

**THE ASSESSMENT AND ANALYSIS OF URBAN GREEN SPACE DISTRIBUTION
AND CHANGES USING MULTI-TEMPORAL SATELLITE IMAGES WITH
EMPHASIS ON SOCIAL JUSTICE
(A CASE STUDY 10th AREAS OF TABRIZ CITY, IRAN)**

Mohsen Ahadnejad Reveshty

Assistant Professor, Department of Geography, University of Zanjan, Iran
University Blvd., 45371-38791, Zanjan, I. R. Iran Tel: +98 (241) 51514164
E-mail : ahadnejad@gmail.com

Ahmad Hoseyni

MSc student in Geography and Urban Planning, the University of Zanjan, Iran
E-mail : ahmad.hoseyni@yahoo.com

KEY WORDS: Spatial distribution, social justice, Williamson index, NDVI, Tabriz

Abstract: Today the city without green space in its various forms is no longer unthinkable. Consequences of urban development and the complexity of environmental problems that caused inevitable of expansion and availability of green space. Based on this, the foundation of this study based on utilizing data and satellite imagery (ASTER multi-temporal) is about 2001 to 2010 and to data analyzes GIS software such as IDRISI and also NDVI and Williamson model has been used for data analysis. The results of analyzes shows that between 2001 and 2011 the distribution of green space in urban areas of Tabriz, rapid increase in population and very high density construction in urban areas the amount of vegetation from 2600.3 hectares in 2000 has decreased to 2216.1 hectares in 2011. In other words during 2000-2011 about 384.2 hectares of green space has been decreased in Tabriz urban areas. This amount was fluctuated 1.1 square meters in area 10 and 36.9 square meters in area 6 in 2011, according to Williamson's model the distribution of green spaces in Tabriz urban areas is 0.36 that indicating a very unequal situation in the enjoyment of green space in Tabriz urban areas. Therefore, equitable distribution of green space in urban areas, has been finding the main motivation for this research.

INTRODUCTION

The distinguishing characteristic of empirical studies that illuminate current inconsistency and injustice of Third World urbanization. These inequalities are reflected in three levels: 1) Inequalities in livelihood opportunities in rural and urban areas, 2) Inequality from city to another city due to focus limited resources on the capital, 3) Economic inequality between the urban masses and a small group of rich elite. These imbalances and inequalities, except for inherent damages may cause expectations in the national economy efficiency (Smith, 2005). This effect is the result of polarized growth policies that the result of this policy, all facilities concentrated in one or more of areas and other areas expected to operate in marginal. In order to create balance and proper form and homogeneous spaces, discuss relevant regional planning and first step in regional planning understands about disparities in economic, social and cultural areas (Monfardin, 2007). Based on the studies that show the importance of urban green spaces that also is an indicator of the quality of living space and community development (Balram, 2005). These factors have led to the modern concept of urban green space in different ways without it is unthinkable because of increasing environmental pollution is one of the most important complications (Mohammadi, 2007). With considering this fact that green space as the city's respiratory lungs and lack of this land use is equal lack of significant physical and mental health in the cities and industrial development that is unique to the importance of green space are more tangible (Willson, 2000). On the basis of this paper is to investigate the spatial distribution of vegetation index (NDVI) using ASTER images from social justice perspective in the city of Tabriz in during 2000-2011. The study showed that the spatial distribution of vegetation does not comply with the principle of equitable distribution and is not adequate access for citizens.

METHODS AND EQUATION

This study is based satellite images (ASTER images) in 2011 and 2010 census data (figures1, 2). In order to data analyze and GIS software IDRISI has been used also NDVI and Williamson index were used for urban green space inequality assessment in this study. Due to the nature of the research, applied research to better assess the issue from different angles, different methods were used as follows:

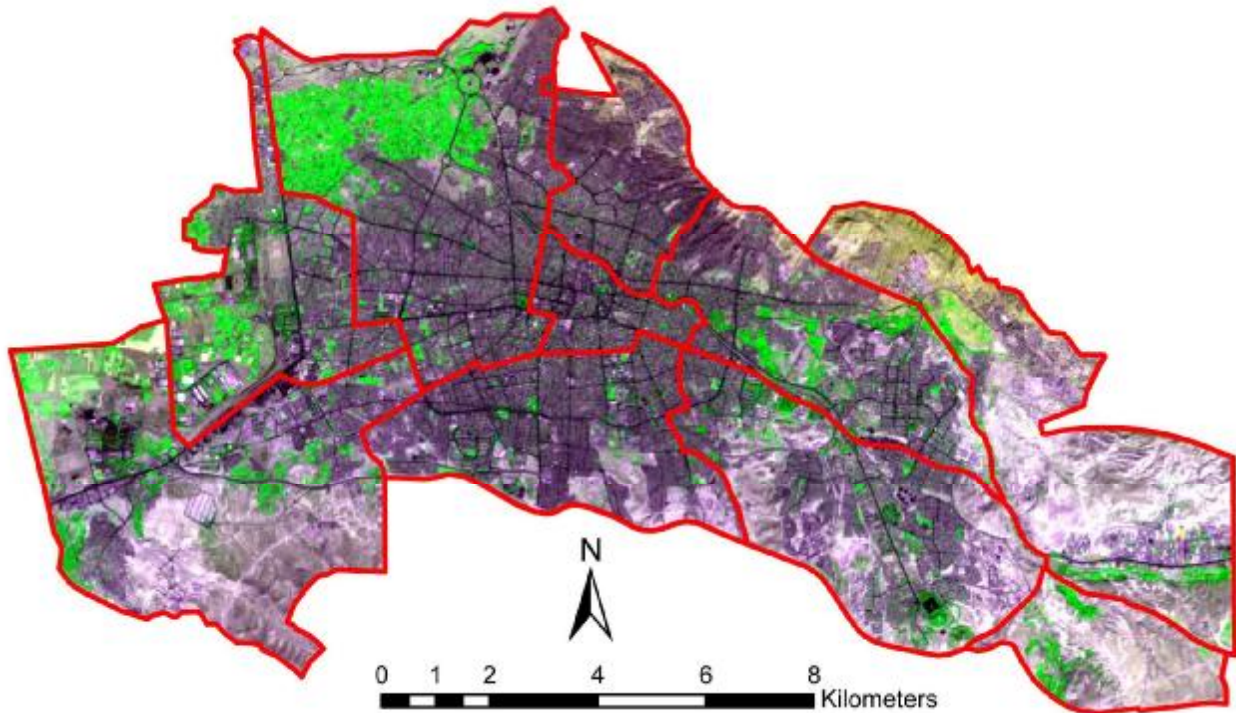


Fig1: Aster color composite of Tabriz city with urban areas boundary on 2000

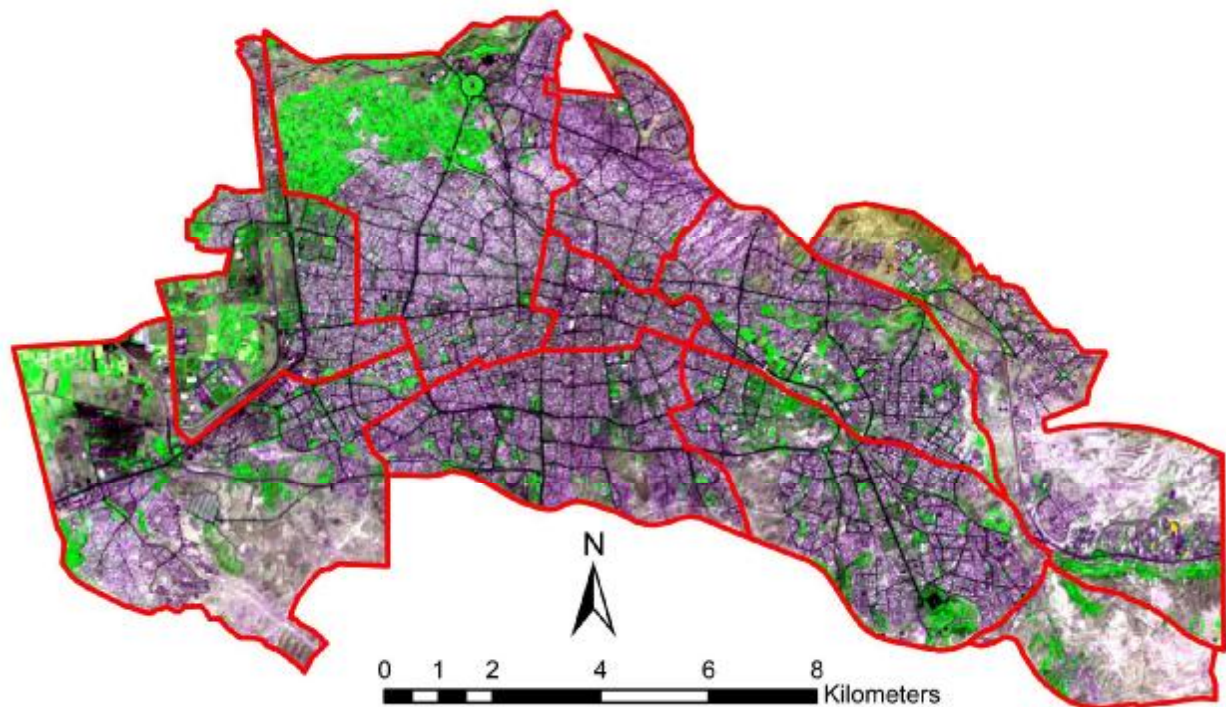


Fig1: Aster color composite of Tabriz city with urban areas boundary on 2011

- Normalize Differential Vegetation Index (NDVI)

In these study visual (band2) and inferred (band3N) bands of aster images with 15 meters resolution has been used. For extract of NDVI form Aster images $(NIR-R)/(NIR+R)$ or $(Band3N-Band2)/(Band3N+Band2)$ equation were used. Due to high quality of ASTER image in vegetation mapping and vegetation assessment especially in urban green space assessment in this study 2000 and 2011 Aster images has been used for urban green space assessment in urban areas of Tabriz city. Figure 3 and 4 shows NDVI images that extract from 2000 and 2011 Aster images.

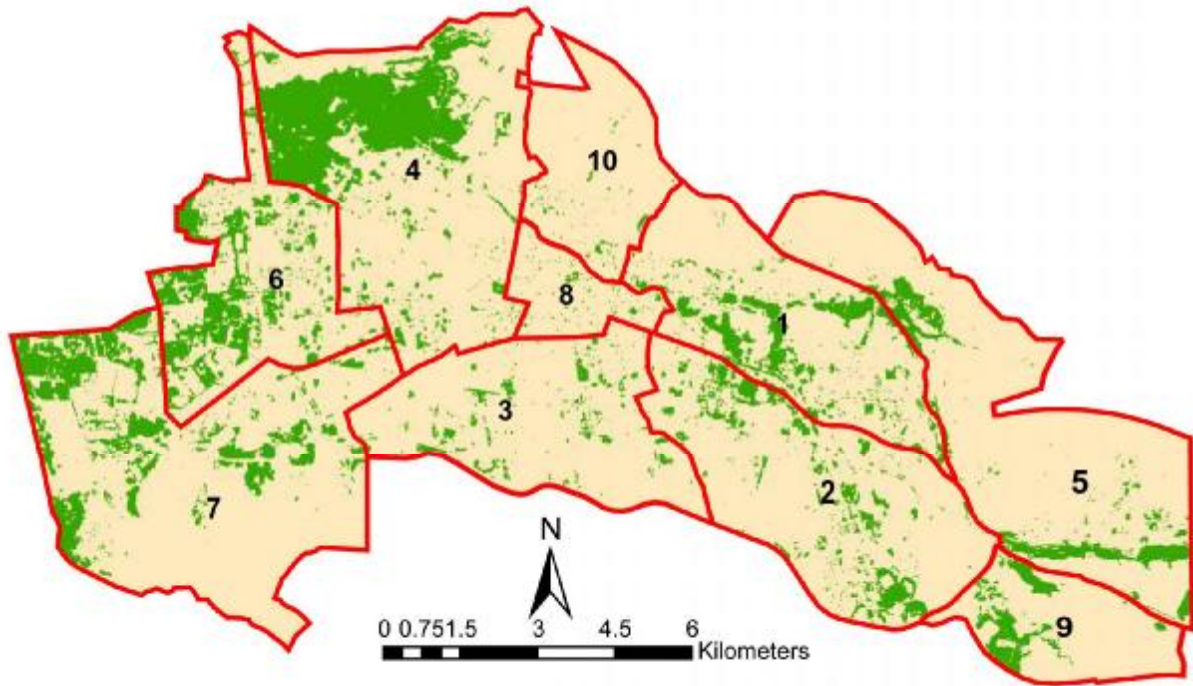


Fig3: Tabriz city NDVI map on 2000

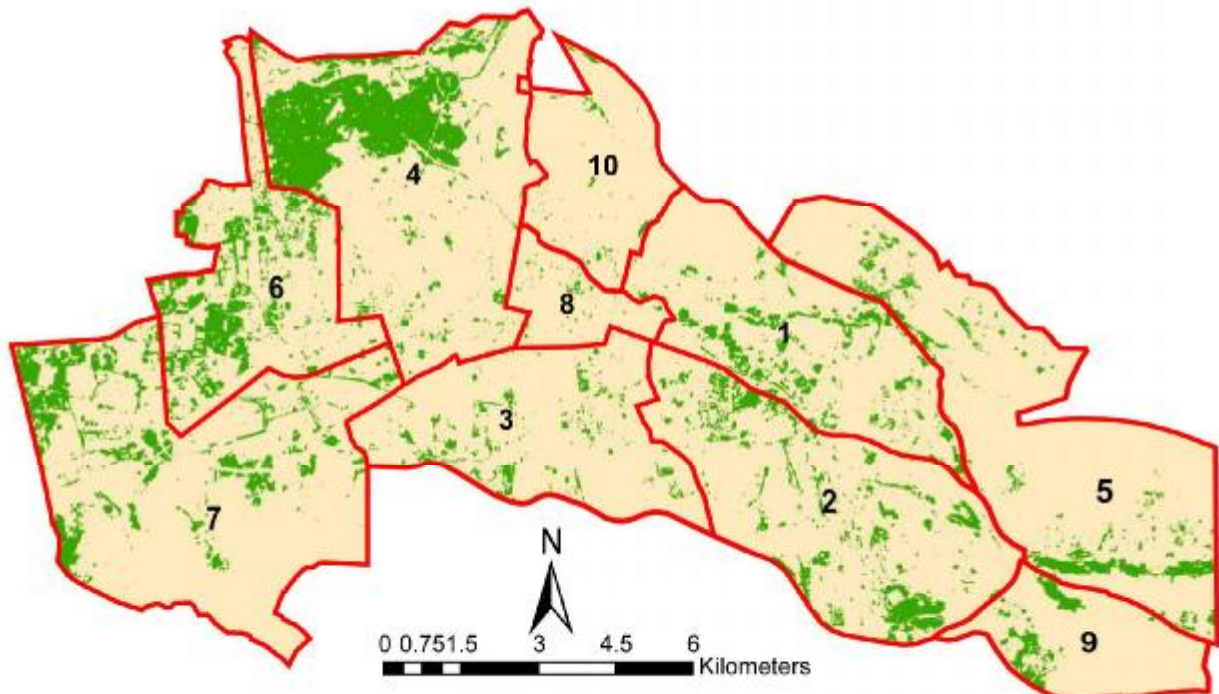


Fig3: Tabriz city NDVI map on 2011

- Williamson model

On regional issues, in 1965 Williamson was the first extended discussion of income inequality (Tadjoeddin, 2003:1). He also believed that regional inequalities will lead to inverted U pattern because income and wealth in the first stages of development was concentrated in certain regions and in the late stages of development would be led to a more homogeneous distribution of the other areas. Thus, according to Williamson regional disparities is done among regions due to the concentration and then distribution in between regions. Williamson model is presented as the following equation:

$$V_i = \frac{\sqrt{\sum_{i=1}^n (Y_i - Y^-)^2 \frac{f_i}{P}}}{Y^-}$$

In this equation f_i is related to population in region i and P is total population, Y_i is NDVI capitation in region i , Y^- is NDVI total capitation and N is number of regions.

Williamson inequality index should help that they can be used to obtain inequalities between regions and between the regional and determining an index of the extent to which the distribution is uneven between regions. Williamson value coefficient of variation is between zero and 1 that will tend towards zero as the number represents a reduction in inequalities.

RESULTS

According to results obtained from ASTER satellite imagery processing and NDVI indices derived from Tabriz urban areas it can be inferred that rapid increase in population and very high density construction in urban areas the amount of vegetation from 2600.3 hectares in 2000 has decreased to 2216.1 hectares in 2011. In other words during 2000-2011 about 384.2 hectares of green space has been decreased in Tabriz urban areas. According to Capitation in the city of Tabriz shows large differences in the urban areas. This amount was fluctuated 1.1 square meters in area 10 and 36.9 square meters in area 6 in 2011. The imbalance in the distribution of vegetation showed no consistent spatial distribution of vegetation in the city of Tabriz. These data indicate that the imbalance in the distribution of vegetation in the city of Tabriz. Table 1 presents the normalized difference vegetation index for urban areas in Tabriz.

Table1: NDVI and population distribution in Tabriz urban areas

| Areas | NDVI per capita in 2011 | Population in 2010 |
|-------|-------------------------|--------------------|
| 1 | 9.25 | 211340 |
| 2 | 17.97 | 143642 |
| 3 | 3.86 | 251348 |
| 4 | 22.11 | 312865 |
| 5 | 24.59 | 64286 |
| 6 | 36.89 | 88887 |
| 7 | 36.13 | 109055 |
| 8 | 4.22 | 31438 |
| 9 | - | - |
| 10 | 1.15 | 189448 |
| Total | | 1402309 |

The main objective in regional planning is development of regions and assessment of facilities spatial distribution in cities could be help for policy makers towards understanding the disparities in different regions. Therefore, in this part of the study, with an emphasis on trying to understand the disparities of regional inequality indices in 2011, Williamson model has been used. On the basis of this research is to use the Williamson index, the present study examined disparities in different areas of Tabriz. According to Table 2, in 2011 the distribution of NDVI in the city of Tabriz, is very unbalanced and the value of 0.05 in area 2 to 0.38 in area 1.

Table 2 the distribution of vegetation in urban areas Tabriz based on Williamson model

| Areas | 2011 |
|--------------|-------------|
| 1 | 0.15 |
| 2 | 0.05 |
| 3 | 0.32 |
| 4 | 0.21 |
| 5 | 0.13 |
| 6 | 0.35 |
| 7 | 0.38 |
| 8 | 0.11 |
| 9 | * |
| 10 | 0.34 |
| Total | 0.36 |

According to Williamson's model the distribution of NDVI in urban areas is 0.36, which represents the very inequalities in urban green space in urban areas is Tabriz

CONCLUSIONS & RECOMMENDATIONS

Justice is a concept that has never been free of human concern. In urban planning that could help the city achieve greater justice attention to spatial justice, which is the spatial concentration of population programs and services are distributed equitably across and given that urban green spaces, as one of the most common areas of service, a large role in promoting the social, cultural, economic, environmental and urban areas. This condensed urban areas grow and be used in various communities, so its role in public health and urban environment for everybody.

In terms of current city and urban and industrial development of the city and its surrounding cities of pollutants in air and water have increased contaminants. According to this research results the green space environment and reducing urban pollution, and will increase the quality of the natural environment, and in parallel with industrial development, the importance of green space are more tangible. Given that the subject of evaluation and analysis of the spatial distribution of vegetation using ASTER images are from the perspective of social justice in the 10th Tabriz urban areas. The results show that amount of vegetation from 2600.3 hectares in 2000 has decreased to 2216.1 hectares in 2011. In other words during 2000-2011 about 384.2 hectares of green space has been decreased in Tabriz urban areas.

The results show that the NDVI index can effectively integrate different data sources for evaluation of urban green spaces and Williamson's model is the appropriate model to show regional differences. In addition, most studies using only the features of existing urban green space have been devoted to the evaluation of new technologies but in this study the variables to be combined using temporal satellite imagery and analytical models have been analyzed according to green space. Therefore, these results can be help to urban planners for understand and prioritize urban issues and find solutions to help fix this problem.

REFERENCES:

- Balram,S and et al,2005. Attitudes toward Urban Green Space: Integrating Questionnaires Survey and Collaborative GIS Techniques to Improve Attitude Measurements, Landscape and Urban Planning.
- Hadder, R, 2000. Development Geography, Rout ledge, London. New York, P.3.
- Masomi,H,1987. Principal of regional planning, Second publication, Somehsara publication.
- Monfaredian,M,2007. The ranking of urban region about degree of development, MSc thesis in economic, university of Isfahan.
- Mollai,N,,2003. Study of the optimization model for planning the development of rural service, Journal of Geographic research, (70), pp.47-73.
- Mohammadi,J and et al, 2007. Quality assessment of urban green space optimization using them citizens, A case study Shahrkord, Journal of Environment,(44),pp.95-104.

- Mosavi,N.,2003. The measuring of regional development of Iran , MSc thesis of Geography and Urban Planning , university of Yazd.
- Nazarin,A,1995. Urban geography of Iran, Peyam Nour university publication.
- Smith, D., 1996. Third World Cities In Global Perspective: The Political Economy Of Uneven Urbanization, Translated by Mosavi,M. Mana Nagsh Publication.
- Tadjoeddin, m.z, 2003. Aspiration to inequality: regional disparity and center regional conflicts in Indonesia, conference on spatial inequality in Asia, United Nations University center, Tokyo.
- Varesi and et al, 2007. A Survey of Urban Services Distribution on Population Spatial Imbalance Case Study: Districts of Isfahan, Journal of Geography and Development, 5(9), pp.91-106.