

RISK CAUSED BY THE SPATIAL FORMATION OF THE CITY OF BURSA (TURKEY) IN HISTORICAL PROCESS, CURRENT DEVELOPMENT PLANS AND LAND USAGES BASED ON DEVELOPMENT PLANS

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Abstract:

In Turkey, it is observed that there is an overgrowth of population, resolutions on land usage have deteriorating effects on natural ecological balance and consequently environmental problems reached threatening levels for all life forms. It is important to remove the impacts of urbanization, which consume irreplaceable natural resources, through planning methods and techniques. Examination of the current land usage of Bursa Nilüfer Creek Başköy – Kestel Section and its subbasins reveal that location organization was radically changed due to industrialization, and functional areas such as settlements and industrial areas, located on first class agricultural lands and on rock formation with geologically high permeability, create pollutions on the natural resources forming the basin, over acceptable parameters of international standards, as a result of governmental decisions.

In this context, resolutions, implementations and their reflections of land usage, population, residence facts and unplanned developments regulated according to development plans prepared in historical perspective and existing development plans in Bursa, the research area, have been discussed within a 20-year process; findings were evaluated and the type and dimension of ecological risks were assessed against international parameters.

Key Words: Basin, Ecological Planning, Ecological Risk, Land Use

Introduction

In order to conduct pollution and risk analysis of Bursa Nilüfer Stream Başköy – Kestel Section and sub-basins, decisions, practices brought by master plans drawn up in the historical perspective of Bursa and current zoning plans, and their reflection on the land use have to be examined.

Space Formation of the city of Bursa in historical process

Analyzing what kind of a development line Bursa city had in the historical process is important in terms of understanding formations in the city space of the 21st century Bursa. In the historical process, changes in the city of Bursa will be addressed in two different eras: Urban transformation in Bursa up until 1980s, and urban transformation in Bursa from 1980 to present day.

Urban Transformation in Bursa up until 1980s

When looking at Bursa in the era up until 1980s, it is observed that, the city had a prominent place in the Republic of Turkey in economical and social terms, as was the case during the Ottoman Empire era. Importance attached to the city during Republic era can be understood from the plans made for the city (Tekeli, 1999).

The first planning study for the city of Bursa was conducted by Karl Löcher in 1924. Such plan , influenced by ‘garden – city movement’ of the era, had an understanding that ignored the existing land uses, and did not play a role in the shaping of urban space of Bursa.

Henri Prost who conducted planning studies of Bursa between 1938 – 1944 adopted an understanding similar to axial planning understanding applied by Baron Haussmann in Paris. Foundations of current transportation separation in Bursa were laid in line with the plan by Prost. According to such understanding, it was planned to adapt the city to motor vehicle traffic, and the plan played an active role in determination of the 1st and 2nd stage road routes. Especially widening of Altıparmak Avenue and connection of Çekirge city center led an immense traffic jam and air pollution

risk attributable to transportation came into being along the road route. As a result of precipitation of such air pollution over the agricultural fields along the road routes, it is observed that risks of soil pollution and, thereby, water pollution came into being and pollution phenomenon are detected along these road routes as a result of the pollution analyses conducted today.

In 1960, under supervision of Luigi Piccinato, Bursa Master Plan with a scale of 1/5.000 was (Fig. 1) drawn up. Piccinato suggested that the city be developed along Ankara – Bursa – Mudanya road, that is, in a linear format on a east – west axis. In order to support such development, he planned to develop small scale industry along Ankara road which is the eastern edge of the city and suggested an Organized Industrial Zone be established along Mudanya road (Dostoglu and Vural, 2004). In line with suggestion by Piccinato, Turkey's first Organized Industrial Zone was opened in 1966 within Bursa.

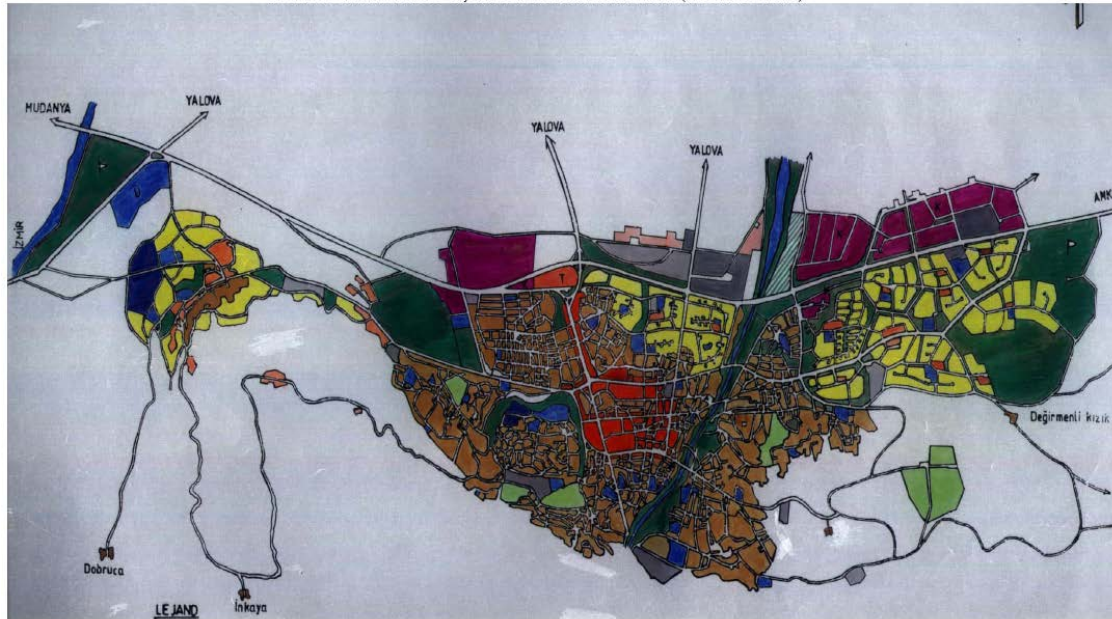


Fig. 1 Bursa Master Plan with a scale of 1/5.000 dated 1960 (Piccinato Plan)

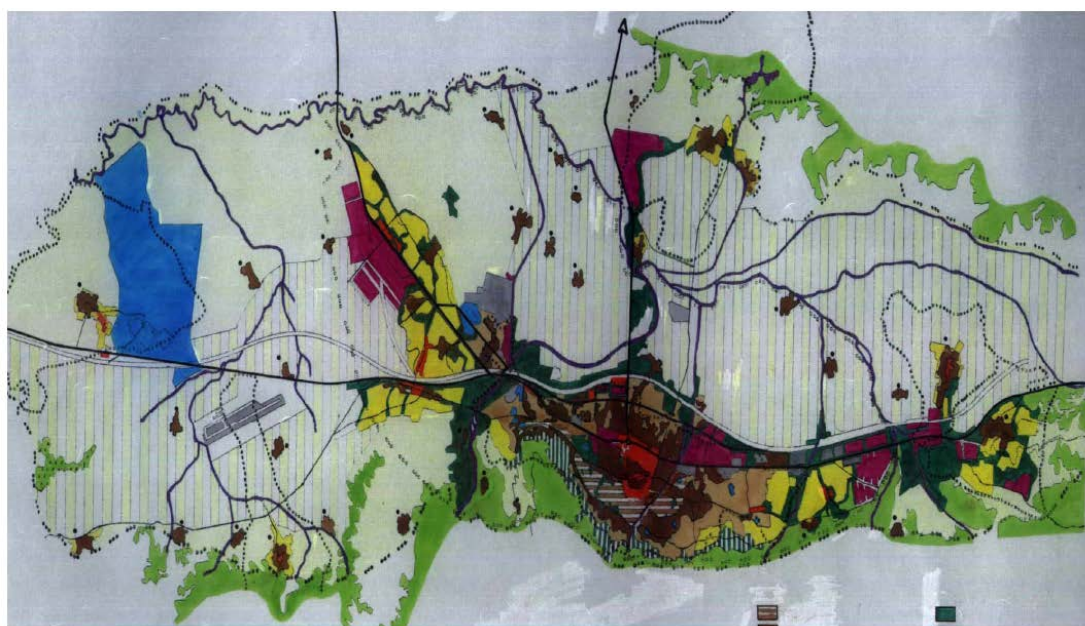
Owing to influence created by establishment of Organize Industrial Zone, immense pressure caused by migration flowing into the city neutralized the population and density projections of Piccinato plan. Population target of Piccinato Plan was 250.000 in 1980, yet population of city had already reached 350.000 in 1975 (Arslanoğlu, 2004).

This affected physical structure of the city. New factories have been established in Mudanya Avenue and city has developed in the western direction. Large scale industrial establishments have heralded the western direction of city's development. New housing settlements have been formed in the region in connection with Renault, Sönmez Filament and Nergis plants being located along Mudanya Avenue. Besides, Tofaş located along Yalova Highway, Karsan located along Izmir highway, and Yeşim located along Ankara highway have been built along main roads outside the city space. In parallel to diversification and increase of city's industry in the 1970s, shanty settlements started to appear in Bursa Plain to the north and the east. Back in that era, 'Plain Conservation Protocol' dated 1977 was drawn up, which determined those portions of Bursa Plain that will be conserved, yet this protocol could not stop shanty settlements and industrial establishments from spreading all over the plain (Kaplanoglu and Cengiz, 2005).

In Bursa, Master Plan Bureau prepared many master plans and revision plans after 1960 (Table 1). Master Plan dated 1976 was a plan that tried to decentralize the city (Fig. 2). Almost all of the plan suggestions remained outside the border of municipality This plan also addressed Demirtaş, Kestel, Gürsu, Görükle, Çalı, Kayapa, Hasanağa and Akçalar Municipalities which are within vicinity of Bursa. Macro form and development directions pertaining to Bursa city were determined by the plan dated 1976 (Albatan, 1999).

Table 1. Master plans and revision plans prepared in Bursa after 1960

Plan Name	Scale	Preparation Date	Institution
Master Plan (Piccinato Plan)	1/5.000, 1/10.000	1960	Ministry of Development and Housing
Master Plan	1/25.000	1976	Bursa Master Plan Office
Master Plan	1/5.000	1984	Bursa Master Plan Office
Master Plan (Revision)	1/25.000, 1/5.000	1990	Bursa Metropolitan Municipality
Coastal Zone Environmental Improvement Plan	1/25.000	1990	Bursa Metropolitan Municipality
Master Plan (Revision)	1/25.000, 1/1.000, 1/5.000	1995	Bursa Metropolitan Municipality
West Planning Region Master Plan	1/25.000	1997	Bursa Metropolitan Municipality
Kayapa Mass Housing Area Master Plan	1/5.000	1997	Bursa Metropolitan Municipality
Environmental Master Plan	1/100.000	1997-1998	Provincial Directorate of Public Works and Bursa Metropolitan Municipality
Center Planning Region Master Plan	1/25.000	1998	Bursa Metropolitan Municipality

**Fig. 2** Master Plan dated 1976

Urban Transformation in Bursa from 1980 to the present day

Previously prepared plans were no longer applicable and plans had to be renewed because of the settlement areas required due to increasing city population and shanty settlements as from 1980. 1984 Master Plan prepared as a result aimed to stop the city from extending in plain area to the north of the city. According to such plan, new plain conservation areas have been established and plain conservation protocols have been drawn up. Also, plan studies were intended to cover İnegöl, Mustafa Kemalpaşa, Karacabey, Mudanya, Gemlik, Yenişehir counties and a 'Bursa Metropolitan Area' was defined. A Bursa City Whole concept was created which included Görükle, Kayapa, Hasanağa, Çalı and Akçalar, to the west, Gürsu and Kestel, and Demirtaş municipalities to the south which entered into a process of integration with the city center. Within framework of this plan, Fethiye, Beşevler, İhsaniye Ataevler to the west and Kaplıkaya to the east were zoned for housing settlements aimed at low or medium income families (Akkılıç, 2002). Since these settlement areas have been planned without proper infrastructure and over the fertile agricultural fields, agricultural fields have been lost,

risks such as pollution of underground waters due to infiltration according to parent rock characteristics and discharging of domestic pollutions into Stream Nilüfer through surface flow have appeared. According to planning decisions made in 1984, risk of water pollution that has appeared has been confirmed by the evaluation of current pollution analyses.

As from 1976, master plans and plan revisions have been made almost every 5 years and urban extension has been tried to be kept under control by opening new areas. In 1990, Bursa Metropolitan Municipality revised Master Plan (1/25.000 and 1/5000) and an additional housing area that is 1970 hectare large was suggested in the west of the city. Owing to such area, in addition to population of 1976 plan, an area that would house additional 240.000 people was opened and housing areas that would be enough for a population of 1.2 million were suggested in the whole city. Having made another Master Plan Revision in 1995, an additional housing area of 1500 hectare and immense housing areas to house a population as large as 420.000 have been suggested. Likewise, agricultural and forest areas have been lost in these areas as well. This revision has paved the way for inaccurate land use over those areas with liquefaction problem in geological terms. Under the Zoning Law dated 1985 (Law on Zoning numbered 3194), neighboring municipalities were authorized to prepare and approve their own zoning plans. Thus, apart from Bursa Master Plans, zoning plans were prepared by municipalities such as Demirtaş, Görükle, Kayapa, Kestel and new areas have been opened (Tosun, 2007). These plans drawn up under the Law on Zoning within the borders of municipality in a way that does not conform to borders of catchment basin indicate that planning was done from a fragmental point of view. Nonconformities between those plans drawn up and current land use demonstrate that plans were totally null and void or remained in force for a very short period of time. Therefore, it has been deemed necessary to prepare Environmental Plan where strategies and planning decisions are made at the macro scale.

In 1997, in collaboration with Provincial Directorate of Public Works and Settlement, “Province of Bursa 2020 Environmental Strategy Plan” with a scale of 1/100.000 was prepared and approved by the ministry in 1998. Target of Bursa 2020 Environmental Strategy Plan with a scale of 1/100.000 is creating an environment that is sustainable and inhabitable until 2020, establishing industrial development targets, planning principles of Bursa within framework of development plan of Turkey and in line with retaining historical identity of Bursa, and ensuring that City extends and develops in a healthy way in line with these principles (Bursa Metropolitan Municipality, 1998). Corer planning principle of Bursa 2020 Environmental Strategy Plan with a scale of 1/100.000 in line with the planning target is not making Bursa merely an industrial or agricultural city as a result of conservation and development principles to surmount one another. Bursa Metropolitan Master Plan Bureau, in accordance with 2020 Bursa Environmental Strategy Plan with a scale of 1/100.000 as approved in 1998, generated and approved Central Region Master Plan with a scale of 1/25.000. In 2004, boundaries of Bursa metropolitan area were expanded by 30 kilometers in radius. New boundaries of Bursa metropolitan area include 3 central counties (Osmangazi, Yıldırım, Nilüfer), 4 counties (Mudanya, Gemlik, Gürsu and Kestel) and 17 first phase municipalities (Akçalar, Hasanağa, Kayapa, Çalı, Göknükbelen, Kirazlı, Barakfaki, Görükle, Emek, Demirtaş, Ovaakça, Güzelyalı, Kurşunlu and Umurbey). Neighboring area of Bursa Metropolitan Municipality is 300.000 hectare large and its population has increased to 1.528.720 (Bursa Metropolitan Municipality, 1997).

Current Zoning Plans

The last time when boundaries of Bursa Metropolitan Municipality were established was when it was done so under law numbered 5216 and boundaries reached their most extensive form. Boundaries of the area defined under the law as a circle with a radius of 30 km covers an area of around 300 square kilometers. In the area covering the larger province of Bursa, “Bursa 2020 Environmental Plan with a scale of 1/100 000” approved by Ministry of Public Works and Settlement applies. Some definitions have been put forward by taking into account development tendencies within framework of Environmental Plan . One of these definitions is “Bursa Metropolitan Area.” Within scope of Bursa Metropolitan Area, seven sub-planning areas have been defined. These include (Fig. 3) Central Area Plan, Western Area Plan, Mudanya Area Plan, North Area Plan, Gemlik Area Plan, East Area Plan, Alaçam (Uludağ) Area Plan.

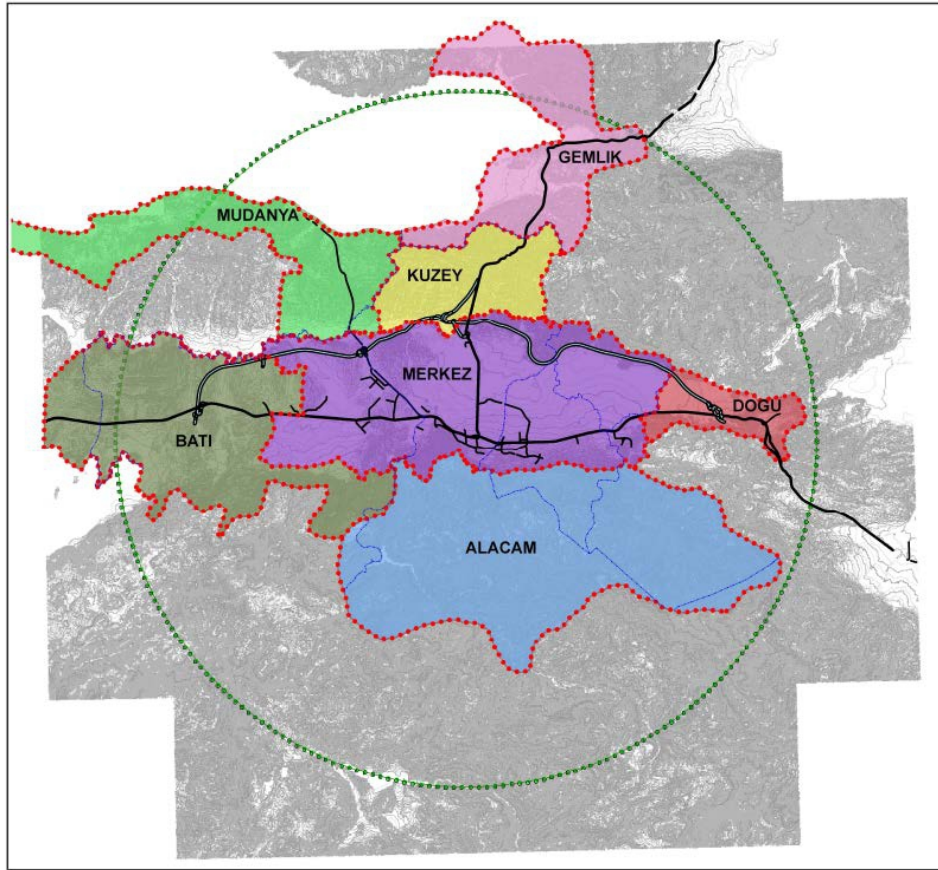


Fig. 3 Bursa Metropolitan Area planning areas

While establishing planning areas of Master Plan with a scale of 1/25.000, only managerial borders and development tendencies have been taken into consideration. Basin based planning where physical structure, natural resource components and ecological relations are relied upon has not been guiding / decisive in respect of the planning studies conducted in Bursa.

Decisions and practices brought by the existing zoning plans to the study area have to be evaluated together with positive and negative aspects thereof . Therefore, planning areas that are included in the study area have to be assessed. The planning areas include: Central Area Plan, Western Area Plan, Eastern Area Plan and a portion of Alaçam (Uludağ) Area Plan.

Bursa Metropolitan Municipality boundaries cover the planning areas defined in the upper scale plan. These planning areas correspond to a portion equal to 170 square kilometers of boundaries of Bursa Metropolitan Municipality that is as large as 300 square kilometers. Planning areas are city spaces established by certain transportation axes and areas which comprise the macro form of these city spaces. Areas beyond such 170 square kilometer large area are predominantly vast forest areas and areas used for agriculture.

Central Area Plan

Boundaries of Metropolitan Municipality and Gürsu, Kestel and Demirtaş Municipalities are defined as land registration boundaries of the villages Adaköy, Hasanköy, Cambazlar, Ağaköy, Kumlukalan, Doğanköy, and Yolçatı and planning area covering Çayırköy Plain.

Target of Central Area Master Plan with a scale of 1/25.000 is, by adopting Bursa 2020 Environmental Plan with a scale of 1/100.000 as target, within the seven planning areas established inside the boundaries of Metropolitan Municipality and neighboring areas, is ‘creating sustainable, inhabitable environment and retaining agricultural, touristic, historical identity, assuring conservation – utilization balance and realizing healthy urban development and extension targets in line with the industrial development targets within scope of development policies of Turkey (Fidan and others, 2005).

It is seen that main criteria guiding the planning in the plan report are composed of the following titles;

- Population structure – projections
- Existing land use criteria and existing formation
- Existing zoning plans (conservation plans, registered plans, plan amendments etc.)
- Structure of property
- Opinions and letters of official authorities
- General structure, morphology and geological structure of the land
- Climate and the other data

As can be derived from the criteria which guide the planning, existing land use criteria, social-economical data and development tendencies guide the planning as the main criteria, only the morphology, geology and climate status is assessed within natural structure characteristics and they are evaluated as secondary criteria which offer data input for the planning. In the planning understanding with basin approach, all natural structure components have to be weighted according to degree of inter-relation and guide the planning. It can be understood from this phenomenon and existing planning understanding in Bursa, risks faced by the natural resources in the study area will continue to grow.

Population of Bursa city center had an overall regular increases between 1935 and 1960. The fact that high rises in the population took place after 1960 can be attributed to migration received by the city due to industrial investments. Over the years, when looking into population movements in Bursa, it is observed that population of Bursa city center doubles every ten years as of 1960s (DİE, 1993; DİE, 2002). Changes seen in population structure after 1960 predominantly reflect changes in economic structure of Bursa.

By having a look at industrial development of the recent years in Bursa, it is observed that employment capacity of agriculture has stabilized, there is a great increase in manufacturing industry, yet employment capacity of the services industry grow a lot faster than the other industries. Despite rapid development and growth in industry, employment does not grow at the same pace due to advanced technology or the other factors. In terms of growth rate, industry with the fastest growth rate is wood, forest and furniture industry with 26,8%. The second fastest growth rate is enjoyed by electrics and electronics industry with 20,2%, and transportation and forwarding is at the third place with 17,7%.

Given growth rates of industries, it is obvious that there is a causality relation between wood, forestry products and furniture industry, the fastest growing industry, and losses in the forests of the study area. Likewise, if relation between transportation and forwarding industry, the third fastest growing industry, and pollution measurements conducted along the road routes of the study area is evaluated; it is observed that air, soil and water pollutions tend to increase in line with the transportation.

Conclusion

When zoning plans shaping the land use within study area and drawn up for planning areas within “Bursa Metropolitan Area” are evaluated, they do not seem to overlap the current land use. Also, land use tendencies that give rise to risks which are subject of thesis can be seen in the plans and plan notes.

Looking into distribution of land use shown on zoning plans according to sub-basins (Table 2); the highest value for areas to be forested seems to be present in Ayvalı Branch with 4,03 square kilometers. Accordingly, region park decision has been made for sub-basin of Ayvalı Branch which has a 1,39 square kilometer large area. Likewise, Ayvalı Branch Sub-Basin is the largest sub-basin with a park area that is 2,76 square kilometers large areas that are defined as areas to be protected as agricultural field with a 33,95 square kilometer large area according to plan decisions.

Table 2. Area distribution of land uses of Bursa Metropolitan Area Zoning Plans according to sub-basins of Stream Nilüfer catchment Basin

LAND USE (km2)	Sub-basins										TOTAL (km2)	
	Ayvalı	Cilimboz	Demirtaş	Gökdere	Hacivat	Hasanağa	Nilüfer	Üçpınar	Y.Karaağaç	Other Basins		
Military Airport											1,383	1,383
Afforestation Area	4,031	0,011	0,642	0,533	0,455	1,274	1,431	0,060	0,139	5,123	13,699	
Forest	30,328	0,565	11,361	0,226	1,836	7,374	8,988	0,143	1,915	45,567	108,303	
Purification	0,448							0,080		0,306	0,834	
Military Area	0,181			0,038				0,214		0,115	0,548	
Regional Park	1,390		0,144	0,114						2,594	4,242	
Framework										0,214	0,214	
University	4,998									6,333	11,331	
Health										0,025	0,025	
Social	1,788	0,185		0,410	0,723	0,267	0,372		0,016	2,429	6,190	
Sports	1,039			0,190	0,020	0,043	0,218			5,547	2,057	
Technical Infrastructure	0,270	0,101		0,026	0,036		0,297			1,433	2,163	
Stream	0,046					0,262		0,002	0,001	0,577	0,888	
Fair										0,210	0,210	
Storage	0,146								0,219	0,080	0,445	
Urban Study Areas	1,563		0,031	1,814	0,170					2,094	5,672	
Rural Study Areas					0,038	1,473	0,281		1,093	2,403	5,288	
Small Industrial Sites	1,648			1,105	0,158	0,971	0,271		0,527	1,345	6,025	
Organized Industrial Zone	4,306		0,032			0,036	0,281		0,737	9,392	14,784	
Industry	2,518					1,781	0,280		0,065	1,662	6,306	
2. and 3 Degree of Commerce	1,480				0,207	0,439	0,281			0,255	2,662	
Wholesale Trade Areas										0,194	0,194	
Trade	1,410	0,434	0,027	1,064	0,505		0,795			4,011	8,246	
Central Business Areas		0,716		1,793						0,039	2,548	
Very Rare Density Residential Development Areas	3,892		0,400	0,063	0,766	0,993	0,664		0,044	2,739	9,561	
Rare Density Residential Development Areas	0,145		0,272				1,157			8,651	10,225	
Medium Density Residential Development Areas	8,290	0,067	0,004	0,870	0,409	6,874	0,576			7,961	25,051	
Development of High Density Residential Areas	0,152		0,628	0,047	0,273	0,153				0,628	1,881	
Very Rare Density Residential Housing Areas	1,195	0,783	0,332	1,742	0,810			1,189		5,873	11,924	
Rare Density Residential Housing Areas										3,276	3,276	
Residential Medium Density Residential Areas	5,190	2,760	1,559	4,840	6,214	1,173	1,935			14,815	38,486	
Residential High Density Residential Areas	4,012	0,621	0,345	2,176	1,459		1,679			3,375	13,667	
Development Rural Settlement Areas	0,521		0,075		0,093	0,583	0,031		0,184	3,643	5,130	
Residential Rural Settlement Areas	1,701		0,002		0,213	0,370	0,183		0,102	3,958	6,529	
Cemetery	0,731			0,039						0,890	1,660	
Specific Project Areas							0,099			1,207	1,306	
Park	2,769	0,804	0,139	0,956	0,942	2,294	1,066		0,826	7,250	17,046	
Recreation	0,119	0,375		0,253		0,398	0,065			3,050	4,260	
Specialty Crop Areas			0,799			1,279	1,076			2,855	6,009	
Other Agricultural Areas	14,968		6,283			3,000	3,095	0,001	6,517	54,806	88,670	
Quality of Agricultural Areas	33,947		6,578	0,960	6,487	7,530	0,011	0,001	4,374	105,654	165,542	
Liquidation										0,963	0,963	
Technopark	0,043									0,540	0,583	
Terminal										0,208	0,208	
Daily Tourism	0,007						0,173			0,467	0,647	
Tourism		0,082					0,220			0,255	0,557	
Path Protection Strip	0,322		0,259			0,030			0,334	2,377	3,322	

Besides, Ayvalı Branch Sub-Basin has been planned in a manner that it will cover the largest area in the study area with a total surface area of 10,19 square kilometers for industrial activities according to zoning plans in terms of distribution of storage areas, urban work areas, non-urban work areas, small scale industrial sites, organized industrial sites and industrial areas. Likewise, Ayvalı Branch Sub-Basin has been planned in a manner that it will cover the largest area in the study area with a total area of 25.10 square kilometers in terms of very scattered, scattered, medium and high density housing development areas, very scattered, scattered, medium and high density residential housing areas as well as development and residential rural settlement areas. When plan decisions related to study area are evaluated in terms of natural structure features, it is seen that Ayvalı Branch Sub-Basin is composed of alluvia, lime stone, metamorphic rocks, travertine and hillside debris in terms of lithologic formation. In Ayvalı Branch Sub-Basin which is dominated by these rocks with large clearance, soil and underground water pollution risk is high in terms of lithologic structure. In terms of soil groups, the soil groups with the highest value in Ayvalı Branch Sub-Basin are brown forest soils and vertisol. These soils have a clay structure, and soil and underground water pollution risk is low. Besides, pollution discharge is likely to reach Ayvalı Creek through surface flow. From perspective of decisions made in the zoning plans for these sub-basins, although area to be forested, regional park and park plan decisions seem to be correct from lithology perspective, caution should be used for industrial activities and residential areas which may give rise to underground water pollution

and soil pollution risk. Since sub-basin is composed of clay soil groups in terms of soil groups, precautions which would prevent pollutions carried by surface water from reaching the surface water have to be taken.

Based on consideration of land uses derived from satellite footage, 5 land uses have been evaluated in details (residential, agriculture, forest, industry and trade) and modifications taking place in the years 1989-1999-2009 have been evaluated. Based on the land uses laid down in the zoning plans, these 5 land uses have to be evaluated according to use and compared to current land use. At this point, area distribution of residential, forest, agricultural, industrial and commercial land uses is as follows:

When comparing the land uses of zoning plans to current land use, since all of the forest and agriculture areas inside the study area have not been planned, it is not possible to make a comparison for forest and agricultural fields in case of zoning plan – current land use comparison due to lack of data. Besides, comparisons made for housing, industry and trade (Table 3) demonstrate that zoning plans support the increasing trend in the current land uses.

According to current land use, while there is a housing area of 118,08 square kilometers, zoning plan stipulates a housing area of 125,73 square kilometers. As a result, zoning planners support a housing area of 13,65 square kilometers and increase of current housing areas by 12,18%. Looking from perspective of sub – basins, at some sub-basins (Cilimboz, Gökdere, Hacivat, Üçpınar, Y. Karaağaç branches) housing areas are in excess of values stipulated in the zoning plans . Production of houses is encouraged at the other sub-basins by the zoning plans.

According to current land use, while there is an industrial area of 22,54 square kilometers in study area, zoning plan stipulates an industrial area of 37,53 square kilometers. As a result, zoning planners support an industrial area of 14,99 square kilometers and increase of current industrial areas by 66,50%. When looking from perspective of sub-basins, while it is observed that industrial activities intensify at Ayvalı branch, zoning planners believe that industrial investments have to be made along Hasanağa Branch and Demirtaş Branch.

Table 3. Area distribution of housing, agriculture, forest, industry and commercial land uses of Bursa Metropolitan Area Zoning Plans according to sub-basins of Stream Nilüfer catchment Basin

	LAND USE (km2)	Sub-basins										TOTAL (km2)
		Ayvalı	Cilimboz	Demirtaş	Gökdere	Hacivat	Hasanağa	Nilüfer	Üçpınar	Y.Karaağaç	Other Basins	
Housing	Very Rare Density Residential Development Areas	3,89		0,40	0,06	0,77	0,99	0,66		0,04	2,74	125,73
	Rare Density Residential Development Areas	0,15		0,27				1,16			8,65	
	Medium Density Residential Development Areas	8,29	0,07	0,00	0,87	0,41	6,87	0,58			7,96	
	Development of High Density Residential Areas	0,15		0,63	0,05	0,27	0,15				0,63	
	Very Rare Density Residential Housing Areas	1,20	0,78	0,33	1,74	0,81		1,19			5,87	
	Rare Density Residential Housing Areas										3,28	
	Residential Medium Density Residential Areas	5,19	2,76	1,56	4,84	6,21	1,17	1,93			14,81	
	Residential High Density Residential Areas	4,01	0,62	0,34	2,18	1,46		1,68			3,38	
	Development Rural Settlement Areas	0,52		0,07		0,09	0,58	0,03		0,18	3,64	
	Residential Rural Settlement Areas	1,70		0,00		0,21	0,37	0,18		0,10	3,96	
Agriculture	Special Crop Areas			0,80			1,28	1,08			2,85	260,22
	Other Agricultural Areas	14,97		6,28			3,00	3,10	0,00	6,52	54,81	
	Quality of Agricultural Areas	33,95		6,58	0,96	6,49	7,53	0,01	0,00	4,37	105,65	
Forest	Afforestation Area	4,03	0,01	0,64	0,53	0,46	1,27	1,43	0,06	0,14	5,12	122,01
	Forest	30,33	0,57	11,36	0,23	1,84	7,37	8,99	0,14	1,91	45,57	
Industry	Storage	0,15								0,22	0,08	37,53
	Urban Areas	1,56		0,03	1,81	0,17					2,09	
	Urban Study Areas					0,04	1,47	0,28		1,09	2,40	
	Small Industrial Sites	1,65			0,11	0,16	0,97	0,28		0,53	1,35	
	Organized Industrial Zone	4,31		0,03			0,04	0,28		0,74	9,39	
	Industry	2,52					1,78	0,28		0,07	1,66	
Trade	2. and 3 Degree of Commerce	1,48				0,21	0,44	0,28			0,26	13,66
	Wholesale Trade Areas										0,19	
	Trade	1,41	0,43	0,03	1,06	0,51		0,79			4,01	
	Central Business Areas		0,72		1,79						0,04	

According to current land use, while there is a commercial area of 3,59 square kilometers in study area, zoning plan stipulates a commercial area of 13,66 square kilometers. As a result, zoning planners support a commercial area of 10,07 square kilometers and increase of current commercial areas by 280,50%.

When comparing Bursa Metropolitan Alanı zoning plans and current land use in terms of sub-basins (Table 4); for Ayvalı Branch Sub-Basin, an increase at housing areas by 7,51 square kilometers (42,69%), at industrial areas by 2,07 square kilometers (25,52%) and at commercial areas by 2,89 square kilometers. In Cilimboz Branch Sub-Branch, it is observed that housing areas of the current land use have exceeded housing areas shown on the zoning plans by 2,24 square kilometers (34,62%) and an increase by 0,58 square kilometers is planned for commercial areas. At Demirtaş Branch Sub-Basin, for housing areas, an increase by 1,63 square kilometers (81,91%), for industrial areas an increase by 0,01 square kilometers and for commercial areas an increase by 0,03 square kilometers is foreseen.

Table 4. Comparison of Bursa Metropolitan Area Zoning Plans and current land use

	LAND USE (km2)	Sub-basins										TOTAL (km2)
		Ayvalı	Cilimboz	Demirtaş	Gökdere	Hacivat	Hasanağa	Nilüfer	Üçpınar	Y.Karaağaç	Other Basins	
Housing	According to the Development Plan	25,10	4,23	3,62	9,74	10,24	10,15	7,41	0	0,33	54,92	125,73
	Current Status	17,59	6,47	1,99	14,47	14,32	2,75	7,31	0,09	0,77	46,32	112,08
	Diffirence	7,51	-2,24	1,63	-4,73	-4,08	7,40	0,10	-0,09	-0,44	8,60	13,65
	Exchange Rate	42,69%	-34,62%	81,91%	-32,69%	-28,49%	269,09%	1,37%	-100,00%	-57,14%	18,57%	12,18%
Industry	According to the Development Plan	10,18	0	0,06	1,92	0,37	4,26	1,12	0	2,64	16,98	37,53
	Current Status	8,11	0	0,01	0,45	0,16	0,49	0	0	1,53	11,79	22,54
	Diffirence	2,07	0	0,05	1,47	0,21	3,77	1,12	0	1,11	5,19	14,99
	Exchange Rate	25,52%	0,00%	500,00%	326,67%	131,25%	769,39%	100,00%	0,00%	72,55%	44,02%	66,50%
Trade	According to the Development Plan	2,89	1,15	0,03	2,86	0,71	0,44	1,08	0	0	4,50	13,66
	Current Status	0	0,57	0	0,98	0,68	0	0,43	0	0	0,93	3,59
	Diffirence	2,89	0,58	0,03	1,88	0,03	0,44	0,65	0	0	3,57	10,07
	Exchange Rate	100,00%	101,75%	100,00%	191,84%	4,41%	100,00%	151,16%	0,00%	0,00%	383,87%	280,50%

(based on Bursa Metropolitan Area zoning plans and Ikonos 2009 satellite footage)

In Gökdere Branch Sub-Branch, it is observed that housing areas of the current land use have exceeded housing areas shown on the zoning plans by 4,73 square kilometers (32,69%) and an increase by 1,88 square kilometers is planned for commercial areas. In Hacivat Branch Sub-Branch, it is observed that housing areas of the current land use have exceeded housing areas shown on the zoning plans by 4,08 square kilometers (28,49%) and an increase by 0,03 square kilometers is planned for commercial areas. At Hasanağa Branch Sub-Basin, for housing areas, an increase by 7,40 square kilometers, for industrial areas an increase by 3,77 square kilometers and for commercial areas an increase by 0,44 square kilometers is foreseen. At Nilüfer Branch Sub-Basin, for housing areas, an increase by 0,10 square kilometers (1,37%), for industrial areas an increase by 1,12 square kilometers and for commercial areas an increase by 0,65 square kilometers is foreseen. At Üçpınar Branch Sub-Basin, it is observed that housing areas in the current land use have exceeded housing areas shown on the zoning plans by 0,09 square kilometers.

In Y. Karaağaç Branch Sub-Branch, it is observed that housing areas of the current land use have exceeded housing areas shown on the zoning plans by 0,44 (57,14%) square kilometers and an increase by 1,11 square kilometers is planned for industrial areas (Küçükali, 2012).

When the relationship between these change and planning decisions and the current pollution due to land-use change in the 20-year period are evaluated; we see that there are discrepancies between the zoning plans made for the planning areas in “Bursa Metropolitan Area” shaped for land use in the field of research, and the current land use in the areas of, observed. This fact reveals the importance of pollutions caused by changes in land use led by legal planning decisions, as well as the pollutions caused by unplanned and illegal uses of land. Ecological risks arise on land-use development plans, especially for the Research area, due to land use plans and plan notes that support the increase in residential and industrial land uses. Especially due to these processes that cause loss of agricultural lands and forest areas, natural thresholds are exceeded and natural resources are disposed.

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