



CLIMATE CHANGE:- SUSTAINABILITY OF AGRICULTURE & ITS IMPLICATION FOR AGRICULTURAL GROWTH IN PUNJAB (A GEOGRAPHICAL ANALYSIS)

Jagseer Singh

Geography G.S.S.S Mana Singh Wala, Ferozepur (Punjab)

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ABSTRACT

Climate is a critical factor that determines the habitability of a place. Determining the climate of an area in a need to recognise and to consider the climate parameters such as minimum and maximum of temperature, precipitation humidity etc. Thus, climate change is a dynamic phenomenon and is most evidently visible in the phenomenon of Global warming. Global warming is the increase in the average measured temperature of the atmosphere near the earth's surface. The temperature at or near the surface of the earth is determined by the amount of sunlight the earth receives and reflects, retention of heat by the atmosphere and evaporation and condensation of water vapour.

Recently agro-climatic Sustainability assessment is gaining weightage as an important basis for Sustainable agricultural development planning. Malwa region is a potential region which has great opportunity of agricultural development through systematic appraisal of its natural resources.

The present study is essentially a resource based planning interms of techno-agro-climatic condition with emphasis on maximization of productive efficiency of available resources by the use of appropriate technology. At last the agro-climate regional planning presented for the sustainable development of the Agriculture in the Punjab state.

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INTRODUCTION

In India food security to its inhabitants is one of the prime objective of the present development goal. India vision 2020 says that to reduce food insecurity and poverty. India will have to sustain an agricultural growth rate of 4.0-4.5%. Although, the green revolution since 1960s gave major boost in agricultural production. Yet till the end of eleventh five year plan it is observed that productivity of many of the crops still remains low and thus failed to achieve the targeted growth. Punjab is a potential region but still suffers from low productivity in some areas and yield of many crops despite technological innovation during and post green revolution periods. A wide Variety of physico-climatic factors create a conducive environment for agricultural operation. Among those soil, water and climate are the basic prerequisite for the survival of all the vegetation especially agricultural crops. Because the role of thermal energy and moisture are crucial in the determination of crop selection and its distribution. The accurate climate information of a particular area helps to determine suitable cropping pattern for better crop yields to secure food security for people (Singh and Singh, 2011). Similarly, physico-climate conditions of Punjab have also a broad control on the distribution of vegetation as well as agricultural crops.

The interactions of these elements are studied in agro-climatology which deals with the study of crop distribution and production in relation to physiography, soil and climatic factors (Singh and Sinha, 2000)

Recently agro-climatic suitability assessment is gaining weight age as an important basis for sustainable agricultural development planning. Soil and climate based agro-climatic suitability analysis enables to identify areas with permutation of homogeneous climatic and soil condition (Sarkar, 2008)

Agro-climatic regional planning for sustainable agricultural development is being of great concern in recent developmental studies. The government planners, policymakers and others have drawn more emphasis on regionalization of agriculture on the basis of broad natural resources, existing cropping pattern and other related factors to make strategy for development planning. Overlooking the problems of the study region there is an urgent need to make a strategy for sustainable agricultural development which should be economically viable, environmentally sound and socially acceptable.

Objectives

The major objectives of the present study are:-

- To study the characteristics of each identified agro-climatic region along with major crops grown within

***Corresponding author: Jagseer Singh**

Geography G.S.S.S Mana Singh Wala, Ferozepur (Punjab)

each region in terms of areal coverage and production of each crops.

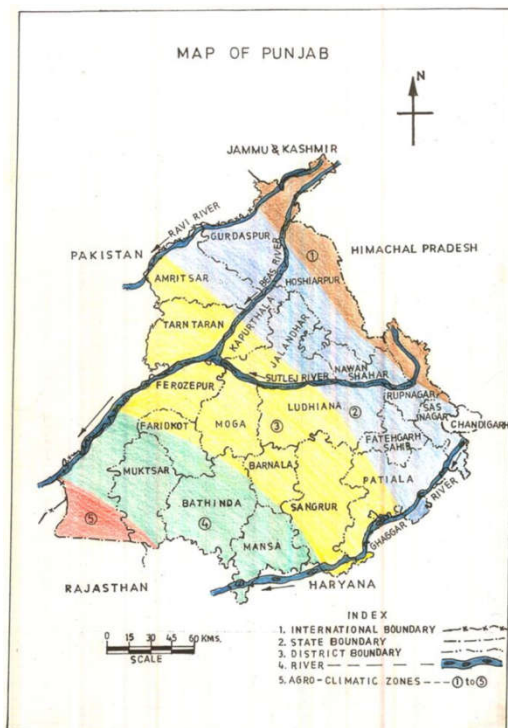
- To suggest agro-climatic regional planning for sustainable agricultural development in every district of Punjab.
- To work for protecting and promoting healthy natural environment through various action programmes an environment awareness.
- To delineate the agro-climatic region on the basis of prevailing physiography, soil and moisture adequacy of different districts of Punjab.

DATA AND METHODOLOGY

The core of the present research paper is delineations of agro-climatic region on the basis of physiography, soil, climate and existing cropping pattern of Punjab. The required data of climatic elements like rainfall, temperature have been obtained from the Director, IMD, Chandigarh.

The agro-climatic regional variation in areal coverage and production of dominating crops are discussed taking the average of 10 years data. For delineation of agro-climatic regions each parameter has been separately mapped and by overlapping these maps with minor adjustments five climatic regions have been identified. At last the agro-climatic regional planning is presented for the sustainable development of Punjab.

The present study is based on secondary data. These secondary data were collected from published and unpublished documents of Government like water resources department, agricultural department and metrological department of Punjab.



Study area

The State of Punjab is part of the northern fertile plains. The Punjab area comprises the districts and cities of the state. The name Punjab is supposed to be derived from the five rivers that follow through this region. The region of Punjab was part of the Indus valley civilization.

Punjab state is a well defined Geographical unit of the five rivers. It lies between 29°55'36" and 31°10'58" North latitudes and 73°52'33" and 75°09'19" East longitudes. The Punjab state has total Geographical area of 5.03 million hectares out of which 4.20 million hectares is under cultivation (about 83%)

Punjab is predominantly an agrarian state. According to data collecting of climate change and environment assessment studies of world Bank experts, between 2011 through 2016. Punjab has made some of the fastest progress in addressing its environmental quality in the Punjab state. Global warming, climate change & land degradation is a major challenge and opportunity for Punjab state.

Environmental issues are one of the primary causes of disease, health issues & long term livelihood impact for Punjab state. The agricultural productivity in the same districts of Punjab State remain limited due to un-conductive environment and aberrant weather conditions.

RESULT AND DISCUSSION

Physio-climatic conditions - Punjab is situated in the North-Eastern part of India. The Punjab climate is determined by the extreme hot and extreme cold conditions. The region lying near the foothills of Shivalik (Himalayas) receive heavy rainfall whereas the region lying at a distant from the hills, the scanty and the temperature is high.

Punjab climate comprises of three seasons. They are the summer months that spans from mid April to the end of June. The rainy season in Punjab is experienced during the months of early December to the end of February. The transitional season in Punjab are the post monsoon season and the post winter season.

Summer in Punjab actually commences from mid April. But the temperature starts rising from February onwards. Generally, the rainy season in Punjab begin in the first weeks of July. It ranges from 250mm to 1000mm. The agriculture of the state higher depends on the rains. The monsoon is brought by the monsoonal winds blowing over the Bay of Bengal. The winter season in Punjab is mostly experienced in the month of January, when the temperature falls to 5 degree in the night and it is around 12 degree in the morning.

The post monsoonal transition season remains quite fair and dry. In the past winter transitional season, hail storms and brief showers occur which causes damage to the crops. During the end of the March, the wind becomes dry, the Punjab climate has been a great factor in contributing to the economy of the state.

Impact of Climate change condition on Agriculture

Punjab is predominantly an agrarian state where about 63% of population lives in rural area and is dependent on farming. But climate change have serious effects on agricultural production and productivity in the state. Most of crops are decreasing in their area due to climate change and decrease in water availability. Quality of water & crops are also deteriorating. Increase in temperature will increase fertilizer requirement for the same volume of production and results in high green house gases emissions.

The role of agricultural sector in the state's economy is about 70-80 percent of the Net state domestic product popularly known as "state income". But due to uncertain behavior of

monsoon in the state, agricultural production and employment have been fluctuating year to year.

Agro-climatic region of Punjab

In the present study, delineation of (ACR) is made on the basis of the three important natural determinants of cropping pattern i.e soil, physiography and climate.

Agro-Climatic Region of Punjab

Sr.No	Agro-Climatic region	District
1	Sab-Mountain Undulating region	Gurdaspur, Hoshiarpur, Mohali,
2	Undulating region	Nawanshahr, Ropar, Amritsar, Fatehgarh, Kapurthala
3.	Central plain region	Ludhiana, Patiala, Tarn Tarn, Faridkot
4.	Western Plain Region	Ferozepur, Barnala, Bhatinda
5	Western region	Mansa, Muktsar, Sangrur

- **Sub-mountain undulating region-** The region extends along the eastern borders of the state and is 10-20km in width except in Gurdaspur district where it is much wider. This region covers nearly 4800sq. kilometers which is about 9.5% of the total area of the state.
- **Undulating plain region-** This narrow and traditional region runs parallel to the sub-mountain undulating region and is 15-30 kilometers in width. This region covers about 4600sq. kilometers of land which represents about 9% area of Punjab.
- **Central plain region-** This region 70-80 kilometers in width, cuts through the state from north-west to southeast. The region covers 18000sq. km which represents about 36% of the total area of Punjab.
- **Western Plain Region:-** This region lies between the central flat plain on the east and the plain with sand dunes in the extreme west. it covered about 9500 sq.km representing nearly 19% area of the state.
- **Western Region:-** This region lies in the extreme south-west covering nearly 10,000 sq km representing nearly 20% area of Punjab.
- **Flood plain region (bet):-** This region has four separate components- The Ghaggar, The Satluj, The Beas and The Ravi flood plains. The flood plain are locally known as bet. Area Covered by the flood plains in about 3500 sq. km which is about 7% of the total area of Punjab.

Agro-Climatic regional planning for sustainable agricultural development:- On the basis of the above consideration here an attempt has been made to highlight the main problems associated with low crop yield and productivity and thus planning for agricultural development in each agro-climatic region of the study area. In the study region due to high density of rural populations and favourable agro-climatic conditions the planning strategy is initially based on

agricultural development commensuration with rural development.

Planning for sub mountain Undulating Region:- In SMUR lying in the northern part of the study region, heavy rainfall and occurrence of frequent flood are the main problems due to high rainfall in foothill of Shivalik region. This region in the Border areas of Himachal Pradesh & Jammu Kashmir, Beas & Satluj rivers come from the shivalik carrying huge amount of rain water reappear in this region. In spite of good land potential and high moisture availability the two district, Gurdaspur & Hoshiarpur of this region are not performing well in agricultural development low rural literacy, Poor Agricultural infrastructure, low irrigation and poor road network are the main problems of this region.

The region is suffering from deficiency of Soil nutrients very low to low deficiency of zinc status and low to marginal deficiency in manganese and copper have been observed in this agro climatic region (Singh, et.al, 2008) so to maintain the soil health as well as crop health there is an urgent need of proper use of those micronutrients in soil. Poor infrastructural facilities and agricultural extension services have also been observed on development of infrastructural facilities may play better role in the development of farmers.

Planning For Undulating Plain Region: In north eastern part of the study region, all the three districts: Mohali (S.A.S Nagar) Nawanshahr & Ropar also effected by frequent floods in rainy season. Which cause major loss in soil quality and thus is crop yield also. Moreover the zinc status is found from low to very low due to use of chemical fertilizers besides these lack of agricultural mechanization agricultural infrastructural services, weak canal irrigation etc are the other major problems identified for its agricultural backwardness.

Therefore this region also requires intensive farming with use of modern agricultural devices, Organic manures like vermicompost and green manure are also proposed for improving the soil health.

Planning for central plain region: All these districts i.e. Amritsar, Fatehgarh, Sahib, Jalandhar, Kapurthala, Ludhiana, Patiala & Tarn Taran of this region show good development in agricultural sector. High literacy, improved irrigation facilities, high cropping intensity, better infrastructural service etc are the main indicators responsible for it.

High irrigation intensity & intensive cropping leads to continuous deterioration in soil health to sustain the soil health in future balanced use of fertilizers based on soil tests has been suggested. Organic farming increases the soil health. So organic manure is suggested to enhance the soil fertility.

Therefore to improve the ground water table in this region, promotion for surface irrigation is suggested to reduce the dependency on ground water.

Planning for western plain region: The western plain is quite different with other agro climatic region having typical physiography. In this region Ferozepur & Faridkot districts in more cultivated areas situated.

Canal and surface water sources of irrigation are popular in this region. Tube well irrigation is also available in this region. Small community tanks are also suggested for horticulture crops in such areas, micro irrigation schemes like sprinkler /drip irrigation should be promoted for judicious utilization of

water. Information related to local weather like rain fall, temperature, humidity etc. are significant for crop cultivation. Agro meteorological weather services should be localized at district level for local timely weather forecasting specially, during crop growing period. Fortunately an agro-meteorological service station has currently been working in district level of this region. This type of meteorological information centers should be established in other Agro-climatic region also.

Planning for western region:- This region is also known for malwa region of Punjab. In this region districts is Barnala, Bathinda, Moga, Mansa, Mukatsar & Sangrur. This Region is heartland of Punjab for Agro cultivation sector.

Canal and tube well of irrigation are popular in this region. This region show good development in agriculture sector, improved irrigation facilities, high cropping intensity, better infrastructural services etc.

High irrigation intensity and intensive cropping leads to continuous deterioration in soil health.

High uranium content in water found in this region so sustain the soil health in future balanced use of fertilizers based on soil test has been suggested.

Planning for flood plain region (Bet)

The flood plain seen here which are found due to repeated deposition of new alluvium during each flood is known as bet. This plain region is bounded by the Shiwalik range to the north-west. The Ravi and Sutlej rivers to the north-west and south-west respectively.

Agriculture is the mainstay of the region's economy and most of the plain is farmed, cereals, cotton, wheat and rice are grown. Most of the region is crisscrossed by irrigation canals.

In this region suggested to the meteorological information centers should be established in other Agro-climatic region also.

Suggestions

Some common suggestion for sustainable agricultural development of Punjab

Besides above mentioned specific agro climatic regional planning development in Punjab for sustainable agriculture production, Organic farming is one of the better way in agricultural irrigation practices. This type of agriculture focuses on "living soil" on optimization of the use of biological process and on avoiding the use of Synthetic chemical and fertilizer (Gautam and Bhardwaj, 2011). It is mainly based on crop rotation, use of crop residues, animal manure, legumes, green manures of farm organic wastes, bio-fertilizers, mechanical cultivation etc.

Small scale organic farming should be promoted for small land holdings and small farmers, organic manures are highly supportive to enrich soil fertility.

Therefore vermi-compost is gaining wide popularity to enriching soil organic matter. Decentralized production of organic manures at the village level and their marketing is suggested. Promotion of bio-fertilizers and bio-pesticides need more attention in future, bio-fertilization is the major source of nitrogen fixation in soil. Bacterial and fungal bio-fertilizers (Singh and Dabas, 2012) Help to improve plant growth,

increase crops field (Specially rice field) and enriches soil fertility by nitrogen fixation in soil. Therefore it is suggested that the bio-fertilizers should be distributed by providing basic information about them to the farmers with maximum subsidy.

The new technique of Ridge and furrow system of cultivation gives good yields and reduces 50% water requirement of paddy crops. It also help to maintain the environment by reducing emission of methane, improve soil texture, soil health and increase farmers profitability. So the demonstration cum training programs for small and marginal farmers should be organized at village level.

Promotion of agro-based industries will support the production of horticulture crops. Many steps have been taken for encouraging investment in food processing sector by rationalization of procedures, encouraging, entrepreneurs, strengthening of food processing units to focus on quality and brand building exercise at state level (SHM.2012). Punjab Development of Agro based mega food park at Ludhiana is the result of this scheme. Many schemes and funds are being provided under the Rastriya Krishi Vikash Yojana (RKVY) by State Government for the promotion of animal husbandary, fisheries, dairy and poultry farm development for the economic benefits of farmer (SAP,2007-12). These schemes are very effective for additional income of farmers but these are not properly implemented.

CONCLUSION

In this study, the major problems of all agro climatic region (ACR) are related with frequent occurrence of floods, water loggings, soil erosion, frequent submergence of agricultural land along the course of the river Ghagar & Beas in each flood year. Looking into the region wise nature of problems some remedial measures for agricultural development have been suggested. These some suggested remedial measures will be fruitful to some extent if not fully to solve the problems associated with agricultural development of the study area.

References

- Singh A and Singh B.N. (2011), Delineation of Agro-climatic Region in Punjab Notational Geographical Journal of India.
- Singh B.N and Sinha. K (2000) - Agro-climatic region of Bihar and their characteristics, *National Geographical Journal of India*, 46(1), 191.
- State Agricultural plan (SAP), Punjab, Rastriya Krishi Vikas Yojana, Eleventh five year plan (2007-2012) Dept. of Agriculture, Govt. of Punjab, Mohali, Chandigarh.
- State Horticulture Mission (SHM), Punjab Annual Action plan of 2010-11 to 2015-16 of state Horticulture mission, Punjab for the development of Horticulture in the state, 25.
- Strategic plan for extending green revolution (SPEGR) to Punjab (2011) The Project sponsored by Deptt. of Agri, Krishi Bhawan Punjab, Mohali, SAS Nagar, 23.
- Tiwari, K.N. and Tiwari, R (2011), Balanced fertilization - real benefits for Agricultural sustainability, *Kurukshetra - Better Agricultural practice*, 59(9),37.
- Broad Soil Groups (1987) planning Atlas of Punjab. Plate No. 12
- A need for live stock management as sustainability check, *Annals of the national Asso of Geographers India* XXXV(i),27.

General Review Report, 2010-11, Govt of Punjab, <http://goo.gl/images/avDJCO>
Economics Review, Economic Association, Punjab, <http://goo.gl/images/BsJinp>
Directorate of economics & Statistics, 21

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