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Investigating the effect of vegetation on the absorption of carbon dioxide (Case study: Yadavaran oil field, Iran)

Mohammad Velayatzadeh****, *Sina Davazdah Emami***

Industrial Safety Department, Caspian Institute of Higher Education, Qazvin, Iran

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CORRESPONDING AUTHOR:

mv.5908@gmail.com
Tel: (+98 61) 34609241
Fax: (+98 61) 32218340

ABSTRACT:

Introduction: One of the most important environmental issues related to the energy sector is the global climate change caused by the accumulation of greenhouse gases. Increasing the concentration of greenhouse gases in the atmosphere causes global warming, which has dangerous consequences. This research was conducted to investigate the effect of vegetation on the amount of carbon dioxide emissions in the Yadavaran oil field in 2017.

Materials and methods: In this research, information was collected and parameters were measured in 5 stations (Contractor Services Camp, Water Supply, Permanent camp, Green space and Pioneer camp) with 3 replications. Regarding the administrative and operational hours, measuring the parameters of research was carried out during the working hours of the day in spring and June 2017. In this study, the amount of temperature, velocity and wind direction of the dominant region, moisture content, oxygen content, green space and vegetation, buildings and barriers, and the distances and closeness of the emission sources and altitudes from the ground surface were taken.

Results: According to the results obtained in areas with vegetation and trees, at the pioneer camp and the water supply camp with increasing temperature, the amount of carbon dioxide has also increased. In the campus, the service contractor and the green area of the region with a decrease in temperature, carbon monoxide in the air was also downtrend.

Conclusion: The temperature and humidity did not affect the concentration of oxygen in the air, and it was the same in the five study areas.

Introduction

Carbon footprint can be one of the major environmental, health and environmental impacts of the environment today [1]. This term has been taken into consideration in the public and in the public sector as well as in the private and media sectors. The dangerous consequences of global warming and the importance of solving this great crisis can be clearly seen in the media and government and non-state news. The carbon footprint is, in fact, the scale of the total amount of carbon dioxide and methane output pertaining to a population of a system or a given activity, taking into account all sources, subsidence, storage, in the limited time and location of that population, system or activity [2, 3].

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Carbon dioxide is considered one of the most important gases in the life cycle of living organisms, but the excess emissions of this gas, which are produced by burning fossil fuels, increase the uneven terrestrial temperature and creating global warming is a destructive phenomenon [4, 5].

In a research, identified energy sources and carbon emissions in the iron and steel industry in South Asia (Sri Lanka, Pakistan, India, Bangladesh and Nepal). This study shows that about 30% of the total energy is in the manufacturing industry. Electricity accounts for almost 60% of total energy consumption in five countries in South Asia [6]. In other research is to reduce carbon dioxide emissions in China evaluated the food industry. The results show that the intensity of energy and industrial activity are the main factors for changing the amount of carbon dioxide gas [7]. Also, studied showed carbon dioxide emission and its relationship with energy consumption. The results show that the carbon dioxide emission efficiency in China's energy industry and energy consumption has improved over the period 2000 to 2013 [5]. Other researchers investigated the analysis of carbon dioxide emissions and potential decline in Pakistan. According to the analysis, the increase in per capita and population GDP is the main factor in increasing the carbon dioxide emissions of energy [8].The reason for examining the impact of trees is that these plants absorb carbon dioxide daily and in the evening, the opposite, the day returns the amount of gas to the air. Considering the above mentioned issues, in order to reduce air pollution and expand the green space, this oilfield has artificial vegetation cover including trees that have been studied in specific regions and their effect on carbon dioxide emissions [9, 10].

Yadavaran oil field is one of the most important oil fields in the country of Iraq in the west of the Karun River, which is located in the cities of Ahvaz, Khorramshahr and Dasht Azadegan, and is increasingly developing. The aim of this study was to investigate the effect of trees in vegetation areas on the amount of carbon dioxide in the Yadavaran oil field.

Materials and methods

Study Location

This research was conducted in 2017 in the oil field of Yadavaran in Khuzestan province. Yadavaran oil field is one of the western oil fields of Karun in Iran, located in Khuzestan Province, 70 km southwest of Ahwaz and north of Khorramshahr. Therefore, considering all the effective factors, a total of 5 locations (Contractor Services Camp (station 1), Permanent camp (station 2), Green space (station 3), Water Supply (station 4), Pioneer camp (station 5)) were identified for collecting data and measuring environmental parameters (Fig. 1).

Counting Trees

The number of trees was counted as field visits. Age of trees was also determined by the time of planting in the region. Regarding the administrative and operational hours, measuring the parameters of research was carried out during the working hours of the day in spring and June 2017. Due to the fact that the trees breathe airborne dioxide into the air at night and the exposure of personnel in office hours and hours, field research was conducted on a daily basis.

Environmental conditions

In this study, the amount of temperature, velocity and wind direction of the dominant region, moisture content, oxygen content, green space and vegetation, buildings and barriers, and the distances and closeness of the emission sources and altitudes from the ground surface were taken into account for measuring carbon dioxide levels

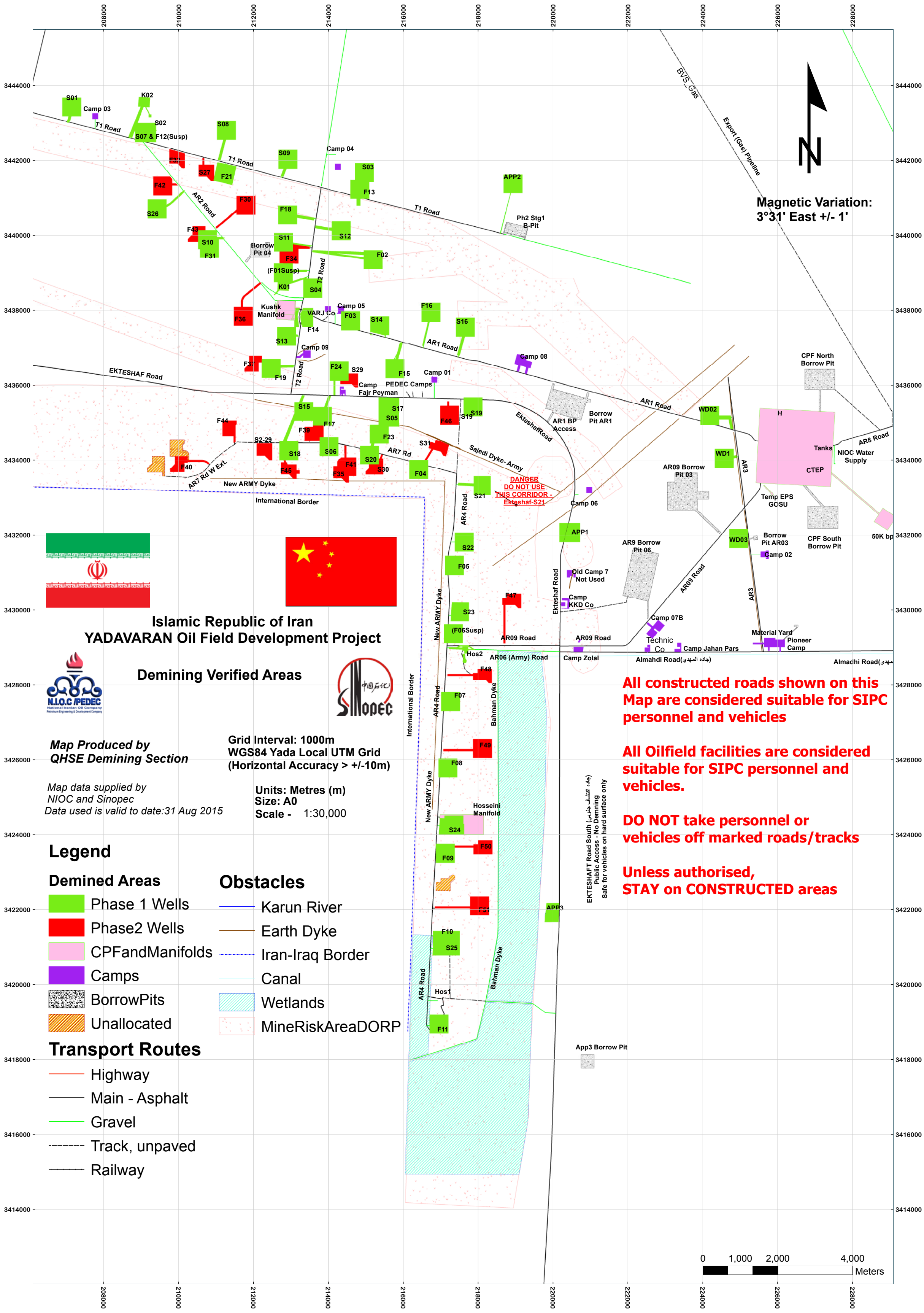

Fig. 1. Location of Yadavaran field in Khuzestan province

[11]. Also, due to the fact that carbon dioxide is heavier than air, this gas was measured near the surface of the earth at a height of 2 to 3 m [12]. For ambient airborne carbon dioxide measuring stations, having at least 20 m distance from the green space, at least two obstacles, obstacle heights, no airflow limitation 270 ° around the station, being away from any source of pollution, such as chimneys and the like, it is considered so that the location of the station representative of the surrounding area is as high as possible [11]. In this study, wind speed was very low and steady during sampling days and was dominated by winds in the northwest of the southeast. The dominant wind direction in the area was determined by a 6-m-high installation installed [13].

Parameters Measurement

Temperature, relative humidity and carbon dioxide were recorded and measured by Trotec machine BZ30 model. This machine is made in Germany. The application range of this device for measuring temperature, relative humidity and carbon dioxide was 5-50 ° C, 99-1.9% and 999.9-0.95, respectively. Also, the accuracy of the Trotec device was BZ30 for temperature of 0.1± 0.5 ° C, relative humidity 0.1% and carbon dioxide 1 ppm. Oxygen gas was used to measure the ALTAIR 4X devices. The manufacturer of the ALTAIR 4X machine in the United States has been used. In this study, oxygen was measured with a range of 0-30%. Precision measuring device for gas for oxygen was 1.0%. To increase the confidence coefficient, environmental factors were measured in each site with 3 replications.

Statistical Analysis

The data were analyzed using SPSS-24 and one-way analysis of variance. Normality of data was evaluated using Kolmogorov–Smirnov test.

Results and discussion

Distribution of vegetation

Naturally, in the Yadavaran oil field, there is no natural vegetation; only vegetation of the area is related to a lot of *Phragmitesaustralis* that can be seen in the canal of Amir Kabir and Mirza Kochak Khan Drainage units in the south of Yadavaran oil field. In some areas, including a Contractor Services Camp, Water Supply, Permanent camp, Green space and Pioneer camp they have been planting *Conocarpus erectus* and *Prosopis cineraria*. In the service contractor, 90 trees were counted including 67 trees of *Conocarpus erectus* (74.44%) and 23 trees of *Prosopis cineraria* (25.55%).

In the water supply center, 72 trees were counted including 58 trees of *Conocarpus erectus* (80.55%) and 14 trees of *Prosopis cineraria* (19.44%). In the Permanent camp, Green space and Pioneer camp were all the trees of the genus *Conocarpus erectus*. All the trees were 5 years old (Table 1).

In the service contractor camp, 90 trees stands consisted of 67 trees of *Conocarpus erectus* trees (74.44%) and 23 *Prosopiscineraria*(25.55%). The highest frequency was related to the longitudinal group of 2-3 m of trees with 52.22%. In the water supply center, 72 trees were counted including 58 trees of *Conocarpus erectus* trees (80.55%) and 14 species of *Prosopiscineraria* (19.44). The most frequent was the longitudinal group of 2-3 m of trees with 68.05%.A total of 3360 *Conocarpus erectus* trees were counted in the permanent camp. In other words, in the camp, for the development and extension of the green area, only the *Conocarpuserectus*species has been used. The most frequent was the longitudinal group of trees 3-4 m with 51.04%. In the green area of the region, 2580 trees were

Table 1. The abundance and height of the trees of Yadavaran oil field

Location	Number (trees)	Frequency (%)
Contractor services camp	90	1.23
Water supply	72	0.98
Permanent camp	3360	46.11
Green space	2580	35.41
Pioneer camp	1184	16.25
Total	7286	100

counted including 1836 *Conocarpus erectus* trees (70.61%) and 764 asteroids (29.38%). The most frequent was the longitudinal group of trees 2-3 m with 65.03%. At pioneer camp, 1184 trees were counted. The most frequent was the longitudinal group of trees 2-3 m with 59.62% (Table 2).

Reducing carbon dioxide is one of the important functions of green space. Carbon is a major component of plant structure and is naturally degraded in plant tissues through photosynthesis and in soil bedding through plant and root rot [14, 15]. Probably one of the reasons for the high concentrations of carbon dioxide and oxygen in the green space and the margins of trees in the region is the exchange of oxygen and carbon dioxide with the help of trees. The ability of trees to absorb carbon depends on the height and dimensions of the trees, the age, health, and the umbrella of the trees, on the average, large trees can reduce 2 to 3% of the carbon content of the air [16, 17].

Table 2. Separation of the percentage and height of trees in the studied areas

Location	Height (m)	Number (trees)	Frequency (%)	Total (trees)
Contractor services camp	1-2	14	15.55	90
	2-3	47	52.22	
	3-4	29	32.22	
Water supply	1-2	15	20.83	72
	2-3	49	68.05	
	3-4	8	11.11	
Permanent camp	1-2	93	2.76	3360
	2-3	672	20	
	3-4	1715	51.04	
	4-5	523	15.83	
	5-6	348	10.35	
Green space	1-2	672	26.04	2580
	2-3	1678	65.03	
	3-4	230	8.91	
Pioneer camp	1-2	136	11.48	1184
	2-3	706	59.62	
	3-4	342	28.88	

Climate conditions

The results for temperature, humidity, carbon dioxide, oxygen, and number of trees in five vegetation areas are presented in Table 3. With regard to the results obtained in areas with vegetation and trees, at the Camp Pioneer and the water supply camp with increasing temperature, the amount of carbon dioxide has also increased, but in the campus, the service contractor and the area of the green area of the area with a decrease Temperature, the amount of carbon dioxide in the air was also declining. The temperature and humidity did not affect the concentration of oxygen in the air, and it was the same in the five study areas. Also, the amount of carbon dioxide was decreasing with increasing number of trees in each region, according to the amount of carbon dioxide in areas without vegetation. Obviously, with the increase in the number of trees in each region, carbon dioxide is more likely to be absorbed from the air. According to the process of photosynthesis, plants could absorb carbon dioxide during the day and in the night air carbon dioxide into the air after deals. In areas with vegetation, if the temperature and humidity is low, indicating that trees absorb carbon dioxide as well as virgin and vegetation effect the amount of carbon dioxide [18, 19].

Climate change causes 4 to 8% change in carbon dioxide concentrations daily or seasonally. These changes are due to increased or decreased sunlight, temperature, relative humidity and high pressure flux. The concentration of carbon dioxide in the atmosphere is also affected by human activities, such as burning fossil fuels. The concentration of carbon dioxide is usually much higher in cities, factories and combustion activities [20, 21].

The most effective way to stop carbon growth is to increase the number of trees and greenery at the same time, as the world's largest forests and green spaces are the largest carbon dioxide absorber [22]. The reason for examining the impact of trees is that these plants absorb carbon dioxide per day and in the evening; on the contrary, they send the amounts of gas to the air. Considering the above mentioned issues, in order to reduce air pollution and expand the green space, this oilfield has artificial vegetation cover including trees that have been studied in specific regions and their effect on carbon dioxide emissions. Trees are important for long periods of carbon storage outside of its natural cycle. Each 30.48 cm^3 wood of commercial wood produced from the tree, is stored at roughly 14.9 kg of carbon per tree biomass. Urban green spaces are effective in preventing the release of carbon dioxide in urban areas. Urban green space The ecosystems identified by other trees and vegetation coverings in the community include the trees of the areas under the jurisdiction

Table 3. Effects of number of trees, temperature and humidity on the concentration of carbon dioxide and the amount of oxygen in the air of Yadavaran oilfield

Location	Number (trees)	Temperature (°C)	Humidity (%)	Carbon dioxide (ppm)	Oxygen (ppm)
Contractor services camp	90	21.75 ± 0.04^a	36.43 ± 0.05^a	490.88 ± 5.45^a	20.06 ± 0.056^a
Water supply	72	28.43 ± 0.06^b	34.06 ± 0.08^b	584.56 ± 6.36^b	19.63 ± 0.048^a
Permanent camp	3360	21.56 ± 0.04^a	33.26 ± 0.05^c	476.30 ± 5.76^c	20.16 ± 0.059^a
Green space	2580	22.41 ± 0.05^a	33.35 ± 0.05^c	473 ± 5.65^d	20.23 ± 0.055^a
Pioneer camp	1184	27.96 ± 0.05^b	30.20 ± 0.07^d	506 ± 6.98^e	19.56 ± 0.068^a

Different letters (a,b,c,d,e)show a significant difference (P <0.05).

of the municipality and other organizations, such as existing trees along the streets and highways, the park Public buildings and shrubs around the cities [23, 24].

A 30-year-old tree, on average, absorbs and saves carbon 4.9 per year. Also, an average tree absorbs and saves about 15 times the amount of carbon it ejects. Trees are healthy when they are well absorbed by carbon dioxide, they can produce the oxygen needed to breathe life and humans [25, 26]. The results of the convention on climate change also indicated that, in order to reduce greenhouse gas emissions, the method of developing and extending tree cover (through the carbon sequestration mechanism) is recognized as the best method and more than other methods [14].

Plants use carbon dioxide during the process of photosynthesis. The rate of consumption will vary according to the type of product, light intensity, temperature, plant growth stage and nutrient content. Air circulation and wind speed in the region can increase the carbon dioxide gas distribution rate by reducing the boundary layer around the leaf area [27, 28].

Conclusion

According to the results obtained in areas with vegetation and trees, at the pioneer camp and the water supply camp with increasing temperature, the amount of carbon dioxide has also increased. In the campus, the service contractor and the green area of the region with a decrease in temperature, carbon monoxide in the air was also downtrend. The temperature and humidity did not affect the concentration of oxygen in the air, and it was the same in the five study areas. Also, the amount of carbon dioxide gas showed a decreasing trend with increasing number of trees in each region due to the concentration of carbon dioxide gas in areas without vegetation. In other words, increasing the number of trees increases the carbon dioxide absorption of air. The effect of this is because trees absorb carbon dioxide that the plants on the contrary speak at night on the amounts of gas into the air the day after. Considering the above mentioned issues, in order to reduce air pollution and expand the green space, this oilfield has artificial vegetation cover including trees that have been studied in specific regions and their effect on carbon dioxide emissions

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Competing interests

The authors declare that there are no competing interests.

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Ethical considerations

Ethical issues have been completely observed by the authors.

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