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Effect of Industrial Pollution on the Formation of Vegetation South of Jeddah Province (Saudi Arabia)

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Abstract: ***In this research, Wechose study area in the industrial area south of Jeddah province and another area away from the factories was chosen as the control. One location were selected in each of them .each covering (10m× 10m) inside each area we take 10 small quadrates (1m × 1m) were also taken. We have defined plant species. Plant density, Plant frequency, Plant coverage and important value of plants were calculated. The results showed there were 5 plant species. And the highest relative density and frequency to the plant Stipagrostispulmosaat a location 1. while thehighest value of the relative coverage recorded in plant Zygophyllum simplex in location 2. And important value was highest in Zygophyllum simplex in location 2 and was highest in Stipagrostispulmosain location 1.It was observed that the density, frequency and coverage of most of the plants were higher at the Location 2 which is far away from factories. Indicating that industrial pollution has a negative impact on the formation of the vegatation.***

Keywords: Industrial pollution, Vegetation, Zygophyllum simplex, *Stipagrostispulmosa, Belphariciliaris, Prosopisjuli, Senna italic*

1. Introduction

Saudi Arabia covers a large area of theArabian Peninsula which located in a diverse terrain, The difference in climate conditions between the low land under the sea and the mountains that rise to the top 3000 m above level of sea, so there is the different types of wildlife to include groupings trees of coastal Acacia, seaweed forest Shoura,, forest of woody plants. (Shawdary and Aljewayed, 1999).

Soil in Saudi Arabia is considered immature because it lacks moisture and corrosion, therefore, soluble salts, calcium has been fragmented and transferred to the soil faster than removed during previous conditions of climate. According to the soil inventory carried out by the Ministry of Agriculture and Water, Which were released in the soil map of Saudi Arabia in 1406 H. The soil can be classified in Saudi Arabia according to the conditions of composition and composition of the soil in Saudi Arabia. Rows of raw or modern land (Al-Nafee, 2004).

The climate in Saudi Arabia varies from region to region, but there is a rise in the temperature of wetlands in coastal areas and dry heat in the interior except the areas above sea level and is located in the center of Mount Hijaz, therefore, There is a large area of desert in Saudi Arabia (Abu al-Fath, 1999).

The vegetation different from one region to another according to the different climate (Zahran, 1983).

Figure 1: Affected area (Industrial region) (Location1)

Figure 2: Unaffected area (Location2)

The study area

The study area is located south of Jeddah province (Industrial region) the figure (1- 2). Located Jeddah on the Red Sea at the confluence of latitude 21 °23’55.1’’ North and longitude 39 °14’18.5’’ East and it coastal plain is bordered by the Red Sea to the west and from the East the Sarwat mountain and it's name the region western coastal plain (Tihama).(Fig. 3).

Figure 3: The study area

Table 1: Plant species recorded in the study area and inLocations (1 - 2) and family names to
To which they belong.
(+)Available, (-) Un available)

Species	The family	Location	
		1	2
Belphariciliaris (L) B.L Burtt	Acanthaceae	+	-
Stipagrostispulmosa L Munro ex T. Anderson	Poaceae Gramineae	+	+
Zygophyllum simplex	Zygophyllaceae	+	+
Prosopisjuli flora (Sw.) Dc.	Mimosaceae	+	+
Senna italic Mill	Caesalpiniaceae	-	+


Belphariciliaris *Stipagrostispulmosa*

2. Materials and Methods

In the south of Jeddah province (Industrial area) two sites were randomly selected covering 10 × 10 m2 were also taken 10 small quadrates inside each location area of 1 × 1 m 2 and then the definition, classification of plant species and calculation: density, frequency, coverage and Important value with a graphical representation of the results, according to the following equations:

Absolute density =
Total of each type of species for all quadrates× 100
The total number of quadrates × area of the quadrates
Relative density =
Absolute density of the species × 100
Total of the absolute density of all species
Absolute frequency =
Number of quadrates that were found by species×100
The total number of quadrates
Relative frequency =
Absolute frequency of the species × 100
Total of the absolute frequency of all species
Absolute coverage =
Total length of such intersections of species × 100
Number of sections × Length of the section

Relative coverage =
absolute coverage of species × 100
Total absolute coverage of all species

Important value =Relative density+ Relative frequency+ Relative coverage


Zygophyllum simplex


Prosopisjuli


Senna italic

3. Results

3.1 Vegetation study

3.1.1 Plant species
Five plant species were recorded in the study area as shown in Table 1 at the two randomly selected locations in the area.

3.1.2 Density of plant species (Absolute and relative):
There are obvious differences in the absolute density of the plant. Absolute density was highest in the plant*Z. simplex*, reaching 9.5 plant / meters in location2. And relative density was highest in the plant *S. pulmosa* at a location 1 shown in table(2) figures (4)

3.1.3 Frequency of plants pecies (Absolute and relative):
Absolute frequency has a highest value In the plant *Z. simplex* and *S. pulmosa* were 100% value at location 2.Relative frequency was highest value in the plant *S. pulmosa 41.7%*. as shown in table(3) figures (5).

3.1.4 Coverage of plant species (Absolute and relative)
Absolute and relative coverage record highest values in plant P. juli . and the highest the relative coverage values in locations 2, recorded in plant *Z. simplex* as shown in table(4) figures (6).

3.1.5 Important value of plant species
The highest values of the important value was in plant *S. pulmosa*in location1 and plant *Z. simplexhas*the highest values of the important value in location 2 table 5.

Table 2: Absolute and Relative Density of each plant in study areas
Location1 (Affected area) – Location2 (Unaffected area

Species	Absolute density		Relative density	
	Loc. (1)	Loc. (2)	Loc. (1)	Loc. (2)
Belphariciliaris	2.7	-	33.8	-
Stipagrostispulmosa	4.3	6.9	53.8	36.3
Zygophyllum simplex	0.6	9.5	7.4	50
Prosopisjuli	0.4	0.1	5	0.5
Senna italic	-	2.5	-	13.2

Table 3: Absolute and Relative Frequencyof each plant in study areas
Location1 (Affected area) – Location2 (Unaffected area)

Species	Absolute Frequency		Relative Frequency	
	Loc. (1)	Loc. (2)	Loc. (1)	Loc. (2)
Belphariciliaris	70	-	29.2	-
Stipagrostispulmosa	100	100	41.7	35.7
Zygophyllum simplex	30	100	12.4	35.7
Prosopisjuli	40	10	16.7	3.6
Senna italic	-	70	-	25

Table 4: Absolute and Relative Coverage of each plant in study areas
Location1 (Affected area) – Location2 (Unaffected area

Species	Absolute coverage		Relative coverage	
	Loc. (1)	Loc. (2)	Loc. (1)	Loc. (2)
Belphariciliaris	163.3	-	5.9	-
Stipagrostispulmosa	566.7	490	20.4	14.2
Zygophyllum simplex	50	1853	1.8	53.8
Prosopisjuli	2000	1000	71.9	29
Senna italic	-	100	-	2.9

Table 5: Important value of each plant in study areas
Location1 (Affected area) – Location2 (Unaffected area

Species	Important value	
	Loc. (1)	Loc. (2)
Belphariciliaris	68.9	-
Stipagrostispulmosa	115.9	86.2
Zygophyllum simplex	21.6	1139.5
Prosopisjuli	93.6	33.1
Senna italic	-	41.1

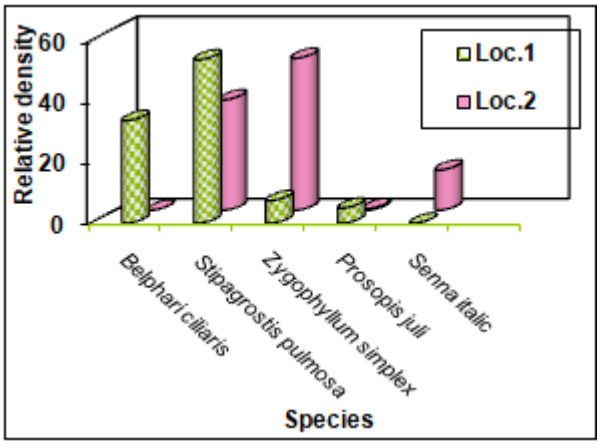

Figure 4: The relative density of plant species

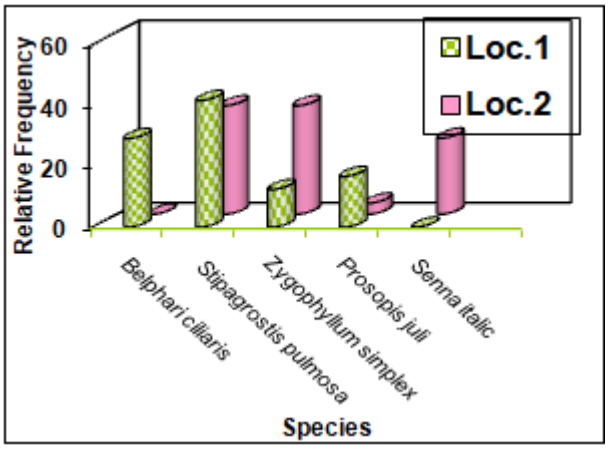

Figure 5: The relative frequency of plant species

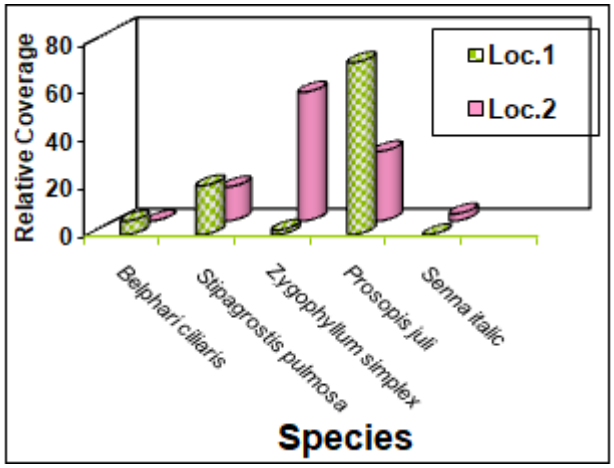

Figure 6: The relative Coverage of plant species

4. Discussion

This study was on a selected area in the south of Jeddah province (Industrial Areaand another area away from the factories was chosen as the control) to find out the effect of industrial pollution on vegetation. Increasing industries and cars constantly add toxic gases and other substances to the environment (Jahan and Iqbal, 1992). The harmful effects of air pollution on living organisms and ecosystems have emerged worldwide. Many experiments have been conducted to analyze the effects of air pollutants on crops and vegetation at different levels ranging from biochemistry to ecosystem levels. (Tiwari et al., 2006).

Characterized the study area the climate is hot and humid most days of the year. These climatic factors are affect on structural structure of soil and the formation of vegetation so that plant species that have the ability to adapt to these conditions. The human has caused some changes in natural ecosystems due to industrial renaissance and development in various fields, which can introduce many pollutants that have negatively affected the environment and the most famous of these pollutants industrial pollution. The response of developing plants to these sites varied, with some responding to growth and productivity while others were affected. Therefore, many countries have been interested in studying industrial pollution from harm to search for solutions (Harthy *et al.*, 2003).

Five plant species have been registered in the industrial zone and other areas away from industrial pollution. These plant species range from shrubs to perennials.

The vegetation of the coastal plain is slightly scattered and limited to some plant species with a large root system that can adapt to the harsh desert environment except for some annual vegetation that grows after rainfall ((Al-Nafee, 2004).

And also the Soil in desert areas is characterized by poverty in organic matter resulting from plant and animal poverty (Zoukah, 2000).

Pollution can directly affect plants by leaves or indirectly by acidification of the soil. When exposed to airborne pollutants, most plants have experienced physiological changes before they show visible leaf damage(Liu and Ding, 2008).In this study Indicating that industrial pollution has a negative impact on the formation of the vegatation.

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