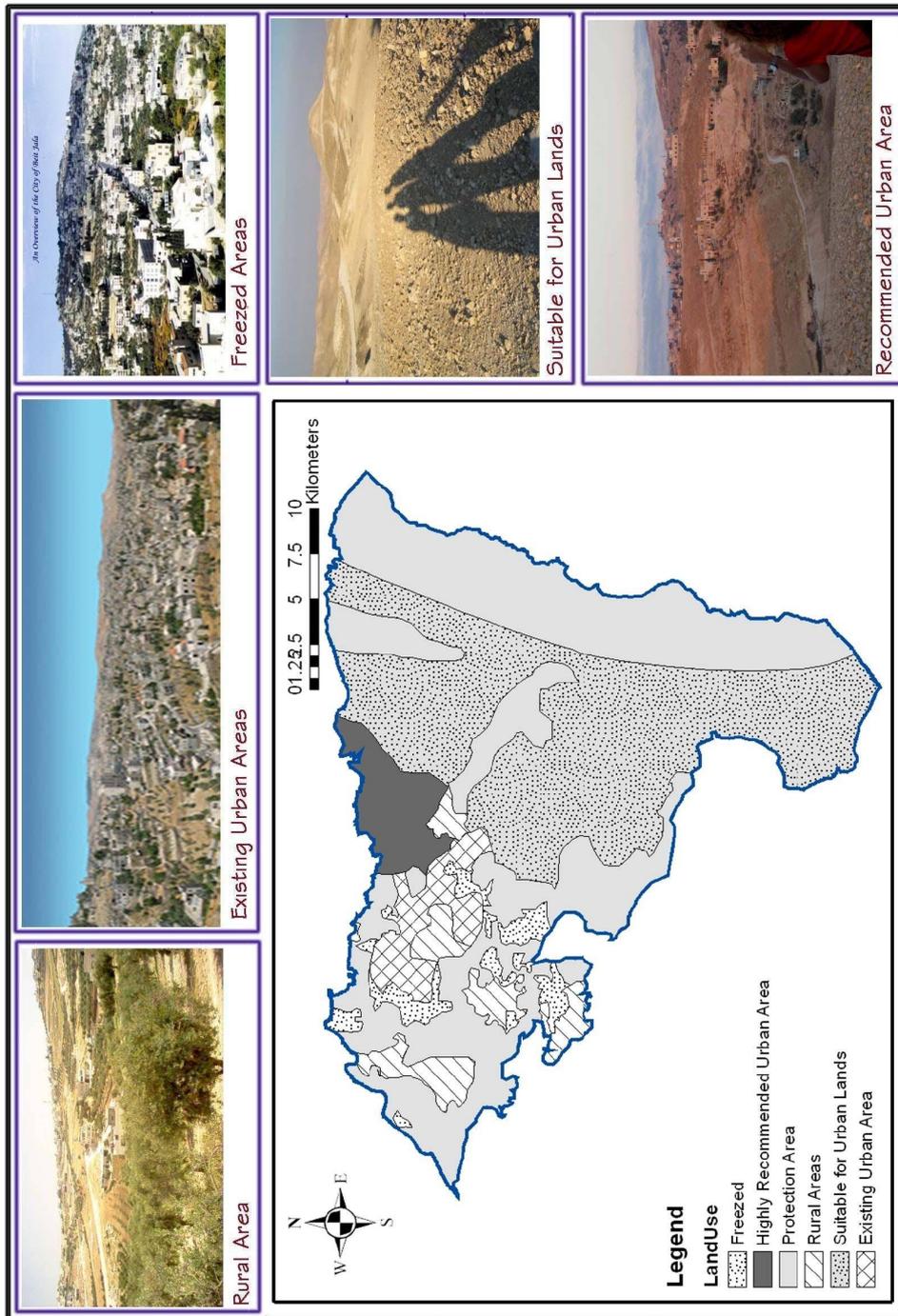


Figure 6.12: Verification Sites

5.5 SUMMARY

This chapter discussed the sustainable land use model for Bethlehem district, and shows its results, depending on the importance of environmental considerations in the planning of future urban growth. The ‘sustainable

development' model took into consideration the most suitable designation areas based on their social, economic and environmental significance using multiple criteria analysis (MCE) and the spatial analyst technology in the Arc View.

Chapter Seven

Discussion and results

7.1 INTRODUCTION

This thesis has investigated the main aspect that lead to urban growth in Bethlehem district. A sustainable model for land use and urban growth is applied. The aim was to efficiently plan for future urban growth by developing regional land use plan by running sustainable development model that incorporate demographic, socio-economic, environmental and physical information.

Sustainable land use planning model for the district of Bethlehem situated within the West-Bank, in the Palestinian National Authority, Palestine were presented in Chapters 6 which utilized by geographical information system GIS and multi criteria evaluation MCE model with land suitability analysis techniques.

7.2 RESEARCH STATEMENT AND OBJECTIVES – REVISITED

7.2.1 Research Statement - Revisited

The research statement: develops an efficiently regional land use plan for integrating aggregated and disaggregated socio-economic, environmental, and physical datasets within sustainable land use planning models in order to formulate and evaluate urban growth in Bethlehem district.”

7.2.2 Research Objectives - Revisited

The main objective of this thesis is to find regional land use plan and policies of Bethlehem district that compliment with the criteria of sustainable Development. As a note of caution Evans (1997, p.8) has said that: “It has become common place to assert that one purpose of planning is to secure

sustainable cities, or perhaps a sustainable pattern of land use."

7.3 REGIONAL LAND USE PLAN AND ATTACHED POLICES

7.3.1 MISSION STATEMENT

To maintain and enhance the District physical, natural, and cultural features and to manage growth and development in a manner that enhances the quality of life in Bethlehem district and reflects an awareness of the environment, ensuring ecological and environmental considerations are incorporated into the Plan.

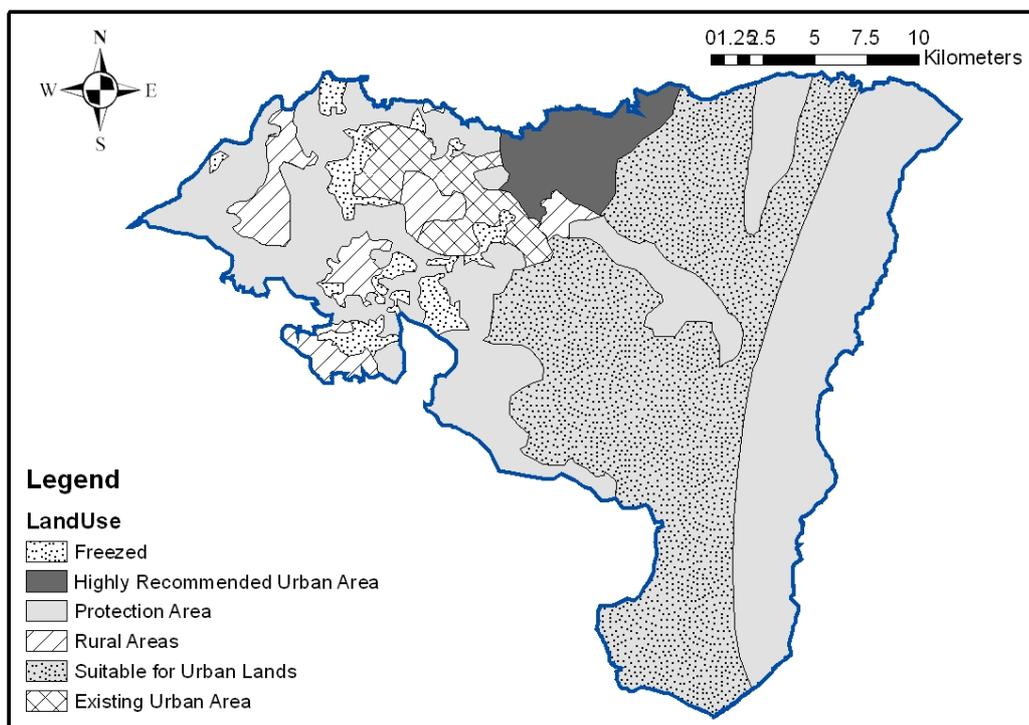


Figure 7.1: Final Regional Land Use Plan

7.3.2 PLAN HORIZON

The Plan provides guidance for the development and planning of regional land uses for a period extending to the year 2025. The Plan anticipates that the population of the district will not exceed 314,687 people by the end of the planning period.

The planning horizon serves as an appropriate measure of the duration of the Plan and should not be regarded as a specific completion date for its implementation. Furthermore, the Plan should not be regarded as a static document that is resistant to the pressures of economic, social, or environmental change during the planning period.

7.3.3 GUIDING PRINCIPLES

The urban and rural environment that is desired for Bethlehem District is summarized as follows:

- a) Control and provide a communities plan and growth strategy. The new communities are 100% preserve the environmental issues.**

The Plan enhances the quality of life for Bethlehem district residents by providing new lands or new community for urban growth, by maintaining and attractive the existing livable community and by freezing the communities' hat effect on the district resources. These communities represented in (Tque...)

- b) Ensure that the district regional infrastructure and services.**

The Plan ensures that land use development is supported by appropriate services, infrastructure and municipal debt load. The plan divides the district for four communities (Central Urban Areas, Southern Rural Areas, Western Rural Areas and New Eastern Urban Area); each community will be served by a local council and the other freeze communities with served by one local council.

Public transportation system will be cost effectively for the region, see figure 7.2. The Plan addresses the need for social fairness by

ensuring that all Bethlehem district community residents have equal access to housing in different areas by offering transit service to most employment areas.

7.3.4 LAND USE VISION

7.3.4.1 Background

The land use vision considers both a view of the physical character of Bethlehem district in the future and a view of the way how the district will be experienced in terms of its quality of life. The vision is based on the mission statement of directing growth in a manner that enhances the district character while providing a broad range of opportunities for its residents and businesses. The four guiding principles provide further direction on the image to be created for the district in the future.

7.3.4.2 The Present Built Form and Natural Environment

The existing district structure is unplanned communities. Bethlehem district is composed mainly of many spreaded communities separated from necessary services, employment and main shopping areas, with small services with each community border, existed primarily around a transportation system based on car and taxis travel, and administratively a local authority for each community. Much of this unplanned development occurred during the last 30 years in a time of increasing average family size, and bad economic and political situation.

Bethlehem residents, municipality and local Authorities have to be more aware of environmental concerns, and limited resources. This awareness will be apparent when the district will declare a "sustainable

community”, with greater emphasis places on quality of life issues and less on unlimited growth. Changes in demographic trends show an increasing in used lands for urban use. This vision anticipates that some aspects of the district structure will stay the same without any change; however, there will be changes in other areas, which will be designed to increase opportunities for Bethlehem district residents and enhance quality of life.

7.3.4.3 The Future Built Form and Natural Environment

Structural features that are expected to stay the same over time include: maintaining a variety of residential communities; an historic central city focused on the Bethlehem city; development of new urban communities in the eastern part of Bethlehem.

Key Changes; Changes that are encouraged by this Plan are:

1. Provide an administratively new divisions for Bethlehem district;
 - New Eastern Urban Area
 - Central urban areas
 - Southern and western Rural Areas
 - Freeze Lands and Undeveloped lands.
2. the development of a new communities to meet the changing needs of the population, and focusing on more intense land uses into specified mixed use centers (infill the open lands) in the existing urban communities;
3. Freeze urban development in the all the un-development marked lands, that’s for the greater emphasis on the long term

preservation and conservation of significant natural features.

4. Move towards a more balanced transportation system;

These changes, discussed in more detail below:

A. Significant Growth Anticipated

Demographic and economic trends project significant increases in both population and number of employees over the next twenty years.

B. Shift in Employment

The Plan also enhances the historical nature of the employment sectors, reflected by the addition to the urban areas near to the historical places within the district which enhance the traditional manufacturing and warehouse of tourist sectors, the plan also enhance more agricultural based industries.

C. New Eastern Urban Area

The main new communities are the area that assigned in the plan by “Highly recommended Urban Lands”, and administratively Assigned by (New Eastern Urban Area). Its location in the nearest eastern Part of the District. This area can be an extension and combination of three existing village (Al-Ubeidya, Dar-Salah, Al-Shawawreh and Zatara). This Area classified as a highly recommended for urban use because its location in the political Zone A, which is under a full control of the Palestinian Authority.

D. Central urban areas

The main existing community is the area that assigned in the plan by “Existing Urban Lands”, and administratively Assigned by (Central

urban areas). This area can be an extension and combination of three main cities and three towns (Bethlehem, BeitSahour, Beit-Jala, Al-Khader, Ertas, and Al-Doha). The center of this community is a main center of the district due to its historical Place and demographic density. This communities is located within the political Zone A and B, while it is also locate on a moderate agricultural lands. So any future detailed land use plan must comprise a set of policies that ensure a sustainable land infill within this region.

E. Southern and western Rural Areas

The second existing community is the area that assigned in the plan by “Urban Lands with restrictions”, and administratively Assigned by (Southern Rural Areas), this area can be an extension and combination of (Beit-Fajar, Umm Salamonah, Al-Masara, Rakhama,), and the (Western Rural Areas), this area can be an extension and combination of (Battir, Husan, Nahaleen...). This community is located within the political Zone B and C, while it is also locate on high and moderate agricultural lands. Future detailed land use plan must comprise a set of policies that control urban development without affecting the agricultural lands. These existing communities have the opportunity for expansion with high restrictions laws, and only to satisfy the urgent requirement for the existing urban communities.

F. Protected Area, Preservation of Natural Features

Another change to the district is the increased emphasis placed on the protection, preservation, and conservation of significant natural

resource features and providing accessibility to public open space.

G. Integrated Transportation System

This Plan supports development of an integrated transportation system consisting of roads and public transportation.

H. Agricultural Operations

Existing agricultural operations are a permitted use in all land use designations outside of the Urban Planning Area.

6.4 FUTURE RESEARCH

“Research is never conclusive. In exploring an area, one comes across additional problems that need resolving. Research begets research... Each researcher soon learns that genuine research creates more problems than it resolves. Such is the nature of the discovery of knowledge”, Leedy (1997; p9). Such has been the case with the research detailed in this thesis. Future research is recommended in the following key areas:

5. Political situation and fact on lands shows the need for periodic plans to fit with the thesis output plan for Bethlehem region.
6. Detailed land use plans for the suggested urban communities, these plans has to infill the lands within the existing urban lands and then to a detailed infrastructure and housing strategies
7. After applying these results on the Israeli vision of segregation wall which comprise most of the eastern and western lands of Bethlehem district, the future expansion without affecting our recourses will be during the next 20 years only. This mean that after 20 years there will be no lands in Bethlehem district for any another future expansion, which may lead

for a new revolution between the year 2015-2020

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Appendix A

