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Irregularities in Rainfall and Its Role in Aggravating land Degradation

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Abstract – Desertification is a form of land degradation which is affecting many parts of the world. Climatic changes are considered as a major cause for the degradation of natural resources. Once the desertification is caused by natural or human causes it affects the productivity of the land. The spread of desert-like conditions is directly linked to the slow advancement of the desert towards the productive land by shifting dunes, winds, intense heating of land and also a scarcity of rainfall. Rainfall is an important phenomenon which is responsible for groundwater replenishment. In case of scarcity of rainfall, there will be a shortage of water which may cause drought in a region. Advancement of Thar towards the eastern side of Rajasthan is a big issue. Efforts are being made to identify the areas prone to desertification and restore the ecology before the condition becomes irreversible. According to a report published by ISRO in Desert Atlas of India, effects of desertification are now visible in Ajmer and Dausa districts. Since Desert is the end product of Desertification, identifying the problem at an early stage will be helpful. In this research paper, a straight line curve fit by Trend analysis method has been used to obtain an overall view of fluctuations in rainfall.

Keywords: Desertification, Climate Change, Fluctuations in Rainfall, Impact of Desertification, Changing Pattern of Land use.

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INTRODUCTION

Desertification is the biggest environmental challenge where the Arid, semi-arid and dry sub-humid land is affected primarily. Lessor fluctuating rainfall creates water scarcity in the dry areas and makes the land susceptible to the degrading condition called 'Desertification'. This problem is not only limited to the people living in deserts and surrounding areas but the problem is amplifying beyond that. Desert fringes are most likely to suffer. Multiple factors drive the forces to degrade the land but human activities and climatic changes are the most prominent. Global warming is a major cause behind the climatic changes, which contribute to desertification and leads to poor management of land. Breaking down of rocks and removal of blocks due to variation in temperature, erosion of fertile topsoil due to excess rainfall or human activities such as agriculture (ploughing, excess watering), deforestation, over-grazing etc. has been exacerbating the process.

Around 29.32% area of total geographical land in India is under desertification (during 2011-2013). Approximately 96.40 mha area of the country is undergoing land degradation. Jharkhand, Rajasthan, Delhi, Gujarat and Goa states have more than 50% of the area under desertification concerning the total geographical area of the country. Rajasthan is the largest state of India (area wise) with the highest area affected by high desertification. The most important process of land degradation in the state is wind erosion (44.41%), next comes vegetation degradation (7.62%) followed by water erosion (6.18%). The most significant process of desertification/ land degradation in the country is Water Erosion (10.98% in 2011-13 and 10.83% in 2003-05) which is caused mainly due to excess rainfall in few seasons and scarcity in others. Analysis of rainfall data of Ajmer district in Rajasthan shows clear fluctuations in monsoon. Rainfall plays an important role in the assessment of land degeneration. Variations between annual rainfall patterns pose a threat of aggravating dryland degradation. Less rainfall can be the cause of drought and rising temperature along with it can cause prolonged dryness. Excessive rainfall, on the other hand, is more dangerous as it causes surface run-off and soil erosion. Rainfall meets land at the soil surface. Desertification is a condition which exacerbates runoff and soil evaporation and decreases infiltration, the water-retaining capacity of soil and transpiration.

REVIEW OF LITERATURE

Desertification: causes, impacts and consequences- Roy.L.Behnke (2017)-Different authors possess different views on desertification. The opening chapters of the book talk about the late twentieth-century desertification crisis in the Sahel. The author considers it as a non-event and states that the droughts did not happen due to over-exploitation by the local people rather it was the result of global climatic changes brought about by changes in the composition of atmospheric greenhouse gases and particulates.

State of India's environment (2017): A Down To Earth Annul-

According to the studies, nearly 30% of India is facing desertification. Of India's total geographical area 328.72 million hectares, 96.40 mha is under desertification. 26 out of 29 Indian states have reported an increase in the area undergoing desertification in the past 10 years.

Major reasons include-

- Water erosion- responsible for 10.98 % desertification
- Vegetation degradation- contributes to 8.91% desertification
- Water erosion- 5.55% desertification is because of this factor
- Salinity- 1.12% desertification is due to this factor.
- Human made settlement- responsible for 0.69% desertification.
- Others- other factors contribute to 2.07% desertification.

Amal Kar, Ajai, R.S Dwivedi –

Along with climatic variations, human activities are equally responsible for the process of desertification. Arid, Semi-arid and dry sub-humid regions are prone to land degradation. Two important questions have been answered in this work-(i) the rates of processes that translocate the sediments/solutes and, hence, degrade a particular land, and (ii) the impact of such translocations on productive capacities of the land.

OBJECTIVES

The objectives of this research paper are to know the role of fluctuations of rainfall in Ajmer district of Rajasthan and its impact on land degradation. We can also forecast the amount of rainfall in the coming years with the help of trend analysis method which is used to analyze the data.

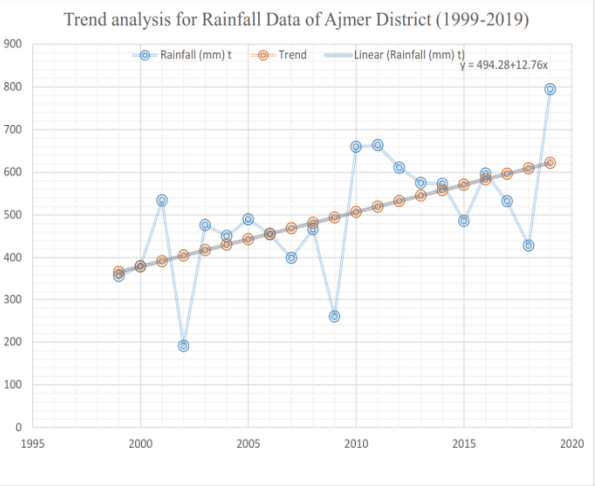
RESEARCH METHODOLOGY AND DATA COLLECTION

The data used for the analyses is secondary data collected from the secretariat, Ajmer district. The data is an accumulation of annual rainfall collected every year at 20 stations of Ajmer district. Cumulative data for the last 20 years (1999-2019) has been taken for the trend analysis by curve fitting method for a straight line. Principle of least squares is used for straight-line curve fitting. The straight-line trend between the given time series value is given by y= a+bt.

RESULTS AND DISCUSSION

Year(t)	rainfall (mm) (y)	x	x*y	x^2	Trend values
1999	357.43	-10	-3574.3	100	366.6238528
2000	379.58	-9	-3416.22	81	379.58
2001	534.14	-8	-4273.12	64	392.2
2002	190.93	-7	-1336.51	49	404.96
2003	476.5	-6	-2859	36	417.72
2004	450.8	-5	-2254	25	430.48
2005	489.96	-4	-1959.84	16	443.24
2006	454.96	-3	-1364.88	9	456
2007	399.44	-2	-798.88	4	468.76
2008	466.83	-1	-466.83	1	481.52
2009	259.95	0	0	0	494.28
2010	659.53	1	659.53	1	507.04
2011	663.42	2	1326.84	4	519.8
2012	610.89	3	1832.67	9	532.56
2013	575.29	4	2301.16	16	545.32
2014	572.69	5	2863.45	25	558.08
2015	485.81	6	2914.86	36	570.84
2016	596.87	7	4178.09	49	583.6
2017	532.23	8	4257.84	64	596.36
2018	428.46	9	3856.14	81	609.12
2019	794.3	10	7943	100	621.88
	10380.01	0	9830	770	

Table showing the calculation of Trend values for the data.



Graph showing trend analysis of Rainfall (1999-2019) in Ajmer District (Rajasthan)

RESULT AND DISCUSSION

By observing the Trend analysis we can state that there is a straight line trend which shows that there is an overall tendency of growth in Rainfall. The peaks in the graph, crest and trough show the excess and least rainfall in particular years. There is no cyclic component in the data and few seasonal changes are due to the geographical factors such as El-Nino and La- Nina.

Based on the results we can state that although there is a general trend of increase in rainfall data there are ample fluctuations which may be arising due to many reasons. These fluctuations are responsible for aggravating land degradation. We can also forecast rainfall.

SOLUTIONS

The major problem with excess rainfall is of runoff. It causes soil erosion and makes land unproductive. The water-retaining capacity of the soil is reduced. The groundwater table is not recharged and the problem intensifies. We need to stop deforestation and overgrazing by animals to protect fertile soil from getting washed away. Prevention is a lot more cost-effective than rehabilitation. The best way to control the problem is to avoid it.

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