Sindh Univ. Res. Jour. (Sci. Ser.) Vol. 41 (2) 59-64 (2009)

Sindh Univ. Res. Jour.

SURJ

IMPACTS OF CLIMATE ON AGRICULTURE AND IT'S CAUSES: A CASE STUDY OF TALUKA KAMBER, SINDH, PAKISTAN

N. H. Chandio and M. Anwar*
hussian.chandio@salu.edu.pk

Department of Geography, Shah Abdul Latif University Khairpur, Sindh

(Received 19th August 2009 and Revised 20th September 2009)

Abstract

This is collective geographical study of climate, agriculture and soil of Kamber taluka. The study area is 60 meters above sea level and covered on 2260sq kilometers. The region is facing to drought and sun shining, since last seven years. Fluctuation of climate is more harmful than metrological drought. The high temperature 124.88^{0}F reported in 2002 during the summer season, on the contrary 77^{0}F reported in winter season in same year. The relative humidity is above 60% which is reduced to 40% varied with temperature. The rainfall varies about 100 to 120 mm the region is famous for paddy (rice) and considered to be irregular topography, 15% area is under western mountains, 75% area is considered as an agricultural and other remaining 10% area is considered near the foothills of mountain. All crops of the region are under crises.

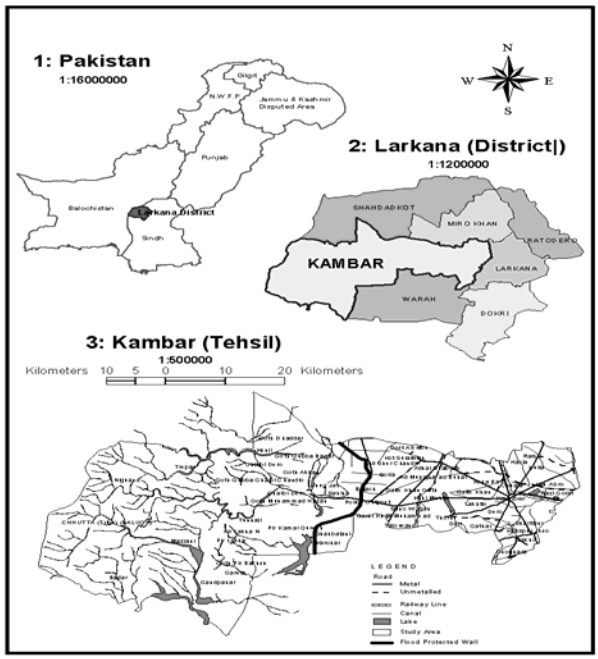
Keywords: climate, effects, agriculture, soils, Kamber, Pakistan

1. Introduction

Pakistan has 26% area for the purpose of cultivation, but there is about 38% area of Pakistan is able to cultivation. Remaining 14% area is not under cultivation due to shortage of water and water salinity and aridity in the country. 53% population of our country is earning by this sector. From 100% cultivated area, 65% area is irrigated by canal water system and other 35% area by rain (Barani) wells, Tube wells, and Karez (Karez an old method of irrigation found in Bolochistan and NWFP). Agriculture has an important role in our economy, 25% of total GNP is depending on this valuable sector. About 59% area of Pakistan is mountainous.

Study Area

The world famous mountain range Khirthar Mountain crosses from the western border of Kamber taluka. About 15% area of region is mountainous. The region situated in north latitudes 27.33^{0}F and east longitudes 68.16^{0}F Its shape is roughly octagonal.



Location of study area in different maps

Agriculture is depending on favorable climatic condition. The region is not favorable for large scale cultivation. About 35% area of

* Department of Geography, Islamia University of Bahawalpur, Punjab.

Kamber is under agriculture; remaining 65% area covers ponds, lakes, foothills etc. Lake *Hamal*, Lake *Saroh*, Lake *Chagro* and Lake *Drigh* are very famous lakes of the area. Chief crops of the region are rice and wheat, but some crops i.e maize, sorghum sesame are also found here**.**

Kamber is the hottest region subsequent to Jacobabad, Nawabshah and larkana in Sindh, the maximum temperature is 124.88^0F reported in July 2002. May, June and July are the hottest months of Kamber; geographically the region is divided into two parts *viz*: the Kohistan tract (Western tract) and central canal irrigation tract. The western portion of the region comprises uneven topography of hills and uplands consist of the Kohistan area. A range of lime stone hills and mountains referred to by the "*Halar*" but generally known as Khirthar range extends along the whole western boundary of Kamber with breadth of 19 to 21 Kilometers in a straight line. The Khirthar range consists of an ascending series like *Kakrio* (Broken) *Karo* (Black) *Pinaro* (Saffron Colour).The most elevated peak known as ***kuti-ji-kabar*** (Dog"s Grave) is 2065 meters above sea level and 300 meters above the adjoining area. At the North of *Kutti-Ji-Kabar* the *Darhyaro* plateaus (1800 meters above seal level), is situated with nearly a thousand acres of cultivable land. At one time *Darhyaro* was proposed for a sanatorium.

Agricultural capacity

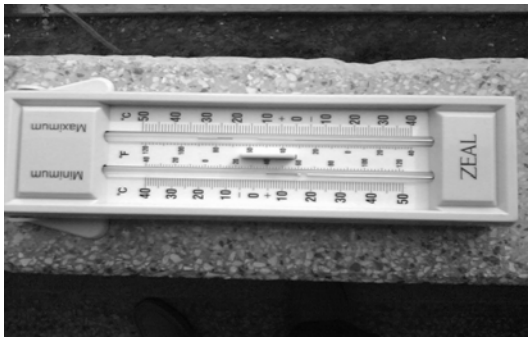
Rice is one of the leading cash and foreign exchange earning food crops. It requires a constant and plentiful supply of irrigation water. It needs 46 acre inches as soaking dose 4-6 days before transplanting, 1-2 acre inches at the time of transplanting and 3-4 acre inches 7-10 days after transplanting to maturity of the crop, the reproductive stages from panicle initiation to flowering and grain formation are the critical stages. Any stress at this stage will affect the yield and grain quality. However, rice requires over all 60-70 acre inches irrigation water on the basis of varieties.

Wheat is a staple food of more than one third of the world population. The major wheat area in Pakistan lies in Punjab, but the yield per hectare is slightly higher in Sindh. 5-6 irrigation's (21 acre inches) are sufficient for normal wheat crop, under optimum soil conditions.

2. Material and method

The boundary of study area is only 12 kilometers away from the Larkana city, where a sub-station of Meteorological department is available. For collection of meteorological data we used this sub-station. A part from this sub–station, we used small type instruments i.e thermometer and Rain gauge for measurement of temperature and rain fall in the different areas of the region. (A small home type thermometer showing Maxima and Minima temperature (Ranging from 40^0C to 55^0C) manufactured by *ZEAL* International made in China, In weather station, the air temperature is read at regular intervals from thermometers mounted inside a boxlike shelter built several feet off the ground. To find out the temperature in the shade, thermometers are kept in a special shelter called *Stevenson Screen*. This screen is a wooden box with a thick roof and sides having double louvers, so that it shades the thermometers from the sun but allows free movement of air. There is the maximum and minimum temperature of each day. A part from this an automatic recording thermometer, called a thermograph, may be used to draw continues temperature record on a piece of graph paper. Freezing temperature is 32^0F, the boiling point is 212^0F in Fahrenheit scales, but on the contrary on centigrade scale 0^0C (zero degree centigrade) is freezing and 100^0C is boiling point. A thermometer consists of bulb X completely filled with alcohol, a U-tube Y containing a long thread of Mercury, a bulb Z partially filled with alcohol and two indices, AI and A2. When the temperature rises the alcohol in X expands, Thus AI records the maximum temperature. As the temperature falls, the alcohol in X contracts, thus A2 records the minimum temperature. The difference between the highest and the lowest temperatures of a day gives us the "Daily Range or Diurnal range of temperature". The recorded temperature shifted on a graph paper by certain lines, on the weather map, that lines are known as Isothermal lines. The temperature of the region is not different to other district of the northern Sindh i.e. Larkana, Sukkur, Jacobabad and Shikarpur, etc.

Thermometer and Rain gauge are kept at Meteorological station Larkana



A small type of Thermometer used in the Field

Table-1: Maximum and Minimum temperature of 13 years (1992-2004)

S. No.	Year	Maximum ^{o}F	Minimum ^{o}F
01	1992	93.92	68.00
02	1993	95.00	68.00
03	1994	91.58	68.18
04	1995	92.30	68.92
05	1996	93.02	68.92
06	1997	90.5	68.72
07	1998	88.34	67.7
08	1999	93.92	68.36
09	2000	96.8	68.9
10	2001	96.4	69.09
11	2002	98.06	69.62
12	2003	98.26	69.7
13	2004	98.7	69.7

Source: Pakistan Meteorological Department University Road Karachi, Pakistan

Climate and agriculture

Agriculture is essentially a combination of processes designed by man to promote plant growth in semi-controlled environment. Climate together with soil are the main constraints to agriculture. Among the elements of climate influencing plant growth the temperature, rainfall, and sunshine are directly involved in various stages of plant growth from germination to grain formation. The water requirement of plants can be met, even in water deficit areas, by man's ingenuity of storage and conversation of water through dams, canals and tube wells. The temperature variations, both diurnal and annual are large. Each crop has a minimum, optimum and maximum temperature. The Area is having the temperature range between 59^{0}F to 123.8°f reported in 2002. Its fate of cultivation is the rice crops, which require higher concentration of water and supports optimum biological action required by the plants. Such cultivation is based on pH, moisture, organic matter and nitrogen content plus the total dissolved salts in the soil. These environment factors vary in soil fertility, crop productivity and many biological activities, carried out by number of soil micro flora.

The region is facing an agriculture drought* since last seven years. Drought is defined as a long period of abnormally low rainfall, especially one that adversely affects growing or living conditions (Allaby, 1989) Rain does not fall here throughout the year, but in monsoon season rain falls only for a few days. Convectional rain falls here in months of the May and June at noon time, but not more than three or four time in a year.

Table- 2: Rainfall from 1987-1994 (mm)

Month	1987	1988	1989	1990	1991	1992	1993	1994
Jan:	3.1	2.6	2.2	-	-	-	2.9	2.1
Feb:	-	1.3	1.2	-	2.0	4.7	3.3	1.2
Mar:	3.1	4.9	-	1.9	-	3.5	1.8	3.00
April	-	-	2.9	3.9	1.7	1.9	3.5	3.7
May	-	1.7	2.3	-	2.7	2.2	3.1	2.4
June	2.1	2.00	2.7	3.8	-	3.7	-	2.7
July	4.2	4.3	5.4	3.8	4.4	4.9	3.7	4.00
Aug:	5.3	4.9	5.4	5.9	3.8	5.7	4.9	4.4
Sept:	4.7	7.7	4.9	-	5.1	5.8	3.1	2.9
Nov:	-	0.89	-	1.9	0.9	2.7	3.7	1.3
Dec:	0.7	-	1.2	1.00	0.7	0.65	-	-

Source: Pakistan Metrological Department, Karachi Pakistan.

Rain gauge is partially sun into the ground, but the funnel must be at least 0.3 meter above the ground so as to avoid splashes. The amounts of rainfall recorded on all the days of a particular month are added to give the monthly rainfall of that month. The rainfall figures for the 12 months of particular years are added to give that years total is the annual rainfall. Rainfall can be shown by particular lines on weather map called isohyets'.

*When soil moisture and rainfall are inadequate during the growing season

3. Results and Discussion

Winds from the western direction can not affect on the region due to *Khirthar mountain range,* but hot and strong winds from the east and the southeastern direction immediately affects the region. Winds from Arabian Sea (Sea-Breezes) reaches here after 9:00pm but Land Breezes from Rajasthan , NARA and Thar Desert reaches here at early morning, during the May, June and July months.

The pH influences on the availability of soil nutrients, solubility of toxic nutrient elements in soil, physical breakdown of root cells, action exchange. The up and down of the pH range depends upon the available minerals in the soils. The soil of this Taluka is alkaline in pH i.e above 7.0. The decomposition of organic matter will result in the formation of carbon dioxide that combines with water in the form of carbonic acid, which is also an essential source of increased pH in soil.

Fluctuation of climate, changes in Ph is result of low precipitation. Soil is composed of calcium carbonate, silicon dioxide, magnesium, and potassium, etc but lack and excess of above mentioned elements is also harmful for the agriculture. On the contrary, water content, Air, Temperature, soil is also very effective for agriculture maintenance.

Table 3: size and water holding capacity of different soils

Type of soil	Minimum size (in mm)	Maximum size (in mm)	Capacity of water holding
Clay soil	0.02	--------	27%
Sandy soil	0.2	0.02	09%
Silt soil	0.02	0.002	10%

This region belong the BWH*. No one can deny that some relationship does exist. The climate of the world today differ considerably from those in the parts seems to have experienced both "Warm periods" and "Cold Periods "and also "Arid periods".

Causes of climatic change

The climatic change in the region is caused by few ecological disasters, which are under:

(1) The region belongs to semi-arid area, the rainfall is inadequate but in the monsoon season rain falls here after the July and August. The regularity of rainfall does not be conventional in monsoon months. Due to less rain, vegetation cover on the surface is not seemed every where about 02% area is under vegetation.

**Arid with hot summer and mild winter*

This percentage of vegetation is not sufficient for fine climate. Forests in the region are also ineffective; Trees belong to Bobul (Acacia

Arabia) Kandi (Prosipis Spieigera) and Ber (Zizypus jojoba). So these trees can not attract to rain due to low rate of transpiration.

(2) The second main cause of rapid climatic change is air pollution. The ozone layer (19 to 48 km Above the earth's surface) protects life on the earth from full force of sun's rays and its ultra-violet band of light, the use of chloroflouro carbons (CFC'S) in refrigerants and propellants in conned Sprays have been responsible for creating a hole in the Ozone layer above the north pole and parts of hemisphere. This damage is allowing unfiltered rays of the sun to contribute an increase in the different diseases, damage to certain crops, plankton and even marine food chain and Eco-system. Air pollution is main cause of damage of Ozone's layer, vehicle exhaust, fossil fuel burning, pesticides deforestation, forms, refrigerants, fire extinguishes and plastics are primary air pollution'.

(3) According to soil analysis, the soil of the region contains loam and clay, so it is also used as a building material. According to a survey there are more than 790 Brick-kiln these are burning like a volcano. One brick-kiln occurs on 1500 sq: meters. So 790 X 1500=1185000 ±10,000* =118.5 It means 2.4% area is occurred by brick-kilns.

* 1 sq km is equal to 10,000 sq. meters.

Table-4: Temperature of surrounding Districts of Kamber Taluka

District	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Dadu	1.12	1.18	3.32	2.06	9.33	13.8	2.54	4.58	10.61	3.88
Khairpur	1.36	0.79	5.00	0.05	2.00	18.1	2.45	1.00	4.60	4.00
Jacobabad	0.94	1.41	2.95	2.23	4.75	10.4	3.98	0.37	4.73	1.08
Larkana	1.68	0.76	4.84	1.68	3.59	9.04	2.04	1.99	4.53	3.88
Nawabshah	2.28	2.29	6.82	2.02	8.13	15.7	1.07	2.87	8.57	4.74

Source, Pakistan metrological Department University Road, Karachi

(4) Kamber is a developing city of Sindh, which steps forward to the development, with 326512 populations the density of population 144.5 persons per sq: kilometer. There are so many users of refrigerators and air conditioners. A part from this atmosphere above the region is usually disturbed by smoke of the transportation and bric-klins. Kamber is a rice productive district of the Sindh. During the seeding of paddy for growing, farmers are using the fire for the purpose of ash to penetrate the roots of paddy in soil easily, consequently, due to the fire in the agricultural fields, the region became heat-up and temperature may rise.

4. Conclusion

Kamber is the fourth the hottest region of the Sindh subsequent to Jacobabad, Nawabshah and Larkana. Maximum temperature of Kamber is 124.88^0F recorded in July 2002. The region is located at the foothills of Khirthar mountain range, so the wind from the western side can not affects directly on the region. *Khuzdar* and *Kalat* districts are the western borders of the region positioned at Balochistan plateau. *Khairthar* mountain range crosses the region, where the temperature of summer season is 96.62^0F recorded in July 2002 at the top of Dog's Grave. The reason of low temperature is similar taluka is high peak of the mountain that is 2065 meters above sea level, but due to lack of facilities people can not avail from this mild temperature. Government should make a hill station at Dog's grave to entertain the local inhabitant.

Due to high unemployment ratio in the district people want to do private jobs and business like vehicle driving and business of Brick- Kiln. Both factors take major responsibilities for climatic change in the region.

Due to lack of precipitation, the vegetation is not found everywhere, but vegetation of the region is not functional outstanding to low rate of transpiration and its short leaves. The agriculture of Kamber is facing to agriculture drought since last seven years due to shortage of canal water and rainwater. High temperature is recorded here, therefore climate kept its negative impacts on the soils especially in the Western direction. *Nai Gaj* is situated in the western side of Kamber; this is the largest rill (Nai) of Sindh coming from Balochistan plateau. Water of *Nai Gaj* is sinuous in *Kenjhgar* Lake situated in *Dadu* district. If the water of this largest Nai may collect in the region (small Water Reserve Dam) the water table of the region may raise and the water will be used for multi purpose i.e. drinking and agriculture purpose also. In focus area, Oil and Gas (Pakistan Petroleum Limited) reserve fields are already established, since 2004. Oil and Gas companies are working under China and Pakistani co-ordinations. If Pakistan Petroleum Limited Company (PPL), Sindh Government and Local government of Kamber-Shahdadkot district want to assistant of inhabitants, that they can mange easily.

Canal system in the region is not seemed every where. Network of canal system in eastern side is found after distance of two miles only, similarly western side required a close network of canal system, but there is no any canal system. A minor canal (*Noor Wah)* ends near the Region. If *Noor Wah* canal may extend at the foot hills of Khirthar Mountain, the unfertile soils may convert in fertile soils.

References

Anwar, M. M., (2004) Modern Physical Geography White rose publishers, Urdu Bazaar Lahore, Pakistan.107 Pp.

Brick–Kiln – Union – Kamber - Shahdadkot and Larkana Districts July (2005).

Chandio, N.H., (2004) Climatic Deterioration and its Causes: A case study of Larkana District. Scientific Sindh, Shah Abdul Latif University Khairpur, Sindh, vol. (**11**): 110 Pp.

Khan, F. K. A., (1998) Geography of Pakistan (Environment of Pakistan) Oxford University press. Karachi, Lahore, Islamabad. Eighth edition. 138-145.

Khan, F. K. A., (1998) Geography of Pakistan (environment of Pakistan) Oxford University press. Karachi, Lahore, Islamabad. Eighth edition.12 Pp.

Khan, J.A., (1993) The climate of Pakistan, first edition may Rehbar publishers, new Urdu, Bazaar, Karachi, 52 Pp.

Mangi, A.A., (2005) Some studies of the Physiochemical and biological properties of the soil of Taluka Ratodero, District Larkana, Sindh Pakistan: Pakistan Journal of Biological science 8 (**1**): 156-159 Asian Network for scientific information.56 Pp.

Mangi, A. A., (2005) Some studies of the Physiochemical and biological properties of the soil of Taluka Ratodero, District Larkana, Sindh Pakistan: Pakistan Journal of Biological Science 8 (**1**): 156-159.

Malik, T. A., (2004) Text book of Botany (Plant Physiology Element of Ecology) for degree classes, Carven Book House 394Pp.

Mushtaque-ur-Rehman (1975) Geography of Sindh Province Pakistan. Geographer Association, Karachi 8 Pp.

Oxford Atlas for Pakistan. (1998) Oxford University Presses 82 Pp.

Patrick S. (1993) Secondary Geography. FEP International (Pvt.) Ltd. Pakistan New edition 85-86.

Physical Geography. (1999) National Book Foundation Islamabad. 371Pp.

Qureshi, K.U., (1991) Pakistan Geography National Book service Lahore March 13Pp.