ASSESSING LAND USE /COVER CHANGES UNDER POLITICAL TRANSITIONS USING REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

Samer Raddad*

Geography and Urban Studies Department, Aquds Unversity, 51000 Jerusalem, Palestine

ABSTRACT. Currently, half of the world‘s population live in an urban environment and urbanization is increasing rapidly. Consequently, the world will face a significant increase in demand for land in urban and peri-urban areas in order to satisfy the needs of urban residents for housing and other services. Thus, planners and urban managers need to understand the dynamic of land use change in order to reduce the negative impacts such changes on social, economic and environment of cities. This study aimed to explore and evaluate land use changes in the Ramallah area, a region which has experienced a significant increase in urban population during the last decade, mainly due to the political conditions in the Occupied Palestinian Territories (OPT). Satellite images from 1990 to 2003 were used to acquire land use/cover data. This study then, used Geographic Information System (GIS) techniques to monitor and evaluate land use changes for these periods. Based on the analysis, it was found that there was a close association between political transformations and land use changes in the Palestinian urban environment. The size of urban land use decreased or experienced no expansion during the occupation stage (1990-1996), experienced rapid urban expansion during the autonomy stage (1996-2000), and increased at a decreasing rate during the re-occupation stage (2000-2003). The findings could be used to help urban planners and managers to establish more control of future urban expansion and land use change in urban environments which experience political instability.

Keywords*: GIS, remote sensing, land use/cover changes, urbanization, Occupied Palestinian Territories*

INTRODUCTION

Land use change is one of the most frequently researched topics in the last few years. Furthermore, it is one of the real challenges facing human communities in the world because it has critical and direct impacts on environmental conditions such as climate change and loss of natural resources as well as on human communities, especially in urban environments (Samat et al., 2014). Therefore, detecting and analyzing land cover/use change at different scales are essential processes in understanding various socioeconomic and environmental problems, which threaten the future of the earth’s surface and humanity (Pelorosso et al., 2009). Therefore, various approaches were undertaken to improve our knowledge of the current and future conditions of our environments through understanding and predicting the drivers, processes, and consequences of land cover/ use changes at global, regional, and local scales in order to protect our environments (Kong et al., 2006; Lowicki, 2008; Ostwald & Chen, 2006; Soini, 2005; Wang et al., 2008).

* Email: raddad_s@hotmail.com

In order to monitor and analyze land conversion trends, remote sensing, image processing and geographical information system (GIS) technologies become powerful tools that can be used to provide the necessary information and evaluate changes over time (Mundia & Aniya, 2005; Mohammed et al., 2014). Many researchers have used satellite remote sensing data such as Landsat Thematic Mapper (TM) and spot images in the identification of different land uses/covers. These data can be used to explore and extract the spatial and temporal characteristics of land units. For example, satellite images that were reclassified to produce thematic maps could then be inputted to and compared in GIS in order to detect the changes that have occurred on the earth's surface (Ding et al., 2007; Hu et al., 2007; Shalaby & Tateishi, 2007; Xiao et al., 2006).

The detection of land use changes can assist in identifying drivers of such changes. Briassoulis (2000), for example, divided major drivers of land use change into two main categories bio-physical and socio-economic. The first category is related to natural environmental elements such as climate, soil, vegetation and slope. The second category is related to human context and includes demographic, social, economic and political factors. Empirically, most of the land use change studies have associated drivers of land use change with soil erosion, transportation development, policy and economic development (Bakker et al., 2005; Braimoh & Onishi, 2007; Giupponi et al., 2006; Long et al., 2007). Those studies, however, were undertaken in countries that underwent rapid urban transformation mainly due to economic growth or political reformation (Ding et al., 2007; Xiao et al., 2006). Fewer studies, however, have investigated land use changes in relation to political instability and transformation, especially in conflict areas. This study, therefore, aims to identify and evaluate the association between land use changes and political instability in the Occupied Palestinian Territories (OPT).

OPT is a term used by the United Nations for those parts of Palestine which were occupied by the Israeli army after the 1967 war between the Arab countries and Israel. that involved the West Bank, East Jerusalem city and the Gaza strip (UN, 2009). The OPT have witnessed many political events since 1967 war. After the war, planning and urban development in the West Bank and Gaza strip fell under the administration of the Israeli Military until 1995 (Samara, 2005). In 1993, the Palestine Liberation Organization (PLO) signed a peace agreement with Israel which was called the Oslo Agreement and established Palestine as a state in May 1996. The Palestinian Authority was established as a result of 'Oslo II' which was an interim agreement signed in September 1995 (ARIJ, 2007). Between 1995 and 2000, civil administration of the cities was transferred from the Israeli military to the Palestinian Authority. The big challenge that faced the Palestinian Authority was described by the Palestinian Ministry Of Planning and International Cooperation (MOPIC) in 1998 as the urgent need for development after 30 years of the occupation. The Ministry stated:

> *"The Israeli territorial strategies of unrealistically limiting border expansion of cities and villages has overloaded infrastructure and increased population density in the built-up areas. It has also translated to the random, unplanned, and unlicensed construction of houses and urban sprawl. Furthermore, it has contributed to rural-urban migration by people who are unable to find housing in the rural areas"*(MOPIC, 1998a).

In 2000, the Israeli army re-occupied the Palestinian Territories, but did not destroy the Palestinian Authority. In June 2002, the Israeli Government started building the separation zone between Israel and the OPT and close Palestinian areas. This action had serious implications; between 2000 and 2003, urban development and planning in the OPT was under the control of the Palestinian Authority but also under Israeli occupation (ARIJ, 2007).

Consequently, between 1990 and 2003, the OPT underwent many political events and transformations that had significant implications on land use change, especially in urban environments. This study, therefore, aims to explore the association between the political instability and land use changes in the OPT. The result of such analysis would provide essential contribution to understanding the drivers of land use changes, especially under conditions of political instability. Such information would be useful for planners and managers in of urban spatial growth such that the development that has occurred in the OPT does not produce negative impacts on the society, economy and environment of area.

STUDY AREA

The Ramallah Metropolitan Area (RMA) is located in the central region of the West Bank and borders the Jerusalem governorate (Figure 1). According to MPOIC (2008), the RMA is located between 51' N and 31 ^{o} 56' N latitude and 35 ^{o} 06' E and 35 ^{o} 14' E longitude and covers approximately 134 km^2. Nine Palestinian localities are located in this area. The three main cities are Ramallah, Alberih and Betunia and there are six villages: Sorda, Rafat, Kufr Aqab, Ein Areek, Ein Qinia and Beteen. The area had a population of approximately 101,603 in 2005 (MOPIC, 2007). Ramallah is the political, economic and cultural centre of the West Bank and most of the Palestinian authorities and international organizations are located in this city.
Source: MOPIC (2007)

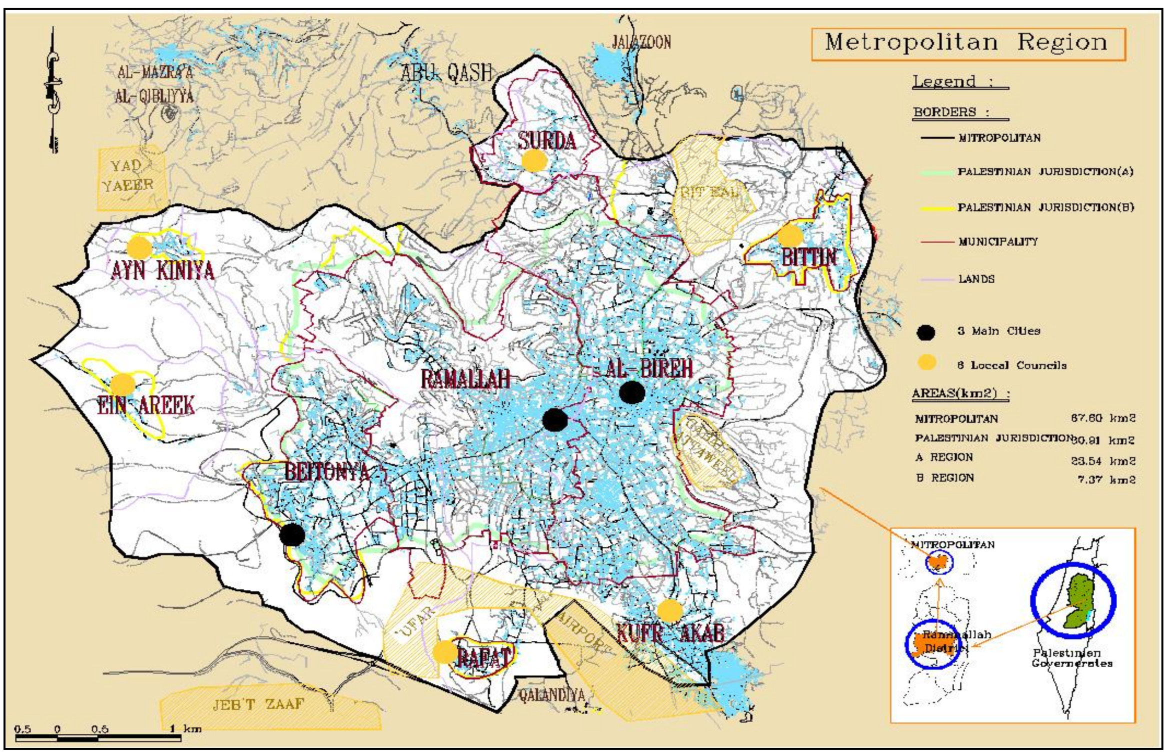

Figure 1: Ramallah Metropolitan Area

METHODOLOGY

The study was undertaken using GIS and remote sensing technologies. It involved acquiring satellite data and undertaking 'image pre-processing'. The satellite images were then reclassified to produce land use data, which was classified according to the Corine Classification System (EEA, 1994). Finally, these data were analyzed using GIS to evaluate the land use distribution and trends in land use change in the RMA. The following discussion is focussed on the satellite data and the image pre-processing operations, the land use classification system, the image reclassification and the detection of land use change.

Satellite Data and Pre-processing

Five satellite images: three Landsat TM satellite images for 1990, 1996, 2003, and two Spot satellite images for 2000 and 2005 were used in the study. Table 1 below shows the satellite data obtained for this study. It should be noted that the images obtained were in different coordinate systems and had different spatial resolution. This study, therefore, used a spot satellite image 2005 as a reference image to geometrically correct all images. It involved changing all satellite images to Palestine Grid 1923 Coordinate System, with the error obtained being less than 0.5 pixel root mean square error (RMSE). This study also used bilinear interpolation method to resample all satellite images from 1990 to 2003 to the spatial resolution of 28 m. ERDAS IMAGINE 8.5 software was used to perform pre-processing operations.

Table 1: Spatial data sources

Data	Year	Spatial resolution	Coordinate system
Landsat TM	1990	28.5 x 28.5 m	UTM
Land sat TM	1996	28.5 x 28.5 m	UTM
Spot	2000	20 x 20 m	Pal_Grid_1923
Land sat TM	2003	15 X 15 m	UTM
Spot	2005	2.5 x 2.5 m	Pal_Grid_1923

Land Use Classification System

As mentioned earlier, this study used modification of Corine Land Cover system (EEA, 1994) which has been used by the European Environment Agency (EEA) and certain Palestinian Research organizations such as the Applied Research Institute Jerusalem (ARIJ, 2004) and many other land use land cover changes studies (e.g. Feranec et al., 2007; Pelorosso et al., 2009). Table 2 shows two major levels of the land use classification used. The first land use type in the top level is known as the 'urban fabric area' and consists of buildings, industrial areas, commercial, and road network surfaces, mining and dumping and constructions sites at level 2. The second land use at level 1 is 'agriculture area' and consists of arable lands, permanent crops, and pastures and level 2. Finally, the third land use at level 1 is 'forest and semi-natural areas' covering forest surfaces and open spaces with little or no vegetation.

Image Classification

The image classification process aimed to extract information and map land use/ cover classes from the digital remote sensing data by using images of different areas or images of the same area but obtained at different dates (Ding, 2007; Shalaby & Tateishi, 2007). Land use activities could be divided into three main classes' namely urban fabric areas, agriculture areas, and forest and semi-natural areas. A maximum likelihood approach was used in the classification process in this study context. This classification was undertaken by comparing ground control points taken from the satellite images and visual interpretation of land cover maps, land use maps and aerial photographs. Then, the accuracy assessment was undertaken by using 180 ground points which were chosen by using a random method. Finally, the overall accuracy assessment of the land cover classification based on a modified Corine Land Cover system was obtained. Overall accuracy was quite high where 81.7% was obtained for Landsat TM 1990, 91.1% for Landsat TM 1996, and 85% Spot 2000 images. The accuracy of all the images obtained for this study was considered good (Monserud and Leemans, 1992). Finally, after the image classification was undertaken, the data were input to ArcGIS 9.3 software and IDRISI Kilimanjaro software for change detection analysis as discussed in the following section.

Table 2: Modified Corine land use classification system

Level 1	Level 2
1. Urban fabric areas	1.1 Urban fabric
	1.2 Industrial, Commercial and Transportation
	1.3 Mining, Dumping and Construction sites
2. Agriculture areas	2.1 Arable lands
	2.2 Permanent crops
	2.3 Pastures
3. Forest and semi-natural areas	3.1 Forest
	3.2 Open spaces with little or no vegetation

Source: Modified from EEA (1994)

Land Use Change Detection

Land use change detection was undertaken by a cross-tabulation method. This approach was undertaken using the CROSSTAB module available in the IDRISI Kilimanjaro software. CROSSTAB analysis involves two major operations: the first is to compare the land use class of a pixel in the first image with that of the same pixel in the second image. The result of this operation is presented in the form of table representing all measurements between the images. The second operation is a cross-classification which represents multiple overlays of all the land use categories. The result of this operation is a new image which represents all combinations of the classes in the original image. Land use change analysis was undertaken by comparing each pair of images, pixel by pixel. From the analysis, if the RSME increased by more than 1-pixel, then the land use change analysis undertaken has problem. The result of such analysis, therefore, is to produce an RMSE of less than 0.5 pixel in the registration performance (Shalaby, 2007).

RESULTS

The analysis was undertaken to detect land use/cover changes between 1990 and 2003. The study started by evaluating changes from 1990 to 1996, 1996 to 2000 and 2000 to 2003. The results obtained from the analysis were discussed below.

Land Use Changes 1990-1996

Land use change detection between 1990 and 1996 (Table 3) shows a significant decrease in urban areas from 30.75 km^2 in 1990 to 28.33 km^2 in 1996. During this period, forest and semi-natural areas also decreased from 48.88 km^2 in 1990 to 30.81 km^2 in 1996. Interestingly, agriculture land increased by 20 km^2 during those six years period.

Table 3: Land use change in RMA between 1990 and 2003

Period		Urban fabric area	Agriculture areas	Forest and semi-natural areas
1990-1996	1990 (km^2)	30.75	54.64	48.88
	1990 (%)	22.90	40.70	36.40
	1996 (km^2)	28.33	75.15	30.81
	1996 (%)	21.10	55.95	22.95
	1990-1996 change (km^2)	-2.42	+20.51	-18.07
1996-2000	1996 (km^2)	28.33	75.15	30.81
	1996 (%)	21.10	55.95	22.95
	2000 (km^2)	40.66	45.70	47.94
	2000(%)	30.27	34.03	35.70
	1996-2000 change (km^2)	+ 12.33	-29.45	+17.13
2000-2003	2000 (km^2)	40.66	45.70	47.94
	2000 (%)	30.27	34.03	35.70
	2003 (km^2)	44.39	52.15	32.76
	2003 (%)	36.78	38.82	24.40
	2000-2003 change (km^2)	+8.73	+6.45	-15.18

In addition to calculating the statistics of land that underwent land use transformation, the study also produced a land use/ cover conversion matrix table, which could be used to derive the type of land undergoing land change. Table 4 shows conversion matrix of land cover/ use change between 1990 and 1996. It shows that in detail major land use changes that had occurred in RMA between 1990 and 1996. It shows that urban areas decreased about 2.4 km^2 during the first six years of the period, while 17.25 km^2 of the urban area remained unchanged. Approximately 9.78 km^2 of land was converted to agriculture lands and 3.74 km^2 was changed to forest and semi-natural areas in the study area. Forest and semi-natural areas also experienced significant lost during 1990 and 1996, where 5.8 km^2 and 22.58 km^2 was converted to urban and agriculture land use respectively. Approximately 20.45 km^2 of Forest and semi-natural areas remained unchanged during 1990 and 1996. This period, however, experienced significant increase of agriculture land that is from 54.64 km^2 in 1990 to 75.15 km^2 in 1996. It was found that 9.78 km^2 of urban surfaces and 22.58km^2 of forest and semi-natural areas were converted to agriculture land, while 42.8 km^2 of the agriculture land remained unchanged during this period. Figure 2 illustrates areas undergoing land use/ cover transformation in the RMA. The results obtained from this analysis were quite interesting since in many part of the worlds, it was difficult to find urban areas being converted to agriculture. The unique characteristics of OPT and the political situation in the RMA seems to differentiate land use conversion in this study area.

Land cover land use changes in the study area between 1996 and 2000 can also be seen from Table 3 above which shows that urban land covered approximately 28.33 km^2 in 1996 and 40.66 km^2 in 2000. During this period, urban areas increased about 12.33 km^2. This positive change of urban areas came from the conversion of 13.9 km^2 of agriculture lands and 7.6 km^2 of forest and semi-natural area (Table 4). About 19.13 km^2 of urban areas in 2000 did not experience any change.

Table 4: Land use conversion matrix of RMA, 1990 and 2003

Period		**1996**		
		Urban fabric area(km^2)	Agriculture areas (km^2)	Forest and semi-natural areas (km^2)
1990	Urban fabric area	17.25	9.78	3.74
	Agriculture areas	5.22	42.8	6.64
	Forest and semi-natural areas	5.87	22.58	20.45
1996	Urban fabric area	**2000**		
		19.13	3.34	5.88
	Agriculture areas	13.9	36.93	24.29
	Forest and semi-natural areas	7.6	5.45	17.77
2000		**2003**		
	Urban fabric area	26.72	7.25	6.69
	Agriculture areas	9.31	27.86	8.55
	Forest and semi-natural areas	13.37	17.05	17.52

Table 4 illustrates the land use classes that underwent land use conversion and Figure 3 shows areas experiencing land use change. Agriculture lands accounted for about 75.15 km^2 in 1996 but decreased to about 55.95% and became about 45.70% of land use in 2000. This decrease was due to the conversion of 13.9 km^2 of the agriculture areas to urban and 24.29 km^2 to forest and semi-natural areas between 1996 and 2000. Forest and semi-natural areas covered about 30.81 km^2 in 1996 and 47.94 km^2 in 2000, a positive change of 17.113 km^2. These changes come from the conversion of 5.88 km^2 and 24.29 km^2 of urban and agriculture land respectively during four year period.

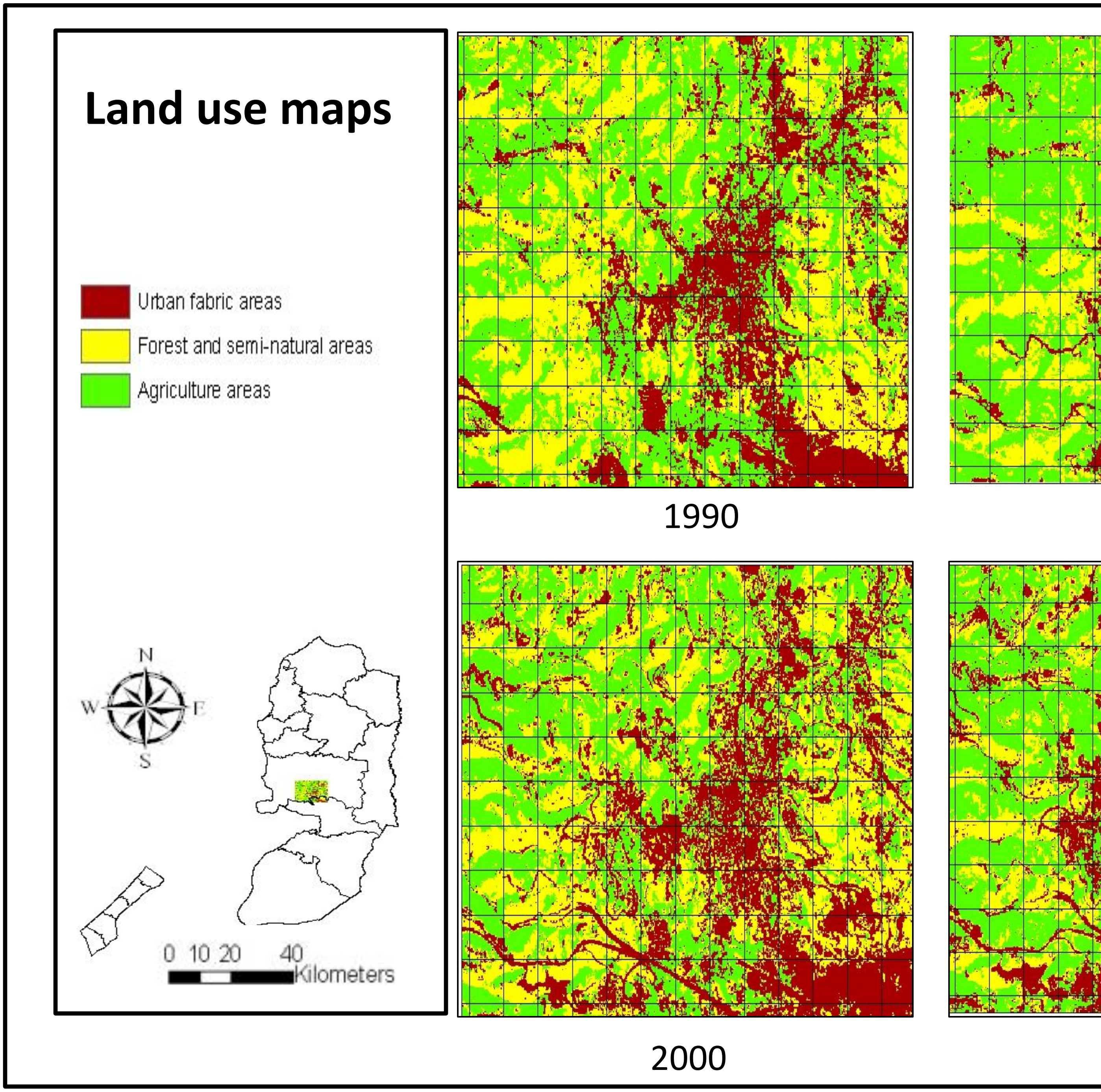

Figure 2: Land use maps in the RMA between 1990 and 2003

Land use changes in the study area between 2000 and 2003 are presented in Table 3. The urban fabric area increased by 8.73 km^2 from 2000 to 2003 and only 26.72 km^2 of urban areas remained as unchanged, whilst 9.31 km^2 of agriculture lands were converted to urban land and 13.37 km^2 totals were converted from forest and semi-natural areas to urban fabric areas during four years. The agriculture land area showed an increase of 6.45 km^2 from 2000 to 2003. This positive change came from the conversion of 7.25 km^2 urban lands in 2000 to agriculture and 17.05 km^2 from forest and semi-natural areas, with 27.86 km^2 of agriculture land remaining unchanged. In the same period, the forest and semi-natural areas showed a decrease of 15.18 km^2 while the total of the area in 2000 was 47.94 km^2 and 32.76 km^2 in 2003. Furthermore, this decrease was the result of conversion of some of the forest and semi-natural area to urban fabric (13.37 km^2) cover and to agriculture (17.52 km^2) with 17.52 km^2 remaining unchanged. .

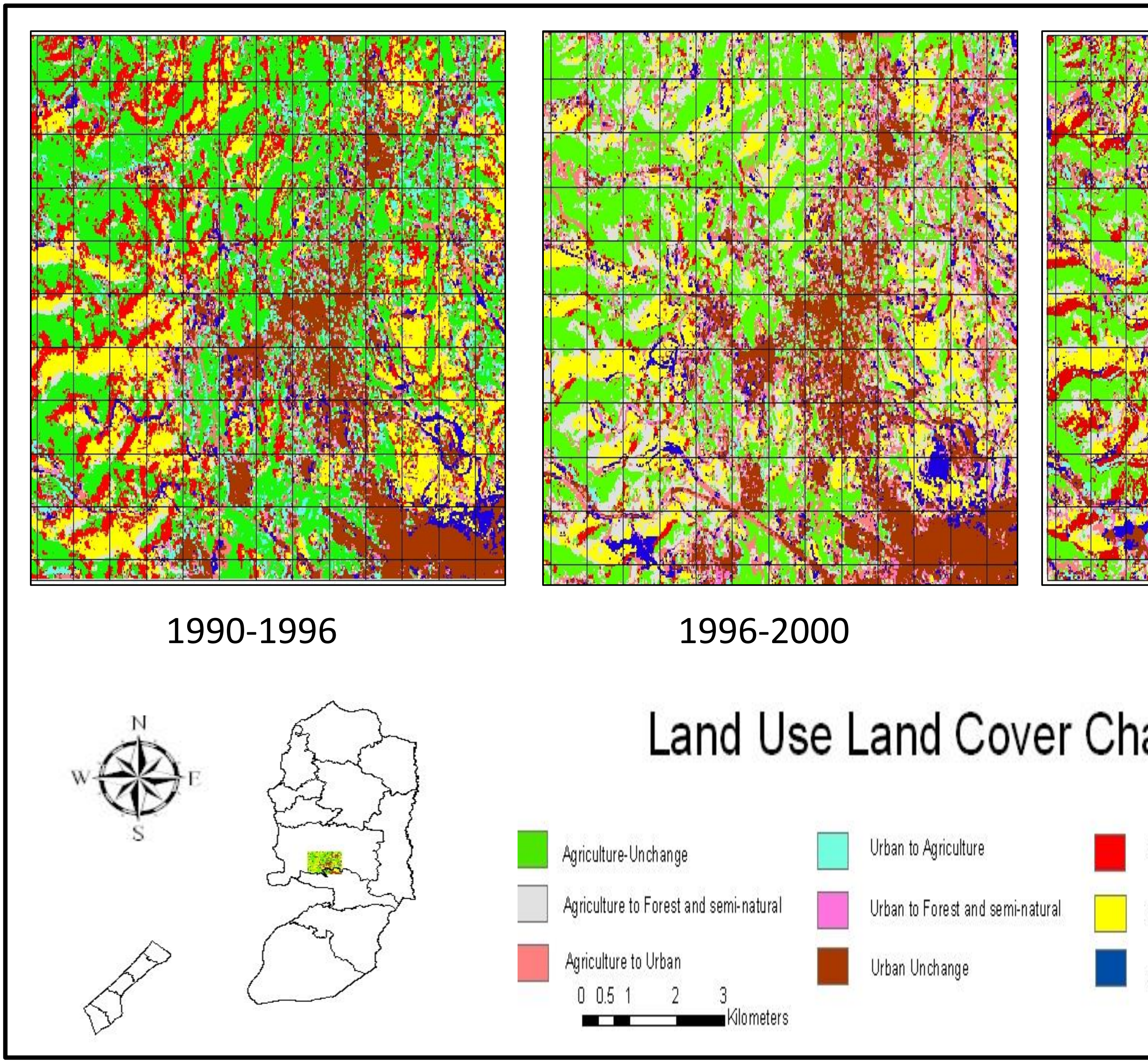

Figure 3: Land use change in the RMA between 1990 and 2003.

DISCUSSION

Land use change analysis in the RMA can be divided into three main stages: (i) land use changes during a period of full occupation, (ii) land use changes during a period of autonomy, and (iii) land use changes during a period of re-occupation. The first stage between 1990 and 1996 coincides with the OPT study area being under full Israeli occupation. Land use changes during this stage witnessed little change in the urban land use class but significant change in the agriculture and natural categories. Urban areas decreased by 2.4 km^2 at a rate of 0.4 km^2 per year (Figure 4). Most of the land use change studies have tended to find increase of urban areas in urban environments (Huang et al, 2008), but this study shows the opposite. This can be explained by looking at two issues. The first issue is the conversion of urban to agriculture land such as open and agriculture roads, to mining areas, especially in the south east of the study area, to incomplete construction sites. This type of change was common in the study area since it was under occupation and most of the development was stopped. In the studies conducted by Hu et al. (2007), Huang et al., (2008) and Xiao et al., (2006), for example, built-up areas or urban land uses were converted to other uses such as agriculture or water or grass, but the area of land that was converted from other uses such as agriculture or forest was much greater than the conversion of land from urban to other uses. In this case study, the volume of the urban land that was converted from urban land uses to others uses was more than the land which was converted from agriculture to urban uses (Table 3). According to (MOPIC, 1998b) *"The Israeli territorial strategies of unrealistically limiting border expansion of cities and villages has overloaded infrastructure and increased population density in the built-up areas"*. Consequently, during this period of occupation, urban land was not developed because of the control by the Israeli Army on the planning and urban development sector. During this period, the development of OPT was significantly affected by political instability including conditions in the Middle East with the First Gulf War and the emigration of the Palestinians from Kuwait to Jordan and OPT. Therefore, the economic status and social conditions in the OPT was greatly affected by the political instability events in the OPT context and at the regional level.

The second stage (1996-2000) is associated with a relatively stable political condition as a result of a peace agreement between the PLO and Israel. During this period, the Palestinian Authority was established and civil administration was transferred from the Israeli army to Palestinian organizations. Assistance from donor countries and international organizations played critical role in the development of the OPT during this period. International financial aid for the Palestinians between 1996 and 2005 reached $8 billion (ARIJ, 2007; MOPIC, 1998b). The study area became the centre of the Palestinian Authority's ministries and economic bodies as well as international organizations. This resulted in a rapid increase in urban areas during the period which reached 12.33 km^2 during the four year period with a rate of 3 km^2 per year which was a high rate of land use conversion. Agriculture land, however, decreased by approximately 29.45 km^2 during this period because it was converted to urban and natural uses due to the stable conditions and donor assistance.

The re-occupation stage (2000-2003) involved the Israeli army re-occupying all the Palestinian areas in the OPT, including all the Palestinian cities. The army attacked the Palestinian organizations and destroyed infrastructure in the cities. Paradoxically, in 2002, the Israelis started to create a separation zone between the OPT and Israel. During this period, the Palestinian ministries were still in operation but faced many challenges and obstacles as a result of the military operations in the OPT. Furthermore, there was a decrease in development projects in all socio-economic sectors. Land use change during this period was significantly affected by these conditions; urban areas increased by approximately 8.73 km^2 during the three years at a decreasing rate, while agriculture land decreased and natural areas increased.

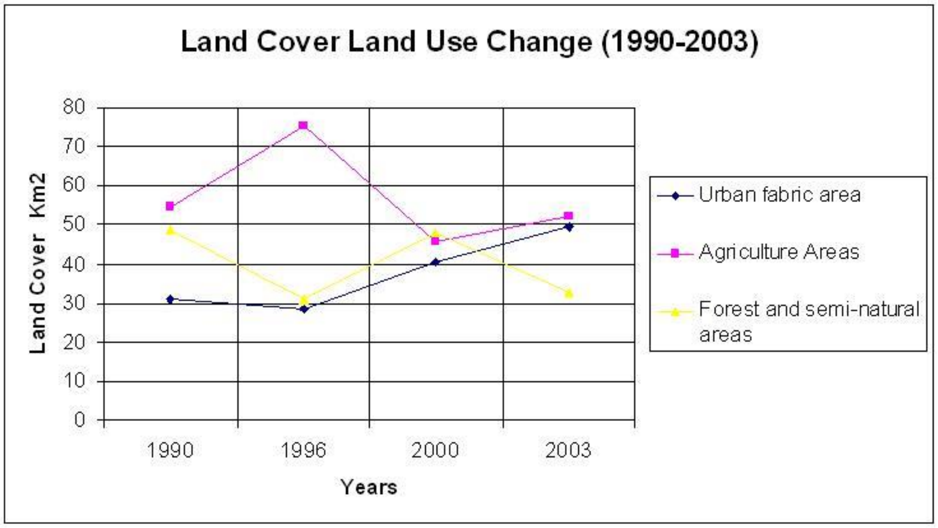

Figure 4: Land use land cover changes between 1990 and 2003

CONCLUSION

The impact of political factors on the land use changes is clear from this study. During 13 year period (1990-2003), the Occupied Palestinian Territories witnessed many political events and transformations. This study was conducted when the Palestinian urban environments was under full military occupation, resulting the Palestinian cities not being able to extend or grow because of constraints imposed by the Israeli army in Ramallah city. This conclusion is aligned with the findings by the Palestinian Ministry of Planning and International Cooperation. The real and critical challenge was shown in the second stage (Autonomy stage) when the study area witnessed conditions of political stability with peace agreements between Israel and the PLO. Finally in the last stage, the Palestinian planning and administrative context pushed the land use changes to be informal, speedy and uncontrolled. The land use change process lead to more pressure on certain socio-economic and natural environments. Land use continued its transformation under conditions of re-occupation by the Israeli army but at a lower rate than during the previous period of autonomy because the changes were still impacted by the second stage and the development process as well as existing Palestinian planning organizations, especially local governments that continued to provide for the basic needs of the residents. The main finding of this study is that land use changes occurring when political conditions are unstable involve informal, rapid transformation and the destruction of natural areas and resources. This conclusion should be help urban planners, managers, and policy makers to understand the land use change drivers, processes and consequences when a country suffers political instability. Under these conditions, national, regional and local governments in the conflict areas should prepare dynamics policies, plans and programmes that can focus on the change processes or at least reduce the negative impacts on urban environments.

Any place in the world exhibition to facing the political transformations, especially in the conflict and crisis areas. Therefore, land use change researchers need to conduct more studies and develop models to confront the political transformation scenarios and understand better the impacts on land use change. This study suggestions three main scenarios to modelling land use changes in the Palestinian urban environments. The first one is an autonomy scenario which suggests modelling under Palestinian control of urban development and land use change in Palestinian urban environments with Israeli limits and control on the regional and national levels. The second scenario is full re- occupation and complete destruction of the Palestinian Authority, as well as control of Israeli army on planning and land use changes in Palestinian urban environments. The third scenario is disappearance of the impacts of occupation by end of the occupation stage and the creation of a Palestinian State with full control on the OPT land. These models will help of the Palestinian urban planners, managers, and decision-makers to have more control on the future land use changes in their urban environments.

REFERENCES

ARIJ, Applied Research Institute. (2007). *Status of the Environment in the Occupied Palestinian Territory* Jerusalem Applied Research Institute (ARIJ)

Bakker, Martha M., Govers, Gerard, Kosmas, Costas, Vanacker, Veerle, Oost, Kristof van, & Rounsevell, Mark. (2005). Soil erosion as a driver of land-use change. *Agriculture, Ecosystems & Environment, 105*(3), 467-481.

Braimoh, Ademola K., & Onishi, Takashi. (2007). Spatial determinants of urban land use change in Lagos, Nigeria. *Land Use Policy, 24*(2), 502-515.

Briassoulis, Helen (2000). *Analysis of Land use change: Theoretical and Modeling Approaches*.

Ding, Han, Wang, Ren-Chao, Wu, Jia-Ping, Zhou, Bin, Shi, Zhou, & Ding, Li-Xia. (2007). Quantifying Land Use Change in Zhejiang Coastal Region, China Using Multi-Temporal Landsat TM/ETM+ Images. *Pedosphere, 17*(6), 712-720.

EEA, European Environment Agency. (1994). *CORINE land cover* o. Document Number)

Feranec, Jan, Hazeu, Gerard, Christensen, Susan, & Jaffrain, Gabriel. (2007). Corine land cover change detection in Europe (case studies of the Netherlands and Slovakia). *Land Use Policy, 24*(1), 234-247.

Giupponi, Carlo, Ramanzin, Maurizio, Sturaro, Enrico, & Fuser, Simonetta. (2006). Climate and land use changes, biodiversity and agri-environmental measures in the Belluno province, Italy. *Environmental Science & Policy, 9*(2), 163-173.

Hu, Zhao-ling, Du, Pei-jun, & Guo, Da-zhi. (2007). Analysis of Urban Expansion and Driving Forces in Xuzhou City Based on Remote Sensing. *Journal of China University of Mining and Technology, 17*(2), 267-271.

Huang, Jinliang , Lin, Jie, & Tu, Zhenshun (2008). Detecting spatiotemporal change of land use and landscape pattern in a coastal gulf region, southeast of China. *Environ Dev Sustain*.

Kong, Xiangbin, Zhang, Fengrong, Wei, Qi, Xu, Yan, & Hui, Jiangguang. (2006). Influence of land use change on soil nutrients in an intensive agricultural region of North China. *Soil and Tillage Research, 88*(1-2), 85-94.

Long, Hualou, Tang, Guoping, Li, Xiubin, & Heilig, Gerhard K. (2007). Socio-economic driving forces of land-use change in Kunshan, the Yangtze River Delta economic area of China. *Journal of Environmental Management, 83*(3), 351-364.

Lowicki, Damian. (2008). Land use changes in Poland during transformation: Case study of Wielkopolska region. *Landscape and Urban Planning, 87*(4), 279-288.

Mohammed, K. S., Samat, N. and Elhadary, Y.A.E. (2014) Bottom up Approach: Urbanization in the Perception of the Local Communities of Balik Pulau, Penang Island, Malaysia, *British Journal of Applied Science & Technology*, 4(32): 4533-4549.

Monserud, R. A. and Leemans, R. (1992) The comparison of global vegetation maps. *Ecol. Model*. 62, 275-293

MOPIC. (2007). *Metropolitan Ramallah , Al Bireh & Betunia* Ramallah o. Document Number)

MOPIC, The Palestinian Ministry of Planning and International Cooperation. (1998a). *The National physical planning Policies*. Ramallaho. Document Number)

MOPIC, The Palestinian Ministry of Planning and International Cooperation. (1998b). *The National Physical Planning Policies*. Ramallah

Mundia, C. N., & Aniya, M. (2005). Analysis of land use/cover changes and urban expansion of Nairobi city using remote sensing and GIS. *International Journal of Remote Sensing, 26*(13), 2831-2849.

Ostwald, Madelene, & Chen, Deliang. (2006). Land-use change: Impacts of climate variations and policies among small-scale farmers in the Loess Plateau, China. *Land Use Policy, 23*(4), 361-371.

Pelorosso, Raffaele, Leone, Antonio, & Boccia, Lorenzo. (2009). Land cover and land use change in the Italian central Apennines: A comparison of assessment methods. *Applied Geography, In Press, Corrected Proof*.

Samara, Ali Abdul. (2005). *Management of Physical Planning in the Occupied Palestinian Territories: Existing Challenges and Future Prospects*. Paper presented at the 2nd Arab forum on management of large cities.

Samat, N. (2014) Monitoring the expansion of built-up areas in Seberang Perai region, Penang State, Malaysia, *IOP Conf. Series: Earth and Environmental Science*, 18 (2014) 012180, doi:10.1088/1755-1315/18/1/012180.

Samat, N., Ghazali, S., Hasni, R. and Elhadary, Y (2014), Urban Expansion and its Impact on Local Communities: A Case Study of Seberang Perai, Penang, Malaysia, *Pertanika-Journal of Social Sciences and Humanities*, 22 (2): 349 - 367 (2014)

Shalaby, Adel, & Tateishi, Ryutaro. (2007). Remote sensing and GIS for mapping and monitoring land cover and land-use changes in the Northwestern coastal zone of Egypt. *Applied Geography, 27*(1), 28-41.

Soini, Eija. (2005). Land use change patterns and livelihood dynamics on the slopes of Mt. Kilimanjaro, Tanzania. *Agricultural Systems, 85*(3), 306-323.

UN, United Nation. (2009). Question of Palestine Retrieved 10 December, 2009, from http://www.un.org/Depts/dpa/ngo/history.html

Wang, Xiuhong, Zheng, Du, & Shen, Yuancun. (2008). Land use change and its driving forces on the Tibetan Plateau during 1990-2000. *CATENA, 72*(1), 56-66.

Xiao, Jieying, Shen, Yanjun, Ge, Jingfeng, Tateishi, Ryutaro, Tang, Changyuan, Liang, Yanqing, et al. (2006). Evaluating urban expansion and land use change in Shijiazhuang, China, by using GIS and remote sensing. *Landscape and Urban Planning, 75*(1-2), 69-80.