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THE MOTOR VEHICLE POLLUTION ON THE BELGRAD FOREST IN ISTANBUL

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Air pollution is a common problem in many urban and suburban areas today. Large concentrations of various human activities cause significant amounts of pollutants to be emitted. The main pollution sources are the motor vehicle and the heating systems in urban areas. The development of industry makes people wealthy but on the other hand it creates lots of problems. One of these problems is in the form of air pollution effect on forests. The main emission elements which are COx, HC, NOx, SOx, Pb and PM (Particle Matter) causing the pollution come from motor vehicles. This pollution is more effective when the traffic is crowded and some meteorological conditions developed simultaneously. Istanbul is the biggest city of Turkey both in population and in industry. Belgrad forest is a very important recreational place for the people who live in Istanbul. The potential pollution source for Belgrad forest comes from motor vehicles passing through the forest especially during weekends.

There are two main routes through the Belgrad forest. These are Maslak, Bahcekoy with junction to Kilyos and to Kemerburgaz and Cayirbasi, Bahcekoy with junction to Kilyos and to Kemerburgaz. These routes and the number of motor vehicles are analysed at the weekend and on week days in the summer. In addition, motor vehicle pollution effects on trees are given in this study.

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INTRODUCTION

Belgrad forest is the biggest forest around İstanbul and it is recreational place and produce oxygen more than 10.000.0000 people they live in İstanbul. Growing air pollutant and deforestations lead to research relation between air pollution and forest in last years all over the world. For this reason a lot of countries do stations for measures air pollutions and want to determine it is source and want to protect it is harmful effect. Unless there is no air pollution stations systems over Türkiye and there is no continues stations to measure air pollution. The studied were only short time period. There a lot of source of air pollution. One of them is vehicle emission. Especially, it is well understand important to determine of pollution effect on forest if we think the crowded traffic in İstanbul. Belgrad forest is under the pollution because of the TEM highway near the forestland recreational place.

Pollution is not only effect where it is emission the other subject it is source and long range transportations. For example, it was calculated that about 70 % of sulphur deposition are imported from the other countries in Austria. According to Eruz and others (1995) precipitations are acidic (some time less than pH=3) in winter season in Belgrad forest. The % 42.51 of total precipitation is in winter in Belgrad forest.

SAMPLING

In this study five different route are carried out to calculate motor vehicle emission in Belgrad forest. These routes are as named like A, B, C, D, and E. There is only calculated of this route in Belgrad forest parts and sampling was did at same time all five route. These routes are sequentially, Çayırbaşı and Bahçeköy as named A route is 5 km, Hacıosman and Bahçeköy as named B route is 5.8 km, Bahçeköy and recreational place as named C route is 4 km. Bahçeköy and Kilyos route in Belgrad forest as named D route 8 km, the last one is Bahçeköy and Kemerburgaz route is 8 km. Additional to this, the total emission value of these routes is also calculated.

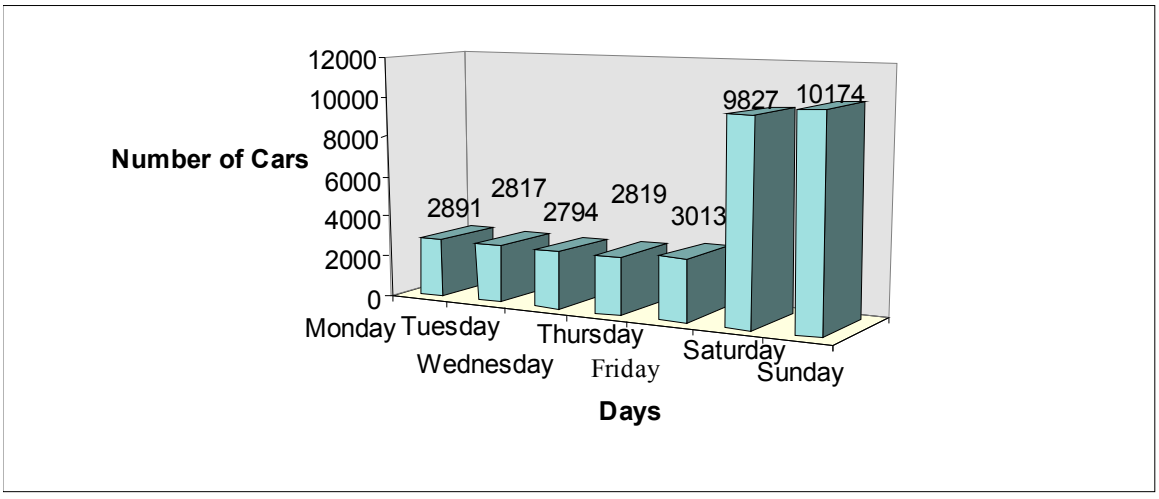

Figure 1. Motor vehicle traffic with benzene in Belgrad Forest.

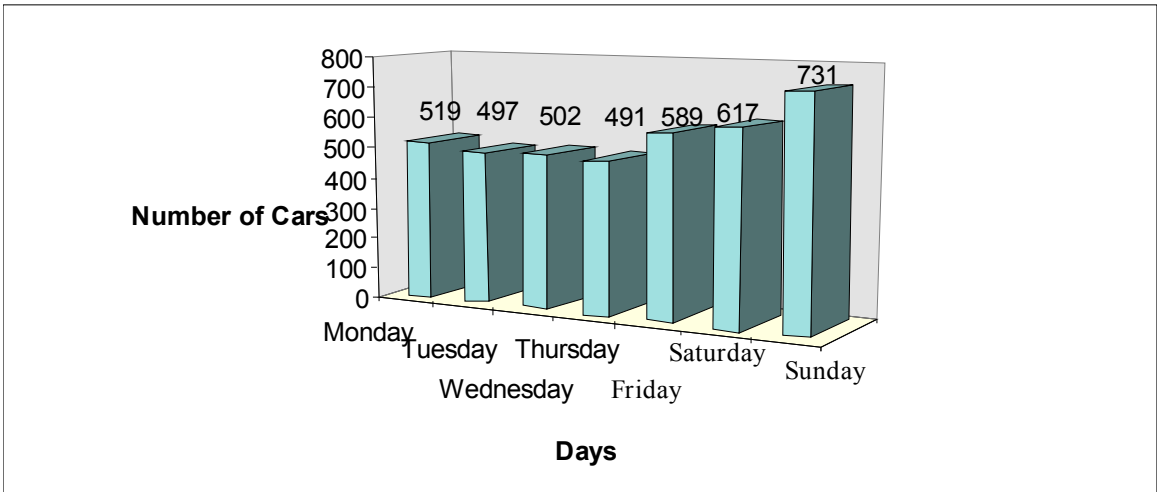

Figure 2. Motor vehicle traffic with Diesel in Belgrad Forest.

METHODS

The major source of the air pollution is the emissions from vehicles. Two types of methods have been used to calculate the emissions from vehicles to the atmosphere. One method estimates the emission from gasoline and diesel vehicles on the basis of fuel consumption. The second method is a function of the speed which the emissions strongly dependent on speed (Mellanby, 1991). The pollutants from vehicles can cause acidic deposition on the surface of soil and leaves of trees and plants and can damage our ecology. Acidic deposition is a more inclusive term for acidic pollution and includes all forms of acidic materials transferred from the atmosphere to the earth surface in the dry and wet form (Adriano et al., 1989). Emission, transport, deposition and transformation of air pollution were caused the acid precipitation (It can define as precipitation a pH less then 5.6).

CALCULATION OF VEHICLE EMISSION AND ASSUMPTION

Motor vehicle emission is changing depend on fuel type, velocity and motor vehicle (Şahin and Şen 1995). Due to this effects motor vehicle velocity is assumed average 60 km/hour in researching area and calculation is done this average velocity. Motor vehicle emission is also change depend on what kind of fuel it is use, for example Gasoline or Diesel. Average emission is like this;

Table 1. Average motor vehicle emission depend on fuel type

Fuel type	CO	HC	NOx	PM	SOx	Pb
Diesel	16.1	1.8	3.0	0.05	0.05	0.2
Gasoline	0.72	2.2	16.5	1.5	2.0	-

These values is calculated like this,

E=(Emission factor)*(Number of motor vehicle)*(Distant)*2 (Two way)

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RESULTS AND CONCLISIONS

How can be affected the trees by acidic precipitation?

Acidic precipitation has directly and indirectly effects on trees and plants. Direct effects is change the mineral uptake and damage to tissues of plant. Indirect effects can cause change mineral nutrient availability, increase the toxic materials and decrease the frost resistance of trees.
Especially, because of the sensitivities leaves, germination process of trees can be negative affected by acidic deposition. Many scientists have studied to estimate the effects of acidic deposition or air pollution on trees. According to Van Ryn et al. (1986, in Ulrich, 1989) the tree reproduction can be affected by air pollution and decrease pollen germination with decreasing pH. For example, the deciduous genera, Betula, Acer, Cornus and Populas were negatively affected by acidic deposition and the growth of Pinus strobus was stimulated between pH 2.5 and 3.1. For some trees the structural damage of leaf surfaces have been estimated at pH levels of 2 and 3.
Some studies show that young conifers neutralize incoming acidic precipitation. After the processes of acidic deposition can take place acid production (SO_2 reacts to form H2SO3), proton buffering (cation exchange on cell walls), precipitation or dissolution, depending on pH, reactions with plant cells and formation of gaseous compounds (Kenndy, 1992).
Ulrich (1989) concluded that the direct effect of acid deposition, SO2, NOx upon the leaves of trees well supplied with nutrients and water can not explain the defoliation symptoms observed in German forests. The same scientist used a dynamic model to asses the effects of deposition of air pollution. Asche and Beese (1987) observed a positive correlation between SO2 concentrations in the air and sulphate concentration in stem flow.
Acidic deposition can effect the availability to trees of essential elements in following ways:

- The fertilization effect (because of S and N).
- The loss of some cations (Mg, Ca and K from the soil) (because of H, SO4 and NO3)(Abrahamsen et al., 1980).

Increased soil acidity can result in increased solubility of heavy metals (Tyler, 1978).
Pollen germination and pollen growth of trees generally can be affected by acidic precipitation in the range pH 2.5 to 4.0 . Damage to leaves and roots occurs usually 1 or 2 pH values. NOx, CO, SOx Pb and HC may influence photosynthesis and respiration insect past of trees in Belgrad forest.

On the effects of acidic deposition have been carried out in a number of countries of the world (Canada, Japan, Austria, Italy). The monitoring of acidity of precipitation began in Canadian in 1976 and working groups were established to meet and discuss the scientific findings (Keith et al., 1989). It has found that mobile sources are two thirds of NOx source in this country. In 1980 the emission of NOx in Canada was because of transportation 1 million ton per year. In Canada there is an air and precipitation monitoring network to obtain air concentrations of selected elements and precipitation chemistry at rural sites. pH conductivity SO4, NO3, NH4, Cl, K, Na, Ca, Mg, alkalinity have been measured by using these network systems (Keith et al., 1989).
Acidic precipitation research conducted by Canadian government since the late 1970s, by Japan government since 1930. In many countries of the world like Germany, Japan, Japan, Austria there are working groups to estimate of forest damage. International cooperation is important part of these researches.

The acid deposition affects the soil. Soil contains a large amount of aluminum silicates. This aluminum is not available to the roots of plants. But the acid precipitation make the aluminum available to plants.

Consequently the trees are weakened. Acid precipitation releases Ca, P, Mg., which are the fertilizer for the tree. Acid precipitation releases these fertilizers to be washed out of the soil, leaving the soil depleted of nutrients.

Motor vehicle emission is calculated in summer days. As shown Table 2, 3, 4, 5, 6 and 7 the pollutant emission value is changing in week days and weekend. The total Carbon Monoxide (CO) emission is change with days from Monday to Sunday as sequentially 512, 498, 494, 499, 534, 1730, 1792 kg per day. The total Hydro Carbon (HC), 61, 59, 59, 59, 64, 198, 205 kg per day. The total Nitrogen Oxygen (NOx), 99, 96, 95, 96, 103, 326 kg per day. The total Particulate Matter (PM), 6, 5, 5, 5, 6, 10, 11 kg per day. The total Sulfate Oxygen (SOx), 6, 5, 5, 5, 6, 10, 11 kg per day. The total Lead (Pb), 6, 6, 6, 6, 7, 21 and 22 kg per day.

Table 2. Daily motor vehicle traffic in Bahçeköy Belgrad Forest (Two ways, D: Diesel fueled, G: Gasoline fueled.).

Days	Gasoline	Diesel
Monday	2891	519
Tuesday	2817	497
Wednesday	2794	502
Thursday	2819	491
Friday	3013	589
Saturday	9827	617
Sunday	10174	731

Table 3. Daily emission from motor vehicle on A route, (kg/day).

Days	CO		HC		NOx		PM		SOx		Pb
	D	G	D	G	D	G	D	G	D	G	D
Monday	93,1	0,7	10,4	2,3	17,3	17,1	0,3	1,6	0,3	2,1	1,2
Tuesday	90,7	0,7	10,1	2,2	16,9	16,4	0,3	1,5	0,3	2,0	1,1
Wednesday	90,0	0,7	10,1	2,2	16,8	16,6	0,3	1,5	0,3	2,0	1,1
Thursday	90,8	0,7	10,1	2,2	16,9	16,2	0,3	1,5	0,3	2,0	1,1
Friday	97,0	0,8	10,8	2,6	18,1	19,4	0,3	1,8	0,3	2,4	1,2
Saturday	316,4	0,9	35,4	2,7	59,0	20,4	1,0	1,9	1,0	2,5	3,9
Sunday	327,6	1,1	36,6	3,2	61,0	24,1	1,0	2,2	1,0	2,9	4,1

Table 4. Daily emission from motor vehicle on B route, (kg/day).

Days	CO		HC		NOx		PM		SOx		Pb
	D	G	D	G	D	G	D	G	D	G	D
Monday	162,0	1,3	18,1	4,0	30,2	29,8	0,5	2,7	0,5	3,6	2,0
Tuesday	157,8	1,2	17,6	3,8	29,4	28,5	0,5	2,6	0,5	3,5	2,0
Wednesday	156,5	1,3	17,5	3,8	29,2	28,8	0,5	2,6	0,5	3,5	1,9
Thursday	157,9	1,2	17,7	3,8	29,4	28,2	0,5	2,6	0,5	3,4	2,0
Friday	168,8	1,5	18,9	4,5	31,5	33,8	0,5	3,1	0,5	4,1	2,1
Saturday	550,6	1,5	61,6	4,7	102,6	35,4	1,7	3,2	1,7	4,3	6,8
Sunday	570,0	1,8	63,7	5,6	106,2	42,0	1,8	3,8	1,8	5,1	7,1

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Table 5. Daily emission from motor vehicle on C route, (kg/day).

Days	CO		HC		NOx		PM		SOx		Pb
	D	G	D	G	D	G	D	G	D	G	D
Monday	63,3	0,5	7,1	1,6	11,8	11,6	0,2	1,1	0,2	1,4	0,8
Tuesday	61,7	0,5	6,9	1,5	11,5	11,2	0,2	1,0	0,2	1,4	0,8
Wednesday	61,2	0,5	6,8	1,5	11,4	11,3	0,2	1,0	0,2	1,4	0,8
Thursday	61,7	0,5	6,9	1,5	11,5	11,0	0,2	1,0	0,2	1,3	0,8
Friday	66,0	0,6	7,4	1,8	12,3	13,2	0,2	1,2	0,2	1,6	0,8
Saturday	215,2	0,6	24,1	1,8	40,1	13,8	0,7	1,3	0,7	1,7	2,7
Sunday	222,8	0,7	24,9	2,2	41,5	16,4	0,7	1,5	0,7	2,0	2,8

Table 6. Daily emission from motor vehicle on D route, (kg/day).

Days	CO		HC		NOx		PM		SOx		Pb
	D	G	D	G	D	G	D	G	D	G	D
Monday	134,0	1,1	15,0	3,3	25,0	24,7	0,4	2,2	0,4	3,0	1,7
Tuesday	130,6	1,0	14,6	3,1	24,3	23,6	0,4	2,1	0,4	2,9	1,6
Wednesday	129,6	1,0	14,5	3,2	24,1	23,9	0,4	2,2	0,4	2,9	1,6
Thursday	130,7	1,0	14,6	3,1	24,4	23,3	0,4	2,1	0,4	2,8	1,6
Friday	139,7	1,2	15,6	3,7	26,0	28,0	0,4	2,5	0,4	3,4	1,7
Saturday	455,7	1,3	50,9	3,9	84,9	29,3	1,4	2,7	1,4	3,6	5,7
Sunday	471,7	1,5	52,7	4,6	87,9	34,7	1,5	3,2	1,5	4,2	5,9

Table 7. Daily emission from motor vehicle on E route, (kg/day).

Days	CO		HC		NOx		PM		SOx		Pb
	D	G	D	G	D	G	D	G	D	G	D
Monday	18,6	0,1	2,1	0,5	3,5	3,4	0,1	0,3	0,1	0,4	0,2
Tuesday	18,1	0,1	2,0	0,4	3,4	3,3	0,1	0,3	0,1	0,4	0,2
Wednesday	18,0	0,1	2,0	0,4	3,4	3,3	0,1	0,3	0,1	0,4	0,2
Thursday	18,2	0,1	2,0	0,4	3,4	3,2	0,1	0,3	0,1	0,4	0,2
Friday	19,4	0,2	2,2	0,5	3,6	3,9	0,1	0,4	0,1	0,5	0,2
Saturday	63,3	0,2	7,1	0,5	11,8	4,1	0,2	0,4	0,2	0,5	0,8
Sunday	65,5	0,2	7,3	0,6	12,2	4,8	0,2	0,4	0,2	0,6	0,8

Table 8. Daily total emission from motor vehicle in Belgrad forest, (kg/day).

Days	CO			HC			NOx			PM			SOx			Pb
	D	G	T	D	G	T	D	G	T	D	G	T	D	G	T	D
Monday	508	4	512	57	4	61	95	4	99	2	4	6	2	4	6	6
Tuesday	495	4	498	55	4	59	92	4	96	2	4	5	2	4	5	6
Wednesday	491	4	494	55	4	59	91	4	95	2	4	5	2	4	5	6
Thursday	495	4	499	55	4	59	92	4	96	2	4	5	2	4	5	6
Friday	529	5	534	59	5	64	99	5	103	2	5	6	2	5	6	7
Saturday	1725	5	1730	193	5	198	321	5	326	5	5	10	5	5	10	21
Sunday	1786	6	1792	200	6	205	333	6	339	6	6	11	6	6	11	22

The following have to build in the future for Belgrad forest and all forest area of Turkey?
- Measuring and monitoring system of atmospheric pollution
- Application of remote sensing system in forest damage
- Building of interdisciplinary working groups
- Early warning system

One hand the effects of acid deposition on forest must be investigated. On the other hand, it is important estimating the source of pollutants. For example in 1980 about 15 % to 20 % was deposited the amount of the total emission of sulphur dioxide in the Netherlands, the remainder was exported (Bresser, 1989).

Dry deposition on leaves damage to leaves and bark is reduced photosynthesis and growth and soil nutrients leach, toxic mineral released cause root damage and soil acidification damage to soil fungi that aid in root uptake and impaired water and nutrient uptake, increased susceptibility to environmental stresses. All of this effect can death of tree.

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