

# **Growth Management Policies – An Assessment of Their Impact on Open Space. The Case of Israel’s Sharon Region**

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**Key words:** Urban sprawl, GIS analysis, Israel, sprawl indicators

## **ABSTRACT**

Open space, loosely defined as land not utilized for building purposes, is crucial for aesthetic, ecological and recreational purposes. In Israel, as in Europe and North America, the rapid fragmentation and loss of open space has become a dominant environmental challenge facing planners and policy makers. Accordingly, since the 1990s, urban growth management policies have become a central feature of land use planning in Israel. In this research, we conduct a temporal, spatial analysis of urban and exurban development in Israel’s Sharon region, in order to better understand how effective urban growth management policies have been in protecting open spaces. Using a GIS platform, we produce spatially explicit models of regional development by developing a time-series map of built space based on 1:50,000 survey maps. We use this time-series map to analyze spatial configuration and amounts of built land and open space. Concurrently, we derive a second set of urban development spatial indices with which we appraise the characteristics of urban form and sprawl. In this way, we assess whether the trajectories of development conform to the planning goals expressed in growth management and open space preservation policies. Our preliminary results show a consistent rate of land transformation (open to built) in our study site over a period of 25 years (1970 to 1995), in which less than 0.5% of the total open space was developed annually. This is followed by a decade of sudden and rapid rise in transformation rates, in which approximately 1.75% of the remaining open space was developed annually. This latter decade is also a period characterized, ironically, by the introduction of strict open space management policies. We use the results to build conclusions and recommendations with regard to growth management policies in the region and compare our results to assessments done elsewhere. Our goals with this research are thus to 1) improve and refine quantification methods of urban spatial growth; 2) assist in improving land use planning and decision making with regard to conservation of open space, and; 3) increase professional collaboration between land use planners and decision makers.

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## **1. INTRODUCTION**

Open space (e.g. land not utilized for building purposes) is crucial for ecological, recreational and aesthetic purposes. The conversion of open to built space is considered among the most extreme forms of land cover transformation with respect to natural ecosystems (Marzluff and Ewing 2001, McKinney 2002, Theobald 2004). Such transformations result in habitat loss, as well as fragmentation of remaining open spaces. Habitat destruction and fragmentation are implicated as primary reasons for loss of global biodiversity (Ehrlich and Ehrlich 1981, Meffe and Carroll 1994). The high value humans place on open spaces, has been shown in several economic studies (Bolitzer and Netusil 2000, Duke and Aull-Hyde 2002, Geoghegan 2002). In Israel, as elsewhere (Alterman 1997, Weitz 1999, Bengston et al. 2004, Koomen et al. 2008), the loss of open space has become one of the dominant environmental challenges facing planners and policy makers (Shachar 1998, Ayalon 2003). While there is a broad literature reviewing, comparing and debating the need for growth management policies (Nelson 1999, Kline 2000, Frenkel 2004, Robinson et al. 2005, Taylor et al. 2007, Koomen et al. 2008, Van Rij et al. 2008), methodologies for assessing their effectiveness are rare and not always convincing (Bengston et al. 2004).

Israel’s National Outline Plan (NOP) 35, made statutory in 2005, provides legislative backbone for, among other goals, resisting low-density, dispersed human settlement. The plan is the most authoritative document for determining the future development patterns in Israel. Although NOP 35 is relatively new and its effects are only beginning to be felt in land use decisions, there is already a history of more than 15 years of open space preservation and prevention of urban sprawl in Israeli policy thinking. This provides enough history to make a detailed investigation into the efficacy of these policies. Frenkel (2004) assessed the potential impact of growth management policies in Israel by 2020 with or without such policies and concluded that while loss of farmland and open space will be unavoidable given Israel’s growing population and emigration from existing built areas, the implementation of growth management policies will perform well in limiting the loss of open space in comparison to scenarios where no such policies are implemented.

## 2. METHODOLOGY

We conduct a temporal, spatial analysis of urban and exurban development in Israel in order to better understand how effective urban growth management policy is in protecting open spaces. Our spatially explicit, longitudinal study of a single geographical region in Israel provides a quantitative and qualitative picture of development patterns before and after the implementation of a national-scale growth management policy. We use two data sets – the first consisting of 1:50,000 scale survey maps of a subsection of the region that provide 40 years of longitudinal data (included here), and the second consisting of orthophotos that provide snapshots of the entire region at the beginning and end of the past decade. We will also derive a set of urban development spatial indices with which to appraise the characteristics of urban form and sprawl. In this way, we identify and characterize long-term trends, and then assess whether changes in trajectories of development in the last decade conform to the planning goals expressed in growth management and open space preservation policies.

We investigate spatial development patterns in Israel's Sharon region. The Sharon region is situated along the Mediterranean coast to the north of Tel Aviv (Fig. 1). The region covers 348 sq. km., constituting 1.6% of the total area of Israel. In 2006, a total of 363.3 thousand people, constituting 5.2% of the country's population, resided within these borders. Population density in the region in 2006 was 1,044 residents per sq km., in comparison with national population density of 323 residents per sq. km. (C.B.S., 2007). The combination of high-demand for residential development and ecologically valuable habitats (Achiron-Frumkin et al. 2003) makes the Sharon region an ideal site to examine the effectiveness and potential for growth management policies. The Sharon region is also site of some of Israel's prime agricultural land.

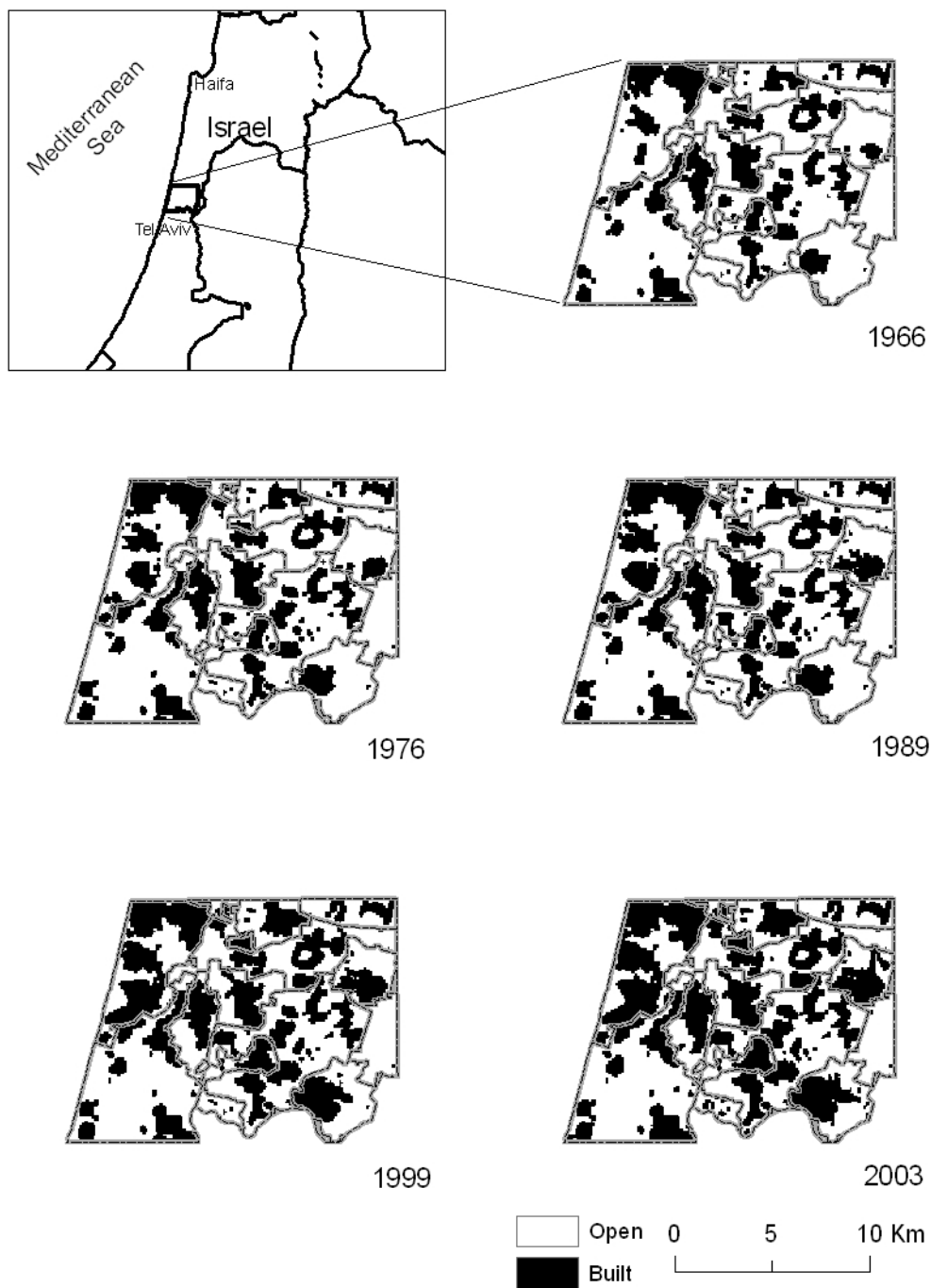
The survey map data set were scanned, digitized and used to produce maps of built areas. Each human-built structure on the maps was digitized with a single point in a vector file, while each paved road was digitized as a line in a vector file. The structure and road vector files for each year were converted into 30 m resolution structure density raster grids using a 30 m search radius and a kernel density function. Any pixel that either 1) contained at least one structure or 2) was within 30 m of a structure was defined as "built." Pixels representing areas of open space with no change (remain open), no change (remain built), and change from open to built were identified, allowing us to identify the net change in built land cover for each study site.

## 3. INTERIM RESULTS

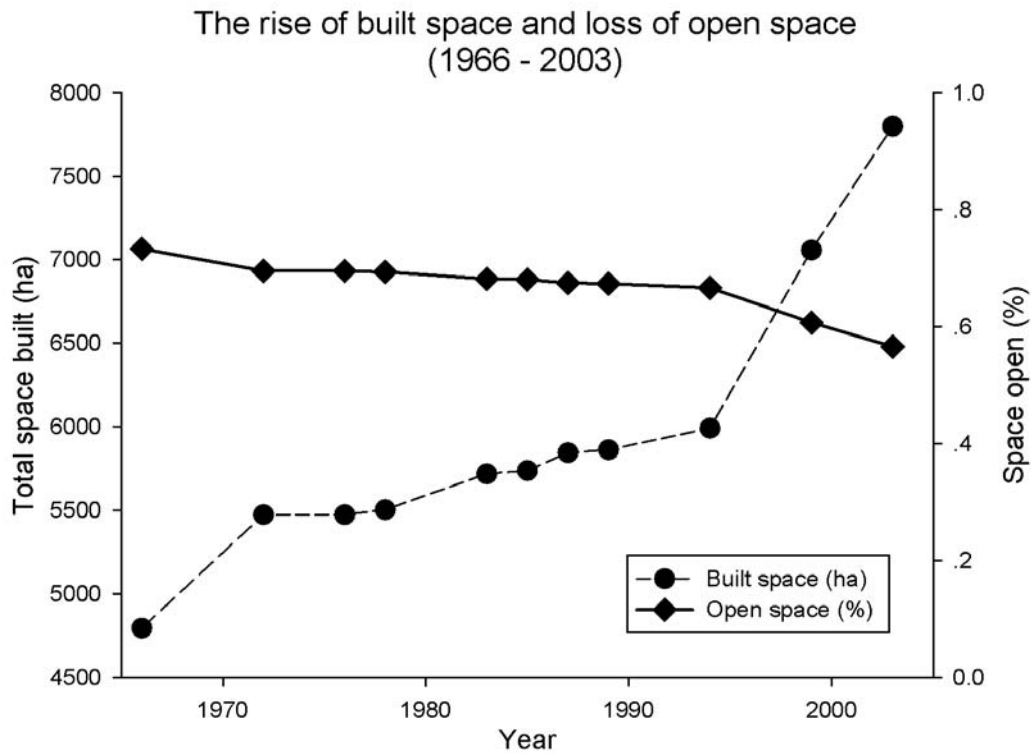
Figure 1 displays the change in the amount of built space in our study site. Figure 2 and Table 1 display the amount of built space and concurrent loss of open space between 1966 and 2003. What is immediately noticeable is that development continued at a relatively constant and low rate between 1972 and 1995. There were two periods of notably high development rates – the first between 1966 and 1972, and the second between 1995 and 2003. The latter pulse of

development coincides with the first urban spatial growth management policies in Israel. While NOP 35 became statutory in 2005, NOP 31 and Israel 2020 (two planning documents that also integrated the principles of open space preservation) had already been a part of land use policy decision making at the national level. Further, NOP 35 had been presented to the National Planning and Building Board for discussion and approval already in 1997.

These results possibly reflect the concurrent rise in both population and in demand for real estate in this region. They corroborate well with results of several investigations into the measures and rates of urban sprawl in Israel conducted by our research group. Frenkel and Ashkenazi (2007) measured sprawl in Israel's municipalities and local councils, and found several communities in this region to qualify as sprawled, according to their multi-faceted sprawl index. We are continuing this research by applying a battery of sprawl indices to the historical spatial development of the region. While urban development continues to expand spatially, we are as of yet agnostic as to whether we will identify growth in sprawl and landscape fragmentation over the past ten years of the study than in previous years; this is the crux of our research question, and anecdotal trends suggest a low level of development and increasingly rigorous planning constraints to prevent new, dispersed development. If the planning constraints are effective, we expect to observe most development congruent to existing development, higher population densities, and less leapfrog development. Strong results will show predictable responses in a variety of spatial indicators, accentuating the importance of a variety of measures of both sprawl and loss of open space, as emphasized elsewhere (Frankel and Ashkenazi, 2007).



**Figure 1** – mapping built space in the Sharon region, 1966-2003



**Figure 2:** Developed space (ha) and open space (%) for the Sharon region, 1966-2003.

Year	Built (ha)	Annual Change Built [(Built $t_2$ - Built $t_1$ )/Built $t_1$ ] / ( $t_2-t_1$ )	Open (percentage)
1966	4795		73.30%
1972	5474	2.36%	69.52%
1976	5474	0.00%	69.52%
1978	5504	0.27%	69.35%
1983	5719	0.78%	68.16%
1985	5738	0.17%	68.05%
1987	5845	0.93%	67.46%
1989	5863	0.15%	67.36%
1994	5992	0.44%	66.64%
1999	7058	3.56%	60.70%
2003	7799	2.62%	56.58%

**Table 1:** Supplementary data for Figure 2, including the annual average percentage increase of built space between each period measured.

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## BIOGRAPHICAL NOTES

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