

# Climate Change Impacts and Adaptation Practices followed by Small Farmers in Jamui, Bihar

Bihar has started to feel the effects and challenges of climate change as the frequency and intensity of extreme events like floods, rainfall, and drought have increased. As agriculture is largely dependent on weather and climate and there is considerable uncertainty in forecast, little can be known as to how, when, where, and to what extent climate phenomenon will leave its impacts. The uncertainties inherent in predicting our future climate are threatening not only the sustainable developments of socio-economic activities, but also rendering the 74 % population whose livelihood is exclusively dependant on agriculture, completely helpless.

## Changing Climate Pattern: Season Creep

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As closely observed by the farmers in the Jamui district of Bihar, the major changes in the weather pattern are linked to rainfall essentially. Monsoon has witnessed a shift in its arrival and retreat. As per the observance by the elderlies of the village, the southwest monsoon used to hit South Bihar by mid June and last until October some 30 years back. From the past couple of years the monsoon downpours have remained centered on the months of July and August. Nevertheless, this pattern too remains erratic and no statement pertaining rainfall can be given with conviction. As shared by a farmer in Chedlahi village ( Gidhaur Block, Jamui district) , “the extended monsoon and the resultant excessive flooding in Katari river during October, has often rendered families in the village miss out Durga pooja fair; now, the river rarely floods”. The coordinator at one of the extension services in Khadigram, Jamui , commenting on the erratic pattern of rainfall remarked that earlier the state used to experience three seasons-summer , monsoon, and winter. As of now, it experiences only two, summers and winters, rainfall has no fixed time of occurrence, it prevails all the year round. The late arrival of monsoon has prolonged the drought period too. This coupled low intensity rainfall has negatively affected the soil moisture and water availability for irrigation.

While summer seasons are expanding, winters are getting warmer and shorter. The post deepawali cool breeze and less intense feel of sun have now shifted to December. Consequently, the average winter days have diminished and so has the certainty of rainfall during winters. Also witnessed has been a rise the population of mosquitoes and the consequent spread of vector-borne diseases like dengue and malaria.



## Water Stress

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The 150 households in Chedlahi village are highly dependent on the very few sources of irrigation available. Nakti River, which could have been a good source of irrigation if channelized, serves them no good at present. Other arrangements like lift irrigation, *chilka* and super- deep boring do not exist but are longed for. What actually meets their drinking, household, and irrigation requirement are 10 wells, 10 hand pumps, one check dam, one *ahar-pyne*. The rainfall dependent check-dam and *ahar-pyne* together irrigate around 300 *bigah* land out of the total 500 *bigah* agricultural land in the village. Digging of wells now take place at a depth of 40-50 feet, which some 2 decades back was restricted to 25 feet. Dry season in the month of May and June further makes wells go dry and tube wells go unfunctional.

In the absence of financial resources, community mobilization for strengthening water management seems unattainable. Government efforts for tiding water crises dates back to a decade (the last water conservation project was the check dam constructed in 2003) now with no prospective plans for solution.

## Soil Complexities

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While the soil in the hilly terrain of south Bihar is Laterite, characterized by high acidic content, the same is not so in the plains of south Bihar. The problem of the acidic nature of the soil combined with the erratic pattern of rainfall makes it prone to reduced soil moisture. Surface runoff due to hilly terrain further leads to soil loss. Therefore, soil quality and the geophysical location of the region had lead to the prevailing soil complexities. To tide over the acidic nature of soil, farmers have resorted to excessive use of fertilizer in their fields. What they see as a problem to the solution will lead forth to added complications in climate change context.

## Crop Management and Agricultural Practices

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Mixed Cropping exists with the following crops grown in the three cropping season. The table below gives a detail of the major crops planted in the three sowing season:

Table 1: Pattern of Mixed Cropping in Jamui

Major crops	Kharif	Rabi	Zaid
	Rice	Wheat	Maize
	<i>Kurthi</i> (horse gram), Vegetables	Gram	Moong

A switch over to System of Rice Intensification (SRI) has increased the dependence on water. In the event of reduced rainfall and irrigation facility, these expensive hybrid seeds serve no good to the farmers. Dependence on local seeds has become minimal, as its productivity is comparatively less. The traditional paddy varieties like *Sitadhaan* and *Basmati* are grown only due to their exception taste and scent. Application of chemical fertilizer and pesticides on farms is also increasing at a staggering high rate<sup>1</sup>. The reason one farmer gives to defend the increased use of chemicals on field is, “initially growing paddy on one *kattha* land produced 40 kilograms of rice, now it produces 120 kgs.”<sup>2</sup>

An important climate change impact as revealed by the farmers was the increase in the number of weeds in paddy fields. Initially the weeds would dissolve in the waterlogged paddy soil but now they need to be uprooted.

## Livestock

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Use for machine for agricultural purposes is minimal in the region and is centered mainly to the use of tractors. Nevertheless, this practice has shifted the focus of the farmers on keeping cattle mainly as milch animal rather than a draught one. The reason they cite is the rising expensive of upkeep to be born in uncertain weather pattern. When food for the family is difficult to arrange in a poor harvest, arranging fodder for the livestock becomes even more difficult. Additionally, the traditional practice among the local community of taking the entire herd of cattle to grazing ground in the north is no longer followed as its tiring and time consuming. Consequently, the community members have restricted the numbers of livestock from 100/household kept some 20 yrs back to manageable limits of 3-4/ household.

Though no climate change impacts in the form of new diseases have been witnessed on livestock, the farmers in Chedlahi village have switched over to crossbred cattle like Sahiwal, Jersey and Friesian, which give more milk compared to the local breeds (*pahadiya*). This clearly indicates a trend towards investing in opportunities in the dairy sector.

## Agricultural Adaptation

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Adaptation to the adverse effects of climate change is vital in order to reduce the impacts of climate change that are happening now and increase resilience to future impacts. At Jamui, these adaptation measures are a combination of traditional method of agriculture combined

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<sup>1</sup> Chemical fertilizer application rate 100 kg/ acre

<sup>2</sup> local unit of measure. One *kattha* = 1240 sq feet



with the innovative experiments at agricultural extension institute. Some of the adaptation practices followed by the farmers are:

1. *Digging small wells for family farm*: Lack of financial support by the government in certain blocks in Jamui and dearth of resources by the community has resulted in negligence in promoting water-harvesting/storage structure. A couple of them that do exist suffer in the wake of scanty rainfall. Farmers have taken upon themselves to dig wells that cost them a hefty sum of Rs 3 lakhs each.
2. *Creating an upland and down land water reservoir*: These structures have been established in Chandan block under NABARD project. A rainwater storage structure is built on  $\frac{1}{4}$ <sup>th</sup> part of the upland that irrigates short-duration rice along with other kharif crops. The down land also has a similar structure used for irrigating long-duration rice as well as Rabi crops.
3. *Upland and lowland cropping system*: In areas where upland and down land water reservoirs do not exist, upland and downland-cropping pattern is followed. Low-lying lands have water table just few inches below the surface. They also support standing water for quite some time. Crop varieties grown on lowland are those that require either good flooding or sufficient soil moisture, e.g., rice while water resilient crops, like pulses and sesame, are grown in upland having less soil moisture.
4. *Dry land paddy cultivation*: Few farmers in Sikandara block, Jamui district have come up with the technique of dryland farming of paddy. It involves ploughing the land thrice and after a light spell of rain shower or irrigation, the rice sapling is planted in the field. This technique reduces reliance on excessive water and prevents release of methane into the atmosphere too.
5. *Dung-coated rice*: Also followed by an innovative farmer in Sikandara block is the water-saving practice of sowing dung-coated rice. The practice involves ploughing a dry land, laying 2-3 rice seeds inside small dung-balls and planting each ball on that land.
6. *Seed Storage*: Huge earthen-drums called *kothi* and straw-drums called *kochar* are traditional storage-vessels that still exist in south Bihar. They store traditional local seeds varieties that prevent losses caused by insects, rodents, birds, mould, heat, and spillage.
7. *Minimum mechanization*: Rice crop is harvested with the help of sickle rather than harvester so that the paddy grain is cut along with the stalk. This practice provides easy fodder for livestock (dried stalk), thus reducing dependence on market.
8. *Fodder Storage*: The harvested fodder is sun dried, turning it into hay, and then stored as winter fodder inside a roof-top structure called machaan to ensure availability in case of poor rabi harvest.

9. *Fodder for increased milk production:* Feed made of rushed wheat-grain is fed to cattle for increasing milk productivity.

Other practices in for sustainable adaptation in agriculture being devised by agricultural extension services in Jamui district are as:

1. *Pit Plantation:* The acidic property of laterite soil found in Jamui district is countered by forming unique pits composed of slate lime +fermented cow dung+ Folidol (insecticide). These pits are made in the month of May so that termites and other pests are killed in the scorching heat. In each pit, one crop is planted that is usually a citrus plant. Organic fertilizers are most suitable for plants grown in these pits.
2. *Promoting zero tillage or no till agriculture:* No till is being promoted in growing wheat, paddy and pulses as it saves labour and fuel, increases organic matter, traps soil moisture and reduces pests infestation.
3. *Maintaining vermi compost units:* Large vermicompost units are maintained where the compost is dried and stored for promotion and distribution in Jamui.
4. *Building check-dam based irrigation system:* Experimental check dams are constructed along hill slopes to prevent soil erosion and divert and store water from hills towards the dam.
5. *Intake wells:* Well-designed intake–wells are also being promoted to divert and harness rainwater into wells.

## Conclusion

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The already draught and flood prone Bihar is all set to witness more complex situation in times to come, climate change being the reason for future complexities. Agriculture being highly dependent on climate factors needs to look into measures of adapting to these uncertainties. In this respect, both the farmers and extension services are making efforts, the former through experience on fields and the latter through experiments on fields. An effective coordination between them and cooperation from the government is the only tool to make agriculture survive through the rough weather.

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