

# LAND DEGRADATION: SOCIOECONOMIC AND ENVIRONMENTAL CAUSES AND CONSEQUENCES IN THE EASTERN MEDITERRANEAN

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## ABSTRACT

Land degradation is a natural and socioeconomic cause–effect phenomenon that is widespread all over the world. This study investigated the socioeconomic factors and causes of land degradation (e.g. population growth and urbanization, poverty, overgrazing, pollution, biodiversity, erosion) in the eastern part of the Mediterranean region. The study revealed a significant land use change from agricultural and natural vegetation to urbanized areas due to the high population increase during the last ca. 80 years (51-times the magnitude of the total built-up area). The high poverty rate that exists in the area (57 per cent of the population can be classed as ‘poor’) has resulted in damaging environmental practices (overgrazing and intensive usage of natural plants); we found 83 per cent of the farmers admitted to the adoption of these practices. Poverty has also resulted in an inverse and significant correlation (at the 95 per cent confidence level) between holding size and the sale of land for urban uses. We also noted that 75 per cent of the smallholder farmers surveyed had sold their lands for immediate benefits to cope with poverty. This relation was affected by the education level of the farmers; we found a direct and significant (95 per cent confidence level) correlation existed between these factors. Overgrazing was practised by 70 per cent of the farmers and was found to be one of the most important environmental consequences of land use change (1600 ha have been transformed from natural grazing to built-up (urban) in the study area).

Socio-economic induced land degradation demands efforts to improve farmer environmental awareness as well as environmental standards, laws and bylaws and the reduction of mismanagement of land. Copyright © 2010 John Wiley & Sons, Ltd.

KEY WORDS: land degradation; Mediterranean; urban expansion; poverty; land use change; overgrazing; Palestine

## INTRODUCTION

Land use changes are one of the main driving factors that negatively influence the agriculture sector, especially in developing countries which have limited natural resources. Amongst the most important anthropogenic factors affecting the land is urbanization and 60 per cent of the human beings are expected to reside in cities by 2030 (United Nations, 2007). Urban expansion both in magnitude and extent has resulted in serious socioeconomic and environmental deterioration at various scales (Prasad and Badarinh, 2004). The result of such deterioration is land degradation (Wakindiki and Ben-Hur, 2002; Arhonditsis *et al.*, 2002). Human interference is one of the important factors that is affecting the rate of such degradation (Millward and Mersey, 1999; Arhonditsis *et al.*, 2002). Human interference may and be harmful in its effect (Pimentel, 2000) in some cases it can result in positive and desirable changes in land use (e.g. rehabilitation or conservation). When land degradation occurs there is qualitative and quantitative decline in

usability and productivity (Upadhyay, 1991; Arhonditsis *et al.*, 2002). Natural factors (e.g. rainfall characteristics, geomorphology and soil properties) as well as socio-economic (e.g. poverty, land fragmentation, decrease in standard of living, low level of education and poor health conditions) are causes of land degradation (Sheng, 1989). Researchers often perceive land degradation as the consequence of existing social and economic conditions experienced by the final beneficiaries (in this study the farmers). Environmental, social and economic conditions form a situation where people work together and intermingle in ways guided by regulatory laws, bylaws and a network of social relationships represented by traditions, culture, ethnicity, inheritance, gender, age and other social forces (Lubwama, 1999). In some cases, socio-economic factors plays a major role in the occurrence of land degradation, for example: where there is urbanization and its related pollution (Prasad and Badarinh, 2004). In other cases, socio-economic factors have hindered the efforts to cope with land degradation (Barrow, 1990; Lubwama, 1999). For example, in the Tigray region of Ethiopia, soil erosion, the economic capacity of households, the existing social and institutional structures, demographic characteristics of the

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households and population growth as well as related urban expansion and basic food requirements, all constitute important driving forces for serious land degradation, which has led to land use changes and land use neglect (Gebremedhin *et al.*, 2003). With regard to the economic factors, the latter study revealed that the farmers' motivation to adopt land conservation measures was influenced by their expectations of their economic benefits (Gebremedhin *et al.*, 2003).

The assessment of the environmental and socio-economic causes and consequences of land degradation, especially in the countries of the Mediterranean, is difficult due to the lack of necessary data and the insufficient funding for such assessment. As a result, proper plans to conserve and manage 'high-risk land degradation' areas are either inadequate or absent (Upadhyay, 1991; Arhonditsis *et al.*, 2002). In areas where land degradation is prevailing, the data available on its causes and its main consequences are either qualitative or absent, which can be considered a major obstacle to any future development because it hinders appropriate plans for sustainable land uses (Upadhyay, 1991; Arhonditsis *et al.*, 2002).

The eastern part of the Mediterranean, especially the central part of the Palestinian Mountains, is subject to sudden and drastic environmental and socio-economic changes. These changes lead to the partial and/or complete abandonment of large areas of agricultural land resulting in noticeable but non-quantified land degradation (Abu Hammad *et al.*, 2004; Abu Hammad and Borresen, 2006). The abandonment of some established soil and land conservation measures (e.g. terraces, stone-bunds, anti-contour plowing) as urbanisation spreads, causes an increase in land degradation. In addition, this part of the Mediterranean has witnessed problematic political and military conditions that have drastic influences on the environmental and socioeconomic situation, contributing further to the deterioration of the environment as well as the peasants' socio-economic conditions. Such a deterioration is reflected in a noticeable increase in pollution, increasing poverty, decrease in the farmers' access to their lands, land fragmentation and the loss of the farmers' land ownership due to land confiscation for military and colonial activities (Palestinian Central Bureau of Statistics, 2003b, 2004a, 2004b). Land holding size in Palestine is estimated to average less than 4 ha (Applied Research Institute of Jerusalem, 1994). Small landholdings are the resultant of the afore-mentioned political situation and land fragmentation due to the inheritance system, which is related to the Islamic Law of Inheritance, where the fathers' land is divided between sons and daughters (Issac *et al.*, 1997). All of these factors can be considered as the human causation contributing to land degradation, which if not tackled

properly, could lead to complete deterioration of the agricultural sector, the backbone of the Palestinian economy.

The objectives of this research paper can be stated as follows: (i) to explore the current status of land degradation in the study area, (ii) to highlight major land degradation causes and consequences, and (iii) to suggest recommendations that might be useful for similar areas of the Mediterranean.

## THE STUDY AREA

The study area is a small portion of the Central Palestinian Mountains. It is approximately 12 887 ha in extent and is located 6 km northeast of the Ramallah Governorate in the West Bank (Figure 1). The study area comprises about one-third of the total area of the Ramallah Governorate. The area was selected on the basis of its environmental and socioeconomic changes, the presence of soil conservation and management practices, and the representativeness of its land use and topography. Also, the study area was chosen so as to represent two main climatic and geomorphologic characteristics, to enable comparison between diverse ecosystems as well as the socioeconomic settings. Based on the afore-mentioned criteria, 12 villages, which represent 15 per cent of the total built-up portion of the study area, were chosen to conduct the field survey of the environmental and socioeconomic factors that are affecting land degradation (Figure 2).

Generally speaking, the study area is characterized by semi-arid and sub-humid conditions in the eastern and western parts of the study area, respectively. A well-marked summer and winter season characterizes the study area. The mean annual rainfall for the period from 1970 to 2005 ranged from 150 to 700 mm in the western part and the eastern part, respectively (Figure 3). Most of the rainfall (more than 90 per cent of the annual rainfall) falls during the winter season between October and April (Palestinian Ministry of Transport, 1998) with virtually no summer rainfall occurrence. Such condition is associated with high runoff and soil erosion as a result of the simultaneous erratic rainfall events and the accompanying drought periods with poor vegetative cover, resulting in soil surface exposure to the occasional and intense rainfall events, with consequent erosion (Johnson and Lewis, 1995). These factors are being considered as the natural-physical factors contributing to land degradation.

The study area is characterized by moderate to steep slopes with limited water and land resources for agriculture. The shortage of agricultural land has been substituted for by the construction of an extensive system of old terraces, aiming at the conservation of the soil moisture and minimizing land degradation by soil erosion.

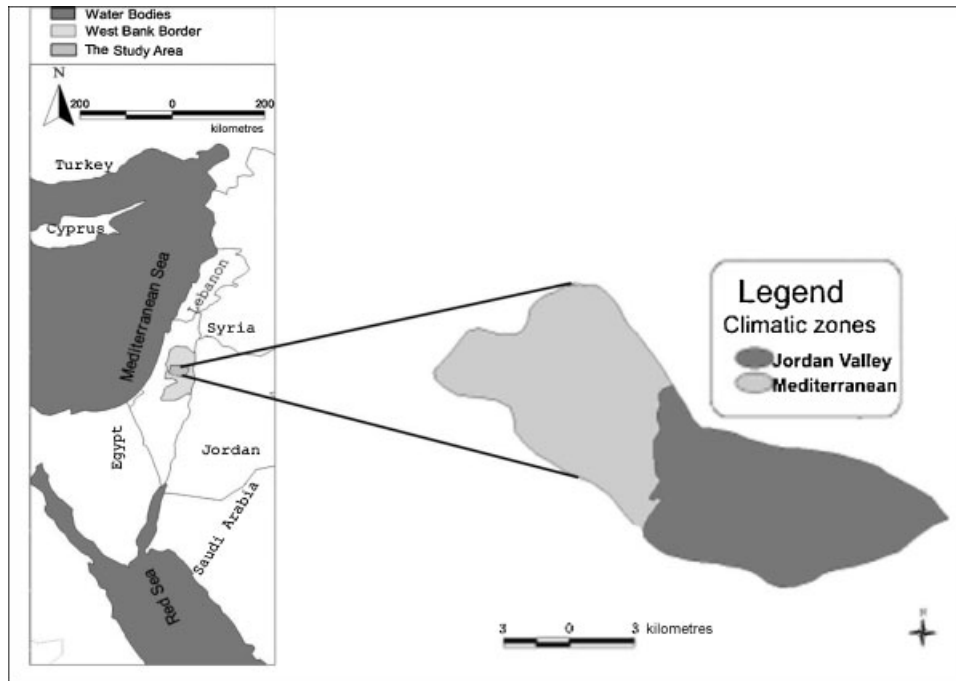


Figure 1. Location of the study area along with the major climatic zones prevailing.

Natural grassland and woodland shrubs cover the greater part of study area followed by olive groves and field crops (Table I). During the winter-time, natural grassland has a thick surface coverage in the western part,

whereas the plant surface coverage is sporadic and thin in the eastern part. During the summer time, most of these grasslands disappeared due to lack of soil moisture, overexploitation by the inhabitants, urban expansion on

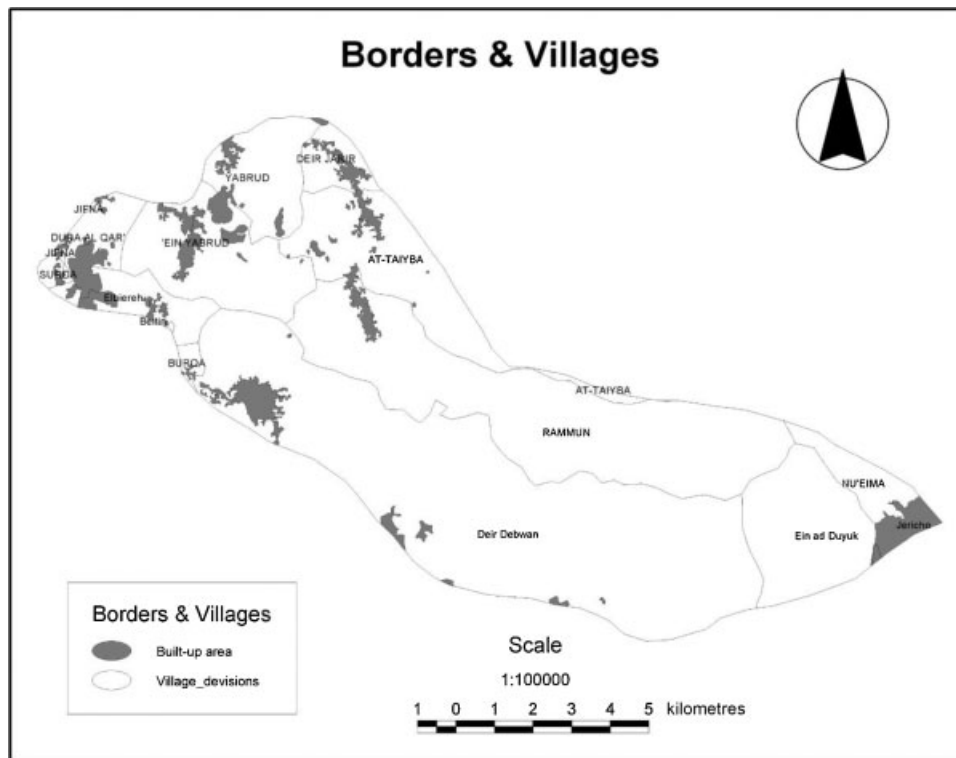


Figure 2. Village boundary areas along with the different village built-up areas existing in the study area.

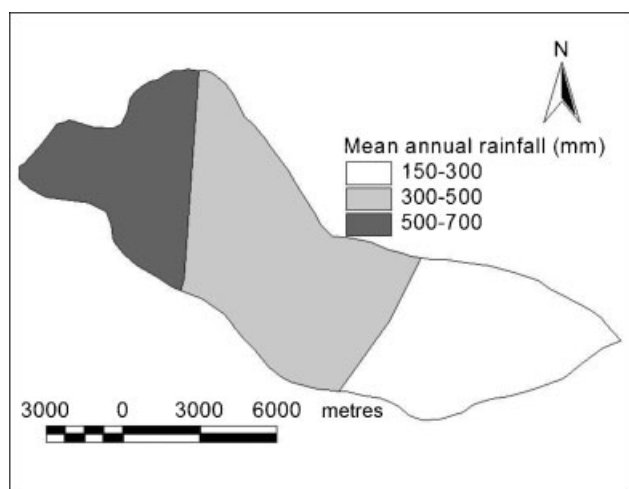


Figure 3. Mean annual rainfall in the study area.

such lands, as well as overgrazing in both parts of the study area.

## MATERIALS AND METHODS

### *Land Use/Land Cover*

For detailed information on different land uses/land cover, a SPOT image 5 of the study area for 2003 was used. The SPOT image has a resolution of 2.5 m and was rectified for correct measures and area calculation. In addition, the SPOT image was correlated to the local Palestinian Grid for proper geographic identification of the study area. ERDAS Imagine 8.2 software<sup>®</sup> (ERDAS Inc., 1995) was used to execute the remote sensing technique in order to extract data on different land use/land cover. The remote sensing technique has used the supervised classification method in order to identify the existing land use. The supervised method of remote sensing technique depends mainly on manual drawing and delineation of the spatial pattern and distribution of the existing land uses from the SPOT image. For quality assurance, the results were compared with actual field data for the validation of different type of existing land use/land cover (supervised method).

Table I. Study area land use

Land use category	Area (km <sup>2</sup> )	per cent of total watershed area
Field crops	14.124	11.0
Natural grassland and Woodland shrubs	89.828	69.7
Olive groves	16.660	12.9
Built-up areas	8.753	6.4

Detailed survey of the natural vegetation was conducted at the end of spring 2003. The main objectives of the survey are to identify various vegetation characteristics (mainly qualitative data) such as the identification of different plant cover types that comprise the natural vegetation (Culmsee and Deil, 2003; Ulrich, 2003).

### *Historical and Current Environmental Settings in the Study Area*

Historical data for the study area, such as those related to main land uses and land use changes in a chronological order, were collected. For this purpose, a detailed historical database was constructed. The database included the following:

- past and current built-up area (size, location, and direction of expansion),
- population growth and population density,
- land uses and land use changes at different time horizon, focusing on agricultural land use and other land uses that are negatively affecting the agricultural land (built-up, industry and commonly practiced mining).

For the current environmental, social and economic conditions of the study area, a close-ended questionnaire was prepared to provide data on different factors that are contributing to land degradation. The questionnaire was divided into five main parts; these are the following:

- (1) General information (village name, gender, education level).
- (2) The prevailing land use in the surveyed villages of the study area.
- (3) Socio-economic data related to the inhabitants.
- (4) Institutional support to the agricultural sector.
- (5) Environmental controls and environmental awareness.

One hundred and fifty questionnaires were filled-out from the 12 villages (Figure 2). The total number of the questionnaire in each village comprised 10 per cent of the total number of the families that are working in agriculture; hence, the total number of questionnaires that were completed is different from one village to another.

For analysis of the questionnaire, a coding process was conducted for the different answers. Data entry was accomplished, using the Statistical Package for Social Science<sup>®</sup> (SPSS 12.0) software. A range of analysis techniques (including multiple correlations, chi-square analysis, cross-tab analysis, graph presentations of different correlations, etc.) has been executed so as to identify the most influential environmental and socio-economic factors affecting land degradation as well as the main consequences of land degradation. In addition, and according to the answers obtained from the questionnaire, classification of the natural vegetation into palatable and non-palatable for animal

Table II. Population growth in study villages area since 1931

Name of built-up area	Year				
	1931	1945	1961	1997	2004
Rammon	744	970	1186	2248	2992
Silwad	1635	1910	3215	5121	6760
An nwei'ma	149	240	240	840	1092
Yabrud	254	300	349	487	642
Dura al Qari'	303	370	576	1937	2553
'Ein Yabrud	788	930	1501	2514	3315
Deir Jarir	847	1080	1474	3042	4010
At tayba	1125	1330	1677	1496	1982
Deir Dibwan	1688	2080	2812	4894	6457
'Ein siniya	288	330	431	533	702
Beitin	566	690	1017	2153	2844
Ad Doyook	291	730	730	588	764
Total population	8678	10 960	15 208	25 853	34 113

grazing has also been done. The classification of value for the protection of the natural vegetative cover and for soil and water conservation, as well as for farm management purposes.

## RESULTS AND DISCUSSION: CAUSES AND CONSEQUENCES OF LAND DEGRADATION

### *Population and Urban Expansion*

Urban encroachment on agricultural and biodiversity land bring negative consequences on the environment. More urban expansion would bring more pressure on the existing natural resources, especially the agricultural land as it seeks to cope with anthropogenic demands. This urban encroachment is accelerating the deterioration process of the existing natural resources (Hussein, 1998; Pimentel, 2000; Prasad and Badarinh, 2004).

The study area has been subjected to a large increase in population during the last 70 years (Table III). The most influential and highest rate of increase occurred from 1997 to 2004 (Palestinian Central Bureau of Statistics, 2007), linked with the Oslo Political Agreement and the consequent increase in economic activities, as well as the partial relaxation of the political crisis. It is estimated that the total population has increased by about four-fold since 1931, with ca. 4 per cent annual growth rate during the same period (Table II) (Palestinian Central Bureau of Statistics, 2007). The large and drastic change in population has been accompanied by remarkable land use changes, especially those related to built-up areas. The main urban expansion has been at the expense of other types of land use, which

affects the future potential of the study area, especially the capacity for production of food (Plaut, 1980).

Analysis of the available data on different land uses in the study area (1940–2003) indicates that the area has been subjected to drastic land use changes (Figure 4), which can be mainly attributed to expansion of the built-up areas. The total built-up area that exists nowadays in the study area has increased by almost 51-times compared to that in 1940 (Table III).

The urban expansion, which has strongly influenced the study area, can be attributed to the following reasons: (i) the preference of the farmers who are living in rural areas to move to urban areas, especially because they lack any type of institutional support. This is evident from about 13 per cent of the respondents who state their preference is to move to urbanized area, especially that 90 per cent of the respondents lack any kind of institutional support (Figure 5), (ii) The trend of the landowners to invest their land in economic activities other than agriculture, where about 13 per cent of the respondents stated their desire to live in cities, and 10 per cent of those who showed this tendency owned their land privately (Figure 6). The tendency to move to cities can be

Table III. Different land uses in the study area since 1940

Year	Different land uses (ha)				
	1940	1967	1987	1994	2003
Built-up area	14.6	53.3	44.9	709.5	755.6
Field crops	1809.0	536.3	571.8	526.2	1112.4
Trees	—	1311.6	1464.8	2122.9	1604.4
Pastures	11 056.8	10 988.5	10 809.5	9501.3	9403.0

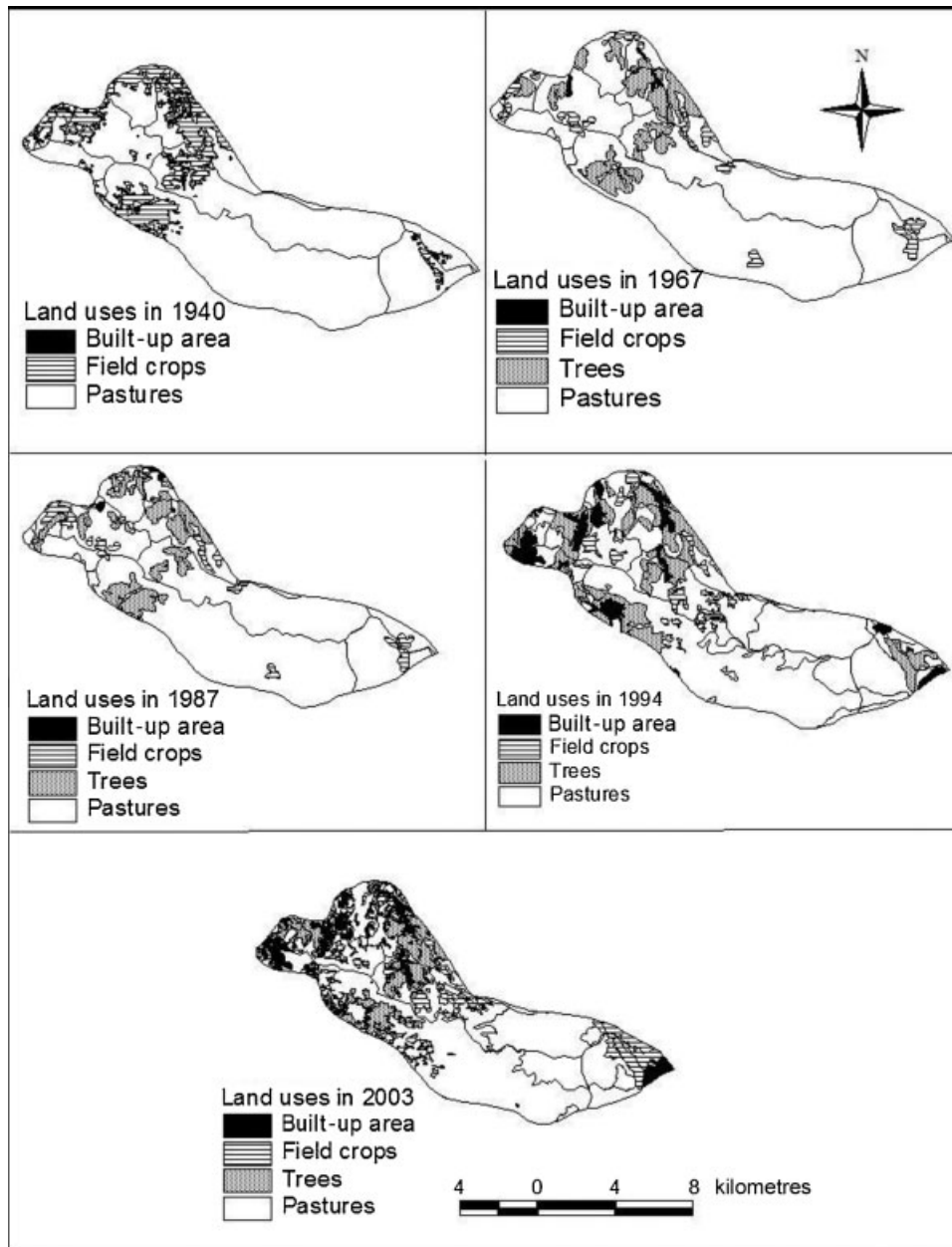


Figure 4. Land uses in the study area since 1940 (1940–2003).

attributed to the low profits of agricultural lands as compared with other land uses; especially for urban expansion, the absence of basic infrastructure and services (e.g. appropriate transportation, health and education facilities), the absence of any type of incentives for landowners (i.e. long-term loans, technical support, substitutes, etc.) to ensure their sustainable agricultural production, and the lack of laws and bylaws to protect valuable agricultural lands from urban expansion.

Urban expansion has resulted in negative environmental consequences including: (i) pollution of land and water by

sewage and random disposal of refuse (Shuqing *et al.*, 2006), (ii) an increase in the stress on other available land resources, especially land and water, (iii) the unplanned use of resources accompanied by the lack or poor management of the existing land uses, (iv) and finally a decrease in the area devoted to other land uses, such as grazing (natural pastures) and the consequent overgrazing associated with the decrease in the grazing area.

Among the necessary steps to reduce accelerated urban expansion at the expenses of other land uses, are the following: (i) strengthen the role of the private sector, which

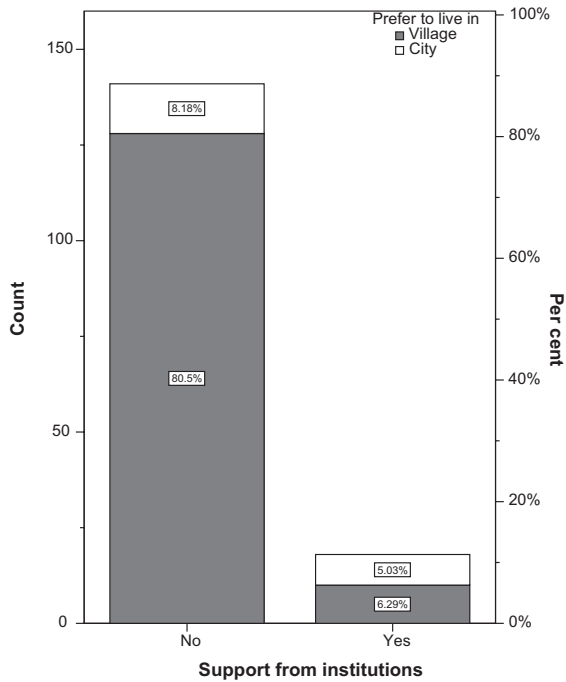


Figure 5. Farmers' behavior: selling the land, with and without getting any type of support.

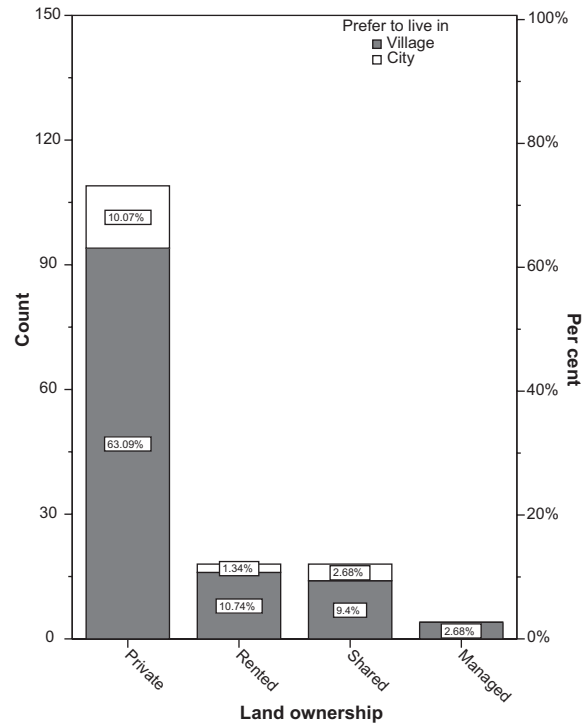


Figure 6. Farmers' behavior: selling the land and the type of land ownership.

can be achieved by increasing government support to farmers to decrease rural migration (Sternberg and Shoshany, 2001), (ii) prepare proper legislation, aiming at the protection of valuable lands, especially for agriculture (Goldreich and Karni, 2001), (iii) boost the community participatory approach, which focuses on the community participation in the formulation of policies and strategies for resource conservation and management (Plaut, 1980; Shuqing *et al.*, 2006), (iv) initiate a loan and support system for the conservation and management of agricultural lands (i.e. the formation of a system of insurance and long-term loans in the agricultural sector), (v) offer incentives, side-by-side with the necessary regulations, aiming at the reduction of agricultural land conversion into urban lands and (vi), build up an inclusive and a well-run service system (i.e. roads, storage, transport facilities, and agro-industrial facilities) to sustain the agricultural sector (Abu Hammad and Borresen, 2006).

**Poverty**

According to the Palestinian Central Bureau of Statistics (PCBS) standards, the poverty line has been set-up to be equal to two or less than two US\$ of daily expenditure for a six-member household (Palestinian Central Bureau of Statistics, 2007). Since 2000 due to diverse socioeconomic and political reasons (including closure of the Israeli labour market, political violence, etc.), the poverty rate in the

area has increased, reaching about 57 per cent of the total households (living below the poverty-line) by 2007 (Palestinian Central Bureau of Statistics, 2007). This situation of extreme poverty has led to environmentally negative activities that are still being practiced by the inhabitants of the study area. Amongst the most important negative activities is the collection of natural medical plants for commercial purposes (i.e. selling to merchants, pharmaceutical factories and for local inhabitants in popular.

The analysis of the questionnaire indicates that about 83 per cent of the surveyed farmers are involved in collection of medical plants for commercial uses (Figure 7). The correlation is highly significant (>95 per cent with chi-square of 35.7) and the main reasons for collections as revealed by the inhabitants are the non-profitability of agricultural lands, the absence of financial support to farmers, and the political crisis that is prevailing in the area. Such commercial use of these plants adds more pressure on the surrounding environment (Hillel and Rosenzweig, 2005; Abu Hammad and Borresen, 2006). The medical plants that are being collected include: chamomile and common mallow.

An important consequence of poverty, which is also contributing to weakening of the agricultural sector, is that smallholder and poor farmers are more likely to sell their land for immediate benefits (Figure 8). About 75 per cent of the farmers have been involved in selling agricultural land

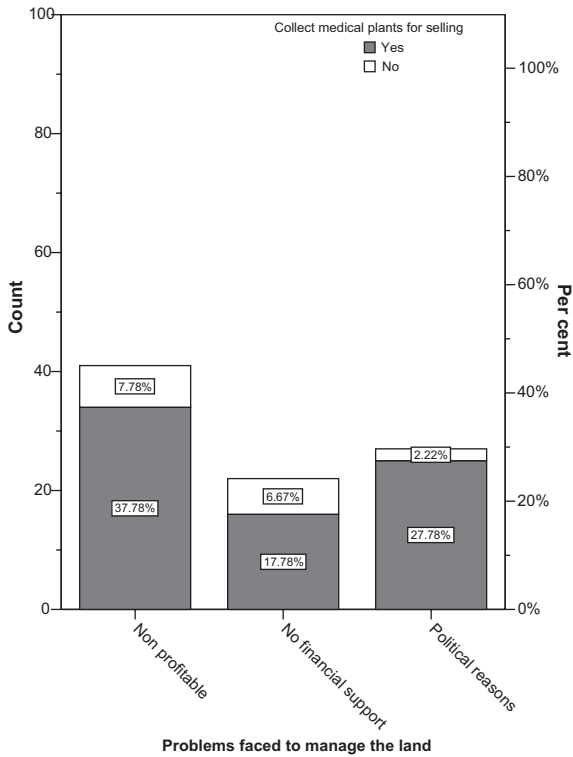


Figure 7. Farmers' behaviour: collecting natural medical plants and reasons for such behaviour.

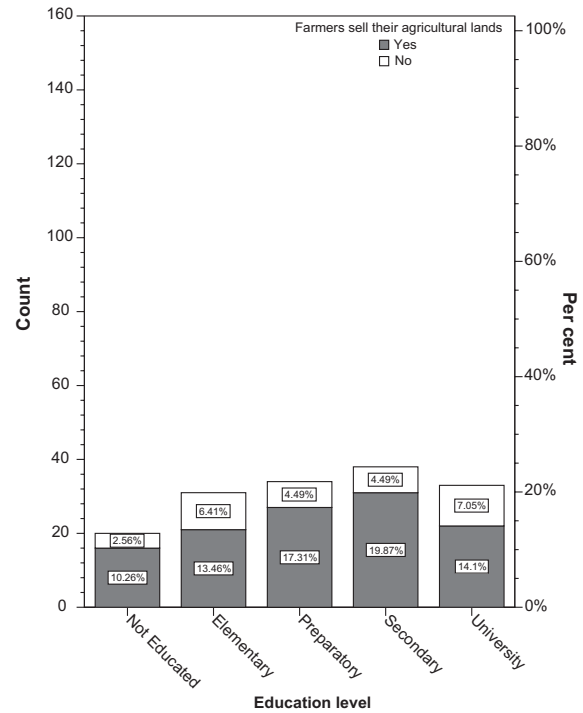


Figure 8. Farmers' behaviour: of selling their lands and their education level.

for construction purposes and the tendency increases with education level (Figure 8). This relationship is significant at the 95 per cent level (chi-square equals 41.1). The correlation between selling the land for construction purposes and education level can be attributed to the high standard of living aspired by well educated persons; highly educated people get to be familiar with different and standards of living as compared to the poorly educated. In addition, highly educated people seek employment. All of these factors have directed highly educated people to sell agricultural lands for immediate benefits and for future investment more than people with a low level of education, which is consistent with the findings of Abu Hammad and Borresen (2006).

#### Land Use Changes

It is estimated that about one-third to one-half of the Earth's land uses have been changed by human beings (Vitousek *et al.*, 1997; Alberti, 2005).

In the study area, it is noticeable that urban encroachment has decreased the area that is devoted to pasture by about 7 per cent, in addition to an 8 per cent decrease in pasture land that is associated with urban infrastructure, services and industrial parks (total reduction in pasture area is equivalent to 1600 ha) (Table III), the field crops area has decreased by

about 40 per cent (equivalent to about 697 ha), and the trees (mainly olive groves) has increased by about 20 per cent (equivalent to about 293 ha). The decrease in the field crops area from 1940 to 1967 can be attributed mainly to the occurrence of two wars between the Arabs and the Israelis inside Palestine; in 1948 and 1967. Both wars have contributed significantly to the farmers' abandonment of their farms, and hence have resulted in appreciable decrease in the field crops' area. After 1967, the study area went through a politically stable phase and the farmers started to resume their normal farming activities, and though out the area field crops started to increase gradually. The increase in olive groves can be attributed to an increase in the dietary needs of a growing population. In addition, the low production inputs needed for olive (i.e. cultivation, harvesting, pesticides and fertilization, etc.) is another reason for this increase.

Among the most important effects of land use change is overgrazing, which is pronounced in the study area. It is estimated that the total livestock (goats and sheep) existing in the study area is about 45 870, comprising about 46 per cent of the total livestock (45 870 head in Ramallah Governorate) (Palestinian Central Bureau of Statistics, 2003a). A rough estimate of the grazing density (number of sheep and goats per hectare) indicates that in 2005 the grazing density was about five head per hectare. The annual grazing capacity of pasturelands is estimated at about 300 kg of dry matter per hectare (Qannam, 1997). The annual amount of dry matter required by one head of sheep or goat



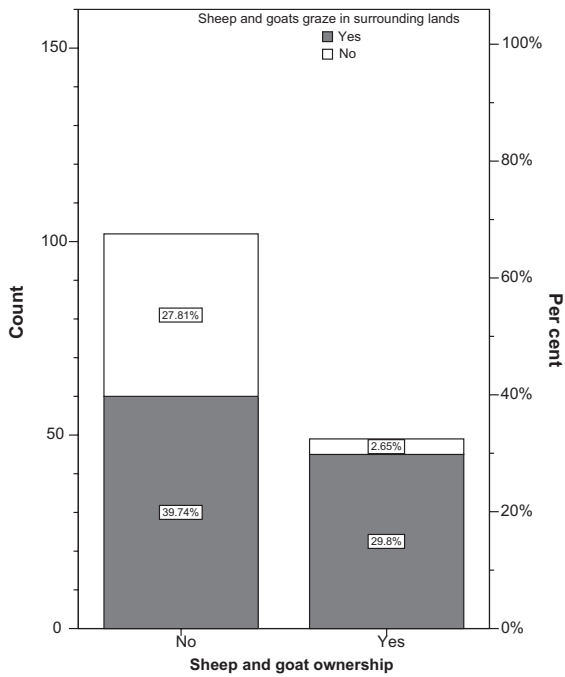


Figure 9. Grazing practices: farmers who have and do not have livestock.

is estimated at about 500 kg (Qannam, 1997). Thus, the size of area needed per one sheep or goat is about 1.6 ha y<sup>-1</sup> (500/300 ha y<sup>-1</sup>) to satisfy basic dietary requirements for moderate production. Hence, the total number of the existing livestock (45 870 head of sheep and goats) needs about 76 450 ha of natural grazing land. The total area available for grazing is only about 9400 ha, resulting in a deficit of about 67 000 ha. Thus, adding more pressure on the natural grazing area will lead to extreme overgrazing.

Analysis of the questionnaire revealed that about 70 per cent of the respondents welcomed free grazing practices in open lands by livestock without any restrictions or control (Figure 9). The survey also showed that about 30 per cent of farmers have livestock and are familiar with free grazing practice in the open natural lands.

The results of the questionnaire indicates that about 30 per cent of the surveyed farmers are grazing plant residue after harvest, which is a common practice in the area, causing a sharp drop in organic matter content of the soil, and hence a decrease in the fertility status and physical characteristics of the soil (e.g. weak aggregation and soil compaction), which to the ongoing process of land degradation (Morgan, 1986; Pimentel, 2000).

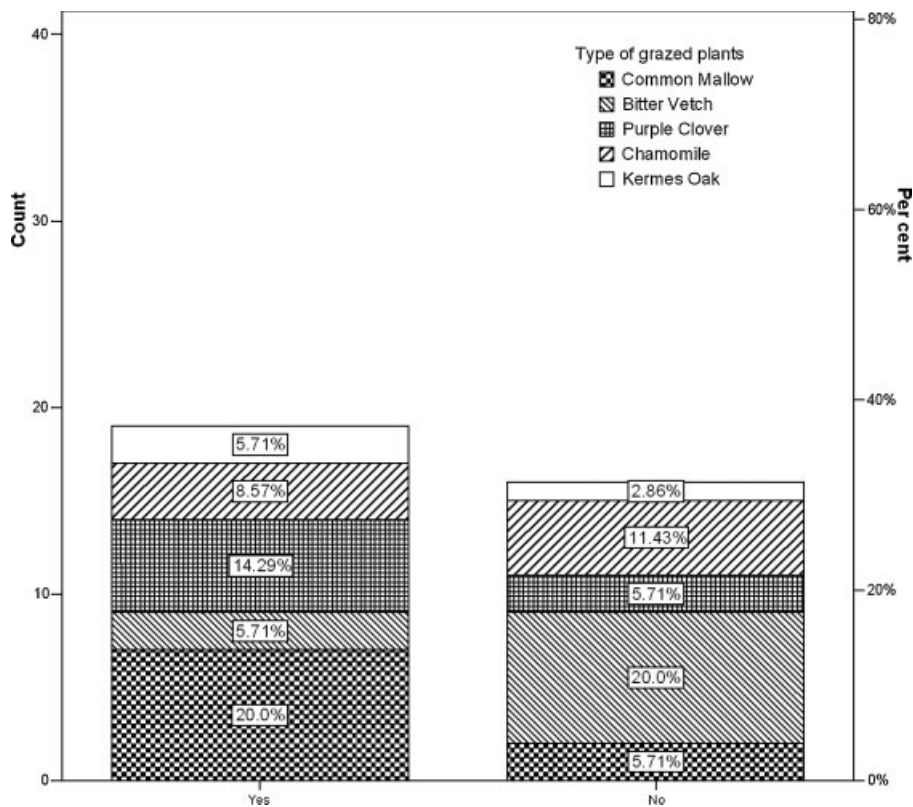


Figure 10. Relation of the existing grazing with type of natural plants.

All respondents indicated that the most favorable wild plants for grazing animals are kermes oak, chamomile, purple clover, bitter vetch, common mallow (Figure 10). The grazing of natural areas has led to the concentration of unpalatable plants (such as spiny burnet and eastern dodder), which are known to offer low protection against rainfall impact on the soil surfaces, leading to increased risk of erosion and land degradation.

#### *Unfriendly Environmental Practices*

The use of herbicides to get rid of the aforementioned undesirable weeds (Figure 11) is associated with negative environmental consequences. In fact, this is increasingly becoming a common practice by the framers, especially those who have another source of income other than agriculture. This practice is being performed by the farmers to reduce the time needed for land preparation and weeding. Such practice allows the framers to replace the normal and time-consuming traditional way of ploughing, for weed control. The use of herbicides affects all types of weeds, including those that might have positive effects on the soil physical properties (soil structure and nutrients) as well as soil fauna. In addition, the use of herbicides causes pollution of ground and surface (Siber *et al.*, 2009). More than 17 per cent of the respondents affirmed the usage of herbicides. This relation is positive with regard to the education level of the respondents, although the relation is not statistically significant (Figure 11).

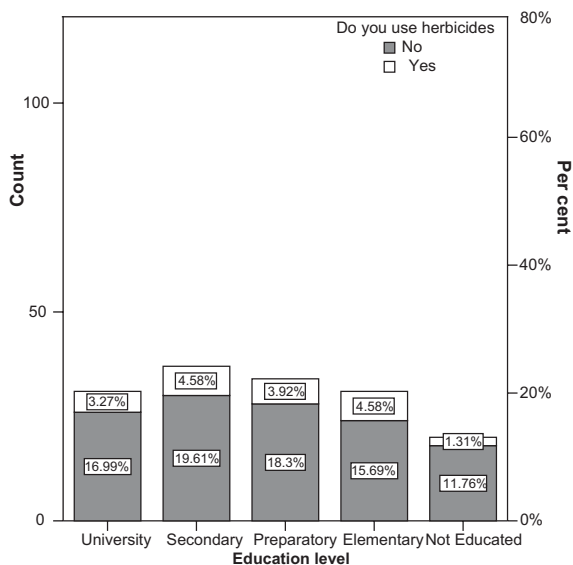


Figure 11. Number of farmers who are using herbicides to substitute for traditional cultivation practices (ploughing).

## CONCLUSIONS

The study revealed that the study area has been subjected to quick and significant land use changes, largely caused by urban expansion. Such urban expansion is associated with negative environmental consequences, especially land degradation. The study revealed the following points:

- (1) The study area has witnessed high population growth (4 per cent) resulting in about 51-times the 1930 population by the present day. Such high population increases has led to rapid urban encroachment on agricultural land with a noticeable land use change (15 per cent decrease in natural vegetation area).
- (2) Land use changes, especially those related to urban sprawl have caused serious threats to the available resources (i.e. pollution of land and water) and hence land degradation. Most of the land use changes that have taken place in the study area were caused by demand for built-up area and its related infrastructure and services.
- (3) Land use changes, especially the shift from agricultural and natural vegetation areas to urban uses, necessitates the need for comprehensive planning, especially urban planning, as well as incentives for the farmers to reduce this trend.
- (4) The high rate of poverty in the area (57 per cent), was found to a major driving factor for the damaging environmental practices (i.e. overgrazing, collection of medical plants for commercial uses, etc.). Hence, strict measures to counter the existing economic crisis are vital.
- (5) As a consequence of poverty, 83 per cent of the respondents were found to collect natural medical plants for either sale or for household usage in popular medication. Such practices expose the land surface to land degradation by soil erosion.
- (6) Inverse and significant correlation (95 per cent level) between the holding size and the trend of the farmers to sell their land for urban uses was found. It was found that 75 per cent of the smallholder framers sold their lands for immediate benefits counter their low standard of living. This trend is mainly attributed to the high poverty rate that exists in the study area and the high price offered for the land.
- (7) We noted a direct significant (95 per cent level) correlation between the education level and the trend of the framers to sell their land for urban uses. Of the 75 per cent of the respondents who declared they supported selling land for urban expansion uses 14 per cent of them were well-educated.
- (8) Overgrazing of palatable and medical plants is practiced by about 70 per cent of the respondents. This leaves unpalatable plants with low and ineffective

surface cover raising susceptibility to land degradation by soil erosion.

- (9) Herbicides are used by about 17 per cent of the respondents and causes land degradation.
- (10) There is a need to improve environmental awareness, especially amongst the farmers themselves. In addition, a set of standards, laws and bylaws focusing on mismanagement, land fragmentation, and the misuse of the available land resources is essential.

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