RESEARCHERID
THOMSON REUTERS
[*Sanjay* et al, 5(11), Nov 2020]

ISSN : 2455-9679
Impact Factor : 3.805

ijrtsm

IJRTSM

INTERNATIONAL JOURNAL OF RECENT TECHNOLOGY SCIENCE & MANAGEMENT

"A REVIEW ON ESTIMATE THE VARIATION IN RAINFALL WITH RESPECT TO NORMAL, SURPLUS AND DROUGHT MONTHS IN A YEAR"

***Sanjay Kumar* [1], *Rajesh Kumar Jatav* [2], *Ranjeet Singh* [3]**

[1] *P.G. Scholar, Department Of Agriculture Engineering, P K University, Shivpuri, Madhya Pradesh, India*
[2] *Asst. Prof. Department Of Agriculture Engineering, P K University, Shivpuri, Madhya Pradesh, India*
[3] *Asst. Prof. Department Of Mechanical Engineering, P K University, Shivpuri, Madhya Pradesh, India*

ABSTRACT

India is the country of village and agriculture plays an important role for development of country. In our country, agriculture depends on the monsoons which has insufficient source of water. So the irrigation is used in agricultural field In Irrigation system, depending upon the soil type, water is provided to plant. In agriculture, two things are very important, first to get information of about the fertility of soil and second to measure humidity content in air. Nowadays, for irrigation, different techniques are available which are used to reduce the dependency of rain. And mostly this technique is driven by electrical power and on/off scheduling. In this technique, a temperature and humidity sensors are placed near the plant and near the module and gateway unit handles the sensor information and transmit data to the controller which in turns the control the flow of water through the pump.

Keyword: *electric power, humidity, soil, agriculture, sensors*

I. INTRODUCTION

The word "drought" is a relative term, and is defined differently by different regions and sources. Webster's Dictionary defines drought as "a long period of no rain"; though this is an inadequate definition for the water supply industry. Droughts are major natural disasters for many parts of world. Dry areas, where precipitation pattern is markedly seasonal, or is otherwise highly variable, are the most susceptible. Unlike most natural disasters, drought onset is difficult to identify. Meteorological and agricultural drought occurrences along time and space take place randomly and therefore their scientific quantifications are possible by the probabilistic methods. Drought is complex event which may impair social, economic, agricultural and other activities of society. It is a prolonged, abnormally dry period when there is shortage of water for normal needs (Sharma *et al.,* 1979). It is temporary, recurring natural disaster, which originates from the lack of precipitation and brings significant economic losses. It is a slow poison, no one knows when it creeps in, it can last any number of days and its severity cannot be predicted. The non-structural characteristic of drought impacts has certainly hindered the development of accurate, reliable, and timely estimates of severity and ultimately, the formulation of drought preparedness plans by most governments. The impacts of drought, like those of other hazards, can be reduced through mitigation and preparedness.

ISSN : 2455-9679
Impact Factor : 3.805

Drought is an extended period where water availability falls below the statistical requirements for a region. It is not a purely physical phenomenon, but rather interplays between natural water availability and human demands for water supply. There are two main kinds of drought definitions: conceptual and operational. Conceptually, it can be defined as "a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield." (National Drought Mitigation Center, 2006).

The Conceptual definitions may also be important in establishing drought policy. Operational definitions identify the beginning, end, spatial extent and severity of a drought. They are often region-specific and are based on scientific reasoning, which follows the analysis of certain amounts of hydro meteorological information (Smakhtin and Hughes., 2004). They are beneficial in developing drought policies, monitoring systems, mitigation strategies and preparedness plans. Operational definitions are formulated in terms of drought indices. It is not possible to avoid droughts. The success of drought preparedness and its impact, amongst the others, on how well the droughts are defined and drought characteristics quantified.

The defining of drought is difficult; it depends on differences in regions, needs, and disciplinary perspectives. Drought always starts with the lack of precipitation, but may (or may not, depending on how long and severe it is) affect soil moisture, streams, groundwater, ecosystems and human beings which reflect the perspectives of different sectors on water shortages. Drought means scarcity of water, which adversely affects various sectors of human society, e.g. agriculture, hydropower generation, water supply, industry (Kasa *et.al.*, 1999). A combination of droughts or sequence of droughts, and human activities may lead to desertification of vulnerable arid, semiarid and dry sub humid areas whereby soil structure and soil fertility are degraded and bio-productive resources decrease or disappear.

Types of drought

Droughts can be classified in four major categories:

Meteorological drought: It simply implies rainfall deficiency where the precipitation is reduced by more than 25%from normal in any given area. These are region specific, since deficiency of precipitation is highly variable from region to region.

Hydrological drought: These are associated with the deficiency of water on surface or subsurface due to shortfall in precipitation. Although all droughts have their origination from deficiency in precipitation, hydrological drought is mainly concerned about how this deficiency affects components of the hydrological system such as soil moisture, stream flow, ground water and reservoir levels etc.

Agricultural drought: This links various characteristics of meteorological or hydrological drought to agricultural impacts, focusing on precipitation shortages, differences between actual potential evapo-transpiration, soil, soil water deficits, and reduced ground water or reservoir levels. Plant water demand depends on prevailing weather conditions, biological characteristics of the specific plant, and its stage of growth and the physical and biological properties of the soil.

Socio-economic drought: It is associated with the demand and supply aspect of economic goods together with elements of meteorological, hydrological and agricultural drought. This type of drought mainly occurs when there the demand for an economic good exceeds its supply due to weather related shortfall in water supply.

ISSN : 2455-9679
Impact Factor : 3.805

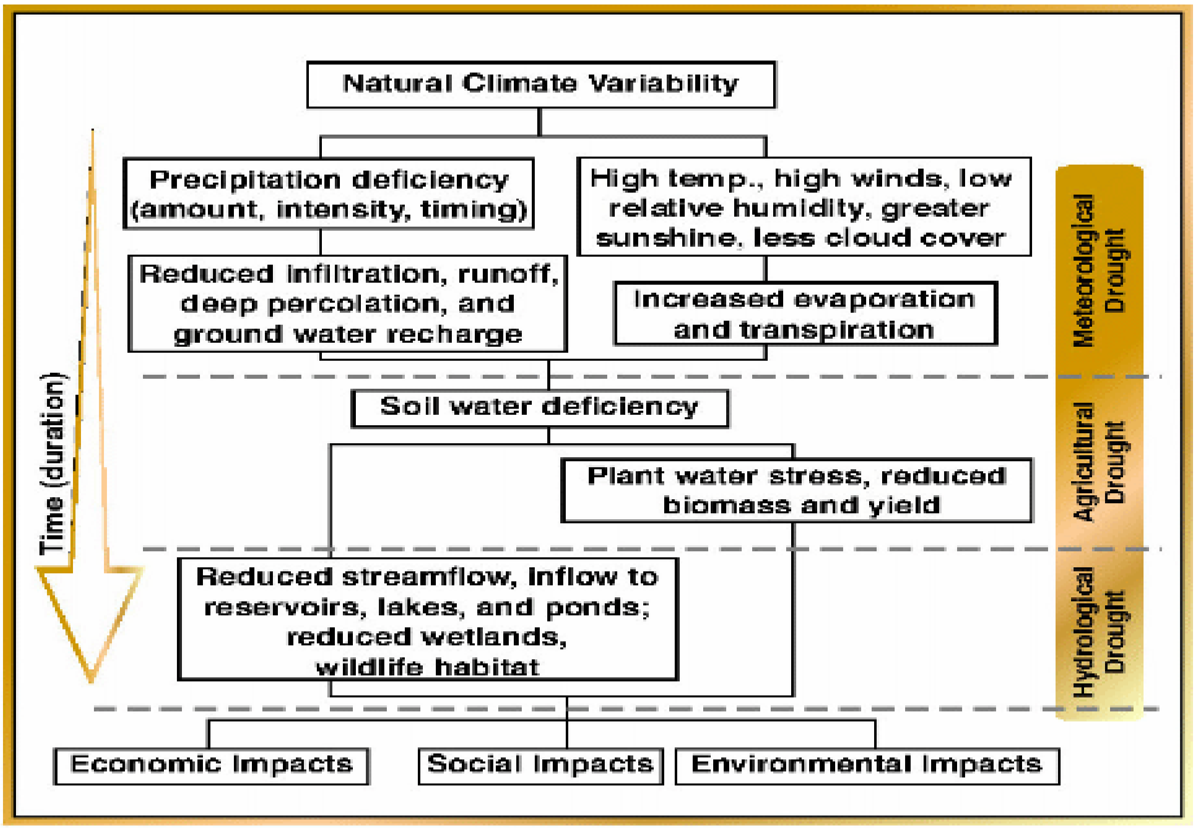

Fig. 1.1: Relationship between meteorological, hydrological and agricultural drought.
(Source: National Drought Mitigation Centre, *http://drought.unl.edu/whatis/concept.html*)

From the Fig.1.1 shows the types of drought and relation between meteorological, agricultural and hydrological drought. The meteorological drought occurs due to high temperature, high winds, low relative humidity, greater sunshine etc. which results increased evaporation and transpiration, reduced infiltration, runoff, deep percolation and ground water recharge. The agricultural and hydrological drought may be occur while meteorological drought occurs in an area.

II. REVIEW OF LITERATURE

Sharma *et.al.*, (1979) analyzed the drought using the definition of ‘ drought month’ as a month in which actual rainfall is less than 50 % of the average monthly rainfall and ‘drought year’ as the year receiving rainfall less than or equal to average rainfall minus standard deviation the data.
Dracup *et.al.*, (1980) Conducted the study of drought is difficult to monitor, and various indexes have been proposed to detect the drought as well as flood. The index previously widely used in the United States is the Palmer Drought Severity Index (PDSI). This is based on the anomalies of the supply and demand components in the water balance equation. In addition to precipitation, the PDSI also needs to use temperature and other local hydrological quantities
Beran *et.al.*, (1985) Analyzed 20 years rainfall data of Rehmankhera, Lucknow, Uttar Pradesh which showed that about 76% of yearly rain occurs during monsoon season and about 9.90% in *rabi* season. They pointed out that successful cultivation of crops in *rabi* season depends on conservation of adequate moisture in soil and irrigation facilities and stressed that data on weekly rainfall are more important than that of monthly and yearly rainfall for selecting suitable crops and their cultivars for cultivation.
Palmer *et.al.*, (1986) analyzed the 25 years (1956-80) rainfall data and indicated that Kota received average annual rainfall in monsoon seasons as 71,285, 235, and 177 mm in June, July, August and September restively. Crop planning on the basis of monthly and annual rainfall values may be inappropriate hence for assessing utilization of rainfall for crop planning weekly, monthly, seasonal and annual values at different probability levels 50-90% were computed by

ISSN : 2455-9679
Impact Factor : 3.805

Weibull's method. Result indicates that assured weekly rainfall of atleast 10mm at 70 percent chances is expected from 27th to 36th meteorological weeks (2nd July to 9th September). Hence dry sowing of Kharif crops in 26th week (end June) and choosing crop varieties with growing season of 11-14 weeks is most suitable for Kota division under rain fed condition.

Isaac and Singh, (1991) estimated that the adequacy of rainfall to meet the water requirement of crops and other evapotranspiration needs is a basic requirement of a region. Estimation of the magnitude and duration of water deficit and surplus rainfall probability plays an important for planning crop and water management practices and promoting the crop yield in dry land areas. The rainfall data of 15 years (1972-1986) of Allahabad district U.P. have been analyzed at the probability densities of 0.99, 0.95, 0.90……..0.01 for the return period of 1.0101, 1.0526……100 years for each month by using Gumbel's distribution of monthly, seasonal and annual rainfall at different percent chance.

Hayes *et.al.*, (1999) examined the drought in the southern plains and southwestern United States. The SPI can determine whether a specific year of an area is a flood or drought year when compared with historical records, but cannot identify if this is a flood or drought area in space.

Panu and Sharma, (2002) Analyzed that there has been considerable research on modeling various aspects of drought such as identification and prediction of its duration and severity. The term severity has various connotations in drought literature such as in hydrological drought, where it is defined as the cumulative shortage or the deficit sum with reference to a pre-specified truncation level. In meteorological drought, the severity has rather been defined in the form of indices such as the Palmer drought severity index. There exist a variety of techniques and methods to analyze the duration and severity of meteorological and hydrological droughts through probability characterization of low flows, time series methods, synthetic data generation, theory of runs, multiple regression, group theory, pattern recognition and neural network methods. Agricultural droughts are analyzed based on soil moisture modeling concepts with crop yield considerations and using multiple linear regression techniques. The prediction aspects of drought duration are developed better than the drought severity aspects. This latter need to be improved because information on drought severity is of paramount practical importance and forms an essential part of the design process of storage facilities for abatement of droughts. A major challenge of drought research is to develop suitable methods and techniques for forecasting the onset and termination points of droughts. An equally challenging task is the dissemination of drought research results for practical usage and wider applications.

Wang *et.al.*, (2004) designed a method to determine objectively the monsoon onset and retreat dates from seasonal cycles of perceptible water with certain criteria. A similar approach can be used to determine the start and end dates (and thus the duration and strength) of the flood and drought from seasonal cycles of WAP. For a given location or area, the daily precipitation data of the 26 years.

Smakhtin *et.al.*, (2004) Conducted an experiment to study the drought analysis is often region-specific and are based on scientific reasoning, which follows the analysis of certain amounts of hydro meteorological information. They are beneficial in developing drought policies, monitoring systems, mitigation strategies and preparedness plans. Operational definitions are formulated in terms of drought indices. It is not possible to avoid droughts. The success of drought preparedness and its impact, amongst the others, on how well the droughts are defined and drought characteristics quantified.

Sudhishri *et.al.*, (2004) Analyzed to study the weekly, monthly and yearly drought and comparing the different models for finding a suitable method for drought investigation by studying the water balance. The IMD method was adjudged more suitable for drought identification than the revised IMD method. Frequency analysis was done to predict weekly,

Bhasker *et.al.*, (2006) examined Normal, abnormal and drought months for the period of 1981-2005 of Udaipur region. Total 12 drought months were found during the rainy season in the duration of 1981-2005. Probability of occurrence of 6 drought months in a year was 96% and for 10 months was 4%.

Mendicino *et.al.*, (2006) Examined the analysis carried out on the study area pointed out an extremely intense drought phenomenon during the period 1996–2002, characterised by a reduction in precipitation together with higher evapotranspiration values and, as a consequence, by a broad decrease in surface and groundwater runoff. Using GIS technologies integrated with tele-metering network, hydrological databases and distributed water balance models, it allows the analysis of different aspects of the wider drought phenomenon. Specifically, meteorological, agricultural and hydrological aspects have been together considered in a common framework according to the features required by Web- GIS applications with the aim of using Internet as a diffusion tool of the spatially distributed information managed by the system. In this research, after a brief description of the drought watch system functionalities, the

ISSN : 2455-9679
Impact Factor : 3.805

capability of detecting severe and prolonged water deficit periods have been verified in two regions in southern Italy during the last decade, considering meteorological and satellite indices together with the principal water balance components.

Guttman *et.al.,* (2007) Estimated that the Palmer Drought Severity Index (PDSI) has been calculated for about 30 years as a means of providing a single measure of meteorological drought severity. It was intended to retrospectively look at wet and dry conditions using water balance techniques. The Standardized Precipitation Index (SPI) is a probability index that was developed to give a better representation of abnormal wetness and dryness than the Palmer indices. If different probability distributions and models are used to describe an observed series of precipitation, then different SPI values may be obtained. It is concluded that the Pearson Type III distribution is the "best" universal model, and that the reliability of the SPI is sample size dependent. It is also concluded that because of data limitations, SPIs with time scales longer than 24 months may be unreliable.

Reddy *et.al.,* (2008) study had been carried out for accounting agricultural drought and climatic shift based on climatic water balance method on seasonal basis in Bangalore region. Drought years were identified and their intensities were assessed by the help of departure of annual aridity indices. During the study period, Bangalore experienced 5 moderate (20%), 4 large (16%) and 4 severe (16%) drought years within a period of 25 years.

Batisani, (2011) Studied about drought is a reoccurring natural hazard in semi-arid regions. However, despite its regular occurrence disaster man-agers are still to develop concrete measures of mitigating and adapting to it. A first step to the development of such measures is the determination of the spatial drought vulnerability variability. The goal of this paper is to determine the spatio-temporal severity drought occurrence, which is vital for drought mitigation planning and resources allocation during responses. To reach this goal, the paper determines the probability of occurrence of different drought categories based on the Standardized Precipitation Index. The analysis identifies areas vulnerable to agricultural and hydrological droughts at various severity levels. The spatial variation in drought occurrence suggests that drought vulnerability maps should be availed to disaster planners for efficient resource allocation during responses and mitigation and development of adaptation measures.

Jakhar *et.al.,* (2011) the probability analysis of rainfall data revealed that the onset of monsoon is on 11th June. The probability distribution of seasonal rainfall indicated that the occurrence of 75% probable rainfall in *Kharif*, summer and *Rabi* season is 1095.5 mm, 91.4 mm and 83 mm respectively, whereas 1274.5 mm is the annual rainfall. It was forecasted that the occurrence of rainy days (<2.5 mm rainfall per day) is 70 days per annum.

Asrari *et.al.,* (2012) Estimated that the Standardized Precipitation Index (SPI) is a widely used drought index to provide good estimations of the intensity, magnitude and spatial extent of droughts. The objective of this study was to analyze the spatial pattern of drought by SPI index. In this research, the patterns of drought hazard in Iran are evaluated according to the data of 40 weather stations during 1967-2009. The influenced zone of each station was specified by the Thiessen method. Each of the vulnerability indicators were mapped and these as well as a final hazard map were classified into 5 hazard classes of drought: one, slight, moderate, severe and very severe. The final vulnerability map shows that severe hazard areas (43% of the country) which are observed in the west and eastern parts of country are much more widespread than areas under other hazard classes. Overall, approximately half of the country was determined to be under severe and very severe hazard classes for drought.

Yusof and Mean, (2012) reported that daily precipitation data of seventeen rainfall stations in Johor from the year of 1996 to 2005 are analyzed to determine the best fitted model in representing the drought events. Three distributions are tested, namely exponential distribution, gamma distribution and weibull distribution. A threshold of seventieth percentile is applied as a cut off point for the rainfall data to be characterized as drought event before the fitting of model. The parameters for each of the distribution are estimated using maximum likelihood estimation (MLE). The best fitted model is chosen based on the minimum error produced by the three goodness-of-fit (GOF) tests used, which are Akaike Information Criterion (AIC), Kolmogorov-Smirnov (KS) tests and Cramer-von-Mises (CVM). This study has determined that weibull distribution is the best fitted distribution to represent the drought events in Johor.

Shamsnia, (2014) Studied about drought is one of the most common natural events that have a great negative impact on agriculture and water resources. Recently, a new index for drought assessment and monitoring is presented called Reconnaissance Drought Index (RDI). RDI is calculated based on precipitation and potential evapotranspiration. In this study, indices of SPI (Standardized Precipitation Index) and RDI were calculated using 29 years meteorological data (1981-82 to 2009-2010) for five regions. The Results showed that dry and wet periods on short time scales, in addition

ISSN : 2455-9679
Impact Factor : 3.805

to precipitation depend on the evapotraspiration and the other weather parameters. It is recommended, in short time scales (1, 3 and 6 months) to be used the RDI index for drought assessment..

Masoudi *et.al.*, (2014) Analyzed that the Standardized Precipitation Index (SPI) is a widely used drought index to provide good estimations about the intensity, magnitude and spatial extent of droughts. The objective of this study was analyzing spatial pattern of drought by SPI index. In this paper, according to the data of 30 stations in Fars Province located in the southern Iran, during 1972-2006, the pattern of drought hazard are evaluated. Influenced zone of each station was specified by Thiessen method. It was attempted to make a new model of drought hazard using GIS. Three criteria for drought were studied and considered to define areas under vulnerability. Drought hazard criteria used in the present model include: maximum severity of drought in the period, trend of drought, and the maximum number of sequential arid years. Each of the vulnerability indicator map and also final hazard map are classified into 4 hazard classes of drought: slight, moderate, severe and very severe. The final drought vulnerability map was prepared by overlaying three criteria maps in the GIS and the final hazard classes were defined on the basis of hazard scores arrived at by using the geometric mean of the main indicators, deploying the new model. The final vulnerability map shows that moderate hazard areas (74% of the region) are much widespread than areas under severe hazard (26% of the region) which are observed in the northwest and eastern parts of the region.

III. CONCLUSION

For continuously increasing demand and decrease in supply of food necessities, it's important to rapid improvement in production of food technology. Agriculture is only the source to provide this. This is the important factor in human societies to growing and dynamic demand in food production. Agriculture plays the important role in the economy and development, like India. Due to lack of water and scarcity of land water result the decreasing volume of water on earth, the farmer use irrigation. Irrigation may be defined as the science of artificial application of water to the land or soil that means depending on the soil type, plant are to be provided with water.

REFERENCES

1. A lley W. M., (1984). The Palmer Drought Severity Index: Limitations and Assumptions. J. Clim. AppI. Meteor. 23:1100-1109.

2. Asrari E., Masoudi M. (2010). Hazard assessment of climate changes, a case study area: Fars Province, Iran. Int Pollut Res 29: 275-281.

3. Asrari E., Masoudi M. (2014). A New Methodology for Drought Vulnerability Assessment Using SPI (Standardized Precipitation Index: International Journal of Scientific Research in Knowledge, 2(9), pp. 425-432.

4. Asrari E., Masoudi M., Hakimi S.S. (2012). GIS overlay analysis for hazard assessment of drought in Iran using standardized precipitation index (SPI). J. Ecol. Field Biol. 35(4): 323-329.

5. Beran. M. A. & Rodier. J. A. (1985). Hvdrological aspects of drought. UNBSCO-WMO, Studies and Reports in Hvdrology no. 39, UNESCO, Paris, France.

6. Benson, C. and Clay E. (1998). The Impact of Drought on Sub-Saharan African Economies: A Preliminary Examination.

7. Batisani N., (2011). The Spatio-Temporal-Severity Dynamics of Drought in Botswana: Journal of Environmental Protection, 2011, 2, 803-816.

ISSN : 2455-9679
Impact Factor : 3.805

8. Berhanu F., Alemaw, Kileshye J. M., Onema, Love D. (2013). Regional Drought Severity Assessment at a Basin Scale in the Limpopo Drainage System: Journal of Water Resource and Protection, 2013, 5, 1110-1116.

9. Bhaskar, S. R., Bansal, A. K. & Singh, R. V. (2006). Rainfall Analysis For Drought Estimation Of Udaipur Region Journal Of Agricultural Engineering Volume: 43, Issue: 3.

10. Dracup J.A., Lee K.S., Paulson E.G Jr. (1980). On the definition of droughts. Water Resour Res 16: 297-302.

11. Guttman N.B. (1998). Comparing the Palmer drought index and the Standardized Precipitation Index. J Am Water Resour Assoc 34: 113-121.

12. Guttman N.B. (1999). Accepting the Standadized precipitation index: A calculation algorithm. Journal of the American water resources association. Vol. 35, No.2.

13. Guttman N.B., Wallis J.R., Hosking J.R.M. (1992). Spatial comparability of the Palmer Drought Severity Index. Water Resour Bull 28: 1111-1119.

14. Guttman, N. B., (2007). Sensitivity of the Palmer Hydrologic Drought Index. Water Resources Bull. 27:797.807.

15. Gore, P.G. and Ponkshe, A.S., (2004. Drought in Gujarat Districts and State as key indicators to all India droughts. Journal of Agrometerology, 6(1): 47-54.

16. Hayes M.J., Svoboda M.D., Wilhite D.A., Vanyarkho O.V. (1999). Monitoring the 1996 drought using the Standardized Precipitation Index. Bull Am Meteorol Soc 80: 429-438.

17. Issac, R.K. And Singh, S.J.(1991). *"*Eco-System Designing*",* International Conference Of SAARC Countries On Environment Management In Developing Countries, Rae-Barely, Pp. 23-24.

18. Jakhar, P., Gowda, H. C., Hombe, N. & Barman, B. S. (2011). Probability Analysis of Rainfall Characteristics of Semiliguda in Koraput, Orissa Indian Journal of Soil Conservation Volume: 39, Issue: 1.

19. Kassa, A. (1999). Drought Risk Monitoring for the Sudan using NDVI 1982-1993, University College London, 39 pp.

20. Masoudi M., Afrough E. (2014). Analyzing trends of precipitation for humid, normal and drought classes using Standardized Precipitation Index (SPI), a case of study: Fars Province, Iran. Int J AgriSci 1: 85-96.