

Climate Change Policy Paper III

Climate Change Adaptation in Arid Region of West Bengal



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The 'Western Tract' of West Bengal broadly lying between 21° 47' – 24° 15' N latitude and 85°49' W - 88° 2' East longitude covering 99 Community Development Blocks in 13 sub-divisions of Purulia, Bankura, Birbhum, entire Paschim Medinipur excluding Ghatal sub-division and Asansol and Durgapur sub-division of Burdwan District and occupying 28,379 sq.km. or 31.98 percent of the total area is identified as the 'drought prone' underdeveloped area of the state.

A close examination of per capita income, persons / families living below poverty level, agricultural productivity, cropping intensity, seasonal/permanent fallow indicate and justify that the area is undoubtedly undeveloped. The physical environment, particularly weather and climate, topography and soil are mainly accused and said to be responsible for the backwardness of this area.



Rainfall

Average annual rainfall is 1446.4 mm which varies from 1218.8 mm at Burrabazar in Purulia to 1704.0 mm at Pingla in Paschim Medinipur. Within 13 sub-divisions, the amount varies from 1316.3 mm at Purulia Sadar to 1636.0 mm at Kharagpur and the number of rainy days varies from 68 to 79. So, regarding the amount of rainfall and number of rainy days this region is not far behind many other regions / districts of the State. Coefficient of rainfall variability is around 16 per cent which is not a very high figure.

Water income and loss

Like other parts of the Indian sub-continent, this region also receives 75-80 per cent of the total annual rainfall during the four monsoon months i.e. between June and September. During other seasons the proportion is 3 per cent during winter (December - February), 8 - 12 per cent during hot weather period (March - May), and 8 - 9 per cent during the period of retreating monsoon (October - November).

Considering rainfall as water income and potential evapotranspiration as loss a balance sheet of the same of some selected meteorological stations of the region is presented in table 1.

TABLE 1

Sl. No.	Name of station	Average annual rainfall (mm)	Potential evapotranspiration (mm)	Amount of water deficit (mm)	Amount of water surplus (mm)
1	Nalhati	1443.9	1283.9	512.1	671.9
2	Suri	1462.1	1526.7	753.5	688.9
3	Susunia	1310.8	1590.6	872.3	592.5
4	Taldangra	1575.3	1357	590.9	809.2
5	Joypur	1443.1	1464.7	646.7	625.1
6	Hatwara	1307	1405.1	747.5	650.1
7	Asansol	1392.2	1468.2	714.5	639.2
8	Medinipur	1485.4	1571.5	707.6	631.5
9	Jhargram	1597.4	1341.4	575.6	831.6
10	Pingla	1704	1385.9	439.5	817.6



Drought proneness

As per criteria followed by the India Meteorological Department this region can not be termed as drought prone! But the tragedy lies with the slope of the undulating terrain and the underlying rock of the area which accelerate surface runoff and the soil type which is very poor in terms of its moisture holding capacity. So the drought proneness is not due to meager rainfall with high variability but due to poor moisture holding capacity of the soil in the back ground of undulating terrain.

Period of bright sunshine hours

The region receives longest period of bright sunshine hours in the State which ranges from 7 to 7.4 hours per day.

Dry and extreme weather

By virtue of its continental or interior location the western tract undoubtedly experiences a relatively dry and extreme weather condition compared to other parts of the State. This extremity is manifested by larger diurnal as well as annual range of temperature and low relative humidity.



Topography

Topographically the region is a part of Chotonagpur Plateau fringe and gradually rises from east to west. The terrain is undulating in character and dotted with residual hillocks or small hilly blocks, the largest and highest among these are Ajodhya Hills the highest point of which is located at 677 m. Towards east and south east it gradually merges with the Ganga plain. 30 and 50 meters contour may be considered as the limit of the region towards southeast and east respectively. This landmass has been dissected by a number of streams flowing from the west to east following the general slope of the land. The river valleys plunge in to the up lands leaving layers of younger sediments on the older alluvium and laterites.



Soil

Red and lateritic soil dominates the landscape and gradually merges with old alluvium towards east. Gravelly soils are also found in patches in the vicinity of the hills. In general the soils are thin, coarse grained, poor in organic matter and very poor in water holding capacity.

With this brief geographical background let us examine the current phenomenon 'climate change' within this zone and its surroundings along with the impact especially in the field of agriculture and adaptation strategies.



A study of the following weather and climatic elements, weather phenomena for a period of about 120 years since 1891 in phases reveals the following:

Rainfall

Bankura - (1891-1980) : A clear declining trend is noticed with cyclic oscillation. But during last 30 years (1976 - 2005) the station registered an increasing trend (Table-2)

Purulia - Increasing trend is noticed during last 30 years.

Suri - Increasing trend is also noticed during the period of last 30 years.

Medinipur - (1891- 1980) A slight increasing trend is noticed. But during last 30 years there has not been any significant change.

Table-2: Rainfall (mm) Analysis of two successive periods of 30 years each

Period	Bolpur (mm)	Siuri (mm)	Bankura (mm)	Purulia (mm)	Medinipur (mm)
1951-1980 (X)	1371.3	1354.7	1282.4	1310.7	1483.9
1981-2010 (Y)	1401.7	1499.5	1429.1	1324.0	1551.7
Y-X as% to X	2.2	10.7	11.4	1.0	4.6

During the last three decades this region registered a considerable increase in the amount of rainfall. It can therefore, be summarised that there is no threat of declining rainfall rather, it is increasing marginally.

The increased amount of rain usually comes in the form of heavy and very heavy downpour in association with the passage of depressions which causes flood in the lower stretches of the rivers.



Temperature

An analysis of mean daily temperature of some selected stations over Gangetic West Bengal from 1891 to 1970 shows an increasing trend between 0.2 °C to 0.7 °C. But after 1970, increasing trend in temperature is well marked. The daily minimum temperature is rising faster than the daily maximum temperature resulting in gradual reduction of diurnal range. Span and intensity of winters are also decreasing. Winter temperature has increased 0.4°C during the last 15 years ending in 2009 compared to the previous 15 years period and span of winter reduced by about a week during the same period. Intensity of winter is also decreasing. Frequency of warm spells during winter are becoming more frequent compared to the cold spells. In general winters are becoming warmer and drier.



Onset of Monsoon

Analysis of the dates of onset of monsoon for a period of last 106 years over Gangetic West Bengal reveals that the mean date of onset of monsoon over this region now stands on 13th June (previously it was 7th June). However, there has not been any substantial change in the date of withdrawal of monsoon. These observations, therefore, clearly indicate a gradual reduction in the span of monsoon over this region.

Frequency and tracks of storms and depressions

An analysis of the frequency of storms and depressions in the area within 80 E - 95 E and 10 N - 27 N for a period of 80 years (1891 - 1970) shows an increasing trend to the extent of 1.6 per annum. This is partially responsible for the increasing trend in rainfall over the coastal as well as western tract. The frequency of severe storms has further increased thereafter.



Frequency of drought

A study of drought for a period of 100 years (1901-2000) indicates that the Gangetic West Bengal experienced the phenomena for 7 years during the first 50 years period but the frequency increased to 12 during the second half of the last century. During the first decade of the current century the region also experienced two more drought years.

Recent change in weather condition

- Deposition of dew is decreasing.
- Erratic nature in weather behaviour is increasing.

- c. Typical seasonal character of weather is disappearing.
- d. Exceptional incidences are becoming the usual ones.
- e. Winter is becoming brief and mild with frequent warm spells in between.
- f. Summer is becoming longer.
- g. Variability of monsoon rain is on the rise with increasing incidences of partial break in one region and heavy rainfall in the other, causing partial droughts and floods.
- h. Post-monsoon weather is becoming too uncertain and variable.

Impact on agriculture

Impact of climate change on agriculture and allied sectors may be summarized as follows:

- a. Productivity of temperature-sensitive crops, especially Rabi crops are decreasing.
- b. Water scarcity is increasing.
- c. Incidences of pests and diseases are increasing.
- d. Problem of weeds are increasing.
- e. Reduction in soil fertility.
- f. Decomposition of organic material and fertilizer are becoming faster.



- g. Incidences of crop failure are increasing.
- h. Length of growing season of pre-kharif and kharif crops is increasing at the cost of the Rabi season.
- i. Decomposition of roots is being noticed.



Few suggestions for adaptation to cope with the situation especially in the field of agriculture in the back ground of terrain and soil are as follows:

- a. Taking up all possible measures to increase water resources and reserves at all levels taking the advantage of local relief.
- b. Water conservation measures to be adopted at all levels with the ultimate aim of minimizing the wastage of water as well as increase in irrigation potentials considering the nature of plots. Plot to plot water conservation and management to be done in the manner as shown in fig. 1&2. Taking the advantages of undulating terrain small and medium size reservoirs are to be created to arrest the surface runoff (Fig 3) and simultaneously the old and existing reservoirs are also to be re-excavated to increase the water resources. Take soil water conservation measures like infiltration ditch, semi circular bunds, stone bunding etc.

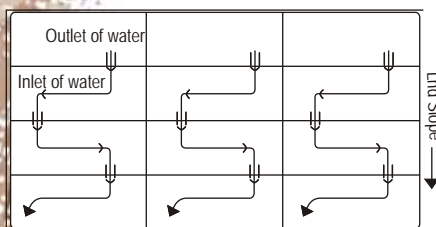


Fig 1

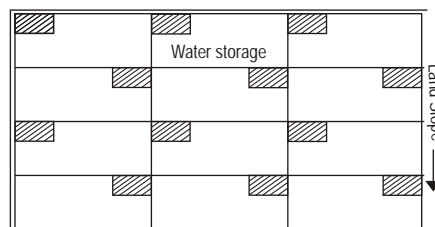


Fig 2

Gully
Plugging



Suggested strategy for Adaptation

Step
Pond



Ditch



Pond



Semi circular
bund



Stone Bunding



- c. Crop planning and variety selection to be done, keeping in view the long term changes of weather elements. Focus to be given on the stress tolerant local varieties of oilseeds, pulses and minor millets.
- d. Apparently so-called less productive western tract has a bright prospect of growing cotton specially in the areas unsuitable for rice cultivation during the kharif season. This will not only provide a scope for the state to put up its name in the list of cotton producing states but will also provide an opportunity to develop small and medium scale industrial units based on the locally produced cotton.
- e. Changes in the cropping pattern and cropping sequence if necessary. Focus to be given on sustainable agriculture techniques like relay cropping, mixed cropping, intercropping, using more organic matter into soil so that the moisture retention capacity increases, growing season extends.



- f. Dependency on a single livelihood option to be reduced by introducing livestock, perennial trees and other microenterprise options.

g. Change in the land-use pattern considering topography and soil depth and water availability of the area (Fig 4)

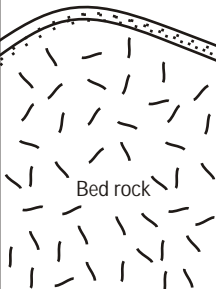
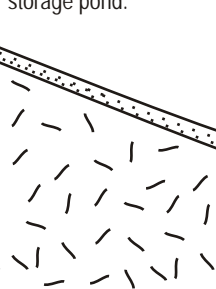
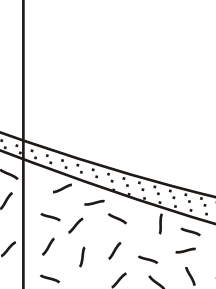
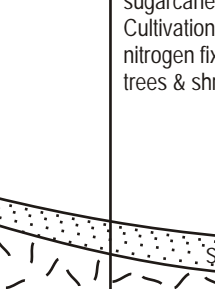
Forest species & grass	Forest species, bamboo, horticultural crops, maize & cotton	Agriculture & horticultural crop	Agricultural crops
Multipurpose trees, tall deep rooted grass, infiltration ditch and semi-circular bunds	Lemons, kaju nut, guava, sweet apple etc. cotton & maize. Pasture, water recharge and water storage pond.	Short duration paddy, pulses, ground nut, other oil seeds, cotton, guava, mabgi etc.	Medium duration paddy, wheat,vegetables, potato, sugarcane. Cultivation of nitrogen fixing trees & shrubs.
			
Slope 1 - 4 %	2 - 3 %	1 - 2 %	0 - 1 %
Tanrd (25 %)	Baid (25 %)	Kanali (35 %)	Soal (15 %)

Fig 4

- Close monitoring of weather elements and their effect on standing crops with a view to evolve and adopt appropriate agro-technique to bring the situation under control to the maximum possible extent.
- For each incidence of probable abnormal behaviour of weather, area - specific, crop- specific and time-specific contingency plans are to be prepared beforehand so that action can be initiated at the very outset.
- Awareness among the farming community and common man about the nature and extent of weather change with possible causes and impact.

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Regional Policy Action Platform on Climate Change

Climate change can be viewed as one of the most critical environmental problems to confront us as it is most immediately and inextricably linked to wellbeing, development and economic growth. Thus the solutions to it cannot be left to the confines of the environment but needs to seek clarity and consolidate its response relating the agendas and interests of the multiple constituencies.

Recognising the need for a coordinated proactive response to climate change, WWF-India has developed the concept of “Talking Solutions”, which is a process that builds a consolidated understanding, informing a strategic response from among the various key constituencies. As a part of this initiative, a Regional Policy Action Platform on Climate Change (RPAPCC) was formed in the state of West Bengal, India.

Papers in this series are:

1. Climate change adaptation in flood plain of West Bengal
2. Climate change adaptation in coastal region of West Bengal
3. Climate change adaptation in arid region of West Bengal

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