

Beenish Javaid*

Abdul Waheed[†]Zafar Iqbal Zafar[‡]

Investigating the Spatio-Temporal Changes in Open Spaces in Major Cities of Pakistan

Abstract

The recent trend of rural-urban migration has consumed most of the open spaces in cities leading to higher build-up to open space ratio. This has adversely affected the ecological balance and environment. This paper is about the Spatio-temporal analysis of three major cities of Pakistan to find the impacts of reduced open spaces between 2000-2015. The data was collected using Google Earth Pro and Arc-GIS. The identified open spaces were classified into six different classes of open spaces. The extracted data was also validated by point data comparison on 30 different locations through Google Earth Pro. The results depict an interesting development as a decreasing trend in open spaces for the years 2005-2010 are shown, while an increasing trend is visible between 2010-2015. Moreover, consumption of open spaces has resulted in many social and economic impacts on the community. Finally, it is recommended that strict policy measures are needed to provide adequate proposition of open spaces in cities and to safeguard the existing stock of open space available in urban areas.

Key Words: Open Spaces, Islamabad, Lahore, Peshawar, Spatio-Temporal Analysis

Introduction

Open spaces are a critical part of the cities as they contribute towards a healthy life. There are several studies done which demonstrates social, ecological, and cultural benefits provided by open spaces (Li et al., 2017). Many benefits have been offered by open spaces, especially related to health and wellbeing, such as relaxation, recreational activities, and nature connection (Chiesura, 2004; Koohsari et al., 2015; Madureira et al., 2015; Verlič et al., 2015). Open spaces also help in balancing of ecosystem services that lead to the diminution of global warming (Bowler et al., 2010; Jim & Chen, 2008; Tan et al., 2016; Verlič et al., 2015), alleviation of pollutants (Cohen et al., 2014), reduction in noise (Tan et al., 2016), wildlife habitats (Barrico et al., 2012; Chiquet et al., 2013; Greco & Larsen, 2014; Hussain & Tschirhart, 2013), and the mitigation of disasters (Greco & Larsen, 2014). Moreover, there are cultural benefits provided by urban green spaces such as spiritual and cultural values and also social cohesion (Daniel et al., 2012; Nisbet & Zelenski, 2011).

Due to a growing global population, urban centres have been increasingly concentrated, which lead to deteriorated quality of the urban environment (Grimm et al., 2008). Therefore, adverse issues have arrived in the 21st century (United Nations, 2004; Parrish & Zhu, 2009). 84% of the world urban population increase is to be expected that makes it from 3.4 billion in 2009 to 6.3 billion in 2050 (United Nations, 2019). Increased number of megacities is developing since 1970, with additionally new cities growing in developing countries (Jim & Chen, 2008). Human saturation levels are reaching its heights in big cities and are failed to cater for diverse types of human-induced pressures (Alberti, 2008a). Urbanization is something in which impermeable surfaces are replaced by vegetated landscapes; it influences several natural processes like hydrological process, climate change, and biodiversity at multiple scales in an adverse way (Alberti, 2008b). Urbanization and population growth significantly influence the functioning of the local and global eco-system and services (Alberti, 2008b). Urban development deteriorates, natural habitats; disrupts natural ecological systems, and

*PhD Scholar, Department of Urban and Regional Planning, NUST, Islamabad, Pakistan.

Email: bjaved.urpphd14nit@student.nust.edu.pk

[†]Assistant Professor, Department of Urban and Regional Planning, NUST, Islamabad, Pakistan.

[‡]PhD Scholar, Department of Urban and Regional Planning, NUST, Islamabad, Pakistan.

modifies food chains. Urbanization always has a dreadful impact on green spaces in cities which leads to global warming, natural cycles disruptions and several other factors that contribute to environmental distortion (Pickett et al., 2011). Mitigation of urban deterioration can be done by restoring through careful planning of urban green spaces, natural and semi-natural landscape and preserving wild habitats near the city (Cieszewska, 2000; Jim & Chen, 2008; Kaplan & Kaplan, 1989). The scientific definition of urban green spaces is said to be the open places or barren land with significant amounts of Greenland, i.e. vegetation and trees and mainly found in semi-natural areas (Kong & Nakagoshi, 2006). Studies conducted by Fanhua Kong et al. (2006) and Tongliga (2016) stated that urban green spaces are viewed in urban areas as the last remainder of nature (Attwell, 2000). Studies conducted in North Carolina for the purpose of planning of multi-purpose greenways in Concord, Conine et al. (2004) demonstrated that urban green space has important functions to perform, e.g. conserving biodiversity and eco-system, averting soil erosion and alleviating urban heat island impacts, and modifies energy flow and nutrients cycling.

Urban green spaces are very beneficial as they provide multi-functional social, cultural and economic benefits, such as providing recreational activities, enhance cultural heritage values, reducing work-related stress (Geoghegan et al., 1997; Gobster & Westphal, 2004; Miller, 1996), Protect community, Improve health, Psychological relaxation (Morancho, 2003) and build social capital (Braubach et al., 2017; Verlič et al., 2015). However, due to reduced open spaces, many people are deprived of many advantages given by open spaces. In order to find the impacts of reduced open spaces, the spatio-temporal change in open spaces is to be evaluated and analyzed.

Spatio-temporal analysis plays an important role to help decision-makers, policy planners, and government in generating evidence to generate data and prepare appropriate strategies to formulate and plan land use spatially as well as to understand agents of change within time (Hailemariam et al., 2016; Tan et al., 2016). Investigating the relationship between land use open spaces and factors influencing their utilization like urbanization can provide basic references for site selection of green open spaces in strategic planning of urban land use open spaces (Hailemariam et al., 2016). Hence, Spatio-temporal analysis helps decision-makers and policymakers ensure proper planning for sustainable development which helps to understand the dynamics of the changing environment (Teferi et al., 2013).

Previously various research has been done using Spatio-temporal analysis to find open spaces being occupied by urban land. Xiaolu Zhou et al. (2011) used integrated approaches in their paper to distinguish the spatiotemporal changes of open space in the city of China called Kunming, from the year 1992 to 2009. Concentric analysis and directional landscape analyses, along with landscape metrics, were integrated to examine the spatial changes of patterns of green space. From time period 1992-2000 and 2000-2009, changing intensities of the whole area was calculated. The results demonstrated that both urban sprawl that had been increasing rapidly and policies reckoned for the process of change in green space. Agriculture land, among the other green spaces, was largely affected by rapid urbanization, especially in the suburbs. Forest land was also encroached by urban sprawl too, but the rate loss was less in contrast to agriculture land.

Change detection analysis is the measure of the data framework that is distinct and information with a thematic change that cause more tangible insight to underlying process that brings about land cover and land-use changes (Ahmad, 2012).

Much work has been done for urban spatiotemporal changes in open spaces more specifically due to urban sprawl using different methodologies and GIS tools and techniques. Fangzheng Li et al. (2017) conducted an analysis in order to find factors associated with green spaces in which they spatiotemporally distributed several visitors into selected green spaces in central Beijing to gain insights on the external factors associated with patterns of visitors that were spatially distributed within these open spaces. Analysis like the Gini coefficient, kernel density estimation, and geographical detectors was used to analyze the relationship between the external factors and the visitor pattern that was spatially distributed within urban green spaces. The results showed that spatially distributed visitors within green spaces at central Beijing were immense, which allowed

forming contrasting agglomerations. The three external factors that were associated with green spaces were examined, to check the transportation convenience correlation, density of population, and commercial facilities with visitors that were spatially distributed in urban green space, commercial facilities were the most important external factor. Another study in which Fanhua [Kong et al. \(2006\)](#) analyzed temporal changes of green spaces. They presented a method, using a case study of Jinan City, China, timed 1989–2004, to quantify and capture changes in patterns of green spaces, using GIS and remote sensing. They used the “moving window” technique (using FRAGSTATS), to quantify local area green spaces and sampling from the urban center to the edge by using gradient analysis. Results stated that the green space pattern that was significantly altered could be assessed in each local area with landscape metrics. From the urban center, taken in eight directions, Gradient analysis reflects the effects and temporal changes of urbanization. When the entire landscape is used by quantifying metrics, in contrast, more patterns and processes are linked more effectively, which demonstrates ecological and socioeconomic functions as an important basis for the analysis of green spaces.

Geospatial tools are very important in order to find temporal changes. [Molla et al. \(2018\)](#), used geospatial analysis tools to analyze spatiotemporal changes of green spaces in Southern Ethiopia. In Hawassa, the green space was 30% covered spatially in 1975 but decreased in 2015 by 12%. In another town named Wolayita Sodo town, the percentage of the green space was 53% in 1975 and fell in 1995 to 24%, but surprisingly it got increased in 2005 to 33% and again reduced in 2015 to 29%. The third town called Bodity town was 48% of green space in 1975 and 23% in 1995, but it expanded to 25% in 2005 and further to 30% in 2015. To find the mean difference of green spaces of the three towns spatially, ANOVA was used. The results demonstrated a significant ($p = 0.003$) difference of green space spatially covered among urban centers. Similarly, between Hawassa and Bodity ($p = 0.007$) there was a considerable difference and Bodity and WolayitaSodo town ($p = 0.005$), but Hawassa and WolayitaSodo town ($p = 0.974$) showed no difference. Urban sprawl, increased population, disasters like drought, lack of awareness and government policy which requires the conservation of green space awareness were the leading causes of the change of green space over time.

Another study was conducted by [Wickramasinghe et al. \(2016\)](#), 47 wards of Colombo city were used on the green cover mapping for the years 1956, 1982, 2001 and 2010. For remote sensing, IKONOS imagery and aerial images were used to make maps, with the help of Geographic Information Systems. Green land was investigated, and the temporal change in each ward during the 54-year study period. The results demonstrated the decline of the green cover of Colombo city from approximately 35.67% to 22.23% from 1956 to 2010. In 2010, Narahenpita was reported to have the highest green cover (49.65%). Moreover, more than 30% green cover overall was estimated to be in only three wards (Kirillipone, Cinnamon Gardens, and Thimbirigasyaya). However, wards like, i.e., Kochchikade North, Kochchikade South, Grandpas North, Masangasweediya, Panchikawatte, Fort, Gintupitiya, New Bazaar, Maligawatte, and Aluthkade East were estimated to have green cover less than 10%.

In this paper, we aim to do a spatial-temporal analysis of open-spaces of three major cities of Pakistan, namely Lahore, Islamabad and Peshawar, to determine that consumption pattern of open spaces in the last fifteen years. Moreover, the study investigates the factors affecting the development pattern of open spaces in the selected cities.

Study Area

This research selected three different cities of Pakistan Lahore, Islamabad and Peshawar as the case study area (figure 1). Lahore is the capital city of Punjab and is the second-most populous city in the country. With the area of the city is 1772 km which spread between 31° 15' and 31° 43' N latitude and 74° 10' and 74° 39' E longitude ([Shirazi & Kazmi, 2016](#)). The city is of historical importance and origin linked with the Mugal era. Peshawar, the capital city of the province Khyber Pakhtunkhwa is

located in the northern part of Pakistan with Latitude 34° 02' and Longitude 71° 37'. The city has been regionally importance due to its boarding with Afghanistan. Islamabad is the capital city of the Islamic Republic of Pakistan. It is located between 33°28'12"–33°48'36" N latitude and 72°48'36" E – 73°24' E longitude. The elevation of Islamabad's urban areas varies between 400–600 m which indicates undulating surface as its dominant character. The capital is flanked by the Margalla Hills in the northern side of the city. The area of Islamabad is about 906 km, and the total population is about 2 million (Naeem et al., 2018).

The reason for selecting these cities as a study area for this research was because all three cities have the character of Capital Cities and a rapid increase in population, which is one of the main reasons of urbanization.

Datasets

Peshawar, Islamabad and Lahore shapefiles were used as a Boundary. Rivers and Road networks were used for these cities. These Maps of these cities were then digitized using Google Map pro for the year 2005, 2010 and 2015 to classify the open spaces of these areas.

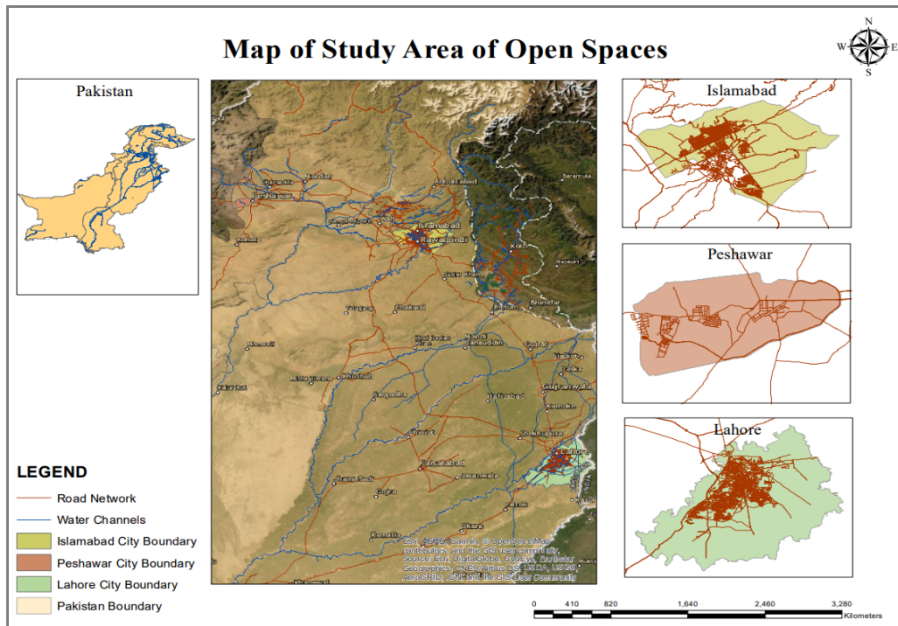


Figure 1: Map Indicating three Cities of the Study Area

Methodology

The urban spaces selected for these cities with five years difference i-e 2005, 2010, 2015. They were digitized using Google earth pro and Arc-GIS. The urban spaces were classified into six groups, and each one of them was given a different symbology color, namely Agricultural Land, Open Land, Garden, Grassland, Park and Playground. The urban spaces were compared for these years, and analysis was done to calculate the areas of each attribute in the table. The areas of different open spaces were compared for each city for 2005, 2010 and 2015 in the form of a table and then its percentage has been calculated to get a statistical value of the open spaces that have been increased or decreased during those years. Using spatial vector tools in Arc-GIS, i.e. Clip and Subtract, data was also extracted for each attribute of open space. The data was also validated by point data

comparison in which 30 random points were selected from the digitized data and compared them on Google Earth Pro for its valid locations.

Results and Discussion

Due to better health and education facilities in cities and urban areas than villages, there is significant population growth and rapid urban sprawl observed in the city causing a decline in agricultural and open land area with increased urbanization. One of the many reasons for reduced Grassland could be explained by the climate change, extremely harsh weather conditions such as more temperature and less rainfall, natural disasters and wildfires which damages the green area and Grassland and deteriorates the naturally balanced eco-system of the city. The following discussion will suggest open space consumption trends in three cities separately:

Peshawar

The results indicate that from 2005- 2010 the percentage of Agriculture land has decreased by about 58.7% while from 2010- 2015 it has increased by only 6.1% (figure 3). The trend of consumption of agriculture land is a clear indication of rapid urbanization and poor control of government towards planned neighborhoods. Garden has also been decreased to a great extent that is 64.8% from 2005-2010 while from 2010- 2015 it has increased to 1.4% only. The data of two eras indicate that city has been losing its plantation with least addition in return. There is also an abrupt decrease from 2005-2010 of 46.4% in Grassland and a further of 53.4% decrease in the year 2010- 2015. Openland has been decreased to 76.5% and a further 46% decrease between 2010 and 2015. Playgrounds have also been reduced to 63% from 2005- 2010 while an additional 9.6% decrease from 2010- 2015. The overall data of different character of open spaces show a significant decline from 2005 to 2015. However, the trend is more from 2005 to 2010.

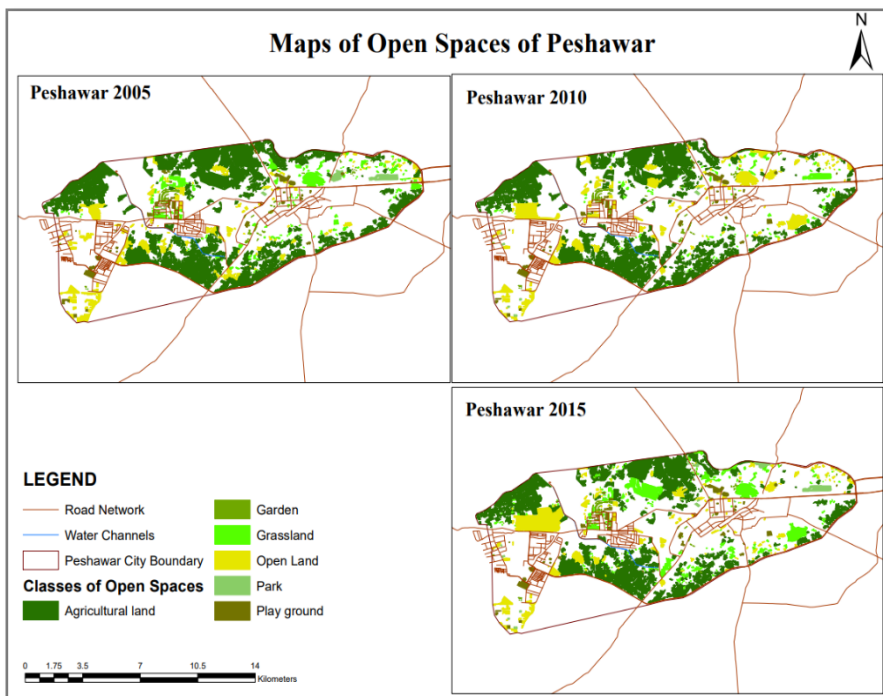


Figure 2: Map Indicating Open Space Distributed over three Different Eras

Table 1. Changes in the Open Space area in Peshawar City during 2005 - 2015(Sqm)

Year	Agriculture	Garden	Grassland	Open land	Park	Playground
2015	142351587	578633	3732866	50862893	116468	1144247
2010	134103241	570538	8018631	34828482	841627	1267093
2005	324757886	1622748	14982876	148270154	2342451	3430180

Table 1 gives the total area of different types of open spaces in Sqm in Peshawar. The table indicates the numerical distribution of open spaces for the city of Peshawar during 2005-2015.

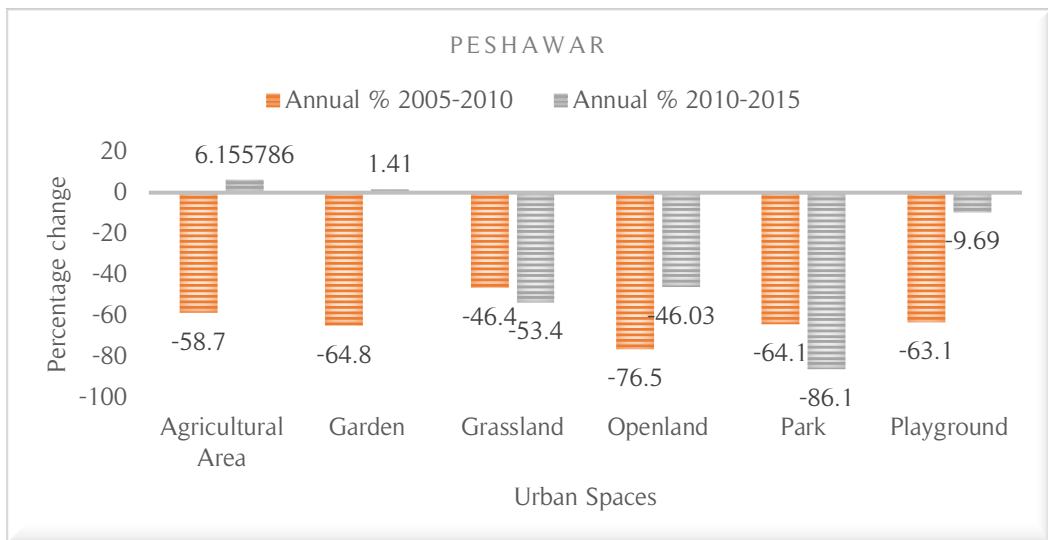


Figure 3: Bar Chart Indicating a Comparison of Percentage Difference of Open Spaces

The results shown above show that in Peshawar, major changes that come in 2005- 2010 is in the agriculture area, open land and playground. [Abdur Raziq et al. \(2016\)](#) in his paper, worked on maximum likelihood classification (MLC) techniques and algorithm to identify land-use changes in Peshawar from 1999 to 2016. The study supports the finding of this research for Peshawar city because maximum likelihood classification detected the land cover changes from 1999 to 2017 and observed a substantial increase in the built-up area resulting in the consumption of the agricultural land and barren land. This trend indicates significant urbanization between the given period for Peshawar city.

Lahore

Lahore is among one of the few historic cities which have been continuously inhabited. The city Lahore has expanded many folds in the past seven decades as is evident from the census results, which indicate the trend of urbanization. And Sheikhpura has become the peripheral area of Lahore. Pakistan is urbanizing at a fast rate. So small cities are growing like Sheikhpura as from here it is easy to access the main city Lahore, the commute is it, and resources are available in the nearby area. And the cost of living here is cheaper than that of the main city.

Lahore is one of the most populated cities in Pakistan, with its population increased from 1.13 million in 1951 to 8.83 million in the year 2010. The relatively increased density in Lahore was 149% during the year 1981-2010 from 128% between 1951-72. Thus, it shows the living condition in Lahore is very stressed because of less space availability per person ([Zaman & Baloch, 2011](#)). [Shirazi et al.](#)

(2012) reported the vegetation cover reduced from 645 km² (36%) in 1992 to 249 km² (14%) in 2009 in Lahore which shows the same result as in this study. Our study also coincides with Riaz et al. (2013), who also observed an increase of urban area in Lahore by 68% till 2009 which led to the reduction in vegetation/agricultural land due to its consequent effects.

The dataset of Lahore indicates that the Agricultural area has decreased by 10.4% from 2005-2010 while it has slightly increased by 0.82% from 2010- 2015. The trend of the percentage of consumption of agricultural land is similar to Peshawar although it is less than Peshawar. Gardens have increased 0.91% from 2005 -2010 and 0.09% from 2010- 2015. Grassland has decreased by 21.7% between 2005-2010 while it has slightly increased by 1.74% between 2010- 2015. Open land has been reduced to a great extent 60% between 2005- 2010 and 76.72% from 2010-2015. Parks have also been reduced by 9.6% between 2005- 2010; however, they have increased by 26.6% from 2010 -2015. Playground has been increased slightly 1.45% from 2005- 2010 and a further 86% between 2010- 2015.

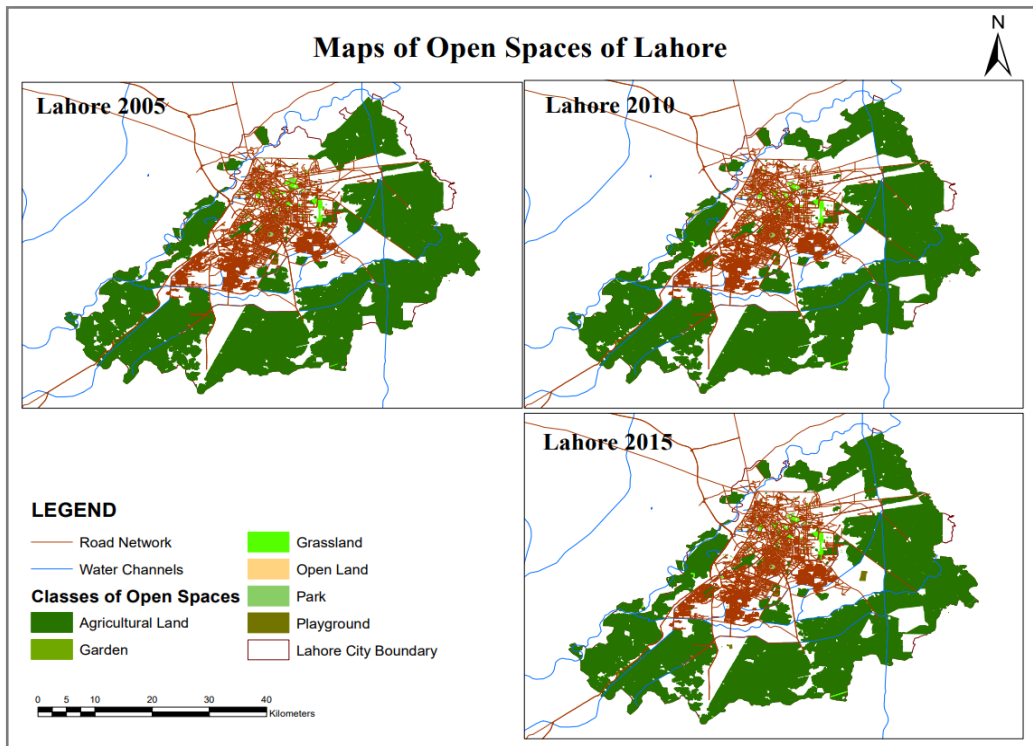


Figure 4: Map Indicating Open Space Distributed Over Three Different Era

Table 3. Changes in the Open Space Area in Lahore City During 2005 – 2015(Sqm)

Year	Agriculture	Garden	Grassland	Open land	Park	Playground
2015	1000186032	1099141	5375339	286219	2644569	3845025
2010	992031330	1098131	5283327	1229726	2089436	2097156
2005	1107150614	1088179	6748399	3081303	2310257	2067156

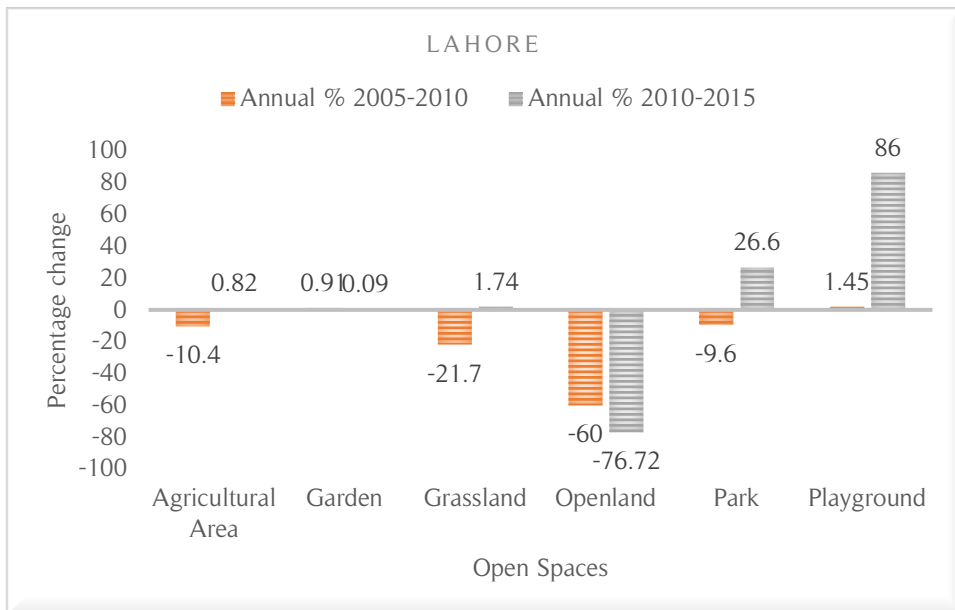


Figure 5: Comparison of Percentage Difference of Open Spaces

Table 3 gives a total area of different types of open spaces in Sqm extracted from spatial data indicated in figure 4. The table shows the numerical distribution of open spaces for the city of Lahore.

The analysis of data suggests that Parks and playgrounds have been increased. These are the planned form of open spaces. These are, most of the time, developed and managed by developing authorities. This trend is showing that departments which are managing the Lahore city are continually focusing on maintaining the green character of the city. The rapid consumption of open land, on the other hand, predicts that the rate of urbanization is on the higher side.

Islamabad

The city of Islamabad is a planned city and youngest among the three because it is planned and developed during the 1960s. Since the inception of Islamabad 17 significant changes have been made in the Master Plan. In the original master plan of Islamabad Doxiadis surrounded the city with a vast expanse of agriculture land in zone II and V so that the city would grow its own food and will not be dependent on other cities to meet its food demand. But unfortunately, these zones were converted into residential areas in 1992 to prevent further haphazard development and formalize the unauthorized urban. The city was planned to expand in the southwestern direction, but the current trends show that it is expanding in every direction except the Margalla hills. The land cover of Islamabad is changing very rapidly.

Starting with percentage consumption of Agricultural area the data indicate that it has been increased by 58.3% from 2005- 2010 while it has decreased -0.27% to 2010-2015. Garden has been decreased by 11% between 2005-2010 and 2010-2015 to 7.95%. There was a gradual decrease in Grassland from 2005-2010 and 14.3 from 2010- 2015. Open land has been decreased by 39.5% from 2005- 2010 however it increased 18.6 between 2010- 2015. Parks have increased 1.06% from 2005-2010 and 0.42% from 2010- 2015. From 2005- 2010, the playground has increased by 63.4% but decreased by 5.3% between 2010- 2015.

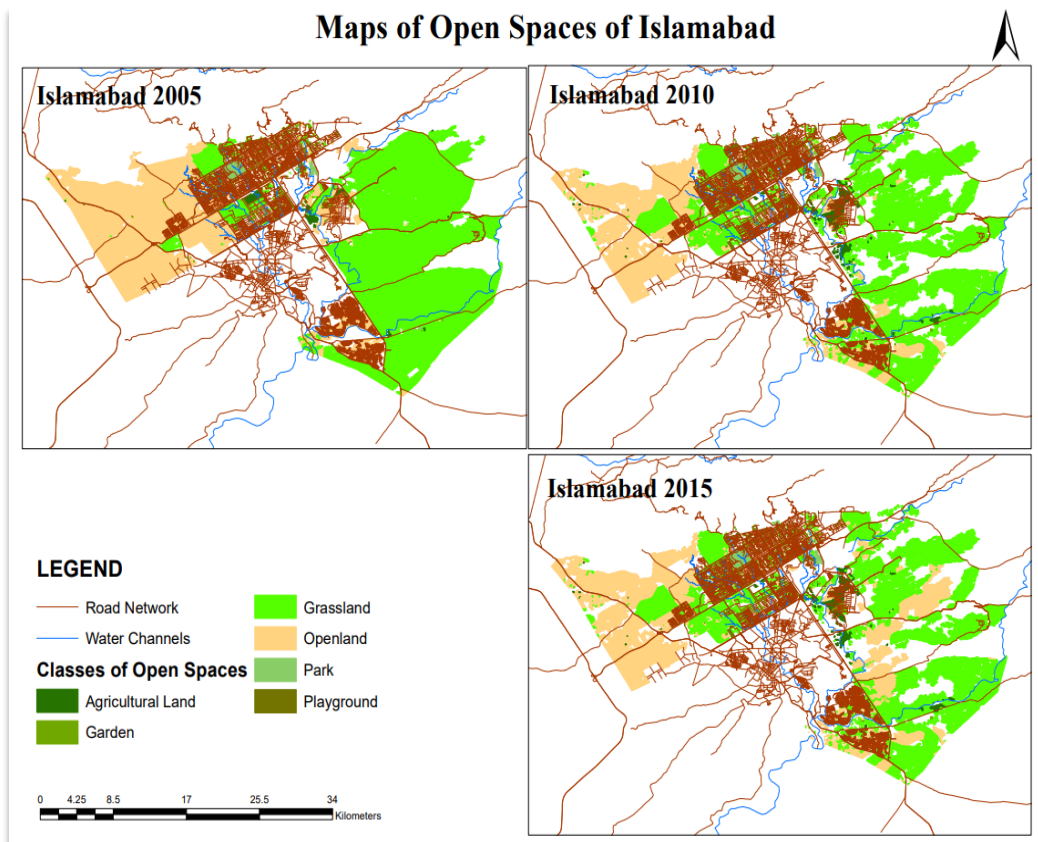


Figure 6: Map Indicating Open Space Distributed Over Three Different Eras

Table 5. Changes in the Open Space Area in Islamabad City during 2005 - 2015(Sqm)

Year	Agriculture	Garden	Grassland	Open land	Park	Playground
2015	8800527	2049879	209443744	122836131	5511526	1917340
2010	8824792	2226951	244250397	103558736	5488194	2038393
2005	5574016	2502584	298572322	171238890	5430783	1247416

Table 5 shows the total area of different types of open spaces in Sqm extracted from spatial data indicated in figure 6. Moreover, table 5 also show the numerical distribution of open spaces for the city of Islamabad.

The data suggest a significant increase in agricultural land and the city is losing its agricultural land at a very slow pace. But the trend of consumption is present. Open land, Parks and Playground have been added more to the cityscape than their loss/consumption. This also suggests that city management has reasonable control over the development pattern of the city.

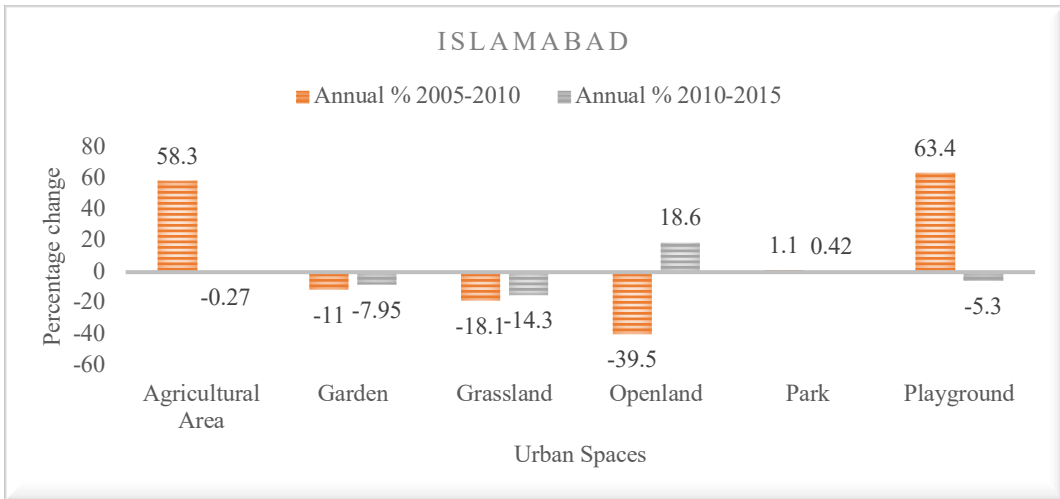


Figure 7: Bar chart indicating a comparison of percentage difference of open spaces

In Islamabad, there is a major increase in Agriculture land and playgrounds in 2005-2010 while a decrease in the garden, Grassland and open land. The Bureau of statistics suggests that in 1998 there were 889 persons/sq. Km, but it has increased double 1632 persons/sq.km in 2015 ([Pakistan Bureau of Statistics, 2016](#)). Thus, it clearly shows the population increase in Islamabad, and hence the urban sprawl which leads to decrease in Grassland, open land, garden etc. Our work coincides with Zahra [Hassan et al. \(2016\)](#) as well. According to them the percentage area of each class in 1992 and 2012 showed that a major shift had been faced by barren land as it was reduced to 1.87 % (1678 ha) in 2012. Forest Area also faced a major decline that is in 1992 was 13.49 % (12,136 ha) of the total area, and in 2012 it was reduced to 6.82 % (6138 ha). The other three classes faced an increase in the total share. The major increment was faced by Built-up Area. Its share was increased from 18.09 % (16,281 ha) in 1992 to 56.73 % (51,039 ha) in 2012. The Agricultural Area was also increased from 11.49 % (10,336 ha) in 1992 to 32.23 % (29,000 ha) in 2012. One of the reasons for reduced Grassland and open spaces and increased urban land is that change in regulations of Zone 4. Islamabad consists of five Zone, and these zones are separated due to their different design and development patterns. Zone 4 was previously declared as green area dedicated to special land uses which have least construction and congestion impact residential and commercial land uses are prohibited. But after 2010 it had changed to mixed land use and all type of land uses are allowed in this zone. This leads to the planned development of major city area which was previously facing unplanned development. Therefore, the data support this as planned open spaces are trending towards increase.

Impacts of Consumption of Open Spaces

The findings of the structured interviews with twenty-two officials from Capital Development Authority (CDA), Lahore Development Authority (LDA) and Peshawar Development Authority (PDA) suggested that open spaces help in reducing congestion of area. It is also used to control the density of a human settlement through the provision of the adequate proportion of open spaces. Moreover, at the designing stage, if proper access is provided through the road network, it will increase the physical impact of open spaces. Furthermore, a consensus was found among the interviewed experts at that sedentary lifestyle can be modified through open spaces. The same observation was reported in a WHO study conducted by Sanchez ([WHO, 1999](#)). For example, greenbelts along roads if provided with walkways increase the opportunity for people to reduce the use of automobiles and adopt the

healthy choice of walking. Similarly, play lots at a walking distance will encourage families to spend time in outdoor activates instead of indoors.

These days the city around the world faces degradation of their environment due to many factors like rapid urbanization, load on the transportation system, haphazard growth of industry and commercial activity. During the interview, the planners from CDA highlighted that the best treatment to improve a city environment is the induction of a healthy environment through the utilization of small and large spaces within the city. For this purpose, the best option is to convert these void places in green open spaces.

Another significant highlight of the expert interview suggested that open spaces can enhance community social capital. At the community level, open spaces provide an opportunity for community members to interact. People interact with each other and have better understating of their surrounding environment. This will have a positive impact on community health. Planners believe that direct economic effects of open spaces are not very significant. However, open spaces in the form of parks, or green belts gives numerous direct and indirect financial benefit to the city and its residents. These play a partial role in hiking the prices of property. Also, local authorities can generate revenue when open spaces by renting these spaces for different entertainment activities.

Conclusion

The present study investigated the situation of open spaces in federal and provincial capitals (Islamabad, Peshawar and Lahore) of Pakistan in the last fifteen years. By using spatial data and mapping the temporal changes, trends occurred in open spaces over the years has been indicated. This highlights that changes are happening in terms of total area consumption of open spaces in three major Pakistan cities. However, these changes are different for distinct types of open spaces, with mix increasing and decreasing trends. The last three centuries have witnessed the evolution of settlement from walled cities to industrial cities then into a metropolis. This journey was full of innovation and rapid transformation, accompanied by three industrial revolutions. Historical walkable Cities gave way to subways and highways.

Pakistan is a developing country with most of its population live in towns and villages. Existing cities of Pakistan are facing an issue of the rapid increase in illegal occupants and encroachment of land in urban areas ([Hogrewe et al., 1993](#)). Most cities of Pakistan have a history before partition. Only a few are planned by Government of Pakistan. Because of the organic growth pattern of cities, planners mostly focused on providing basic infrastructure facilities to the resident. They try to combat congestion by providing wide roads. Less consideration is given to designing and development of open areas. This is because open areas have potential to be encroached by land mafia and have a less financial benefit for owners ([Farkhunda et al., 2007](#)) Planning policies of different developing authorities of Pakistan also indicate that only small percentages are provided in planning parameters for open space. No comprehensive development plan of open spaces for any of Pakistani city has ever been prepared ([Farkhunda et al., 2009](#)) Lack of structured planning for the city growth is causing the existing infrastructure to collapse under growing population. The cities are growing haphazardly, peri-urban growth, leapfrog development and ribbons of settlement along the major highways and urban centre are the new trends. The result is the absence of health, educational facilities and open public spaces.

The consumption trends of open spaces indicated in this research will help decision-makers to determine the socioeconomic and environmental impacts of these changes on the city dwellers. This, in turn, contributes towards developing a correlation between sustainability and open spaces.

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