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Microcosm of interlinking between agriculture, climate change, policies and regulations: a case study of Bundelkhand region

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Abstract
As per report of an International Energy Agency ,India emitted CO_2 to the tune of 2,299 million in 2018.Of the gross national emission 18% is contributed by Agriculture and livestock. Although the agricultural sector is liable for GHG emission led climatic change but it bears the brunt of the change to a far greater extent than other major contributors. India is a member of Food and Agriculture Organisation of the United Nations, International Plant Protection Convention was signed in 1952 by India and ratified on 9 June, 1952 so the intention is apparent to not fall behind in international regime of regulations and conventions. However the particular hardships faced in our country are peculiar and political will and the policies to surpass the same is paramount to overcome them.

Introduction

India's climatic and environmental conditions have significant importance in the sustainable development of the country. The environment, food security, health, economic activities and infrastructure are being adversely affected in the country due to climate change, which is proving to be harmful for the development of the country. According to Mitassi et al. 2010 some of the major causes of climate change in are unwanted rise in temperature, fire in forests, irregularity in rainfall patterns, drought, flood, wind intensity, untimely hail. In addition, a report by Manyatsi et al. 2010 states those rural environments are somewhat adapted to climate change, although poverty and lack of basic amenities to live here cannot be ignored, as about 40% of households Meals are dependent on aid. Similarly, another study conducted by Suchit Kumar Rai in 2014 on the effects of climate change on the central region of India in Bundelkhand drew India's attention to the catastrophic approach to climate change, as there is a continuous reduction in groundwater levels. There has been a problem of infertility of the soil due to which the drought is increasing day by day. Due to which farmers dependent on agriculture are forced to live in bad condition and are migrating to other means for their livelihood. Because of climate change, Jalaun and Jhansi districts under Bundelkhand have been facing severe drought for the last several decades. The farmers from this area have been seriously affected at the mental and economic level, the effect of which

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can be clearly seen on the agricultural productivity in the region (Nxumalo. 2012). Various facts related with the location like annual or seasonal rainfall and other climatic conditions play a key role to plane water harvesting pathways for successful agricultural operations (Kar, G. 2002). Along with this field preparation, seeding, type of irrigation, fertilizer utility and overall planning to showing are also very beneficial for effective crop production (Sharma, H.C., Chauhan, H.S. and Ram, S.1979). Moreover, climatic variability is the foremost issue influencing the agricultural productivity (Virmani, S.M.1994).

Further, studies conducted in 2004 by Parry, M.L., Rosenzig, C., Iglesias, A., Livmore, M. And Fisher, G. Indicate that a decrease in temperature coupled with rainfall uncertainties reduces crop production by 40%. The large population and limited resources with high frequency of extreme rainfall and weather events due to global warming are some of the major reason for seasonal migration due to various uncertainties.

The impact of climate change can clearly be seen that there was a possibility of a drought in the Bundelkhand region for about 16 years around the 19th century, which has tripled in the last few decades and about five drought years are there in the last 10 years has been seen. (Rai, SK, Behari, P., Satyapriya, A., Rai, K. And Aggarwal, R.K. 2012).

The perception on climate change depends mainly on the preparedness of the farmer, his management and the ability to deal with the adverse effects falling in that area. Its positive and prior study will definitely achieve the best possible avoidance of adverse effects of climate change (Grothmann .T. 2005). Climate change affects rural communities and their environment in various ways, due to which farmers experience various changes in the domestic and local agricultural systems (Deressa.T.2011).

A subsistence farmer includes many agricultural experiences throughout his life, including agricultural experiences, his accumulated knowledge of environmental change, climatic conditions, ecological experiences, etc. (Patt A, Schröter D.2008, Deressa.T.2011, Juana J, Kahaka Z, Okurut .F.2011).

To ensure the participation of farmers in providing information regarding climate change and its related risks, and with their cooperation, this information has been started to reach all the farmers (Maddison D. 2007, Amdu B, Ayehu A, Deressa A. 2013).

In order to overcome the adverse effects of climate change, it is essential for people and their families choose an alternative among a wide range of adaptation strategies, identifying useful options for adaptation, in response to exponential environmental changes. The use of differential adaptation strategies can prove to be helpful in optimizing climate change and variability for families within a geographic location. However, the factors influencing adaptation strategies are unknown; Therefore, the main objective of the study is to classify the factors affecting the adaptation strategies preferred by the families.

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A case study of Bundelkhand Region:
Methodology

This lookup work is a descriptive quantitative research carried out to identify factors influencing adaptation strategies adopted by communities in the drought-prone region of Uttar Pradesh, India. The targeted sites for this research are Jhansi and Jalaun districts of UP under Bundelkhand region. All the data has been collected by stratified random sampling method. Interviews were conducted with the heads of some farm houses in the district to collect data. Moreover, the head of the families were chosen as the primary source for collecting information at the grassroots level as the head of the family is a representative for them and makes almost all kinds of decisions related to resource allocation, production, marketing, and adaptation in traditional farming. (Polson Ra, Spencer DSC 199, Bryson DF 2002).

Study Area

Primary data has been collected from Jhansi and Jalaun districts of Bundelkhand. Bundelkhand is a typical semi-arid region covering 13 districts of southwestern Uttar Pradesh and northern Madhya Pradesh with a population of about 21 million. In addition, the region is also highly sensitive to the effects of climate change (warmer temperatures, less rainfall, and greater weather variability), with its dependence primarily on livestock and agriculture. The region is prone to frequent droughts due to climatic uncertainties, which significantly affect its agricultural yields. Jalaun and Jhansi districts lie below the Indo-Gangetic plain in the north, between the undivided Vindhyan mountain range which extends from south to northwest, (Fig. 1) which is located between 23020' 26020'N latitude and 78020' and 81040' longitude (NGSI, 1989). Further, climate change is responsible for a lot of uncertainty related with agriculture due to erratic rainfall in this particular region in. Whereas, the soil types of Jalaun and Jhansi district in Bundelkhand region are Rakar, Parva, Kabar, Mara, which are fertile soil and are good for crop production besides root crops.

Sampling Procedures and Sample Size

To carry out this study, data from both primary and secondary levels have been collected. To collect data, Jhansi and Jalaun districts of Bundelkhand region were selected. Under which about 80 houses from 8 different villages were included. The survey was carried out through personal interview using a questionnaire by using stratified random sampling method and cross-sectional method. The data thus obtained was analyzed through Microsoft Excel 2010, and S A T A 10.3 software. On the other hand, multinational logistic regression models have been used in analytical studies of factors influencing adaptation strategy measures adopted by communities to avoid adverse effects of climate change.

Results and discussion

The researcher found in the work that most of the family heads had great agricultural experience but they were aged. Therefore, they had no direct relationship with climate change adaptation strategies in the current context, as much labor is required in agriculture or allied activities; hence it is mainly dependent on health persons. The majority (67.3%) were married

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at the head of the family, most of whom had land rights. It is worth noting here that despite subsistence rain fed farming, it is a major source of income. From the analysis, more than half of the families headed by illiterates (55.6%) were found to have a difficult task understanding the new and advanced systems and technologies cultivated by these people. That's why Madison (2006) argues that higher education levels reduce the likelihood that no adaptation is taken.

Land Used for the Different Adaptation Strategies

Agriculture is the main occupation of the Bundelkhand region, the land used for farming here is much higher than other agricultural areas of the country. It is estimated that the average size of land holdings in Bundelkhand is high, with medium and large holdings in all the districts here, ranging from about 30% to 45%. Nevertheless, the percentage of land used for farming falls considerably due to a large portion of wastelands in areas like the intermediate region of Bundelkhand and the Bundelkhand upland. Despite being suitable for agriculture, the fertility of the land is constantly declining due to drought and lack of irrigation. Another factor that leads to decline in productivity is also the quality of irrigation, which is related to the amount of irrigation required for crops. Due to poor maintenance of canals available for irrigation in the region, erratic supply of water from dams and decrease in the ground water level due to the geographical location of the area are also the main reason for the decline of agribusiness. However, lack of knowledge of advanced farming technologies is also one of the major reasons for low productivity.

Bundelkhand mainly favours monsoon farming based on rainfall pattern and extent of irrigation, most of the land here is cultivated in the post-monsoon season. The area is cultivated several times a year but it does not exceed 30% of the total cultivated area. The intensity of the crop varies widely throughout the year. Bundelkhand is mainly a pulses growing area, most of the districts here mainly produce wheat. This is seen as against the average productivity of UP for cultivation of this category of crops.

Conclusions

In conclusion, it can be said that the communities surveyed have information about climate change but they cannot tell anything about the negative impact it has on using advanced systems in crops through their experiences. To increase productivity and solve agriculture related problems of the region by bringing flexibility in the crop cycle. It is seen that the people of the area are given minimum tillage, crop cycle, and intercropping, mulching, drought tolerant varieties under climate change adaptation measures. Growing etc. are trying. The financial condition of the families has suffered due to drought, due to which they are forced to live at very low levels of foot. Apart from these, the main tax which are important in influencing the choice of households when adapted to climate change include the age of the head of the family, the main income source of the family, the size and ownership of the land, being a member of social group, crop insurance scheme, loan And extension services that alertness, crops This includes training on diseases and their preventive measures, input cost (input-output ration), knowledge and awareness of climate change, etc. While the education level of the head of the family is not important in influencing household choices, it

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is important to adapt using adaptation strategies with their acquired agricultural experiences. It has been observed that access to extension services through knowledge and awareness proves helpful in adopting optimization strategies. In which farmer unions, organizations and cooperatives have an important role. Access to a sound extension services and training and appropriate guidance is very important in climate change and therefore analysis in communities. That's why it was discouraged from using traditional agriculture by weak extension service support; Therefore it was not a popular option.

Recommendations and Policies

In view of climate change, it seems very important to know the right way to manage and use some new technologies related to agriculture. At the same time it is necessary to develop adaptation responses in which the local community has a wider stake. They know which type of farming is compatible with our climate adaptation and how effective through the crop cycle or through other techniques. Cultivation can be done on which very little effect of climate change is read. In order to generate awareness in local communities, cooperative societies, farmers 'societies, farmers' unions etc. should also be alert so that through them awareness of climate change can reach farmers easily in time. To further upgrade agriculture, technologies have to be built keeping climate change in mind. Potential barriers to innovation include both the private and public sectors. Innovations in policy and institutions will be needed to build the necessary agricultural technologies and enable them to adapt their farming systems to the changing climate of farming communities. In this context, institutions and policies are important on many scales. Implications for the development, dissemination, and use of relevant technologies can surface to multiple levels from the stages of installation and innovation and affect access to agricultural innovations by vulnerable small shareholders.

India has the largest land area under irrigation (around 48%) and various agro-climatic conditions that support the cultivation of various crops. However, Indian agriculture is fundamentally dependent on rainfall / weather conditions.

The link between agriculture and the environment is slowly gaining recognition. Government policies, plans, and reforms have begun to promote eco-sustainability, with a focus on climate-friendly agriculture and appropriate adaptation strategies. For example, the National Mission on Sustainable Agriculture, one of the eight missions under India's National Action Plan on Climate Change, with a particular emphasis on the risks associated with climate change by formulating appropriate adaptation and mitigation strategies to sustainable agriculture. Wants to be addressed. On:

- Soil and water conservation.
- Water use efficiency.
- Soil Health Management.
- Development of rainfed areas.

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Other ongoing government schemes also address adaptation measures, including the following:

• National Initiative on Climate Change Agriculture, a network project of the Indian Council of Agricultural Research (ICAR) that aims to increase the resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration.

• Pradhan Mantri Krishi Irrigation Yojana, a national scheme aimed at achieving convergence of investment in irrigation at the field level, expanding cultivated areas under assured irrigation, improving agricultural water use efficiency to reduce water wastage And to encourage accurate adoption. Education and other water-saving technologies.

• District agricultural contingency plans, which are intended to manage severe weather events and are useful for implementing sustainability agricultural production systems in preparation for these events.

India also encourages post-harvest processing through various incentives.

To achieve the national goal of environment-protection, India's National Forest Policy 2018 also mentions that India must have at least one-third of its total land area under forest and tree cover.

M.C. Mehta vs. Union of India, AIR 1988 SCR (2) 538, wherein the issue of pollution of the Ganga river by the hazardous industries located on its banks was highlighted, the Hon'ble Supreme Court ordered the closure of a number of polluting tanneries near Kanpur.

The Hon'ble Supreme Court in the case of **TN Godavarman Thirumulpad vs. Union of India and Ors.**, W.P.(C) No. 202 of 1995, dealing with the issue of livelihood of forest dwellers in the Nilgiri region of Tamil Nadu being affected by the destruction of forests, passed a series of directions.

Ganesh Wood Products v. State of Himachal Pradesh, AIR 1996 SC 149 – this judgment expanded the definition of forest to its ordinary dictionary meaning, and imposed a ban on all non-forest activities on forest land without prior approval of the Central Government and directions were given to constitute Expert Committee in each State to identify forests and for movement and disposal of timber, and for constitution of a High Power Committee to deal with forest.

MC Mehta v. Kamal Nath, (1996) 1 SCC 38 is a case where there was an attempt to divert the flow of a river for augmenting facilities in a motel. The Supreme Court interfered by recognizing the **Public Trust Doctrine** and held that the State and its instrumentalities as trustees have a duty to protect and preserve natural resources such as rivers, lakes, forests, open spaces and other common property resources.

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MI Builders Pvt. Ltd. V. Radhey Shyam Sahu, AIR 1996 SC 2468, wherein also the Hon'ble Supreme Court applied **Public Trust Doctrine** and asked a city development authority to dismantle an underground market built beneath a garden of historical importance.

In **Vellore Citizens Welfare Forum v. UOI**, AIR 1996 SC 2718, the Supreme Court adopted the **Precautionary Principle** to check pollution of underground water caused by the leather industries in Tamil Nadu. The Hon'ble Court also opined the precautionary principle and the **Polluter Pays Principle** are part of the environmental law of the country.

In **Indian council for Enviro-Legal Action v. UOI**, AIR 1996 SC 1446, the Supreme Court reiterated and applied the principle to restore the environment of a village whose ecology had been destroyed by the sludge left out by the trial run of the industries permitted to produce the 'H' acid.

In **State of Himachal Pradesh v. Ganesh Wood Products**, AIR 1996 SC 149, the Supreme Court invalidated forest-based industry, recognizing the **Principle of Inter-Generational Equity** as being central to the conservation of forest resources and sustainable development.

The Hon'ble Supreme Court also noted in **Indian Council for Enviro-Legal Action v. Union of India (CRZ Notification case)**, (1996) 5 SCC 281 that the **Principle of Sustainable Development** would be violated if there were a substantial adverse ecological effect caused by industry.

1. The **Principle of Sustainable Development** was also recognized by the Supreme Court of India in the **M.C. Mehta v. Union of India (Taj Trapezium case)**, AIR 1997 SC 734.