A Study on Abiotic Climatic Factors in district Kurukshetra, Haryana (India)

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Abstract: Monthly variation in high temperature was varied from a minimum 27^0C (in the month of December, 2016) to a maximum of 41^0C (in the month of June, 2016) with an average±S.E. of 33.92±1.08 while in low temperature it was varied from a minimum 17^0C (in the month of January, 2016) to a maximum of 34^0C (in the month of may, 2016) with an average±S.E. of 27.75±1.97 was observed. Also, rainfall/day was observed from a minimum 2day/month (in the month of January and May, 2016) to a maximum of 11days/month (in the month of July, 2016) with an average±S.E. of 2.5±0.02 was observed. As far as, during the present study, humidity was varied from a minimum 35% (in the month of June, 2016) to a maximum of 78% (in the month of August, 2016) with an average±S.E. of 64.16±2.81 was observed. Similarly, dew point was varied from a minimum 9^0C (in the month of January, 2016) to a maximum of 29^0C (August 2016) with an average±S.E. of 18.09±2.99 was observed. Also, wind (Km/h) was varied from a minimum 1.5Km/h (in the month of January, 2016) to a maximum of 7 Km/h (in the month of May, June and July, 2016) with an average±S.E. of 4.11±0.05 was observed (Fig. 5). Pressure was also varied from a minimum 847 mbar (in the month of June, 2016) to a maximum of 1031 mbar (in the month of June, 2016) with an average±S.E. of 1092.41±2.48 was observed. Also, visibility was varied from a minimum 4/Km (in the month of August, November and December, 2016) to a maximum of 4.5/Km (in the whole month of year 2016) with an average±S.E. of 3.41±0.18 was observed.

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Introduction:

Gradients in climactic factors create physiological barriers to dispersal. All species have limits of tolerance to abiotic factors, which can lower their survival and reproductive success and limit range expansion beyond the edge. Changes in temperature may cause a species to change its geographical distribution. With increasing temperatures resulting from global warming, species have been seen to expand their range northward due to increased survival and reproduction as a result of warming. Precipitation can also be a key determinant in limiting the geographic range edges of species. This is often seen in organisms with high water demands, whose survival and reproduction would decrease beyond the edge due to dry conditions, limiting expansion. Moisture of soil or air is also seen to limit range expansion. In terms of soil moisture, limited range expansion for species that forage on soil organisms or for species that reside in soil and rely on it for nutrients are seen. If moisture requirements are not met beyond the species range, they will not be able to expand due to resulting reductions in fitness. There are many other abiotic factors that can determine a species range, including dissolved oxygen, canopy cover, conductivity, alkalinity and pH. Abiotic components are and ecological factor that acts of living components during any part of their life. Abiotic factors are the factors that are either physical or chemical factors that are the characteristic of the environment being studied. Many ecological studies have been done about the importance of the major abiotic factors which control the physical and biological components in an ecosystem at various ranges of time and space. Many factors influence every part of our environment: things like how tall trees grow, where animals and plants are found, and why birds migrate. There are two categories of these factors: abiotic and biotic. Abiotic factors are the non-living parts of the environment that can often have a major influence on living organisms. Abiotic factors include water, sunlight, oxygen, soil and temperature (Ashraf *et al.,* 2008). The impact would be particularly severe in the tropical areas, which mainly consist of developing countries, including India. Perception, threats and assessments of risks are viewed by various countries with varying positions though per capita of India's emissions is one fourth of the global average, top 10% of urban population of India emit below the global average per capita emission (Parekh and Parekh, 2002). Temperature is an abiotic factor that is strongly influenced by sunlight. Temperature plays an important role for animals that cannot regulate their own body temperature, such as reptiles. Unlike humans, whose normal body temperature is usually around 98.6°F, reptiles (such as snakes and lizards) cannot maintain a constant body temperature. Reptiles are usually found in warm regions around the planet. To regulate their body temperatures, reptiles will sun themselves on rocks, which absorb heat from sunlight and then radiate heat back into the environment (Wag *et al.,* 2007 and Singh, 2010). Like water, oxygen (O_2) is another important abiotic factor for many living organisms. Without oxygen, humans would not be able to live! This is true for the many other living organisms that use oxygen. Oxygen is produced by green plants through the process of photosynthesis, and is therefore directly linked to sunlight (NRAA, 2011 and NCAER, 2013). Soil is often considered an abiotic factor since it is mostly made up of small particles of rock (sand and clay) mixed with decomposed plants and animals. Plants use their roots to get water and nutrients from the soil. Soils are different from place to place – this can be a big factor in which plants and animals live in a certain area (ICAR, 2010). Water (H_2O) is a very important abiotic factor – it is often said that “water is life.” All living organisms need water. Plants must have water to grow. Even plants that live in the desert need a little bit of water to grow. Without water, animals become weak and confused, and they can die if they do not rehydrate. Sunlight is the main source of energy on Earth, which makes it an extremely important abiotic factor. Sunlight is necessary for photosynthesis, the process by which plants convert carbon dioxide (CO_2) and water to oxygen (O_2) and sugar – food for the plants that later becomes food for animals. Without the sun, plants could not live, and without plants, animals could not live! The sun’s heat is also extremely important – see the section on Temperature below (dagar *et al.,* 2001). Due to less and scanty information are available on geographical parameters related to abiotic climatic factors in Kurukshetra, particular. So the present study was planned in geographical parameters related to abiotic climatic factors, i.e., temperature (maximum and minimum), rainfall/day, humidity, dew point, wind, pressure and visibility in district Kurukshetra, Haryana (India).

Materials and Methods:

The climate of Haryana over most of the year is of a pronounced continental character. It is very hot in summer and markedly cold in winter. The rainfall in the region is low and erratic except in parts of the Karmal and Ambala districts. The rainfall is unevenly distributed during the year except for two well marked seasons. One is the monsoon period lasting from the middle of June to the end of September on which autumn crop and spring sowing depend and the other is the winter rains which occur from December to February, benefiting rabi crop. Rainfall is meager, particularly in the districts of Mahendragarh and Hissar. Haryana is extremely hot in summer at around 45 °C (113 °F) and mild in winter. The hottest months are May and June and the coldest December and January. The climate is arid to semi-arid with average rainfall of 354.5 mm.

Fig. 3.1. Location of state of Haryana and of district Kurukshetra, Haryana (India).

The present study was planned in district Kurukshetra, Haryana (India). The district Kurukshetra, also popularly known as ˝Rice bowl of India˝, has an area of 1530 Km^2 constituting 3.8% of the total area of the state of Haryana. It is located between 29°52′ N to 30°12′ N latitude and 76°26′ E to 77°04′ E longitude in the North-Eastern part of the state of Haryana state (Fig. 3.1). Saraswati, Markanda and Ghaggar are the main rivers of this region. It is surrounded by the districts of Yamuna Nagar in East, Karnal in the South, Kaithal in the South-West and Ambala in the North-West side. It has four tehsils, namely, Pehowa, Thanesar, Shahabad and Ladwa with 419 villages and is one of the agriculturally prosperous districts of the state with wheat and sugarcane being the main crops. The industrial sector of the district is also greatly influenced by agriculture. The climate of district Kurukshetra is characterized by hot summer (mid March to end of June), extremely cold winter (mid November to mid March) and with moderate rainfall (end of June to mid of September). Temperature of the area is high as 48° C in summer and as low as 1° C in winter.

Monthly geographical parameters related to abiotic climatic factors, i.e., temperature (maximum and minimum), rainfall/day, humidity, dew point, wind, pressure and visibility in district Kurukshetra, Haryana (India) was observed from January, 2016 to December, 2016. To record above mentioned geographical parameters, direct observation method (Dagar et al., 2001) was followed.

Results and Discussion:

In the present study, monthly variation in high temperature was varied from a minimum 27^0C (in the month of December, 2016) to a maximum of 41^0C (in the month of June, 2016) with an average±S.E. of 33.92±1.08 while in low temperature it was varied from a minimum 17^0C (in the month of January, 2016) to a maximum of 34^0C (in the month of may, 2016) with an average±S.E. of 27.75±1.97 was observed (Fig. 1). Also, rainfall/day was observed from a minimum 2day/month (in the month of January and May, 2016) to a maximum of 11days/month (in the month of July, 2016) with an average±S.E. of 2.5±0.02 was observed (Fig. 2). As far as, during the present study, humidity was varied from a minimum 35% (in the month of June, 2016) to a maximum of 78% (in the month of August, 2016) with an average±S.E. of 64.16±2.81 was observed (Fig. 3). Similarly, dew point was varied from a minimum 9^0C (in the month of January, 2016) to a maximum of 29^0C (August 2016) with an average±S.E. of 18.09±2.99 was observed (Fig. 4). Also, wind (Km/h) was varied from a minimum 1.5Km/h (in the month of January, 2016) to a maximum of 7 Km/h (in the month of May, June and July, 2016) with an average±S.E. of 4.11±0.05 was observed (Fig. 5). Pressure was also varied from a minimum 847 mbar (in the month of June, 2016) to a maximum of 1031 mbar (in the month of June, 2016) with an average±S.E. of 1092.41±2.48 was observed (Fig. 5). Also, visibility was varied from a minimum 4/Km (in the month of August, November and December, 2016) to a maximum of 4.5/Km (in the whole month of year 2016) with an average±S.E. of 3.41±0.18 was observed (Fig. 5).

Sudesh and Mamta (2018) observed monthly variation in high temperature was varied from a minimum 21^0C (in the month of January, 2017) to a maximum of 38^0C (in the month of April, 2017) with an average±S.E. of 32.83±1.08; low temperature it was varied from a minimum 7^0C (in the month of January, 2017) to a maximum of 28^0C (in the month of June, 2017) with an average±S.E. of 18.75±0.97; rainfall/day was observed from a minimum 1day/month (in the month of January, March, April and May, 2016) to a maximum of 7days/month (in the month of Julyl, 2016) with an average±S.E. of 2±0.00; humidity was varied from a minimum 37% (in the month of May, 2017) to a maximum of 72% (in the month of January and august, 2017) with an average±S.E. of 60.16±1.81; dew point was varied from a minimum 8^0C (in the month of January, 2017) to a maximum of 25^0C (in the month of July and August 2017) with an average±S.E. of 16.08±0.99; wind (Km/h) was varied from a minimum 1Km/h (in the month of October, 2017) to a maximum of 4 Km/h (in the month of May, June and July, 2017) with an average±S.E. of 3.83±0.01; pressure was also varied from a minimum 997 mbar (in the month of July, 2017) to a maximum of 1018 mbar (in the month of January, 2017) with an average±S.E. of 1007.66±4.48 and visibility was varied from a minimum 3/Km (in the month of January, November and December, 2017) to a maximum of 4/Km (in the whole month of year 2017) with an average±S.E. of 3.25±0.11 was observed.

A numbers of coworkers like De and Mukhopadhyay, 1998; Lal, 2003, Rao *et al.*, 2009 recorded the Indian climate has undergone significant changes showing increasing trends in annual temperature with an average of 0.56°C rise over last 100 years (IPCC, 2007; Rao *et al,*. 2009; IMD, 2010). Warming was more pronounced during post monsoon and winter season with increase in number of hotter days in a year (IMD, 2010). Even though, there was slight increase in total rainfall received, number of rainy days decreased. The rainfed zone of the country shown significant negative trends in annual rainfall The semi arid regions of the country had maximum probability of prevalence of droughts of varying magnitudes (20-30%), leading to sharp decline in water tables and crop failures (Samra, 2003). By the end of next century (2100), the temperature in India is likely to increase by 1-5 0C (De and Mukhopadhyay, 1998; Lal, 2003; IPCC, 2007; IMD, 2010).

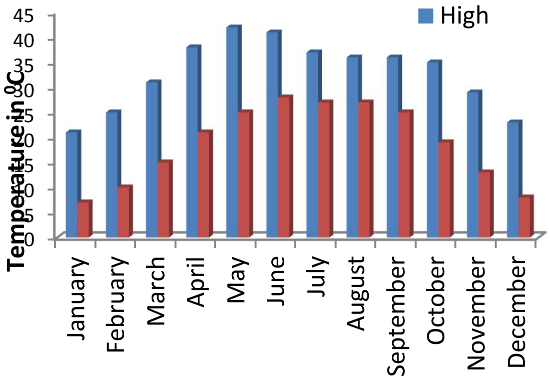


Fig. 1. Temperature variation (high and low) in district Kurukshetra, Haryana (India) from January, 2016 to December, 2016.

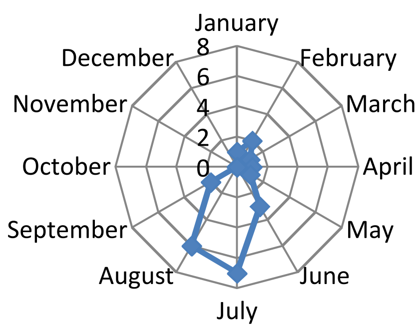


Fig. 2. Rain/day in district Kurukshetra, Haryana (India) from January, 2016 to December, 2016.

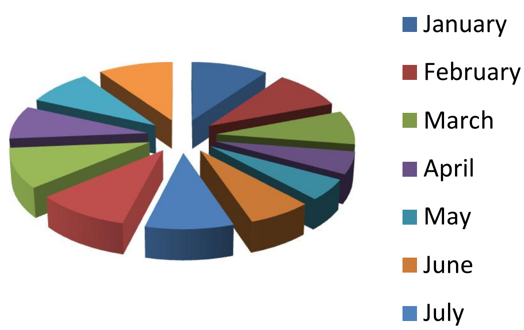
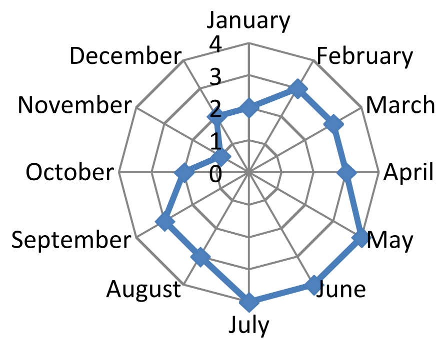
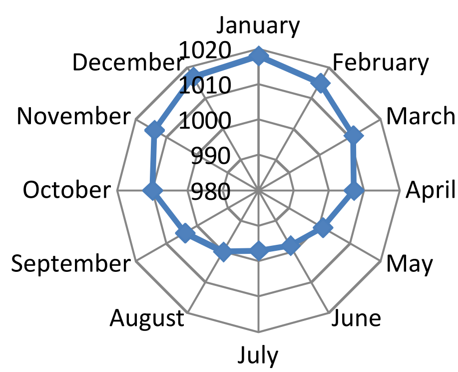


Fig. 3. Humidity (%age) in district Kurukshetra, Haryana (India) from January, 2016 to December, 2016.

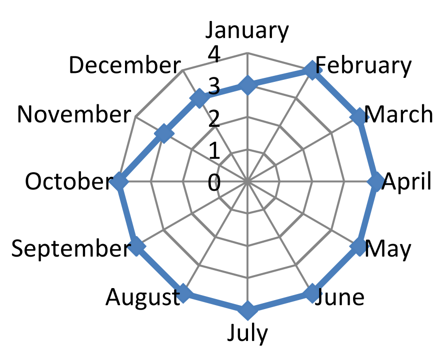
Fig. 4. Dew point (ºC) in district Kurukshetra, Haryana (India) from January, 2016 to December, 2016.



(a)



(b)



(c)

Fig. 5. (a) Wind (Km/h), (b) pressure (mbar) and (c) visibility/Km in district Kurukshetra, Haryana (India) from January, 2016 to December, 2016.

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