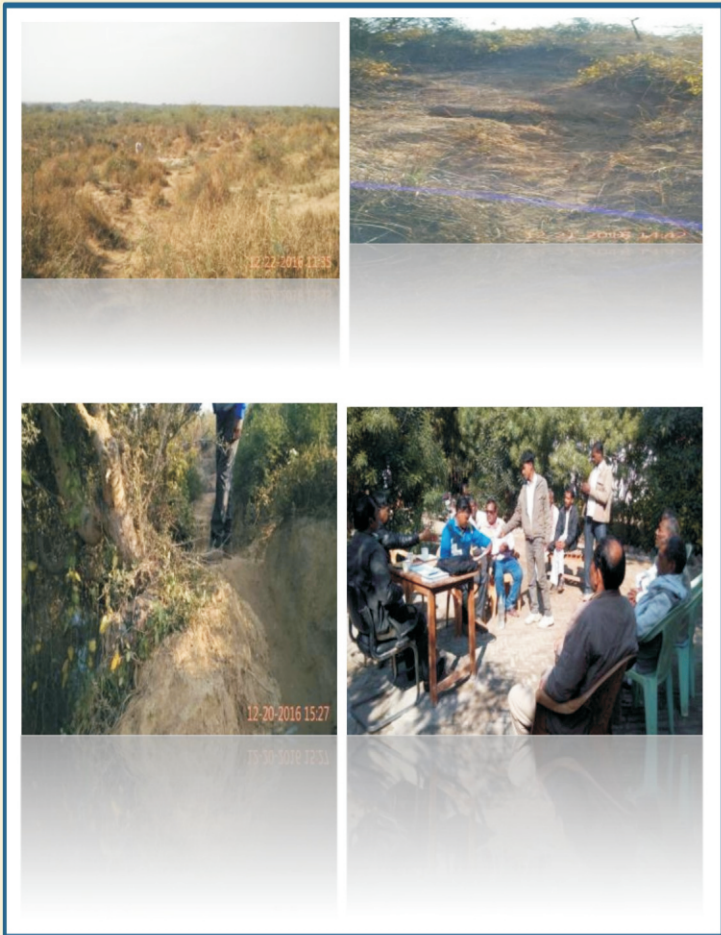




**DETAILED PROJECT REPORT  
ON  
ENHANCING CLIMATE RESILIENCE OF FORESTS AND ITS DEPENDEN  
COMMUNITIES IN TWO LANDSCAPES OF JHARKHAND**



**Submitted to:**  
Ministry of Environment, Forest &  
Climate Change  
Government of India



**Submitted on behalf of**  
Forest Department  
Government of Jharkhand



**Prepared By**  
NABARD Consultancy Services  
Ltd.

**VOLUME : I**

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## Abbreviations

CAMPA	Compensatory Afforestation Management Plan
CENVI	Composite Environmental Vulnerability Index
CSEVI	Composite Socio-Economic Vulnerability Index
CVI	Composite Vulnerability Index
DFO	Divisional Forest Officer
DPAP	Drought Prone Area Programme
ECVI	Economic Vulnerability Index
FSI	Forest Survey of India
GDI	Gender Development Index
GDP	Gross Domestic Product
GHG	Green House Gases
GIZ	German Development Cooperation
Gol	Government of India
HDI	Human Development Index
IISc	Indian Institute of Science
IMD	Indian Metrological Department
INRM	Integrated Natural Resource Management
IPCC	Inter Governmental Panel on Climate Change
IWMP	Integrated Watershed Management Programme
JFM	Joint Forest Management
LPG	Liquid Petroliaam Gas
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
Mha	Million Hectare
NABARD	National Bank for Agriculture and Rural Development
NAFCC	National Adaptation Fund on Climate Change
NAPCC	National Action Plan on Climate Change
NGO	Non Government Organization
NMSA	National Mission on Sustainable Agriculture
NTFP	Non Timber Forest Product
q ha <sup>-1</sup> °C	Quintal per Hectare per Degree

RH	Relative Humidity
RKVY	Rashtriya Krishi Vikas Yojana
SAPCC	State Action Plan on Climate Change
SFR	State of Forest Report
SLM	Sustainable Land Management
SMC	Soil and Moisture Conservation
Tmax	Maximum Temperature
TOF	Trees Out Side Forest
UNDP	United Nations Development Programme
UNFCCC	United Nations Frame work on Climate Change Conventions
VFPCs	Village Forest Protection Committees
WHS	Water Harvesting Structures
WRVI	Water Resources Vulnerability Index

## PROJECT SUMMARY

<b>Project Title :</b>	<b>Enhancing Climate Resilience of Forests and its Dependent Communities in Two Landscapes of Jharkhand</b>
<b>Project Objectives :</b>	The main objectives of the proposal are :
	To enhance capacities and providing support services for facilitating Adaptation
	To improve forest micro-climate through Soil and moisture conservation (SMC) & Water Harvesting (WH)
	To enhance gender sensitive and climate resilient livelihood systems
	To bring about small wood use-efficiency and alternative material use
	To bring about Energy use-efficiency and Alternative Energy use
<b>Project Sector :</b>	Forestry, Land development and Renewable energy
<b>Name of Executing Entity:</b>	Forest Department, Government of Jharkhand
<b>Beneficiaries:</b>	Mostly Tribal/ Marginalized farmers especially women approximately 10300
<b>Project Duration:</b>	4 years
<b>Start Date:</b>	2017
<b>End Date:</b>	2021
<b>Amount of Financing Requested:</b>	INR 24,99,50,000.00
<b>Project Location:</b>	48 villages of Patratu and Narayanpur landscapes
<b>State:</b>	Jharkhand
<b>District:</b>	Ramgarh, Jamtara
<b>Contact Details of Nodal Officer of the Executing Entity:</b>	<b>Addl. PCCF, CAMPA, Jharkhand</b> Van Bhawan, Doranda, Ranchi-834 002 (Department of Forest, Environment and Climate Change, Govt. of Jharkhand)
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## 1. PROJECT BACKGROUND

### 1.1 Project / Programme Background and Context:

- a) *Provide brief information on the problem the proposed project/programme is aiming to solve*

The impact of global warming is visible in Jharkhand. The extreme weather situations are very frequent in the State and have become a regular phenomenon from around the year 2005-06 with rains occurring in the month of February as well, causing large scale loss to life and property due to events like flood, thunderstorms and hailstorms. Forest fires have also been on a rise to the tune of 30 to 40% as observed by Remote Sensing agencies. Droughts have rendered the perennial streams go seasonal; rationing of drinking water has been initiated which is a powerful indicator of the seriousness of the phenomenon.

Impacts of climate change in India are projected to be severe. Water resources, forests, agriculture and human health are likely to be impacted due to shift in precipitation and change in average minimum and maximum temperatures. To prepare for climate change, long term persistent efforts will be required on both the adaptation and mitigation fronts. The international mitigation obligations are centred on the emission reduction for the developed countries. India, although not bound by mitigation commitments, has taken a pro-active stance by coming out with voluntary emission reduction vision for the country as well as prepared a forward looking adaptation plan for the country. Termed National Action Plan on Climate Change (NAPCC), the national adaptation strategies are guided by eight National missions. The NAPCC also sets the stage for the development of State Climate Change Action plans.

Extreme weather events in Jharkhand during 2008-2012

Event	Observation
Heat Waves	100 incidences in 2010
Highest temperature recorded	46.5° C in June 2010
Lowest temperature recorded	3.2°C in January, 2008
Highest rainfall recorded	338.1 mm in June 2008

Multiple simulations carried out by reputed national and international research institutions are analysed to quantify the impact of climate change. All the major climate change projects predict increase of rainfall in the State. Under A1B scenario, it is projected that by the end of this century, the number of rainy days will go up by at least 10 days, similarly B2 scenario predicts that the average rainfall in the State will rise by ~20%. The WORLDCLIM data (for A2B scenario) projects that the average temperature (both minimum and maximum) in all the districts will rise over time and both summer and winters will become hotter by 2080. The summer temperature will go up by a maximum of 2-3<sup>0</sup> C during 2020-2050 whereas average winter temperature will go up by 4.78-5.2<sup>0</sup> C during the same duration. Similarly, B2 scenario, too, predicts that on an average, Jharkhand will witness a temperature rise of 2.5-3.0<sup>0</sup> C by the year 2085.

The two landscapes in the two districts have been selected considering the differences in the vulnerability of different sectors in the proposed districts and the landscape as a whole. The proposal has been formulated to address the following challenges that have emerged in the targeted landscapes in the district of Ramgarh and Jamtara in the wake of climate change.

Some of challenges that climate change poses in respect of forests and people living on forest fringes can be roughly divided into two groups:

1. ***Biophysical impacts:***

- x ***Physiological effects on crops, pasture, forests and livestock:*** It has come clearly during meetings in the targeted area that farmers require more water to irrigate crops due to rising temperatures and losses in soil moisture. It has been observed by farmers and has been substantiated by the data that forest fires have been on the rise. It has been also noted that animals have moved out of their habitat more frequently than earlier and have increased incidences of man-animal conflicts. Animals are forced to come out in search of water during the peak of summers and have killed domesticated animals like cows, goats and poultry which are losses for the common people in the area.



- x ***Changes in land, soil and water resources:*** Reduced per-capita land due to increased population coupled with the competing land-use have forced people living on forest fringes to clear forest land or encroach for meeting the food requirement. This leads to conflict between the department and the people. Many perennial streams have become seasonal and water in the ponds/wells has been decreasing, thereby reducing the irrigation potential of the structures. Changes in the land-use further aggravate the problem and make people more vulnerable. All these are interlinked and have been found impacting each other. These changes have been detrimental for human society. People have been made to struggle for meeting the growing requirement.
- x ***Increased weed and pest challenges:*** It has been observed that weeds like Congress grass, Lantana and Eupotarium are progressing rather fast and covering more area under weed. Locals believe this to be due to change in the rain and temperature regime of the area. These weeds have been reducing the productivity potential by competing with the food crops.
- x ***Shifting of fire seasons and leaf shading timings:*** People observe that earlier forest fires would occur in the month of May and June but now there is a preponing of the same to April. This shifting may be one of the reasons for increased incidences of forest fire. Plants start shading leaves from February and these dry fast due to reduced moisture in the forest area- acting as a catalyst for forest fires. Secondly, human activity like collection of *Mahua* flowers in the traditional way also increases incidences of forest fires. People light fire for getting rid of the dry leaves which cover the *Mahua* flowers on the ground. Sometimes, these fires become uncontrollable and spread in the forest engulfing a large area and killing animals.

## 2. ***Socio-economic impacts:***

- x ***Decline in yields and production:*** Increase in frequency and severity of extreme weather events like heat wave (unexpected rise in temperature in summer months), hail storm (decreased frequency but increased severity) drastic decrease in pre-monsoon convectonal rainfall and cold wave/frost in winter

further restrict the agriculture productivity in the State. The poor agricultural productivity is ultimately reflected in the food deficiency prevailing in the State. The State Department of Agriculture has assessed that the food grain deficiency in the State is 14%, for other nutritional items like fruits, milk and meat, this deficiency is 69%, 43% and 35% respectively. For a State where a large population is poor, this deficiency is alarming as households are exposed to market forces to meet their nutritional demand. This has been mainly because of the decreasing yield of the crops and increase incidences of disease in crops.

- x **Reduced marginal GDP from agriculture:** Lack of irrigation facility is the major infrastructural bottleneck preventing the agricultural sector from performing to its full potential both in terms of food production as well as crop diversification. However, the expansion of area under irrigation in the State faces a number of techno-economic challenges. Maximum temperature which is increasing in Jharkhand has been found to have adverse effects on rice yield if it coincides with the flowering stages- a yield reduction of  $10.2 \text{ q ha}^{-1} \text{ }^{\circ}\text{C}^{-1}$  is possible. Increase in minimum temperature at grain filling stage is expected to have a positive effect on rice yield ( $2.7 \text{ q ha}^{-1} \text{ }^{\circ}\text{C}^{-1}$ ). Both the increasing trend of maximum temperature and decreasing trend of minimum temperature are apprehended to reduce the rice yield in particular and yield of most of the other *kharif* crops, in general. High rainfall at rice flowering stage has been found detrimental causing a yield reduction of up to  $7 \text{ q ha}^{-1}$  whereas at the grain filling stage, the high rainfall is beneficial causing yield increase up to  $6.3 \text{ q/ ha}$ . High evening RH at emergence-flowering stage can cause rice yield reduction (up to  $3 \text{ q ha}^{-1}$ ) while variation in radiation seems to have no effect on rice yield.
- x **Fluctuations in market prices:** Impact of the extreme events has been visible on the market as reduction in production and increase in demand causes price rise in general. Prices of some commodities have become unreasonably high in the recent past, causing unrest. This creates a situation where people have to produce more under more hostile conditions- a challenge that is hard to meet and requires additional infrastructure and adaptation to suit the growing requirement of food and other commodities.

- x **Increased number of people at risk of hunger and food insecurity:** Drought and flood both forces people to become more vulnerable to hunger and death. Jharkhand has been a food-deficient State and with the changes having impacts on the production and prices, people become more vulnerable. It has been observed that there have been increased incidences of drought in the recent past as depicted in table in the earlier section of the report. Drought and sudden flood cause losses of crop and life and increase vulnerability of the people living under such harsh conditions.

Event	Observation
Heat Waves	100 incidences in 2010
Highest temperature recorded	46.5° C in June 2010
Lowest temperature recorded	3.2°C in January, 2008
Highest rainfall recorded	338.1 mm in June 2008

- x **Migration and civil unrest:** Out of the 24 districts in Jharkhand, 22 have been under left-wing extremist-affected area. This primarily has been due to lack of full employment opportunities in rural areas, especially in the forest-rich areas, forcing people towards distress migration that also renders them as easy prey to the different armed groups operating in the area. Both the incidences increase vulnerability of the families. It also causes related pressure on the administration and use of resources which otherwise can be used for more positive purpose.

*b) Outline the economic, social development and climate change in line with the State Action plan on Climate Change and relevant Missions under National Action Plan on Climate Change*

Jharkhand has the biggest reserve of minerals in the country; most importantly coal reserves of Jharkhand are keys to India’s energy security and economic development. Industrial development in the State has picked up after the bifurcation of the State and the State’s GDP is expanding at the rate of 6.35% per annum. Contrary to industrial development, the State lags behind when social indicators are taken into consideration. Although, agriculture

is the backbone of the rural economy, it lacks modernization and suffers with low productivity. Secondly, infrastructure facilities are also limited in agriculture sector and extension mechanism in the State also functions in limited ways to spread awareness about the technologies which are compatible to both environment and productivity of the natural resources.

Compared to other States in the country, Jharkhand fares poorly considering parameters of social development, economic development, infrastructure and other welfare indicators. The HVS ranking of Indian States for various social parameters gives a poor ranking to Jharkhand. The composite State ranking based on Human Development Index (HDI) and Gender Development Index (GDI) information of the State for the year 2006 as calculated by the Women and Child Development Department puts Jharkhand at 29th position (among 28 States and seven union territories).

In this scenario, Jharkhand has a dual responsibility of equity-centric economic development along with reducing the climate change vulnerability of rural masses. This will only be possible when the State takes a pro-active approach by incorporating climate change scenarios in its developmental planning and preferential resource allocation for reactionary and anticipatory adaptation strategies.

The State's ranking makes it clear that Jharkhand lacks essential resources to put it in a fast-track climate adaptation mode. Although Jharkhand should plan and bear the responsibility for mitigation and adaptation efforts to be carried out in the State, it cannot be treated or expected to perform as aggressively on climate mitigation and adaptation as the States that enjoy high NSDP. Hence, mitigation and adaptation targets defined and adopted for Jharkhand will be based on the **'shared vision yet differential responsibility' principle**.

The following points illustrate the actions proposed by National and State programs to address the development as well as climate risk related to agriculture and water.

- x One of the key areas to be addressed under the National Mission for Sustainable Agriculture (NMSA) includes dry-land agriculture. The NAPCC also mentions one of its objectives as to devise strategies to make Indian agriculture more resilient to climate change by focusing on improving the productivity of rain-fed agriculture.

- x National Water Mission seeks to develop new regulatory structures, combined with appropriate entitlements and pricing. It will seek to optimize the efficiency of existing irrigation systems, including rehabilitation of systems that have been run down and also expand irrigation, where feasible, with special effort to increase storage capacity. Incentive structures will be designed to promote water-positive technologies, recharging of underground water sources and adoption of large scale irrigation programmes which rely on sprinklers, drip irrigation and ridge and furrow irrigation. Efficient usage of water ensures less exploitation of water resources available in drought affected regions of Jharkhand and will help drought management. If water usage can be optimized through efficient agricultural practices and irrigation system, the additional water available can be utilized for additional area by more marginal farmers. This will help improve social equity.
  
- x This is with reference to Mahatma Gandhi NREGA and Agriculture convergence guidelines issued in 2009 (Available on [www.mgnrega.nic.in](http://www.mgnrega.nic.in) under the icon "convergence"). Rural poor are most vulnerable to climate change, as their livelihood is directly dependent on environmental resources. As extreme events increase, the potentiality of longer and more severe drought, and increased water stress would be greater. These will have an adverse impact on agriculture, water sources, forest and coastal areas. Several studies have indicated that, as the surface temperature of earth rises, climate change will reduce crop productivity; this will be more pronounced in rain fed areas, and would further increase the vulnerability often the rural poor. A study on Environmental Benefits and Climate Change Vulnerability Reduction through MGNREGA has been conducted by Indian Institute of Science (IISc, Bangalore) and GIZ across 5 States, Rajasthan, Madhya Pradesh, Andhra Pradesh, Karnataka and Sikkim. The study showed that wherever MGNREGA is being implemented effectively, it is generating multiple environmental benefits, leading to improved water availability, soil fertility and increased crop production. MGNREGA works are also helping reduce soil erosion and increase area under plantations. Overall, the study concludes that MGNREGA works have contributed to improving the adaptive capacity of rural people and reducing their vulnerability to climate risks.

National Action Plan on Climate Change emphasizes on aligning the measures to promote national development objectives with co-benefits for addressing climate change effectively. It also advocates strategies that promote, firstly, the adaptation to Climate Change and secondly, further enhancement of the ecological sustainability of India's development measures. The State Action Plan for Climate Change in line with NAPCC, focuses on restoration of native bio-diverse species mix while at the same time enhancing carbon sink in forests and other ecosystems, while being informed by sensitivity to the ecological nature and value of resources.

Jharkhand State Action Plan on Climate Change focuses on eight sectors for the adaptation and mitigation measures, for which it has proposed sectoral action plans. The sectors include: agriculture, forestry, health, industry, mining, power, urban and transport sector and water sector. Droughts, wildfire, precipitation and other climate-related disturbances will increase the stress on forests and other ecosystems, with negative consequences for biodiversity and ecosystem goods and services. Drought has already caused significant tree-mortality in different parts of the State. The agricultural **sector** is already threatened by existing stresses such as the limited availability of water resources, land degradation, biodiversity loss and air pollution; climate change will, thus, make already sensitive systems even more vulnerable. Whereas climate change could improve yields of some crops in mid-to high-latitudes, in areas such as the tropics, even minimal warming will lead to crop-yield losses. Agricultural yields and livelihoods will also be affected by climate-related impacts on the quantity and quality of water resources. As temperatures increase, the need for irrigation will rise in those areas projected to become drier.

The SAPCC targets:

- x Understanding and assessing the extent of vulnerability as and when required is important for responding climate change induced impacts. Micro-level analysis is required to facilitate the habitat to cope with climate change.
- x **Promotion of Carbon Sequestration** - Some pilots like plantation of perennial fruit trees in degraded areas, shade plants, medium canopy floriculture, and agro-forestry can be taken up apart from other management practices described.

- x **Popularizations of Agro-forestry-** In agro forestry, all the weather elements are modified and with proper selection of species and tree management techniques, it is possible to optimize the micro-climate of intercrops. Since, yield of field crops is affected by tree species, therefore, adequate knowledge about choice of tree species, tree canopy architecture, pruning intensity and other management practices has to be imparted. Help can be taken from the State agriculture universities and KVKs in the respective districts for making choice of the species and also choice of farmers should be given due importance.
- x **Increase in the area under forest-** By having restoration, the degraded forest area can be improved and help in sequestration. At the same time, promoting wood lots in the community land and other less utilized land in the private area will help in bringing additional area under green cover and will have multiple benefits.
- x **To endeavour for the reduction of siltation of water and reservoirs:** Putting up different soil and moisture conservation measures in the upper ridges, especially in the forest area will help in arresting the soil erosion and also help in natural regeneration of the local species. It will also help in improving life of the different water storage structures created for improving water availability across the year.
- x **To prepare and implement strategies for conservation and improvement of biodiversity:** To promote mass movement in the State, especially with the active participation of women and rural people residing near forest areas so as to meet all the above objectives.

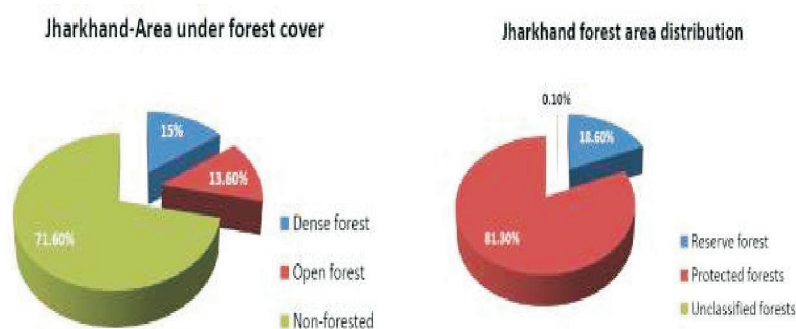
c) *Climate analysis and vulnerability analysis*

*How climate change impacts forests*

As per the State of Forest Report (SFR) 2005, published by the Forest Survey of India (FSI) on the basis of satellite data, the forest cover of Jharkhand is 22,591 sq. km, which is 28.34% of the total geographical area. Jharkhand ranks 10<sup>th</sup> among all the States and Union Territories of India considering the geographical area under forest cover. The dense forest distributed in the northwest and the southeast of the State constitutes about 15%. The open forest areas are evenly distributed in the north, central and south-eastern parts of the State and

constitute about 13.6% of the forested area whereas the non-forested area is about 71.6% of the State's geographical area; The total recorded forest area is about 23,605 sq. km which contains reserve forest of about 18.6%, protected forest of 81.3% and unclassified forest about 0.1% (Ministry of Environment and Forest, 2001). The main forest types in the State are:

- (a) Peninsular Dry and Moist Sal Forests,
- (b) Hill Valley Swamp Forest,
- (c) Moist Sal Savannah,
- (d) Moist Mixed Deciduous Forest,
- (e) Riverine Forest,
- (f) Bamboo and Cane brakes



**Jharkhand area under forest cover and forest distribution**

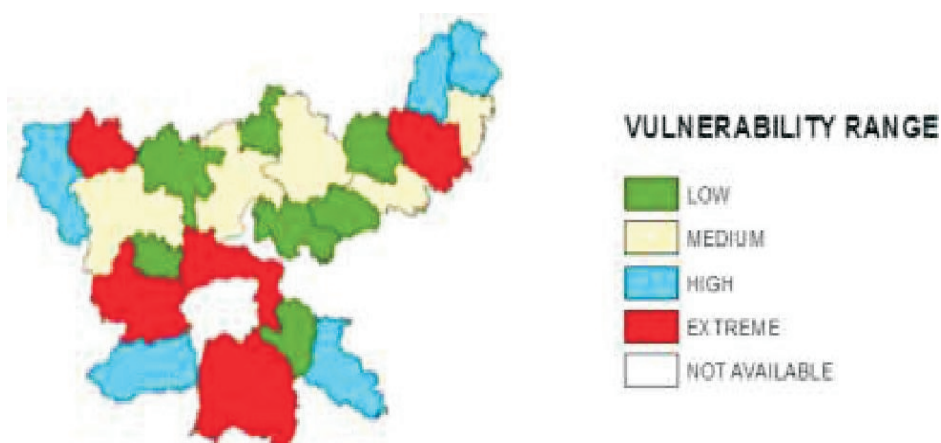
To protect and conserve the State's rich biodiversity, two reserve areas (one tiger reserve and other elephant reserve) and 10 wildlife sanctuaries have been carved out of the area under forests. Forests in Jharkhand have long been under pressure from mining and for meeting the demands for fuel. Initiatives have been taken by the State government to increase its forest cover. Forest Resource Surveys are also being conducted at the district level for better management and planning. The State has also formed Joint Forest Management (JFM) committees besides forest-based livelihood development, wildlife management, biodiversity conservation, clean environment and waste disposal plans. To tackle the impacts of mining, the State Government also proposes to bring legislation in



mining sector so that resources generated from mining sectors can be pumped back for local developmental activities. The results of State actions are visible in the form of improvement in the health and area under forests in the State. During 2001-2011, about 194 sq. km of area was brought under tree cover, similarly vegetation cover in 162 sq. km of scrub land has also improved. The net area under very dense forest category witnessed reduction during the last decade but no changes in area were seen during last five years.

A forest vulnerability index was developed to carry out a comparative study in the administrative units of Jharkhand and identify districts where population is highly susceptible to climate change linked changes. The analysis considered the climatic conditions, demographic features, ecosystem, agricultural attributes and socio-economic structure of the majority of population in the districts. Landscape-level indicators were selected and a composite index was created based on planning.

District	Forest sensitivity	Degraded areas	Forest Vulnerability to climate change	Scheduled or not	Community sensitivity	Vulnerability index
Jamtara	0.62	0.35	0	1	0.41	0.42
Ramgarh	NA					



**Rainfall trends:**

The rainfall pattern in the State has witnessed significant changes during past decades. It is evident that maximum annual rainfall (82.2%, with the average of 1149.3 mm) was received during South West Monsoon season (June to September) and only 6.5% (average amount of

rainfall 92.3 mm) was received during North East Monsoon (October to December) months in the State. The remaining rain was received in winter (3.7%, with average of 52.4 mm), from January to February and summer (7.5%, with average of 104.7 mm) from March to May, respectively. Hence, the State receives majority of rain during monsoon and only 17.7% of the annual rainfall is received during other seasons.

The Jharkhand vulnerability study conducted by UNDP points out that there is a general negative trend in most parts of Jharkhand barring its North Eastern parts, namely, Hazaribagh, Dhanbad, Jamtara, Deogarh, Dumka, Godda, Pakur and Sahibganj which show increasing trend in the monsoon rainfall while in the post-monsoon season, most parts of Jharkhand show positive trend in rainfall barring parts of Jamtara, Bokaro, Giridih, Gumla, Khunti, Latehar, Chatra, Palamu and Garhwa.

It is clear from comparison of rainfall during 1956-2008 that the average rainfall did not follow a range- it was continuously rising during the period. The year 1991 to 2000 received the maximum rain (average 1623.5 mm) among all the decades whereas minimum average rainfall was received by the State during 1956 to 1960.

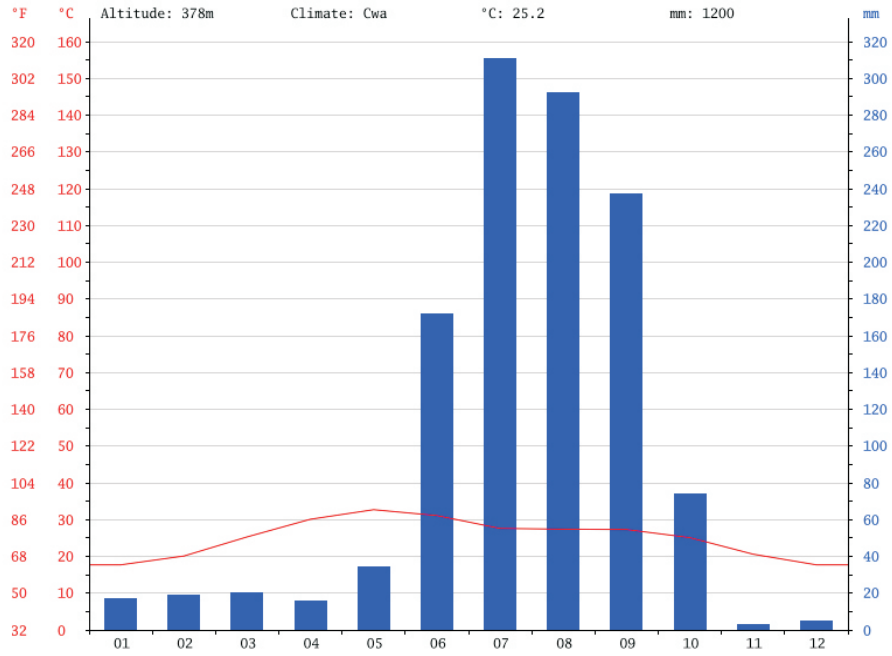
In sharp contrast to the observed trend during 1956-2000, period 2001-08 witnessed sharp decline in annual rainfall. The State witnessed severe droughts post 2000.

#### ***Temperature trend:***

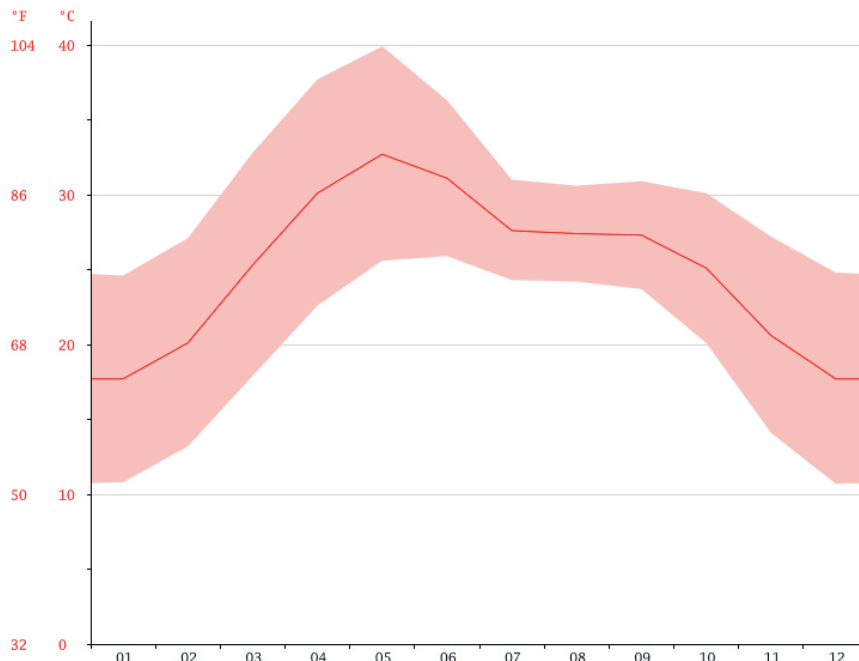
The model projections indicate significant warming over India towards the end of the 21st century. The summer monsoon precipitation over India is expected to be 9–16% more in 2080s compared to the baseline (1970s, i.e. 1961–1990) under global warming conditions. Also, the rainy days are projected to be less frequent and more intense over central India.

Simulated percentage changes in mean monsoon precipitation in the 2020s, 2050s and 2080s with respect to baseline (1961–1990 in three simulations). Q0, Q1 and Q14 simulations project 16%, 15% and 9% rise respectively, in the monsoon rainfall at the all-India level. However, towards the end of the 21st century, the projections indicate a slight decrease in monsoon rainfall over Tamil Nadu and Andhra Pradesh. These three simulations indicate a possibility of higher monsoon rainfall in future for all other States.

### Temperature and rainfall data for Patratu block



### Temperature data for Paratu Block



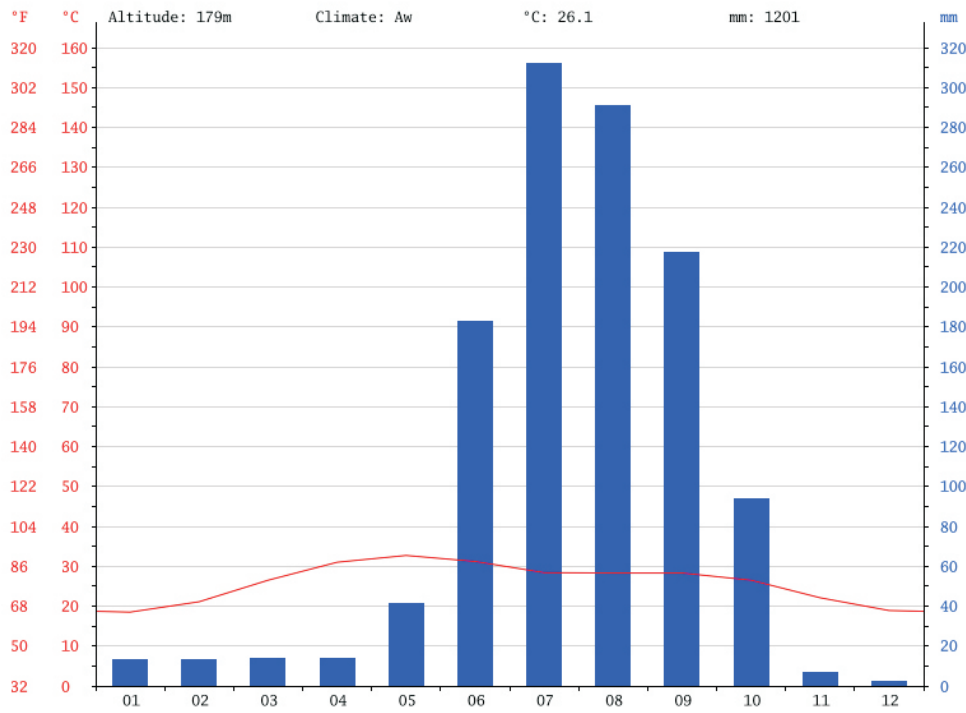
**Table for temperature and rainfall for Patratu**

	Janua ry	Febru ary	Marc h	April	May	June	July	Augu st	Septe mber	Octob er	Nov ember	Dece mber
Avg. T ratu	17.7	20.1	25.3	30.1	32.7	31.1	27.6	27.4	27.3	25.1	20.6	17.7
Min. T	10.8	13.2	17.9	22.6	25.6	25.9	24.3	24.2	23.7	20.1	14.1	10.7
Max. T	24.6	27.1	32.8	37.7	39.9	36.3	31	30.6	30.9	30.1	27.2	24.8
Precipitatio Rainfall (mm)	17	19	20	16	34	172	311	292	237	74	3	5

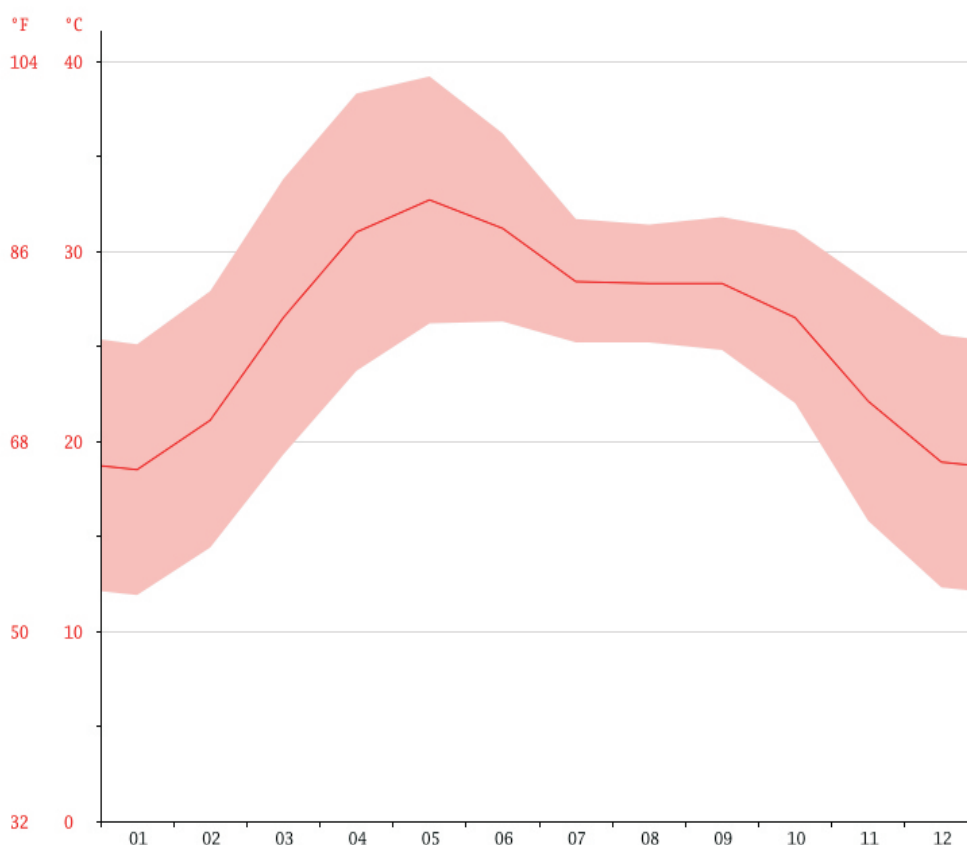
There is a difference of 308 mm of precipitation between the driest and wettest months. The average temperatures vary during the year by 15.0 °C.

PRECIS simulations for the 2020s, 2050s and 2080s indicate an all-round warming over the Indian subcontinent associated with increasing greenhouse gas concentrations. The annual all-India mean surface air temperature rise by the end of the century ranges from 3.5°C to 4.3°C in the three simulations. In near future, i.e. 2020s, Q0 and Q14 show decrease in the number of rainy days over the west coast, central India and the Indo-Gangetic plains and increase over northwest India and the east peninsula. Q0, on the other hand, indicates increase in the number of rainy days everywhere, except northeast and east central India. In 2050s, Q1 and Q14 depict decrease in the number of rainy days over major part of the country, whereas Q0 shows decrease over Uttar Pradesh, Bihar, Jharkhand and Northeast India only. Towards 2080s, the number of rainy days may increase everywhere except northwest India in the Q14 simulations, whereas Q0 and Q1 show increase over the west coast and decrease over central India.

### Temperature and rainfall graph for Narayanpur block



### Temperature graph for Narayanpur

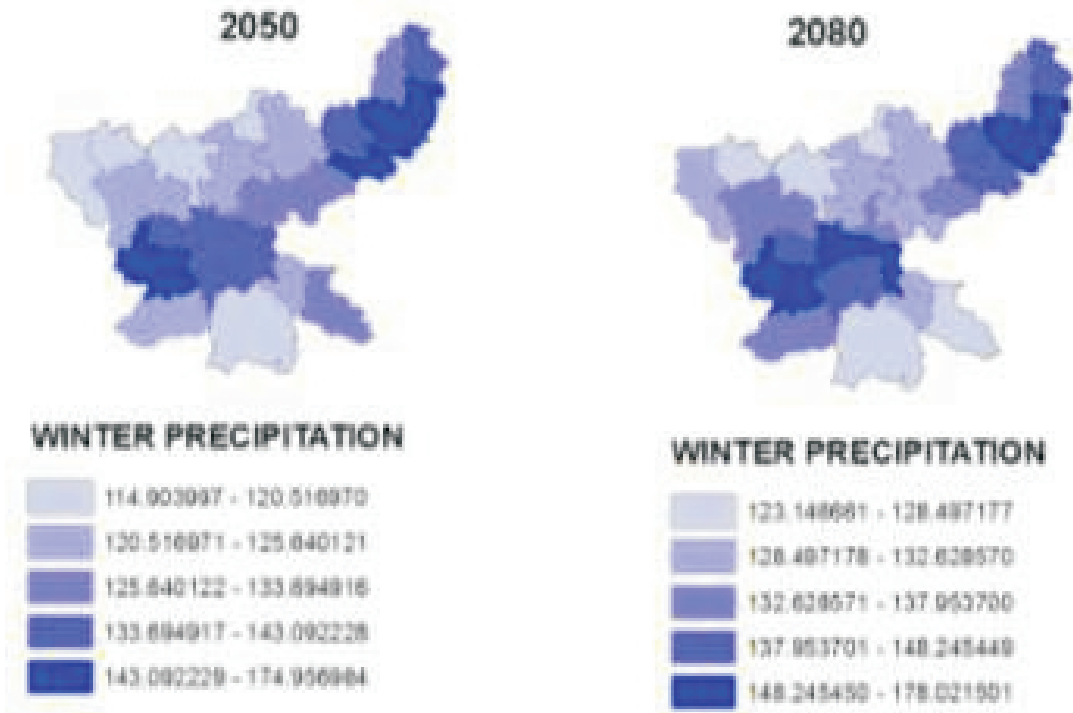


**Temperature and rainfall data for Narayanpur in Jamtara District**

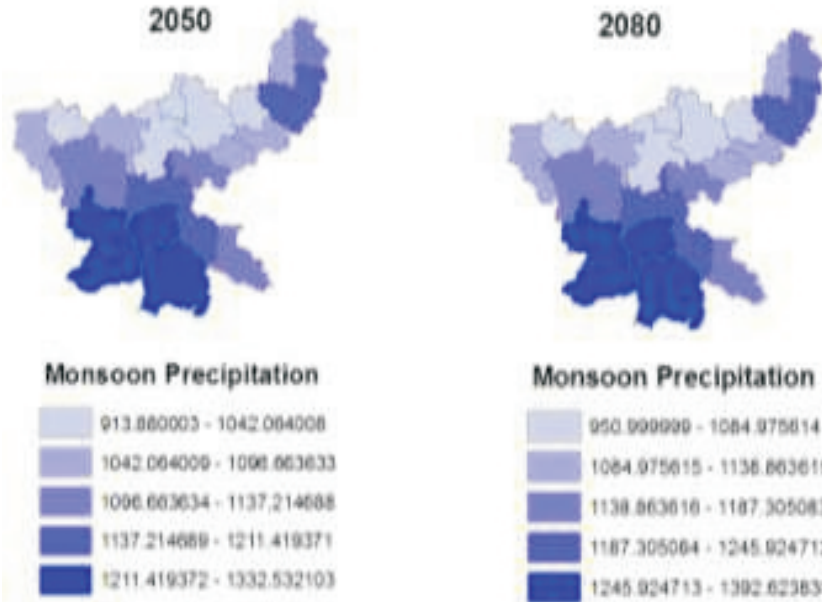
	Janua ry	Febru ary	Marc h	April	May	June	July	Augus t	Septe mber	Octob er	Novem ber	Dece mber
Avg. Temperatu re (°C)	18.5	21.1	26.5	31	32.7	31.2	28.4	28.3	28.3	26.5	22.1	18.9
Min. Temperatu re (°C)	11.9	14.4	19.3	23.7	26.2	26.3	25.2	25.2	24.8	22	15.8	12.3
Max. Temperatu re (°C)	25.1	27.9	33.8	38.3	39.2	36.2	31.7	31.4	31.8	31.1	28.4	25.6
Precipitati on / Rainfall (mm)	13	13	14	14	41	183	312	291	217	94	7	2

The precipitation varies 310 mm between the driest month and the wettest month. The variation in temperatures throughout the year is 14.2 °C.

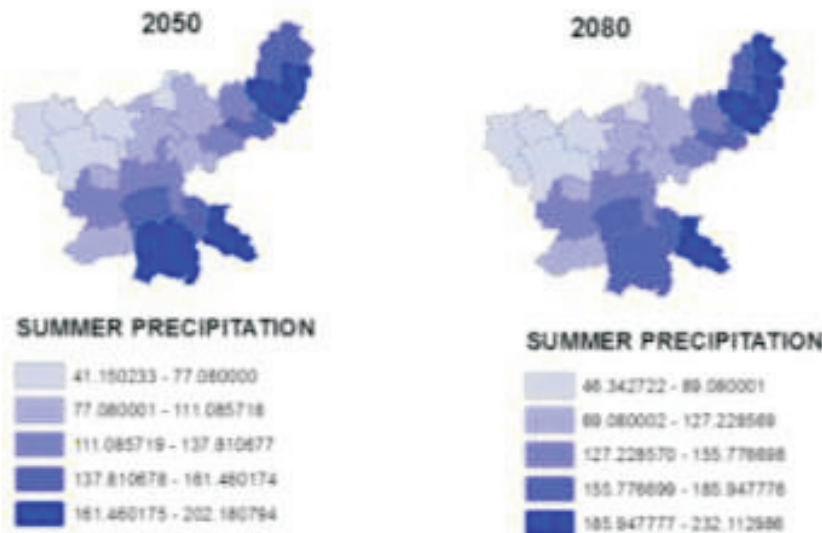
**WINTER PRECIPITATION (IN MM) IN JHARKHAND UNDER A2B SCENARIO (OCTOBER-FEBRUARY)**



**MONSOON PRECIPITATION (IN MM) IN JHARKHAND UNDER A2B SCENARIO (JUNE-SEPTEMBER)**



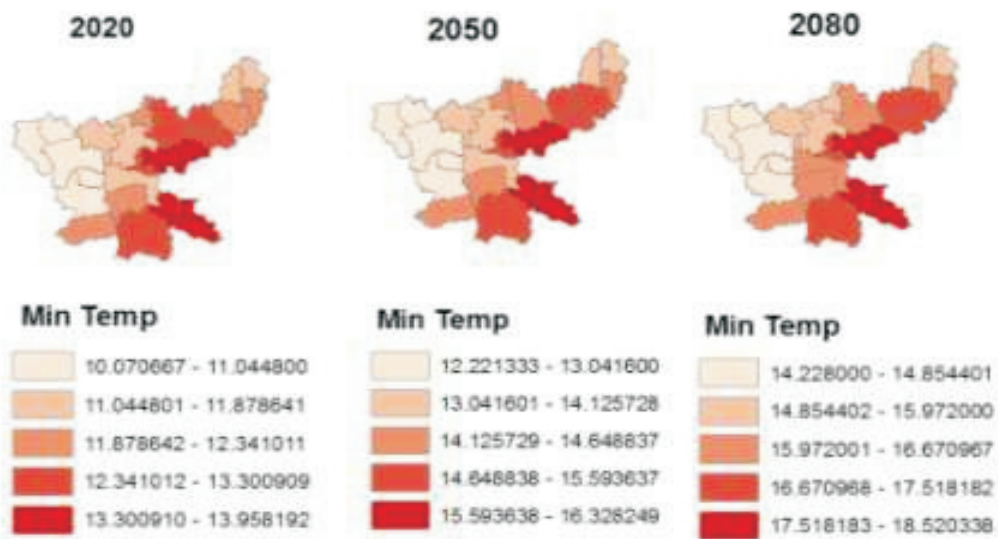
**SUMMER PRECIPITATION (IN MM) IN JHARKHAND UNDER A2B SCENARIO (MARCH-MAY)**



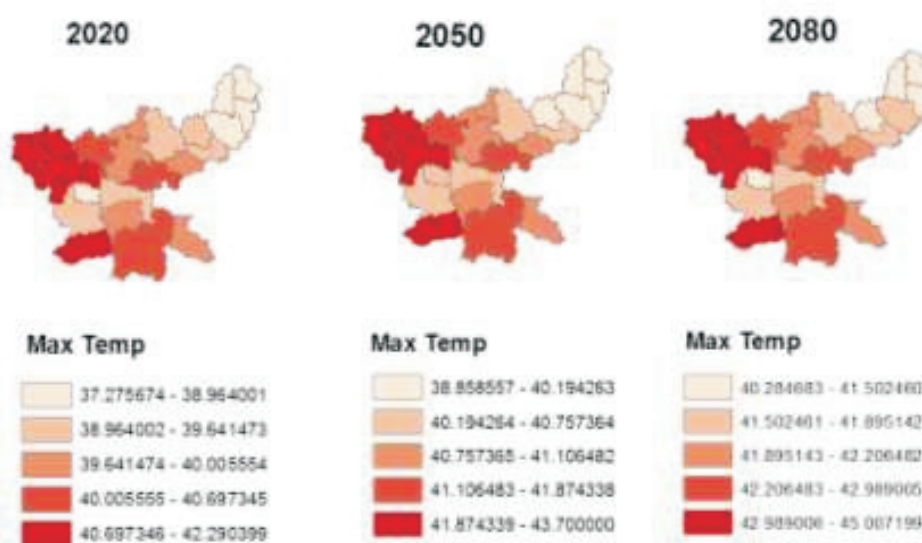


District-level climate change scenarios for Jharkhand, generated through WORLDCLIM for A2B scenario indicate rise in average rainfall in all the districts. The projections indicate that the rainfall in all the three seasons will go up in future and this increase will be significantly large for some of the districts. The model does not predict the indicative number of rainy days over the State.

Minimum Temperature (in degree Celsius) in Jharkhand under A2b Scenario



Maximum Temperature (in degree Celsius) in Jharkhand under A2b Scenario



Maximum temperature which is increasing in Jharkhand has been found to have adverse effect on rice yield if it coincides with the flowering stages and a yield reduction of 10.2 q ha<sup>-1</sup> °C<sup>-1</sup> is possible. Increase in minimum temperature at grain-filling stages is expected to have a positive effect on rice yield (2.7q ha<sup>-1</sup> °C<sup>-1</sup>). Both the increasing trend of maximum temperature and decreasing trend of minimum temperature are apprehended to reduce the rice yield, in particular, and yield of most of the other *kharif* crops, in general.

High rainfall at rice-flowering stage has been found detrimental causing a yield reduction of up to 7 q ha<sup>-1</sup> whereas at grain filling stage, high rainfall is beneficial causing yield increase up to 6.3 q/ ha. High evening RH at emergence-flowering stage can cause rice yield reduction (up to 3 q ha<sup>-1</sup>) while variation in radiation seems to have no effect on rice yield<sup>16</sup>.

High Tmax with High evening RH during vegetative stage has been found to invite Brown spot disease and high rainfall at flowering stage causes chaffy grain of rice. Altogether, a yield reduction of 10-15 q ha<sup>-1</sup> is reported.

Temperature Impact on wheat crop- Above normal high maximum temperature coinciding with the flowering stage of wheat and other *Rabi* crops has been found to cause pollen/flower sterility, thereby causing appreciable yield reduction of *Rabi* crops. However, as per a research, increase in both maximum and minimum temperature during the growing period of wheat has been found negatively correlated with the yield.

Appearance of new strains of disease/pests- Bristle Beetle in *Arhar*, Sheeth Blight and Rust in *Kharif* maize, Powdery mildew in Lentil, Alternaria Blight in Rapeseed-Mustard, Swarming caterpillar in Rice, root Knot Nematode in Rice have been on the rise.

In general, overall predictability of weather and climate will decrease, making the day-to-day and medium-term planning of farm operations more difficult. Increases in the frequency of droughts and floods are likely to affect production negatively, especially in subsistence sectors.

**Impact of climate change on rainfall:** Climate change is expected to significantly alter hydro-climatic regime over the 21st century. It is widely agreed that parts of the Indo-Gangetic basin may receive less rain than in the past, but the rest of India is likely to benefit from greater precipitation. According to IPCC (2001), most Indian landmass below the Ganges plain is likely to experience a 0.5–1<sup>0</sup> C rise in average temperatures during 2020–

2029 and 3.5–4.5°C rise in 2090–2099. Many parts of peninsular India, especially the Western Ghats, are likely to experience a 5–10% increase in total precipitation (IPCC 2001); however, this increase is likely to be accompanied by greater temporal variability. Throughout the sub-continent, it is expected that ‘very wet days’ are likely to contribute more and more to total precipitation. This is likely to mean higher precipitation intensity and larger number of dry days in a year.

***Climate change impacts on groundwater:*** Various climate change model predict increased temporal variability for rainfall, this translates to intense and large rainfall events in short monsoons followed by long dry spells. Evidence suggest that groundwater recharge through natural infiltration occurs only beyond a threshold level of precipitation; however, it also suggests not only that runoff increases with precipitation but the run-off coefficient (i.e. run-off/precipitation) itself increases with increased rainfall intensity (or precipitation per rainfall event) (Carter 2007).

Increased frequency of extremely wet rainy seasons (Gosain and Rao 2007) is also likely to mean increased run-off. Compared to 1900–1970, most of India is likely to experience 5–20% increase in annual runoff during 2041– 60. Higher variability in precipitation may, thus, negatively impact natural recharge in general.

***Climate change and increased water demand for agriculture:*** The rainfall pattern in Jharkhand will be affected due to change in climate, the net impact on a given location will depend upon the change in both the total precipitation and the variability of that precipitation. From agriculture point of view, this will be disastrous for Jharkhand as the State is mostly dependent on rainwater for irrigation. Hence, managing groundwater storage will acquire greater significance for the State than ever before. However, besides groundwater demand, climate change is expected to impact groundwater supply, too, in direct and myriad ways.

***Climate change and increased water demand by thermal power plants:*** As explained in the Chapter on Power Sector in the report, the rise in stream temperature due to climate change will result in reduced efficiency of the thermal power plant which uses water for cooling purpose. The rise of stream water temperature can be compensated to a certain

extent by increasing water intake to dissipate the generated waste heat to a larger quantity of water.

Based on the international experience, it is clear that the rise in water temperature results in excess intake of water by the thermal plants to ensure that the efficiency of the power plant is maintained. It is estimated that for one degree rise in atmospheric temperature, the water demand goes up by 10%. One result of the analysis reveals an increase by up to 30% in water demand during the summer month to compensate for an average increase of 2.1°C (Held, Strepp, Patt, Pfenninger, & Lilliestam, 2012). Hence, for years 2025 and 2050, water requirements for one degree and two degrees rise in ambient temperature is translated into excess water requirement of the thermal power plants.

***Climate change and water demand projections:*** An assessment of the availability of water resource in the context of future national requirements taking particular account of the multiplying demands for water and expected impacts of climate change and variability is critical for relevant national and regional long-term development strategies and sustainable development.

#### **Vulnerability Analysis:**

Analysis based on the **Composite Vulnerability Index (CVI)** and drilled down indices of the districts for baseline and mid-term RCP 4.5 scenarios show that:

- x Ramgarh with rank 2 remains **least vulnerable** district of Jharkhand for baseline and midterm RCP 4.5 scenario since:
- x Ramgarh has higher adaptive capacity as compared to the other districts of the State which makes them well-equipped to cope up with their exposure and/or sensitivity to climatic influences.
- x Ramgarh has higher economic capacity, level of urbanization is high, its highest irrigation potential, high literacy rate, less exposure to extreme climatic events, and better access to drinking water, sanitation facilities, electricity, health, education and road infrastructure. Ramgarh has higher values with regards to both social and economic indices. Thus, their socio-economic vulnerability is also the least and environmental vulnerability is moderate.

- x Ramgarh remains a low vulnerable district in both baseline and midterm RCP 4.5 scenarios.

As per baseline data, Jamtara is **very highly vulnerable**-cluster (4) to climate change since:

- x Jamtara has very low values of Composite Vulnerability Index (CVI).
- x Jamtara has comparatively low adaptive capacity and show higher sensitivity and exposure to climate change with respect to the other districts.
- x Jamtara has very high water-resource, forest, agriculture and health sector vulnerabilities, and thus, higher Composite Environmental Vulnerability (CENVI).
- x Jamtara is located in the North East of Jharkhand
- x Jamtara remains highly vulnerable in the midterm RCP 4.5 scenario also.

#### ***Social Vulnerability Index (SVI) analysis results***

Ramgarh is among the least vulnerable districts since it has a better literacy rate, less percentage of rural households living below the poverty line, better sanitation facilities and better access to drinking water.

#### ***Economic Vulnerability Index (ECVI) analysis results***

- x Six districts are the most vulnerable, namely, Garhwa, Latehar, Chatra, Gumla, Godda and Palamu in ECVI
- x It has a low per capita income (NDDP), low number of banks and poor credit deposit ratio which makes Garhwa and Latehar most vulnerable
- x Purbi Singhbhum is the least vulnerable with rank 1.

#### ***Composite Socio Economic Vulnerability Index (CSEVI) analysis results***

- x Six districts, namely, Garhwa, Latehar, Chatra, Palamu, Pakur and Sahibganj have very high socio-economic vulnerability. These 6 districts show low index values with respect to both social and economic indices as also lower values in the CSEVI
- x Bokaro, Ranchi, Ramgarh, Dhanbad and Purbi Singhbhum are the least vulnerable districts (cluster 1).

### ***Agriculture Vulnerability Index (AGVI) analysis results***

- x Ten districts located in the South and North Eastern regions of Jharkhand, namely, ***Jamtara***, Gumla, Sahibganj, Simdega, Deoghar, Dumka, Pashchimi Singhbhum, Pakur, Saraikela-Kharsawan and Ranchi have very ***high agriculture vulnerability***.
- x It has a low wheat production per capita, larger net sown area in proportion to district geographical area, larger proportion of wasteland, very low percentage of ground water and surface water irrigation to net sown area, less fertilizer consumption, greater share of agricultural and cultivators main workers to total main workers, resulting in more dependence on agriculture income, low livestock units etc. which makes ***Jamtara*** and Gumla ***most vulnerable***
- x Lohardaga, Kodarma, Chatra, Hazaribagh, Palamu, ***Ramgarh*** and Garhwa are the ***least vulnerable districts***
- x Overall, agriculture vulnerability of the districts is projected to increase slightly in the MC RCP 4.5 scenario compared to the baseline scenario.

### ***Forest Vulnerability Index (FOVI) analysis results***

- x Deoghar, ***Jamtara***, Pakur, Giridih, Khunti and Dumka have very ***high forest sector vulnerability***.
- x Hazaribagh, Sahibganj, Paschimi Singhbhum, Chatra, Lohardaga and Latehar are districts with low vulnerabilities.
- x The top 5 most vulnerable districts (Table 27) include Chatra, Gumla, Latehar Hazaribagh and Palamu, considering both climate impacts (IBIS and LPJ) and current vulnerability.

### ***Water Resource Vulnerability Index (WRVI) analysis results***

- x ***Ramgarh*** has very low value of Water Resource Vulnerability Index (WRVI), thus belonging to the ***very high vulnerable category*** (cluster 4) as compared to other districts of Jharkhand. It has low surface water and ground water availability per capita in monsoon and non-monsoon months, which makes these districts most vulnerable to climate change.

- x Overall Water Resource vulnerability of the districts is projected to increase in the MC RCP 4.5 scenario compared to the baseline.

#### *Climate Vulnerability Index (CLVI) analysis results*

- x Four districts, namely, Dumka, Sahibganj, Pakur, and Gumla are highly vulnerable to current climate as these 4 districts show greater exposure to extreme events with respect to the other districts.
- x Seven districts are in the low vulnerable category, namely, Chatra, Simdega, Kodarma, Latehar, Garhwa, Saraikela-Kharsawan and Palamu.
- x The overall Climate vulnerability of the districts is projected to increase in the MC RCP 4.5 scenario compared to the baseline.

#### *Health Vulnerability Index (HLVI) analysis results*

- x Jamtara, lying in the North East of Jharkhand ***is highly vulnerable.***
- x It has greater sensitivity to Anopheles Mosquito causing Malaria, which makes Jamtara, the most vulnerable.

#### *Composite Environmental Vulnerability Index results*

- x Cluster results show that Jamtara has very ***high composite environmental vulnerability.*** They also have very high water resource, forest, health and agriculture vulnerability.
- x Composite environmental vulnerability (CENVI) of districts is projected to increase towards midterm RCP 4.5 scenario compared to the baseline.
- x 33% of the districts (i.e., 8 out of 24 districts) in the moderate vulnerability cluster in the baseline, increases to 38% (9 districts) in midterm.
- x The percentage of districts in very high vulnerable category also increases from 8% (2 districts) in the baseline to 17% (4 districts) in midterm as districts are moving from low and moderate clusters to very high vulnerability.

CVI as one overall figure is good for easy comparison for a non-specialist or for policy-makers; there is a trade-off between the component sub-indices when they are viewed in

aggregated form. Therefore, to add some depth to the overall assessment, drill down sub-indices are also provided to understand about the composition of vulnerability.

Vulnerability table	
Patratu Landscape (Ramgarh)	Narayanpur Landscape (Jamtara)
Has low composite vulnerable index; Ranks 2 <sup>nd</sup> in overall districts, making it second least vulnerable	Have high composite vulnerable index; ranks 24 among the all districts making it most vulnerable
Low social vulnerability index and high adaptive capacity due to education and other social indicators; ranks 2 <sup>nd</sup> least vulnerable district	High social vulnerability and low adaptive capacity due to low education level and infrastructure development; ranks 9 <sup>th</sup> in the table
Ramgarh has same economic vulnerability cluster as Jamtara but higher index value; ranks low at 7 <sup>th</sup> showing comparatively lower vulnerability	Jamtara ranks 17 <sup>th</sup> in the vulnerability index table and despite being in the same cluster, it has more vulnerability than Ramgarh
Composite socio-economic vulnerability index puts Ramgarh as 3 <sup>rd</sup> least vulnerable district	Composite socio-economic vulnerability index puts Jamtara on the 10 <sup>th</sup> rank showing moderately vulnerable index
Ramgarh ranks 2 <sup>nd</sup> in the agriculture vulnerability index making it the 2 <sup>nd</sup> least vulnerable district	Jamtara ranks 24 <sup>th</sup> making it the most vulnerable district in the State
Ramgarh has moderate vulnerability index for forest at the 15 <sup>th</sup> rank	Jamtara has very high vulnerability index at 23 <sup>rd</sup> rank making it 2 <sup>nd</sup> most vulnerable district
Ramgarh has very high water vulnerability index at 21 <sup>st</sup> position	Jamtara has moderate water vulnerability index at 10 <sup>th</sup> rank
Ramgarh has same vulnerability index as Jamtara in terms of climate vulnerability and stands at 12 <sup>th</sup> rank	Despite being in the same cluster, Jamtara has high climate vulnerability index
Ramgarh has moderate health vulnerability index and it ranks 16 <sup>th</sup> in the table	Jamtara has high health vulnerability index and ranks 23 <sup>rd</sup> in the table
Composite environmental vulnerability index puts Ramgarh as moderately vulnerable	Composite environmental vulnerability index puts Jamtara as the Highest vulnerable



**d) Project Location details – villages, block/ Mandal, district**

The Project will be located in the Patratu block of Ramgarh district and Narayanpur block of Jamtara district. It will cover 48 villages in the two proposed blocks on a landscape mode. These landscapes will have an approximate area of 8500 and 3040 ha.

The two landscapes in the two districts have been selected mainly because–

- x They fall in two regions of Jharkhand- North Chhotanagpur and Santhal Pargana
- x Vulnerability-wise, Ramgarh is the least vulnerable and Jamtara is the most vulnerable
- x Patratu has close to 41% forest area whereas Narayanpur has 11% forest area
- x Patratu has more area under irrigation than Jamtara

List of the villages falling under the two landscapes –

NARAYANPUR LANDSCAPE			
Barowa	Lakhanpur	Matuadi	Kenduanr
Palta	Daldala	Ghortari	Thekbahiar
Madhuban Phutaha	Bhagabandh	Goditanr	Mahuadabar
Bhaiyadi	Ledhariya	Kumargariya	Rautdih
Paharpur	Birsinghpur	Ratanpur	JoBriasdhaurnitanr
Narayanpur	Mahtodi	Chitarpur	Naudihani
Raghunathpur	Purnighati	Marichbad Purna Nagar	

PATRATU LANDSCAPE		
Tokisud	Talapur Talatanr	Solea
Palu	Hariharpur	Bartua
Palani	Batuka	Haphua
Koto	Osam	Terpa
Lem	Kirigara	Ukrid
Kurbij	Ichapiri	Rocha
Bicha	Dparidih	Sahitanr

*e) Demographic details of the population – total population (for area in operation), Gender-disintegrated data, small and marginal, etc.*

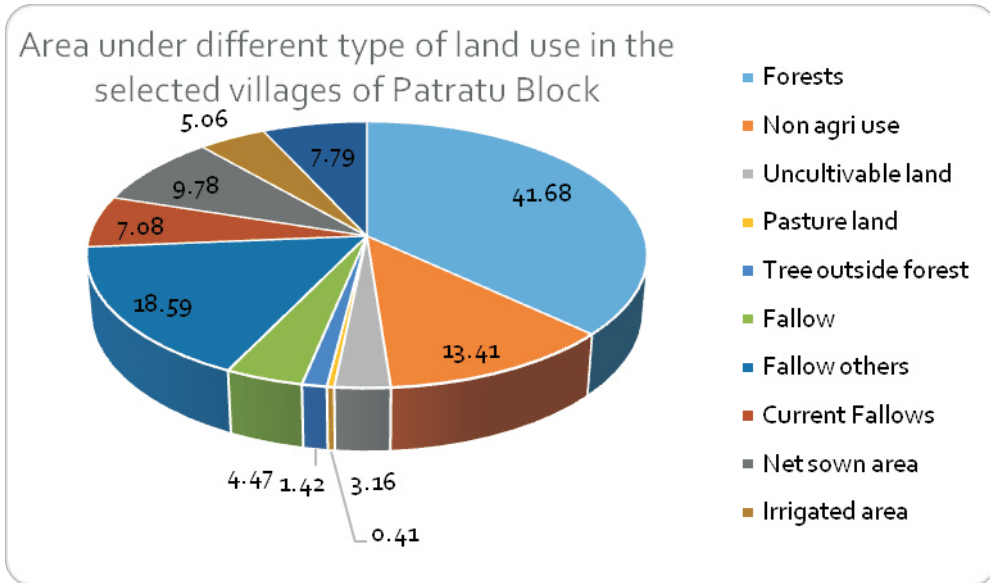
Survey data reveals that the area in Patrattu landscape is dominated by Scheduled Caste and Schedule Tribe population to the tune of 44% of the total population and most of the villages are situated on the forest fringes. As a result, majority of the population depends on forests for their livelihood and other daily needs. With the practice of open-grazing and large demand of fuel-wood for cooking, forests are becoming more vulnerable. On the other hand in Jamtara landscape, the population is dominated by OBC category. However, the population of Scheduled Caste and Scheduled Tribes also has significant presence of about 25% of the total population.

The total number of villages covered in the two landscapes is 48, with 27 villages located in Jamtara and 21 villages in the Patrattu landscape. The total number of households is 8888, with approximately 3173 families belonging to Scheduled Tribes and Scheduled Castes. The landscape has a gender ratio of 957 wherein Patrattu has a gender ratio of 954 and that of Jamtara is 961.

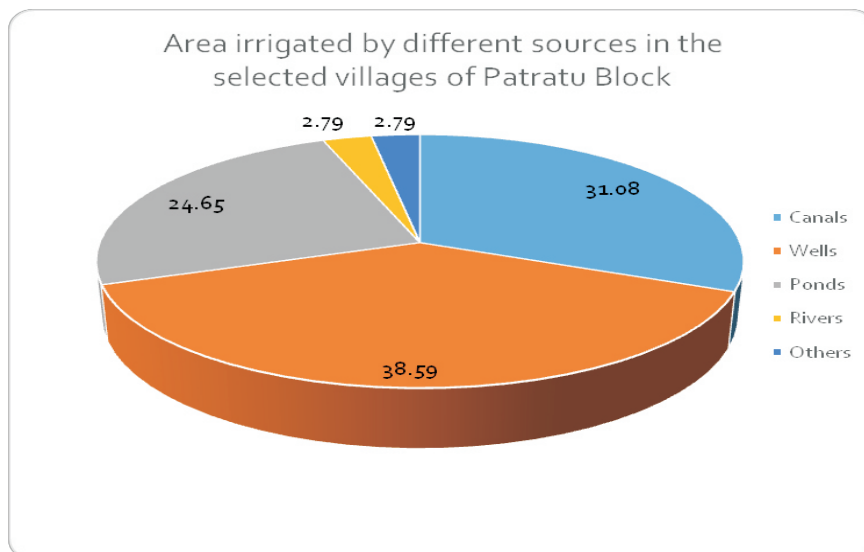
Comparing the land holding, it is found that around 70% farmers are marginal (with less than 2 Acres of land) and most vulnerable due to factors like low productivity, lack of access to timely credit for investments, low literacy, poor health conditions, high migration and influence of different armed groups in the area. Even the small and medium farmers do not have round the year food security which forces them for distress migration.

These have been arrived at on the basis of secondary data and preliminary discussions in parts of the landscapes.

Out of total 85 villages in Patrattu, 21 villages have been selected for the project. These selected villages cover a geographical area of 8580.8 hectares. A major portion, i.e, around 41.68% geographical area of the selected villages is under forest area. About 1151.1 hectares land, which is only 13.41% of the total land of the target villages is under non-agriculture uses. Only 434 hectares land, which is 5.06% of the total area is irrigated by different sources. Around 668.4 hectares (7.79%) land used for agriculture purpose are under rain fed farming in the absence of irrigation facilities.



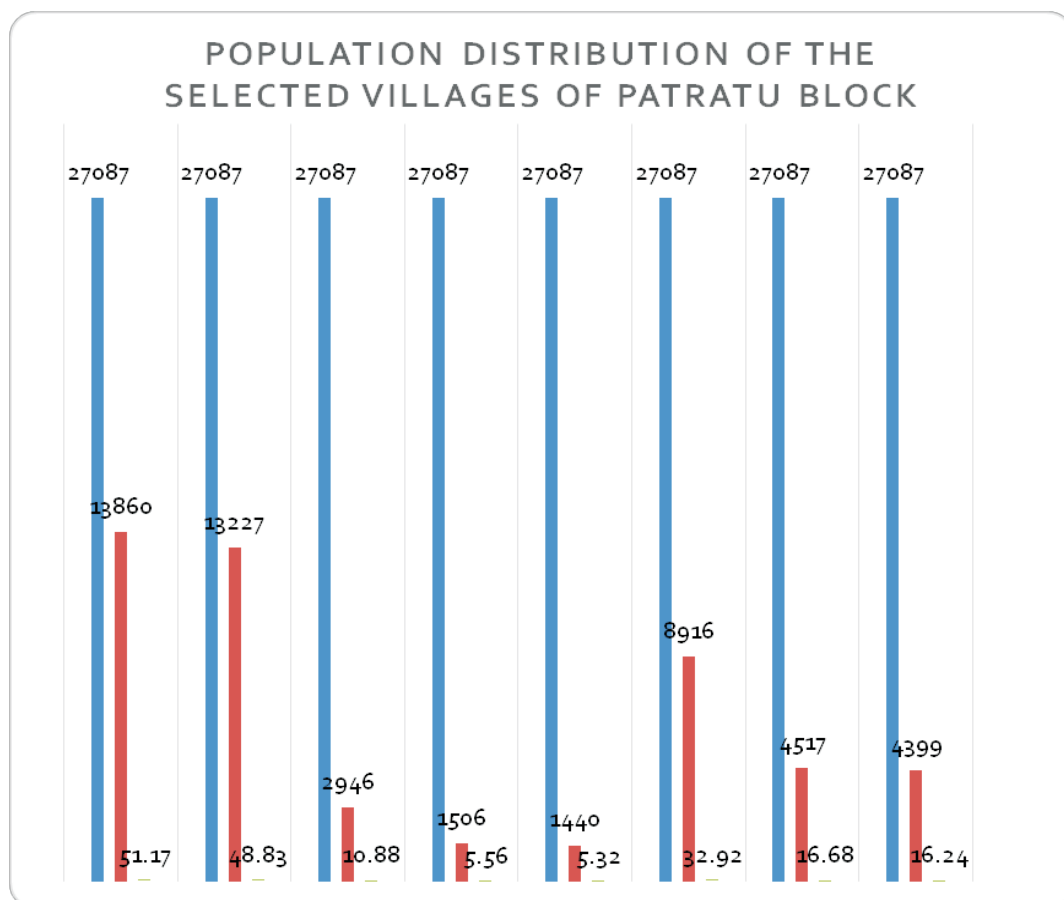
There are mainly 3 types of irrigation facilities available for the selected villages. Canal is one of the most important sources of irrigation of the area covering 31.08% area of the total irrigated area of the selected villages. Another important source of irrigation of the selected villages is wells and tube wells covering a major part of irrigation of the area. About 38.59% of the total irrigated area of the selected villages is covered by this source of irrigation. Tank and lakes is another important source of irrigation covering 24.65% of the total irrigated area of the selected villages. Other than that, there are other sources of irrigation facilities available such as waterfall and some other sources, covering 2.79% of the total irrigated area of the selected villages.



## Demographic profile of the selected villages in the 2 landscapes

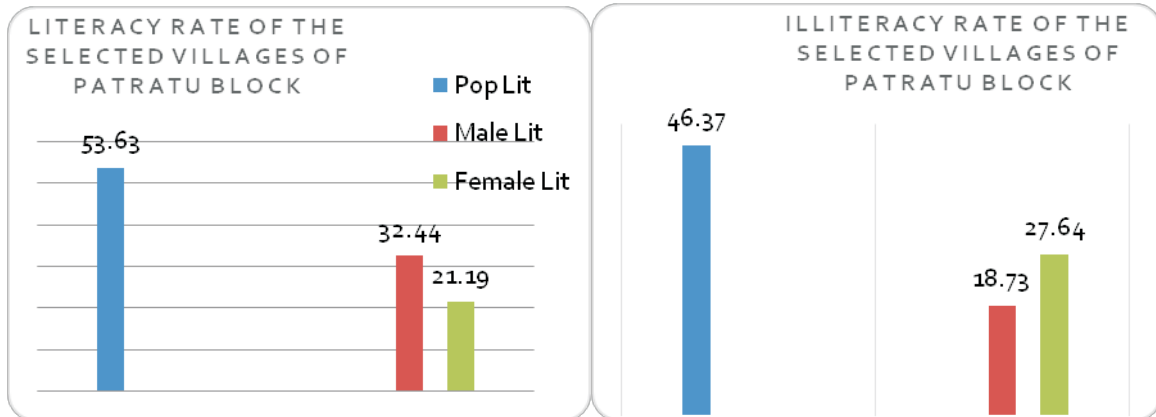
### PATRATU LANDSCAPE

The total population of the selected 21 villages of the project area is 27087 when extrapolated, based on the sample survey conducted for 20% of the total households in each village. It has been verified and cross-checked with the Census report for 2011 and data has found to be very close to the secondary data. This population is only 10.93% of the total population of the Patratu block. Out of 27087 people of the selected villages, the male population is 13860 which is 51.17% of the total population. Female population of the area is 13227 which is 48.83% of population. The area is a Schedule Tribe dominated area with around 32.92% people of area belonging to the ST category, whereas 10.88% are from the Scheduled Caste category. In the SC category, 1506 (5.56%) are males and 1440 (5.32%) are females. The male population of ST category is 4517 (16.68%) and female population is 4399 (16.24%) only. Female population of the selected area is 954 against 1000 male population.

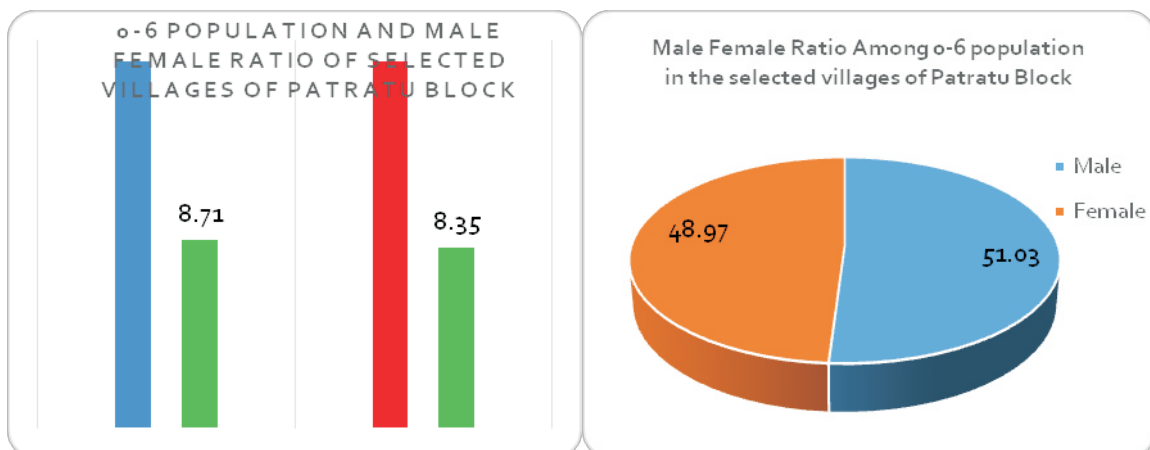


The graph below shows the status of education for the selected villages of the communities in Patratu landscape. Overall, 53.63% people are literate in the area. The literacy rate of

males in the area is 32.44%, whereas that of females is 21.19% out of the total population. Illiteracy rate is quite high among the female population of the area. As per Census of India 2011, about 27.64% female population and 18.73% of the male population are illiterate.



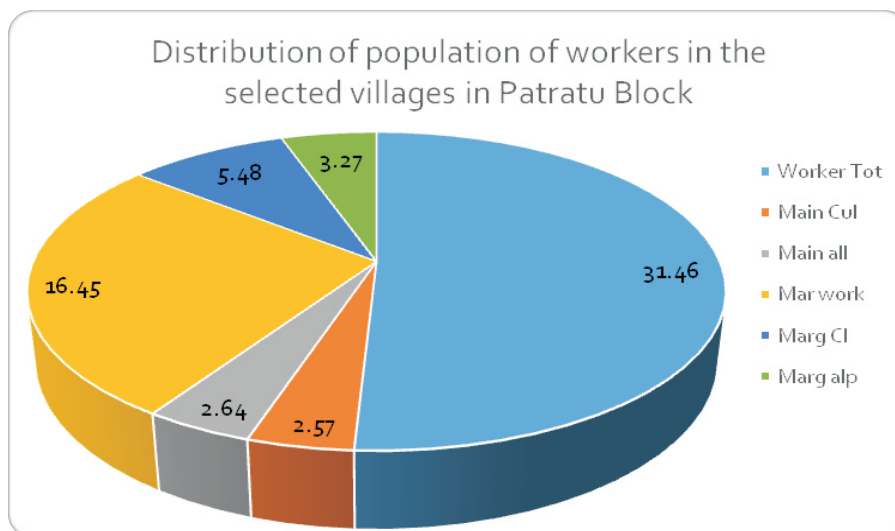
**Literacy and illiteracy in the selected landscape of Patratu block: Adaptive indicator**



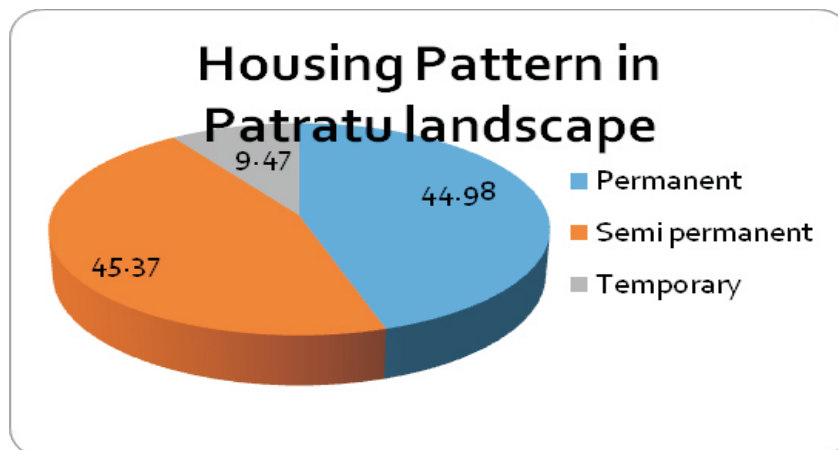
The above figure (left) shows the population and sex ratio of children between 0-6 years in the selected villages of Patratu landscape. Total population of children between 0-6 years is 4621, covering 17.06% of the total population of the area. The population of male child is found to be higher (51.03%) than the female child (48.97%) in the area.

The above figure (right) is a representation of male-female ratio of the selected project villages of the Patratu block. Out of the total population of the area, 51.17% population are males and 48.83% of the population are females. Among the population group of 0-6 years, 51.03% are males and 48.97% are females. Among the Scheduled Caste population, 51.12% are males and 48.88% are females. In case of Schedule Tribe population, 50.66% population are males and 49.34% are females.

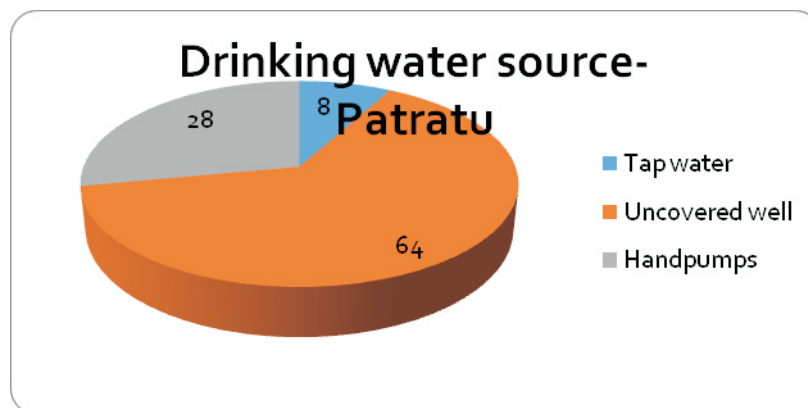
Out of the total population of the selected villages, only 31.46% are found to be workers as per the Census of India 2011. Out of this, 16.45% are marginal workers. About 3.27% population are marginal agriculture labourers and 5.48% population are marginal cultivators. Only 2.57% of the total population of the area are main cultivators and 2.64% are main agriculture workers.



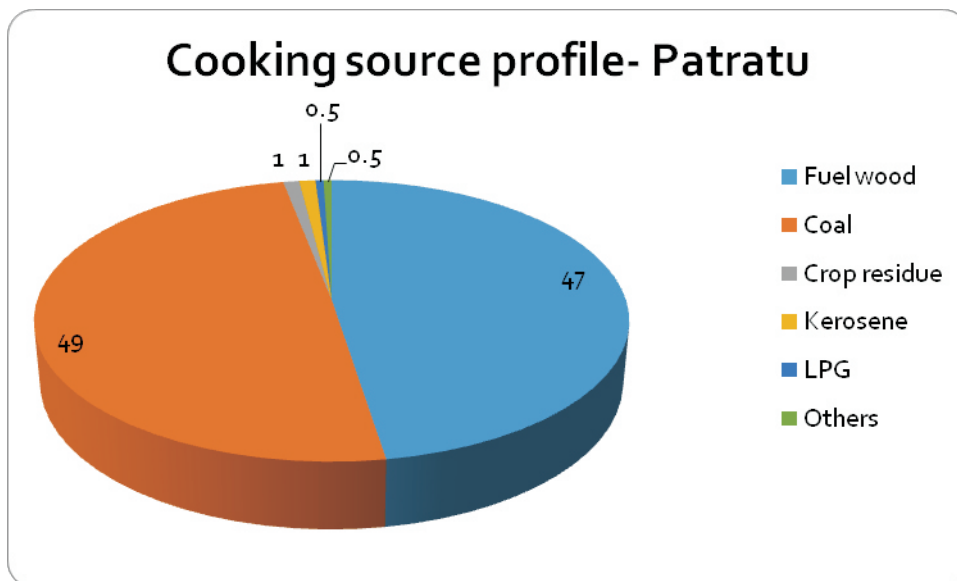
This figure shows the male-female distribution among the worker group of the selected area of Patratu landscape in Ramgarh District. Total workers of the area make up for 31.46% of the total population of the area. Out of this, 23.58% are males and only 7.89% are females. Marginal workers of the area make up for 16.45% of the total population with 10.42% males and 6.03% females. Farming is main activity among 2.57% of the total population with 2.09% males and 0.48% females. The main agriculture labourers make up for only 2.64% of the total population of the area with 2.34% males and 0.30% females. Around 5.48% of the total population of the area are marginal workers with 3.01% males and 2.47% females. Total marginal agriculture labourers constitute 3.27% of the total population of the area with 2% males and 1.27% females.



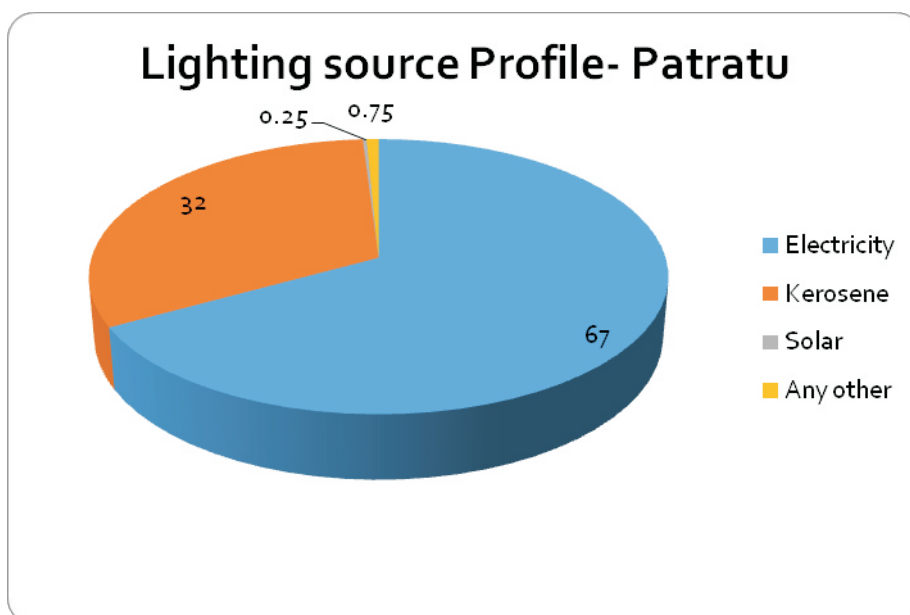
Considering the data of the surveyed households and extrapolating it for the larger landscape, it is interesting to note that around 45% of the households have permanent houses, mainly because of the Indira Awaas Yojana and other housing schemes launched by the Government. Houses with a mix of *Kutchha* and *Pucca* are put in the semi-permanent category and these houses have a half-yearly frequency of repairing and for this, these families depend on the forest. The temporary households are made of mud or are thatched with grasses and straws. These require frequent repairing and people depend heavily on the forest for getting raw materials for their houses.



Patratu landscape is located near the Patratu dam which is the main source of water for power generation and other industrial units at Patratu. As for the drinking water source used by the larger communities in the landscape, by and large, wells which are uncovered continue to be the main source of drinking water, especially during the peak summers, as reported by the locals. Handpumps are also a major source of drinking water while tap water is also available in villages near the Patratu dam but the facilities need improvement, as reported by the community.



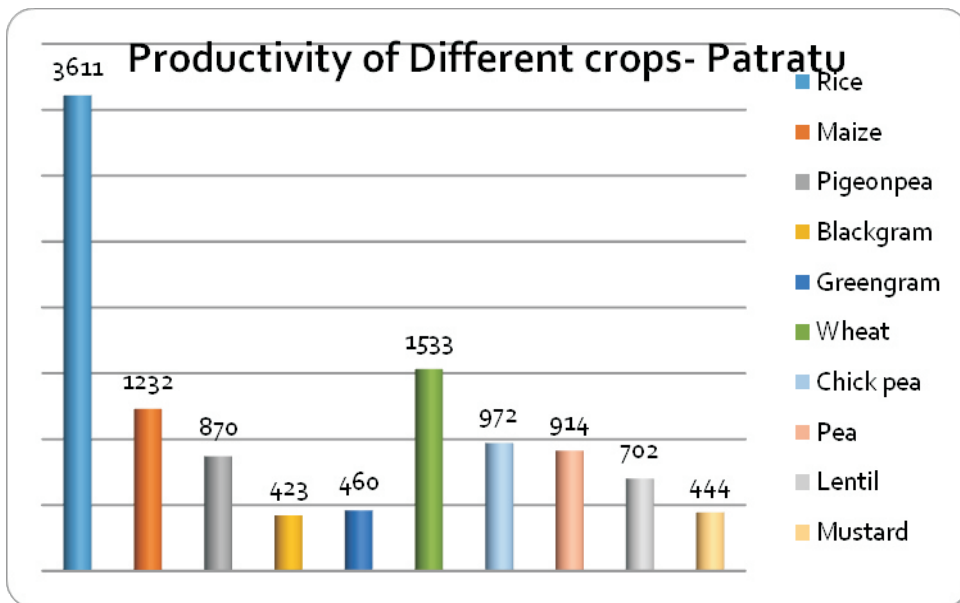
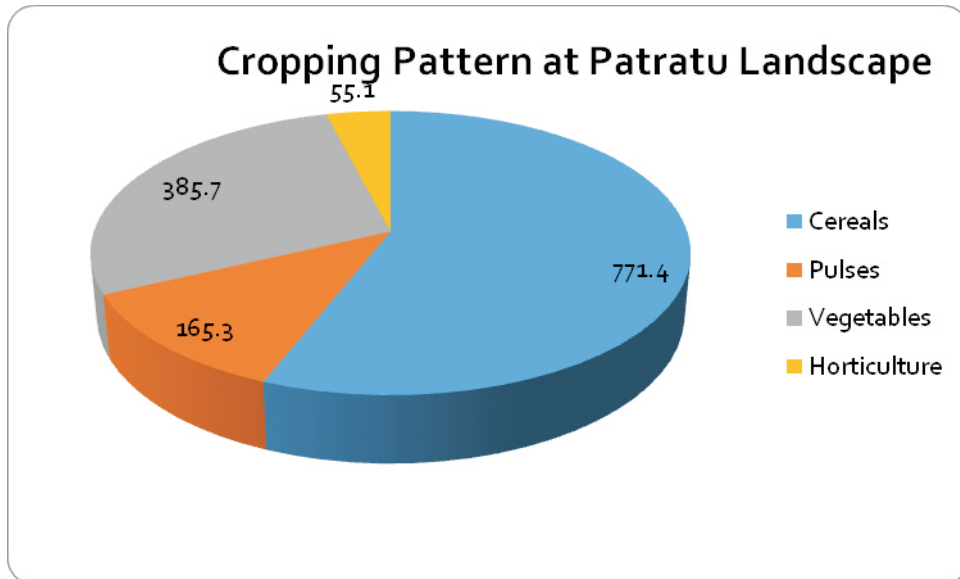
One of the major reasons for emission is cooking and lighting in rural areas. But in Patratu, interestingly, close to 67% surveyed houses have been found to have grid connectivity. This can also be attributed to its proximity to PTPS, the power generation unit. This is followed by Kerosene oil with limited access to clean energy.



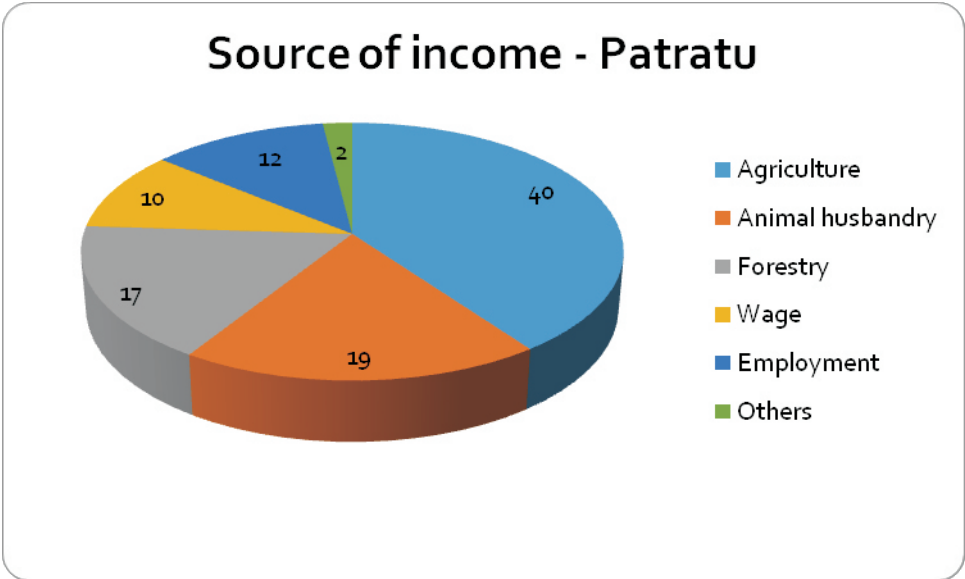
Agriculture is the main vocation of the villagers and a major source of income across the landscape. Data on the cropping pattern and the type of crops suggest that more than 55% land is under cereals. Paddy and maize are cultivated mainly in the Kharif season owing to limited irrigation facilities. Vegetables are mainly grown in the command area of the wells and ponds. Some cultivation is also done in the command area of the Patratu dam. On the uplands where some cultivation can be done, people grow pulses like Arhar which do not



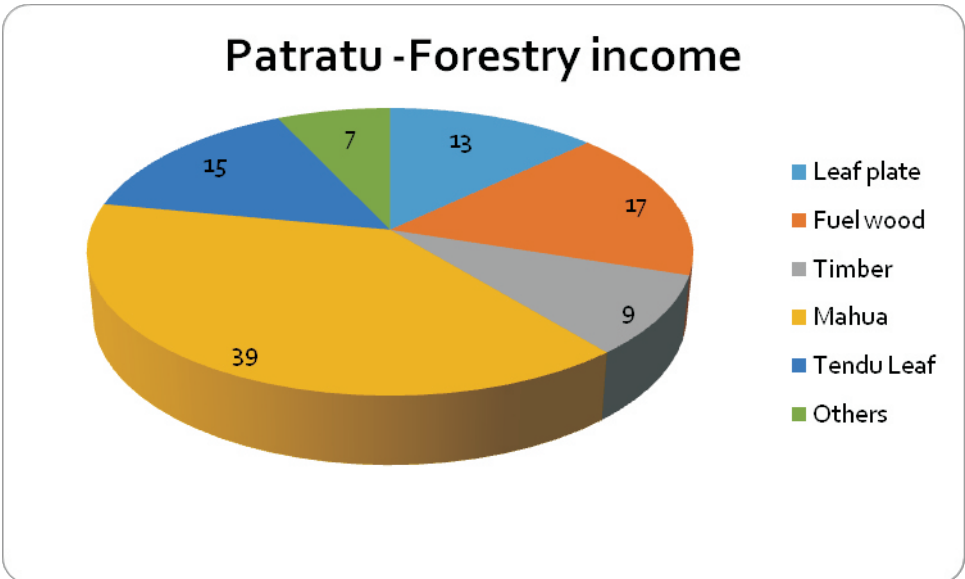
require much water once established. Some upland area is also put under Niger cultivation in the Rabi season. Mustard is grown in some areas as a mixed crop together with wheat and in some places with vegetables. Horticulture is practiced mainly in the form of plants/trees such as Mango and Guava outside the forest area. In some places, lemon can also be seen.



Productivity of different crops in the landscape vary between 36 Q/ha for Paddy to less than 5 Q/ha for black gram. Other crops also show productivity lower than the desired level suggesting that the area can be improved through working on the productivity aspects which would help farmers achieve food sufficiency as also nutritional sufficiency for the families living in the area.



Agriculture and allied activities constitute around 60% of the family income. Forestry and forest-based livelihood sources contribute to 17% of the total income in the family. Hence, it is evident that close to 80% income comes from natural resources and the rest is being contributed by wage-earning and employment and some petty business activities in the village. Annual income hovers around Rs. 60,000 to 70,000 per family. Most of the families are in the bracket close to Rs. 55,000/annum. Project interventions can raise their income by almost 30% to 40% by contributing in the improvement of productivity. Interventions in methodology like SRI will help create a financially viable and environmentally sustainable practice in farming.

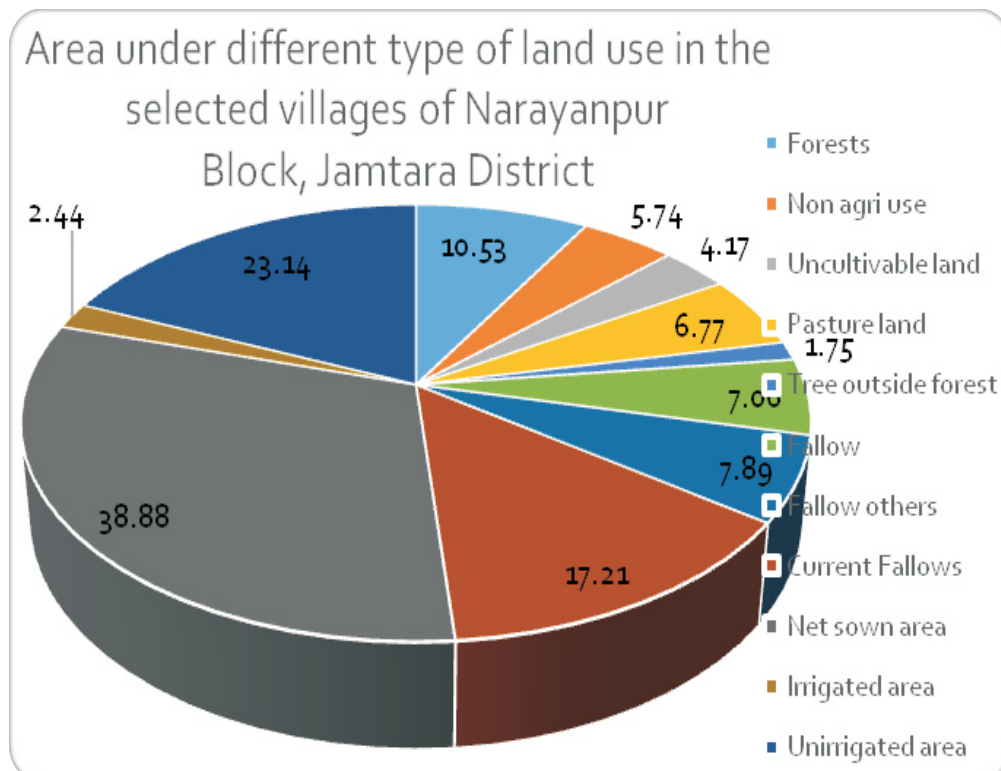


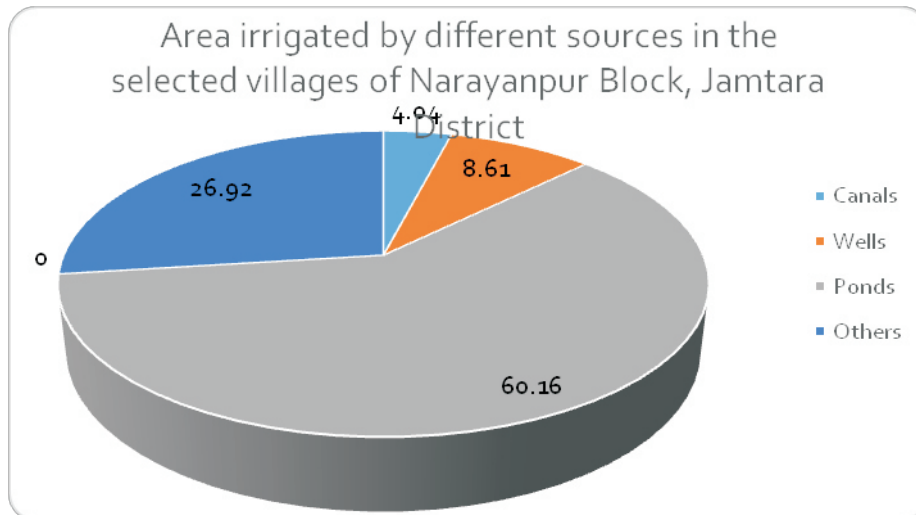
Among the sources of income from forests, major contributor is *Mahua* collection and selling of fuel wood and timber in the local markets, better known as *Haats*. Plates made of Sal leaves are also one of the sources of income alongwith sale of Tendu leaves. Thus, the profile of the forest resources show that forests are a major contributor in the family income.

**NARAYANPUR LANDSCAPE**

There are total 27 villages selected under the programme in Narayanpur block covering a total area of is 3040.8 hectares. Most of the area is under cultivation, which makes for about 38.88% of the total area of the selected villages. Only 2.44% of the total area is under the irrigation, whereas 23.14% area is unirrigated. A very small portion of the selected villages is covered under forest. Only 320.30 hectare forest area is available in the selected villages, i.e., 10.30% of the total area.

Total irrigated area of the selected 27 villages is only 74.30 hectares with tanks and lakes being the major sources of irrigation in the area. These sources cover 44.70 hectares area which is 60.16% of the total irrigated area available in the selected villages. Wells and tube-wells cover 8.61 % and canals cover 4.04% of the total irrigated area. About 26.92% of the total area is irrigated by various other sources.

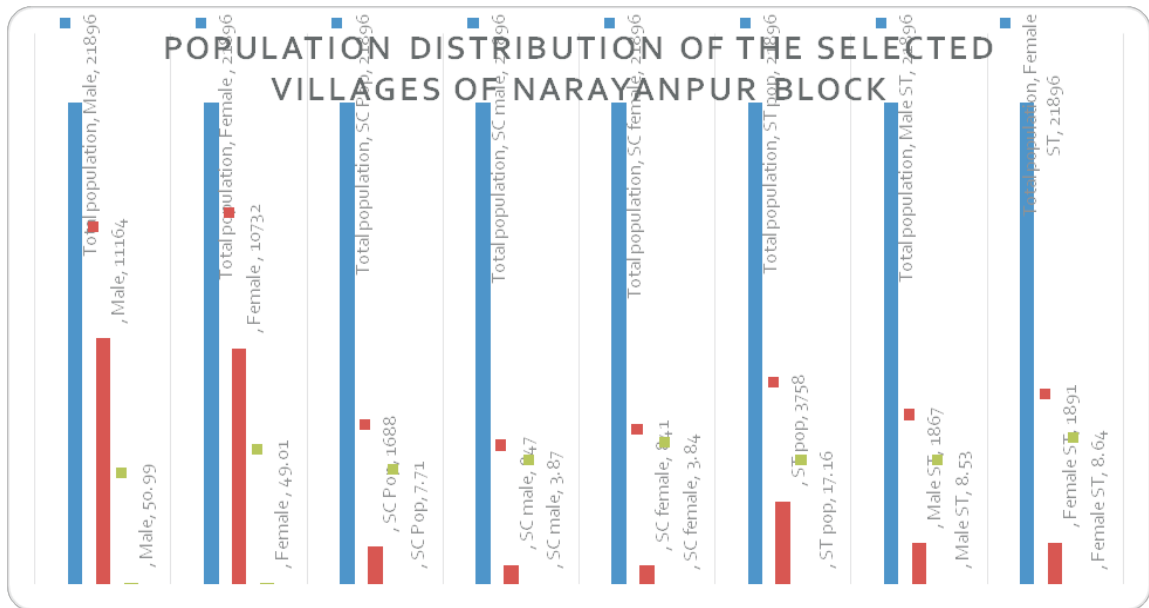




Survey in the selected villages indicates that there are 4 main sources of irrigation in the landscape. Maximum irrigation is done through ponds and other sources like wells while other sources also contribute significantly to the overall irrigation in the landscape. Irrigation helps farmers in adapting to the adverse challenges from the impacts of climate change.

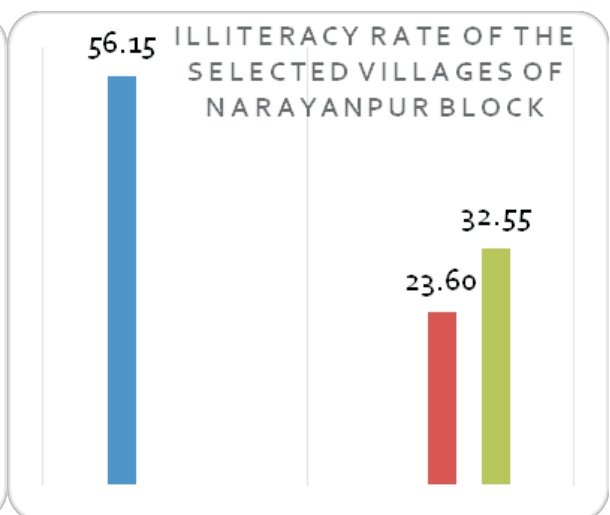
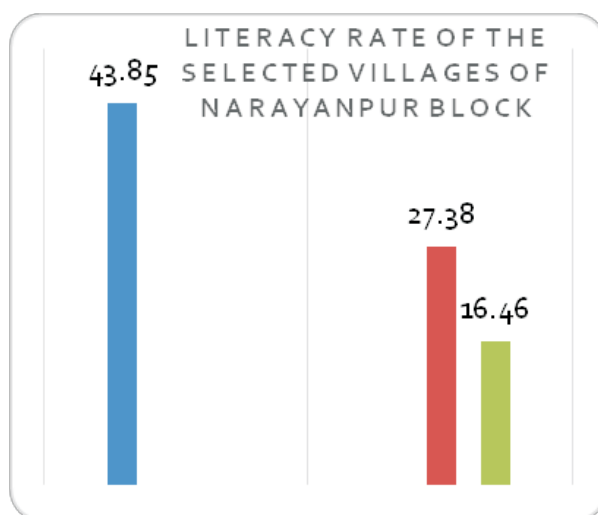
**Demographic profile of the selected villages in Narayanpur landscape:**

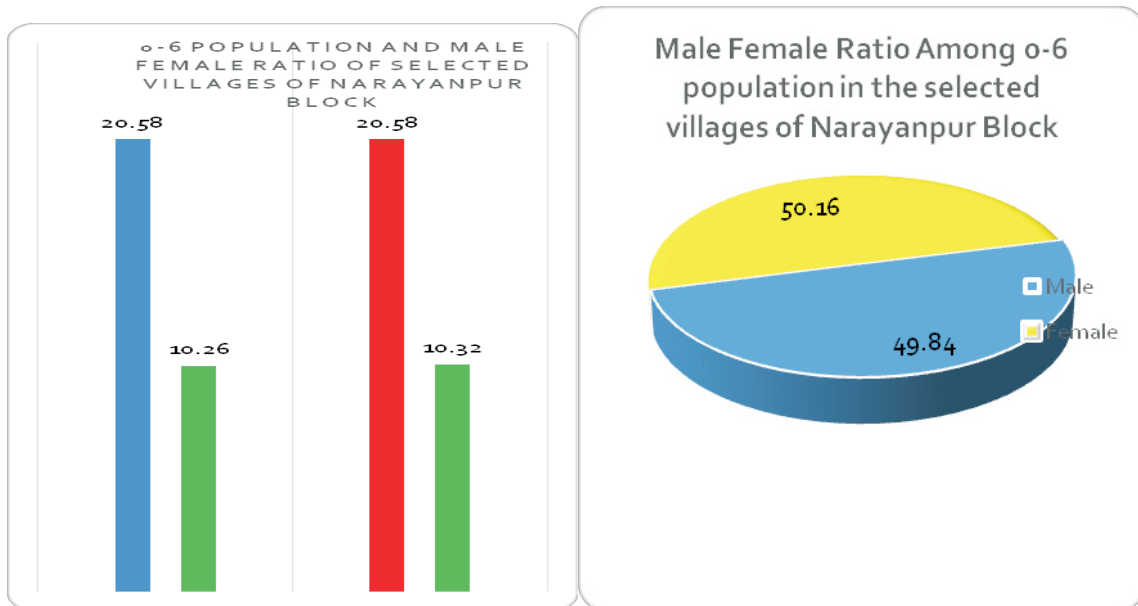
Total population of the selected 27 villages of Narayanpur Block is 21896 with 3858 households. Out of the total population, male population is around 50.99% and female population is 49.01%. Female population of the area is 961 out of 1000 male population. People belonging to both Scheduled Caste and Schedule Tribe live in the area. The Scheduled Caste population is very small (7.71%) whereas the Scheduled Tribe population is 17.16% of the total population. Out of 7.71% of total SC population, 3.87% are males and 3.84% are females. The female population is high as compared to male population in the Scheduled Tribe category. Out of 17.16% of the total ST population, 8.64% are females whereas 8.53% are males.



As per the survey done, the literacy rate of the area is significantly poor. Only 43.85% people of the total population are literate. Out of the total literate population, 27.38% are males and only 16.46% are females. The above figures also indicate that the literacy rate of the females of the area is significantly poor. The female literacy rate is 37.55% while the male literacy rate is 62.45%.

Illiteracy rate among females of the area is higher (32.55%) than that among the male population (23.60%).

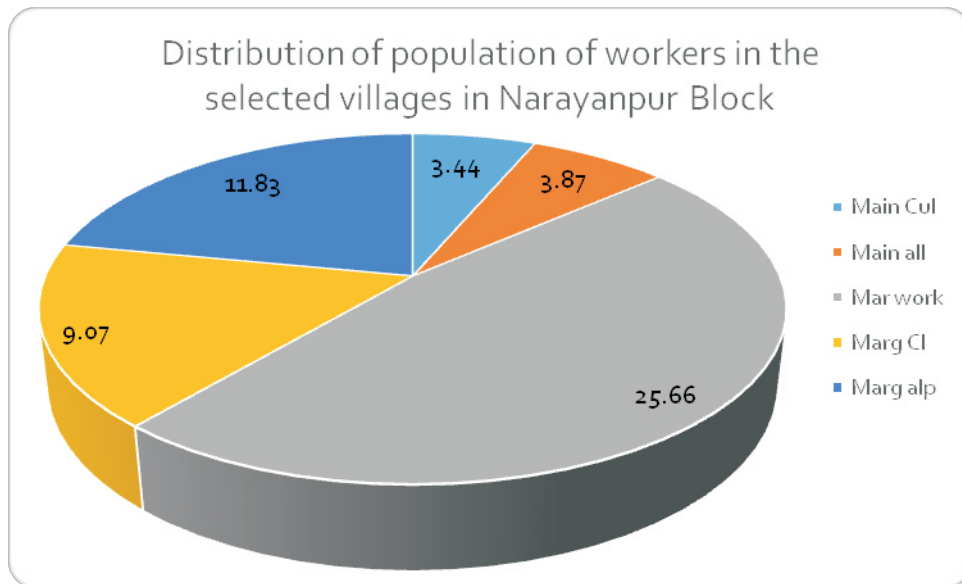




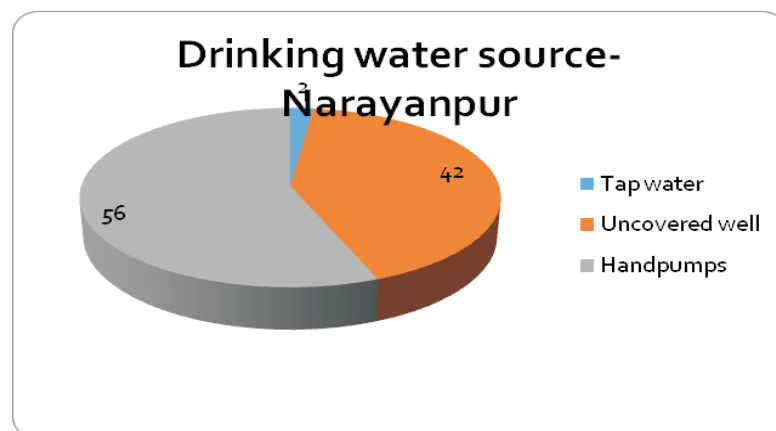
The above figures show the population and sex ratio of children in the age group of 0-6 in the selected villages of the area. Total population in the age-group of 0-6 years is 4506, which covers 20.58% of the total population of the area. The male and female ratio among the 0-6 years population is 50.16% male and 49.48% female.

Total population of the selected villages is 21896. About 50.99% of the total population of the area is constituted by males and 49.01% by females. Among the 0-6 years population, the Female population is a little higher (50.16%) compared to male population (49.84%) among 0-6 years population. Among the Scheduled Caste population, 50.18% are males and 49.82% are females. About 50.32% of the total ST population is female and 49.68% are males.

Out of the total population of the selected villages, only 36.87% are found to be workers as per Census of India 2011. Out of this, 25.66% are marginal workers. Around 11.83% are marginal agriculture labourers and 9.07% are marginal cultivators. Only 3.44% are main cultivators while 3.87% are main agriculture workers.

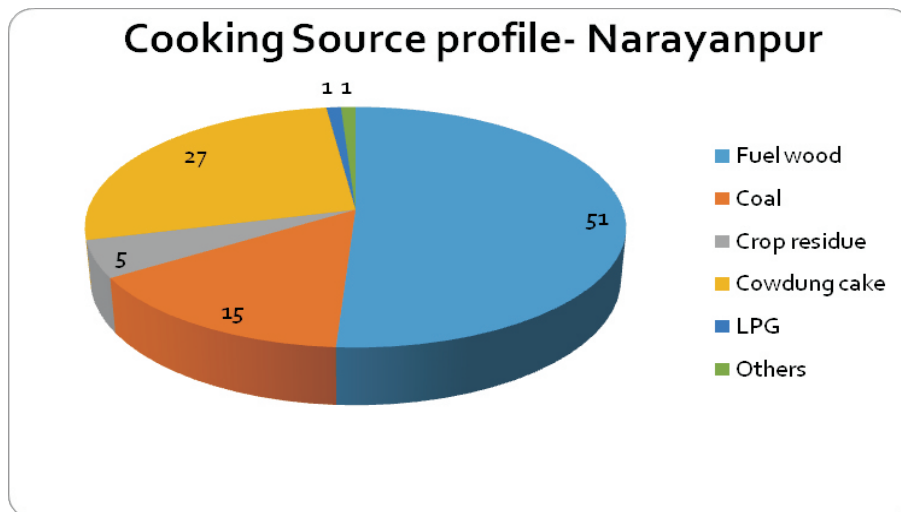


The figure below shows the male-female distribution among the worker’s group of the selected area of the Narayanpur Block of Jamtara district of Jharkhand. Among the total workers of the area, 24.83% are males and 12.04% are females. In the main cultivator group, 2.9% are males and only 0.54% are females. Only 3.53% male population of the total population of the selected area are main agriculture workers, while only 0.34% of this population are females. Among marginal workers, 15.38% are males and 10.28% are females out of total 25.66% of the population. About 9.07% of the total population belong to the marginal cultivator category and 11.83% belong to the marginal agriculture labourers’ category. Out of the total marginal cultivators, 5.26% are males and 3.82% are females while in among the total population of marginal agriculture labour, 6.74% are males and 5.09% are females respectively.



Access to safe drinking water and sanitation facilities are also limited in the area. Tube wells and wells are the primary sources of drinking water with no tap water facilities in the

targeted areas. Open defecation is common. With no sewage system in the targeted villages, water logging near the water sources is a common sight and are breeding grounds for mosquitoes and other vector-borne diseases.



Cooking is done mainly by use of fuel wood and fossil fuels like kerosene. These cause biotic pressure on forests and enhanced GHG emissions adding to the forces of climate change and disturbing the provisioning and ecosystem services from the forest nearby. It also affects the livelihood of the forest-dependent communities, especially tribals.

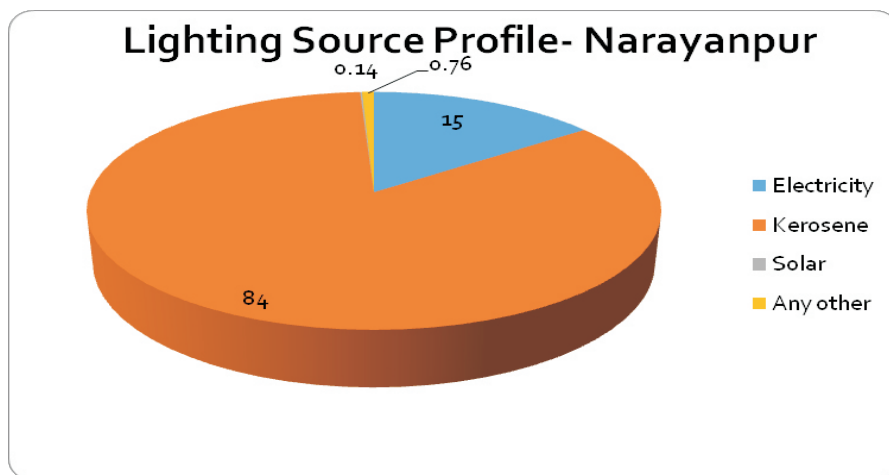
All the above data and figures pose the two blocks as the most vulnerable from the climate change adaptation viewpoint, particularly women with dismal literacy figures and make their adaptive capacities limited.

Biomass has been used for cooking and space-heating since time immemorial. While the gaseous fuels like LPG and natural gas have replaced biomass in developed countries and most urban homes in the developing world, half of the world’s population and about 90% of rural households in developing nations continue to depend on coal or biomass like wood, crop residues, cattle dung and charcoal for their cooking and heating needs. Data from Census, 2011 indicates more than 95% of all households in Narayanpur rely on traditional energy sources for their cooking needs.

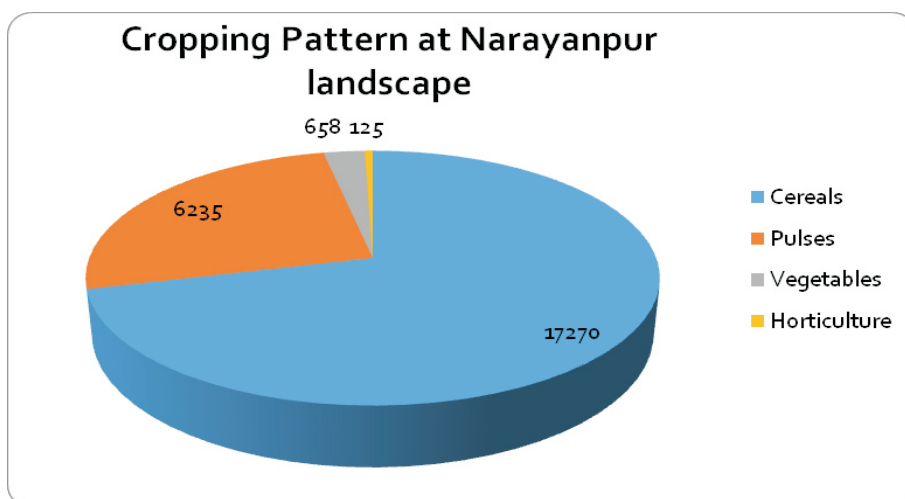
A major part of the household energy consumption is for cooking. Traditional cook-stoves or *chulhas*, which have efficiency less than 10% and are known to be sources of large quantities of pollutants, are used by most rural households in the developing world for cooking. The large fuel consumption of these *chulhas* results in a large amount of time



spent in collecting fuel by these households. In such households, women and children are often exposed to high levels of pollutants, for 3 to 7 hours daily over many years. There are strong evidences to show the relation between exposure to such emissions and acute respiratory infections in children, with estimated two to three-fold increase in incidence and mortality due to the exposure to these emissions.

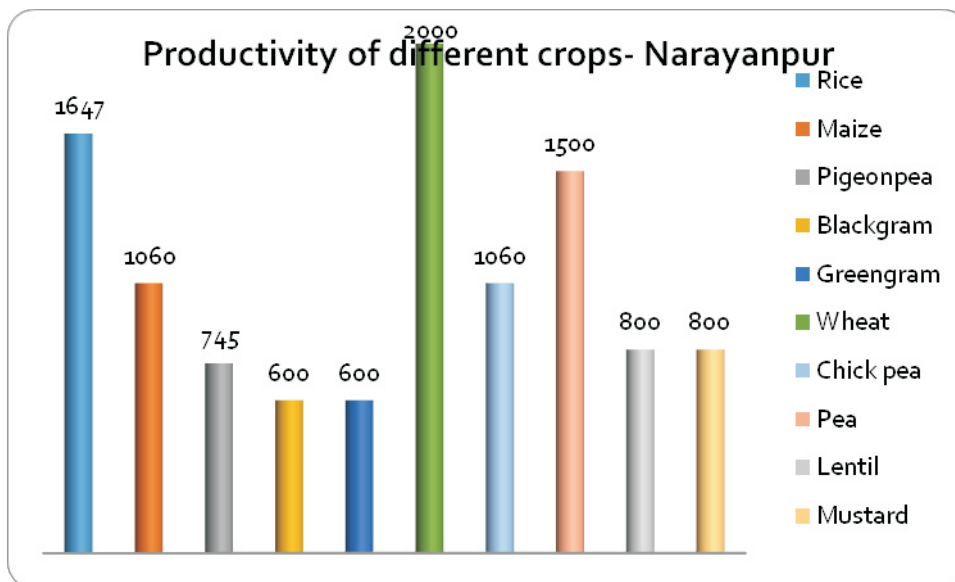


Recently, there have been reports on the effect of black carbon released due to unclean combustion in cook stoves, on climate change. Therefore, development and dissemination of cook stoves that lead to reducing fuel consumption, cooking time, and indoor air pollution can effectively contribute to improving the quality of life of rural women and also contribute to climate change mitigation.

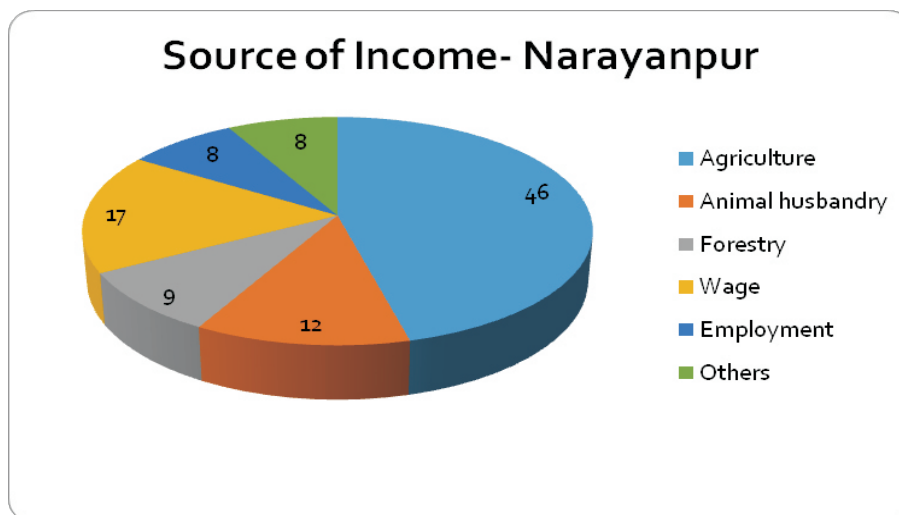


Cropping pattern in the selected landscape indicates that cereals occupy the largest area in cultivation. One of main differences between the two landscapes is that wheat is cultivated in Narayanpur whereas in Patratu, area under wheat is very less. Maize has been one of the

staple crops apart from paddy in the area and is cultivated in both landscapes. Pulses is cultivated in a large area owing to abundance of land which requires adequate crop coverage to reduce erosion from the landscape. Vegetables are cultivated in the command area of wells and ponds, mostly the second and third crop.



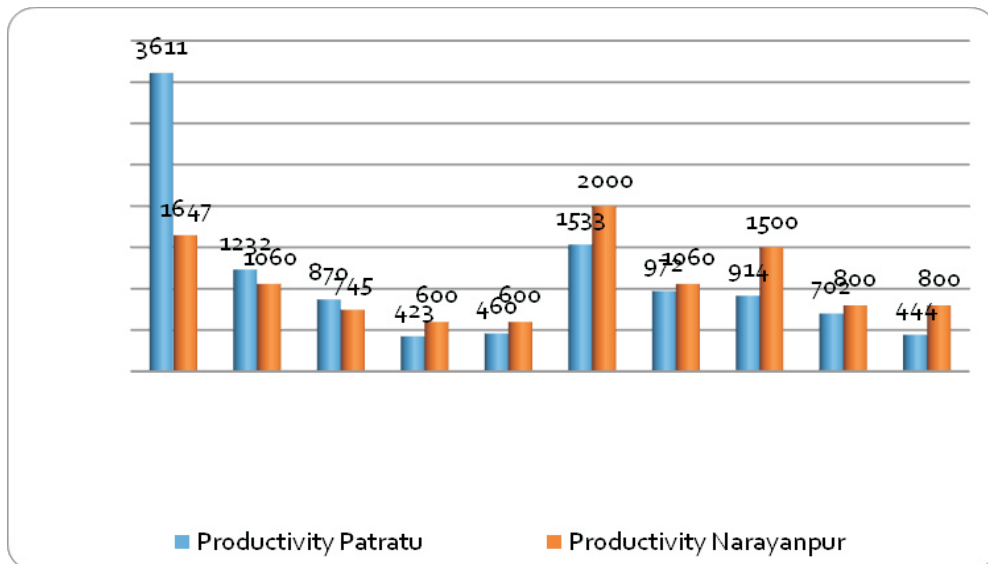
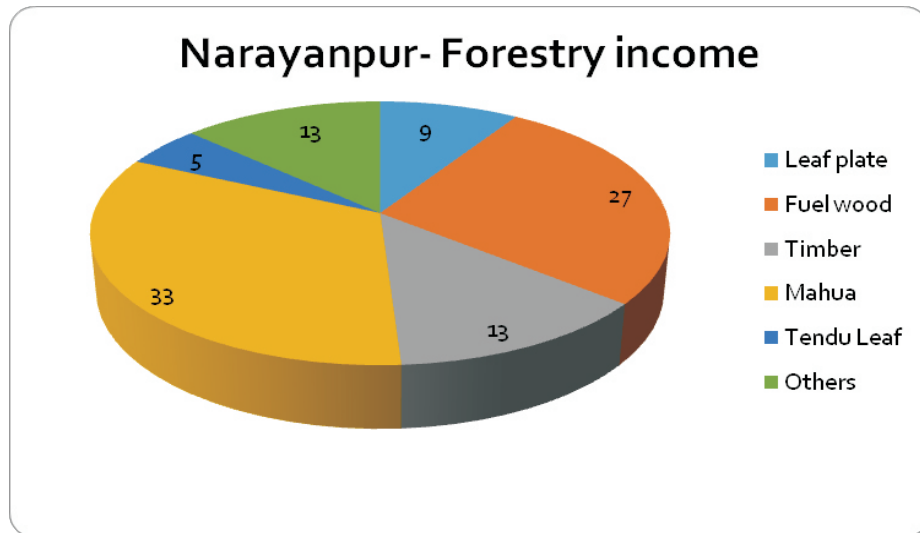
Productivity of different crops in the landscape is lower than the Patratu landscape. In Narayanpur landscape, productivity of Paddy is 16 Q/Ha and that of wheat is 20 Q/ha which is strange. Productivity of other crops has been shown in the graph above.



When it comes to income of the family agriculture, wage and animal husbandry come as first, second and third in the priority ranking. Together, these account for 75% of the total income of the family. Forestry contributes very little to the income of the family which is evident from the fact that only 10% of the total area is under forest and biodiversity is also

very poor. Hence, resources are also few in the Narayanpur landscape as far as forest is concerned.

The graph below indicates the contribution of forest resources in overall income of the family and their priority ranking. *Mahua* contributes as the number one source of income while fuel wood comes in the second place. Thus *Mahua*, fuel wood and leaf plate together contribute to more than 80% of the income of the family amongst forest resources.



Comparison of productivity between the two landscapes clearly shows that Paddy productivity is high in Patratu landscape while wheat productivity is high in the Narayanpur landscape. Narayanpur fares better in the pulses and oilseeds’ productivity whereas Patratu scores better in cereals’ productivity;

### **Green cover:**

Carbon is one of the most important elements supporting the existence of life on earth. It also contributes to the greenhouse gases and its concentration in the atmosphere. Biomass estimation based forest management is the key epilogue of Kyoto protocol of United Nations Framework convention on Climate Change (UNFCCC). Regeneration or afforestation programme taken up by different nations decides the efforts to neutralize demand and supply gap for carbon emitted and sequestered.

Studies conducted by institutions reveal that the naturally-dominant tree species in forest of Jharkhand are *Shorea robusta*, *Madhuca indica*, *Madhuca latifolia*, *Semicarpus anacardium*, *Buchnanian lanzen* whereas in the Trees Outside Forest (TOF), *Anacardium occidentale*, *Eucalyptus spp*, *Pongania piñata* and *Acacia spp* dominate. Estimation of tree species in Jamtara district was found to be 67.56 ton/ha. On the basis of individual tree species contribution of carbon sequestration, *Madhuca indica* (0.207t/tree) supersedes *Shorea robusta* (0.140 t/tree) in forests where as in TOF, *Eucalyptus* (0.407t/tree) and *Mangifera indica* (0.294t/tree) contribute maximum.

### **Availability of fuel wood:**

Most of population in Narayanpur and Patratu block continues to depend on biomass for their cooking needs. The cooking devices used by majority of them have very poor thermal efficiency and serious health impacts due to unclean combustion. While past few decades have seen a lot of interest world over in development of better cook-stoves for burning biomass, the magnitude of the problem is still a major cause of concern. In India, a lot of resources had gone into the National Programme on Improved Cook-stoves between 1985 and 2004 with mixed experiences. Learning from this programme, there is a felt need to start a new initiative on biomass cook-stoves with a different approach considering the changes that have taken place in the society, technology and the global concerns.

### **Economy of the area:**

According to the vulnerability assessment report by UNDP, approximately 75 - 80% of the population is dependent on agriculture sector for their livelihood. Existing irrigation coverage as per 3rd M.I. Census is merely 22% of the available arable land (as against the

National coverage of over 40%). Irrigation is, therefore, the critical factor for increasing agricultural production and productivity.

By the end of March 2007, 0.68 M ha irrigation potential has been created after completion of 1 major, 98 medium irrigation projects and a number of minor irrigation schemes.

Water availability is 28781 million m<sup>3</sup>, out of which 23789 million m<sup>3</sup> is from surface water and rest 4992 million m<sup>3</sup> is from ground water. The total utilization of surface and ground water in the State for irrigation purposes so far is only 4736 million m<sup>3</sup> out of which 3964 million m<sup>3</sup> is surface water and 772 million m<sup>3</sup> is ground water. Both the blocks are dominated by farming communities and people depend on cultivation for making their living. Forest and animal husbandry are the next resort for communities in both blocks. Wage earning is the third option and distress migration is the last resort for survival of the communities in the project area.

Area is dominated by rainfed farming and mono-cropping of Paddy through the traditional system of cultivation. Irrigation is limited and to the tune of 12% only. Diversification of crops is also not practiced. After the cropping season is over, people depend on wage earning and other sources mentioned above for their livelihood.

Absence of water storage structures coupled with less awareness about diversification, crop rotation and access to improved farming practices make these farmers more vulnerable from the climate change perspective.

The total number of villages covered will be 21 in Patratu block and 27 in Narayanpur block of the Jamtara district. The total number of households covered will be approximately 8888, with around 3837 families of tribals and Scheduled Caste. Gender and Sex ratio related information has been already discussed in the earlier sections.

With regards to land holding, it is found that close to 70% farmers are marginal (having less than 2 Acres of land) and most vulnerable due to factors like low productivity, lack of access to timely credit for investments, low literacy, poor health conditions, high migration and influence of different armed groups in the area. Even the small and medium farmers do not have round-the-year food security which forces them to distress migration.

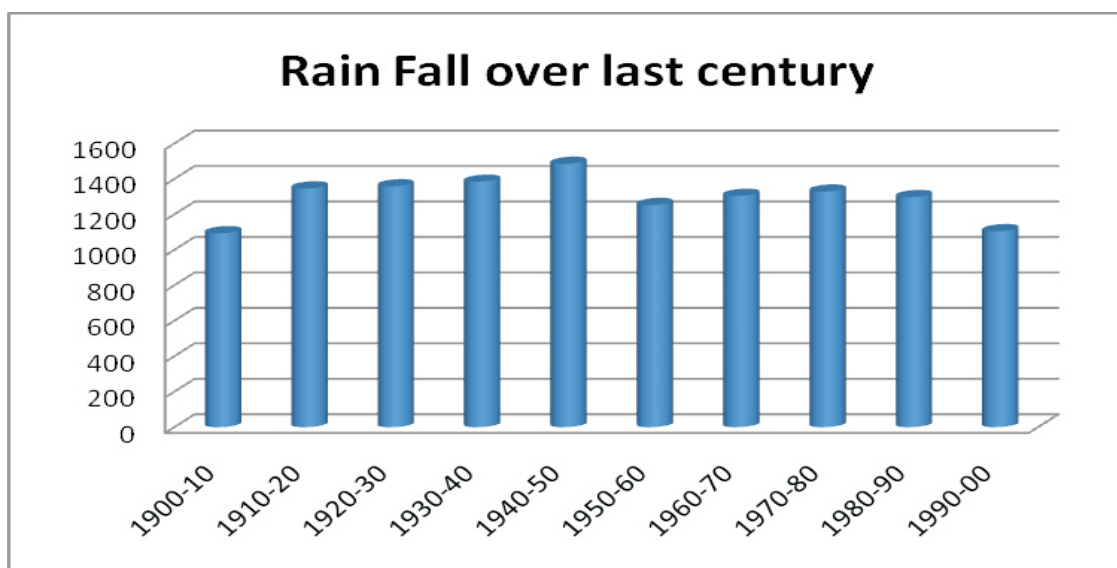
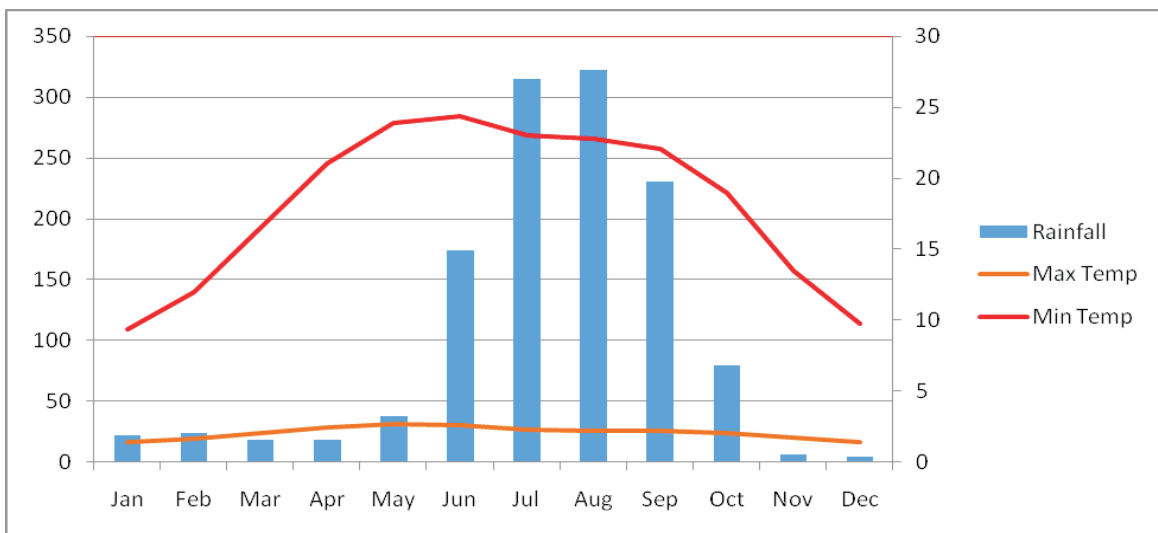
These have been arrived at on the basis of secondary data and a rapid rural appraisal in part of the landscape.

**Historical climate data for the two landscapes: (Indiawaterportal.org)**

**Annual Rainfall:**

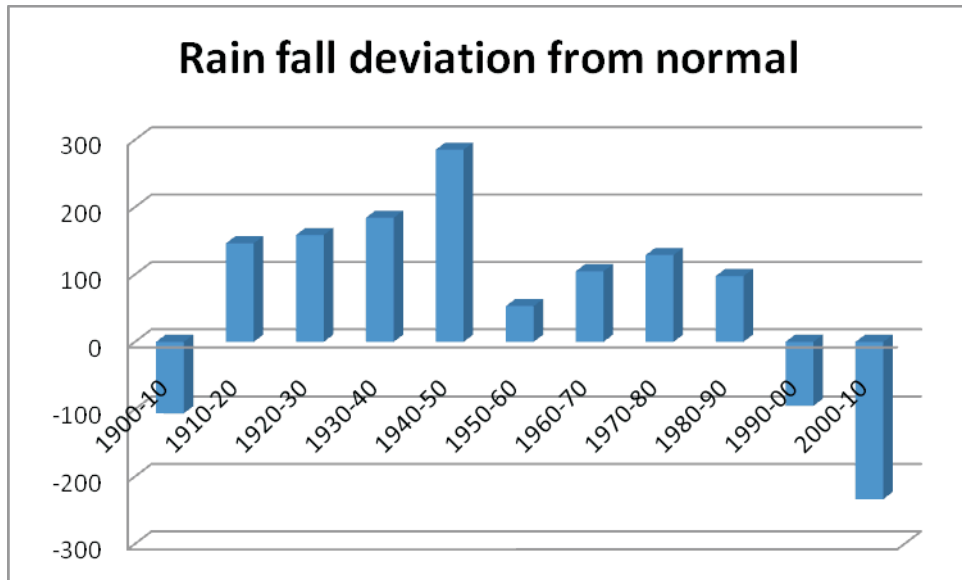
Rainfall data for the watershed has been collected from India Water Portal for the last 100 years. It has been grouped and arithmetic average calculated to get the decadal average rainfall. The normal rainfall has been assumed at 1200 mm and deviation has been calculated based on the assumption and arithmetic average of the decadal rainfall.

Extreme events related to rainfall have been measured with the deviation in the rainfall and number of times that it has exceeded or fallen short of the normal rainfall. These deviations have been depicted in the graphs.

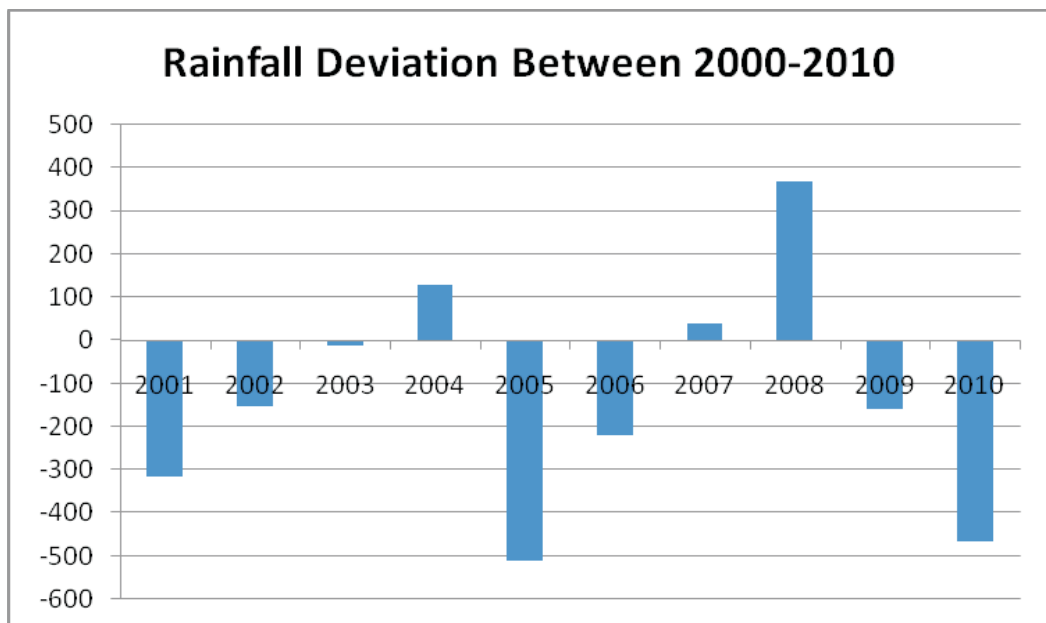


**Deviation of rainfall:**

The deviation has been measured with reference to the normal rainfall and all data has been taken from the IMD data from the year 1900 onwards. Data suggests that in the last 10 decades, seven decades had positive rainfall and three decades show negative deviation.



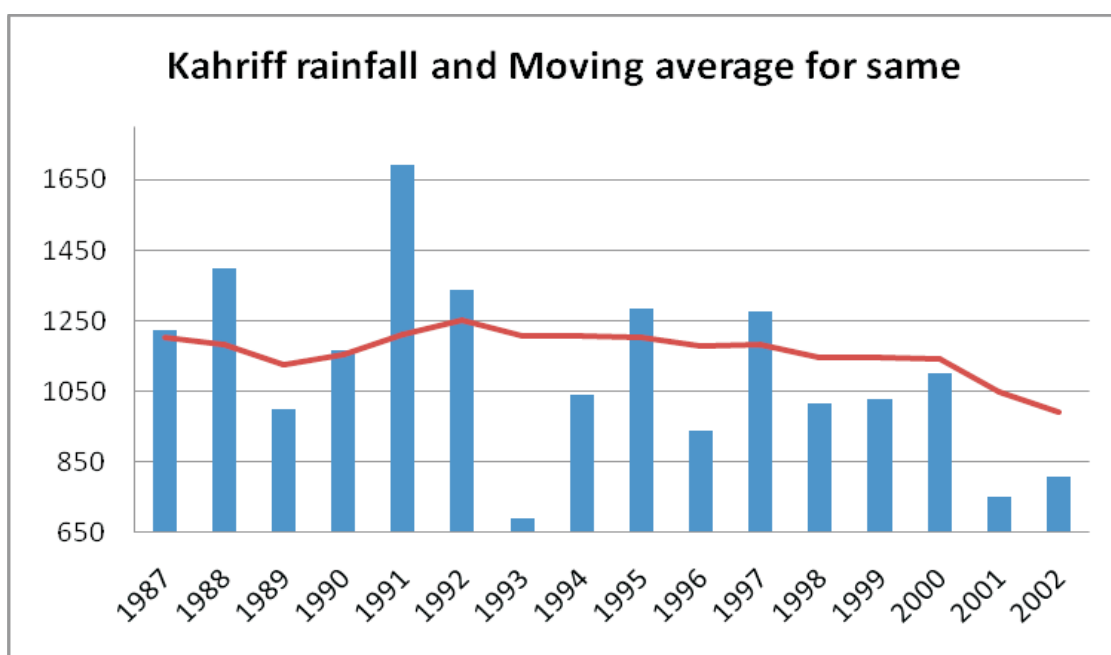
Considering the deviation in the last 10 years, there has been absolute reversal of the pattern. Also, out of these 10 years, only 3 years had positive deviation while the other 7 years had negative deviation.



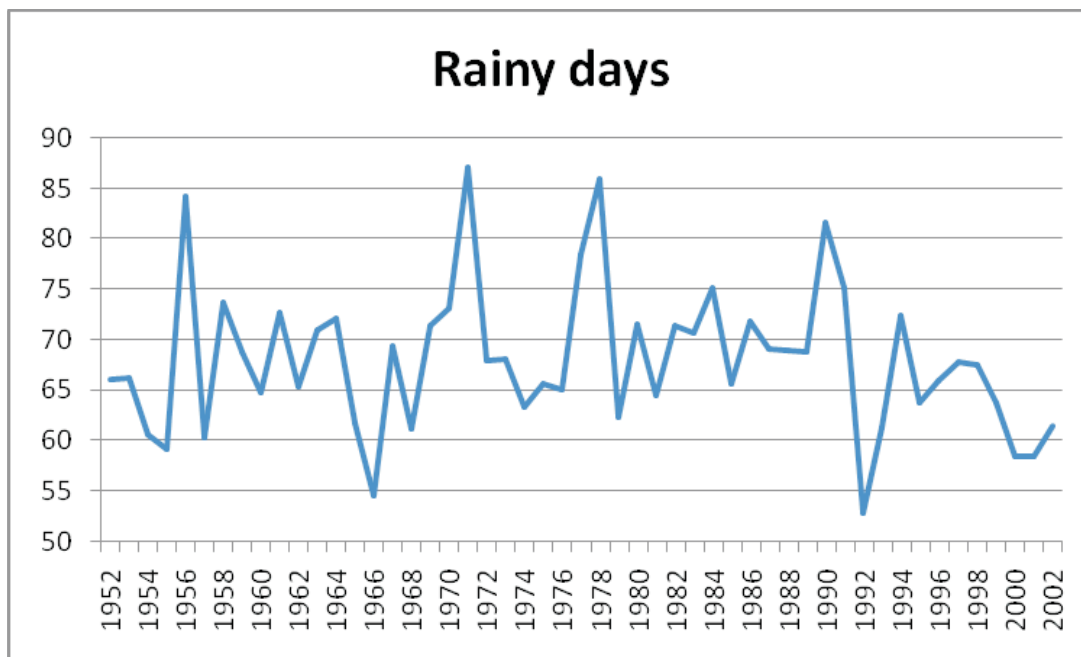
**Seasonal rainfall:**

The district receives maximum rain from the advancing northeast monsoon. The district also receives some rainfall through the re-treading south-west monsoon. District is mainly mono-cropped and it has only 3% area under irrigation as compared to 11% under watershed. This is not because of low rainfall in the district, but mainly because of undulating land that causes faster run-off in the area. The variations, as mentioned above, have also been high resulting in greater run-off. It has also been noted in the recent years that number of rainy days has been decreasing as evident from the wet day data on India Water Portal.

There has been wide variation in the rainfall during the Kharif and Rabi seasons. The graph below shows the decreasing trend over the last few years which can lead to a significant decrease in the coming years. The highest rainfall in Kharif has been reported in the year 1990 at 1693 mm and lowest in the year 1992 at 688 mm. Number of rainy days has decreased from 69 days /year to 63 days/year in the last decade.



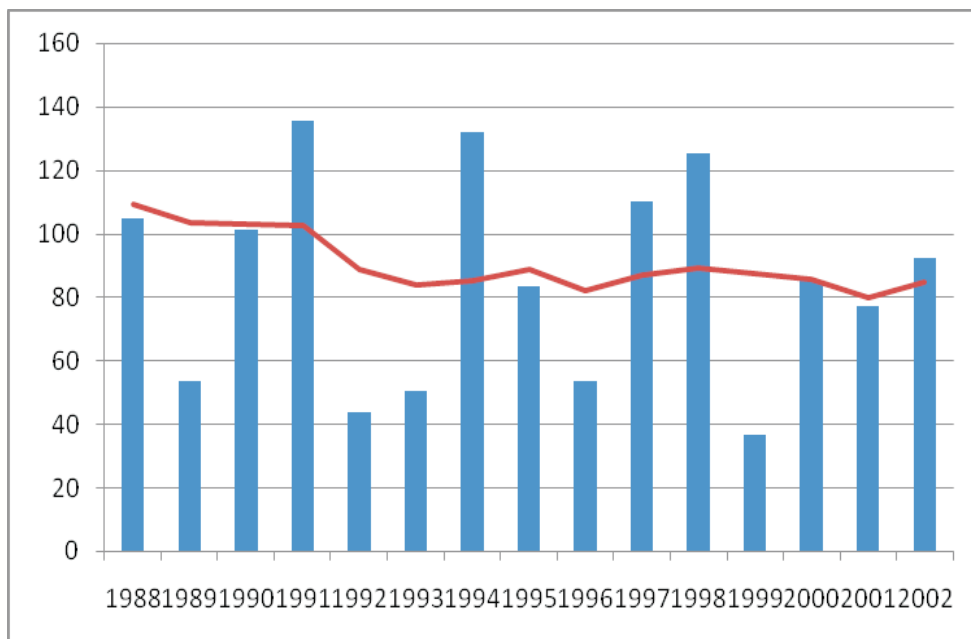




**Rainfall trend in Rabi season:**

The State and district largely remain mono-cropped. However, the red lateritic soil is good for vegetables and hence, rainfall in Rabi or irrigation facilities have a great bearing on the cultivation in Rabi season. Over the last few years, there has been a significant decrease in rainfall. Especially after 1996, the trend has been alarming.

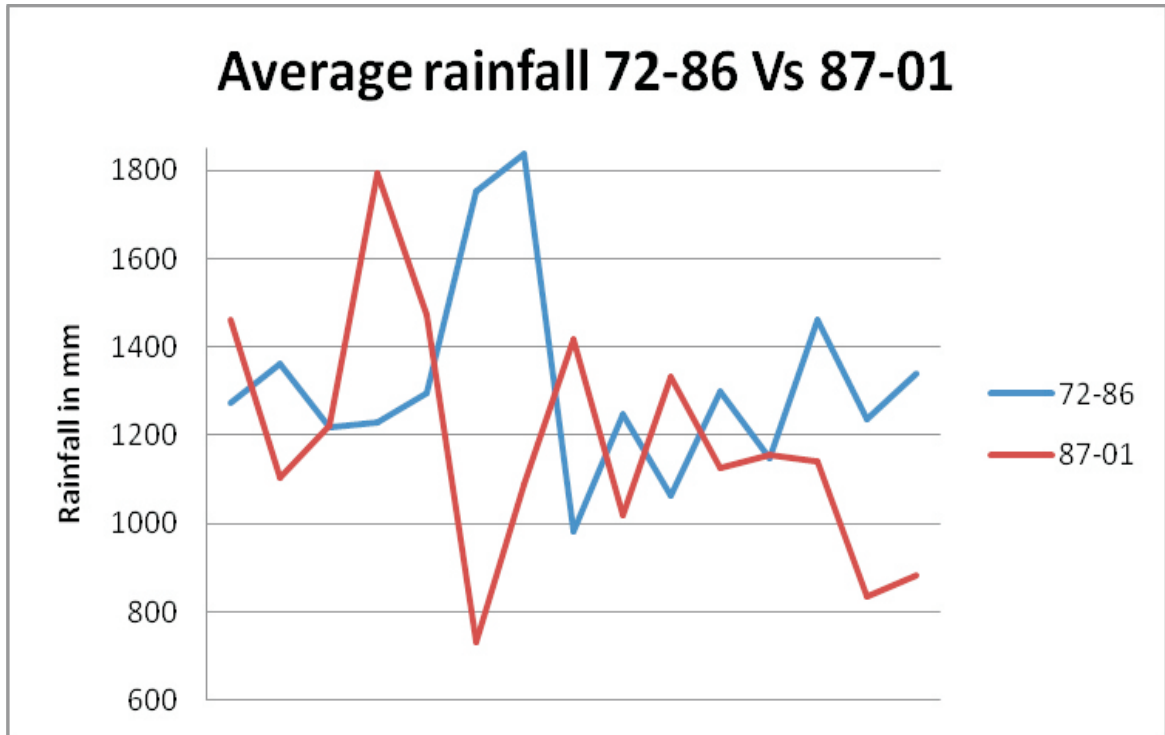
The highest rainfall has been reported in the year 1919 at 138 mm and the lowest rainfall has been reported in the year 1999 at 37 mm. The trend shows that since 1992, frequency of rain in the month of December has been very rare while before 1992, rain in the month of December was more common. The same can be observed for the month of January as well.



**Average Monthly rainfall:**

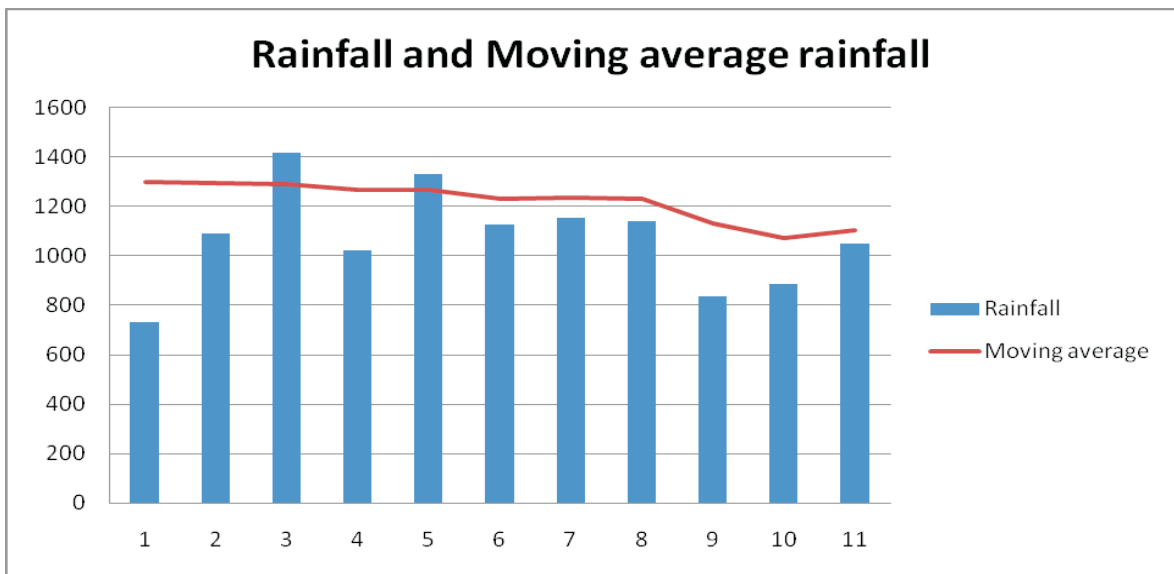
Data for the last 30 years has been collected to know the trends and deviations in the each half of 15 years. The data has been collected for last 50 years from the website. Trends show that there has been variation in average monthly rainfall. For some decades starting from 1990, it shows an increasing trend and then starts showing a decreasing trend for the district.

This has implications on the agriculture production and all livelihood activities based on land and water. Even the allied livelihood activities of fisheries and animal husbandry are bound to be affected by the changes in the precipitation regime.



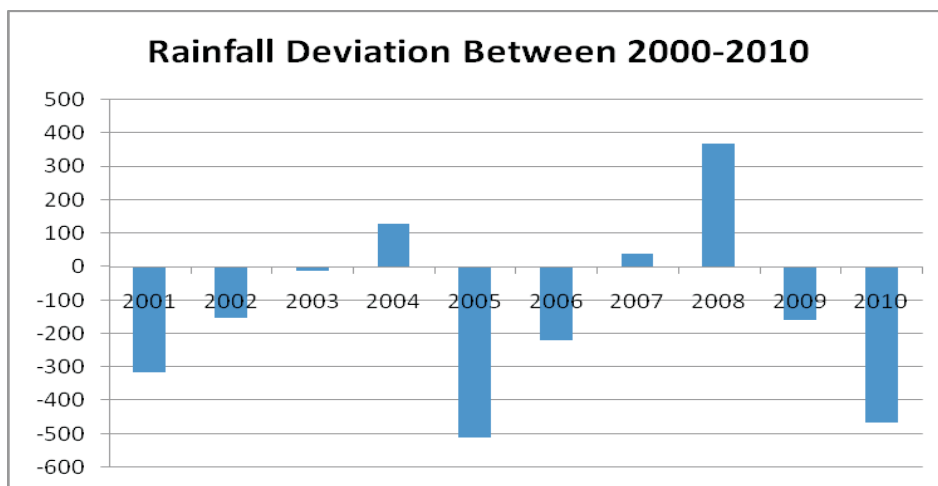
**Moving average of the rainfall:**

A decreasing trend of rainfall is clearly indicated by the moving average line. Post 1992, there has been a decline in the average rainfall. The heaviest rain has been received in the year 1994 at 1416.47 mm and the lowest rainfall has been received in the year 1992 at 732.61 mm. Rest of the years have received lesser rainfall and it varies with the last two years receiving approximately 850 mm rainfall, which is less than the average rainfall received by the State and the district.



**Extreme event analysis:**

As mentioned above, in the last century there has been three decades with deficit average rainfall whereas in the last decade only, there has been three average rainfall years. This indicates the absolute reversal of trends in the last decade.

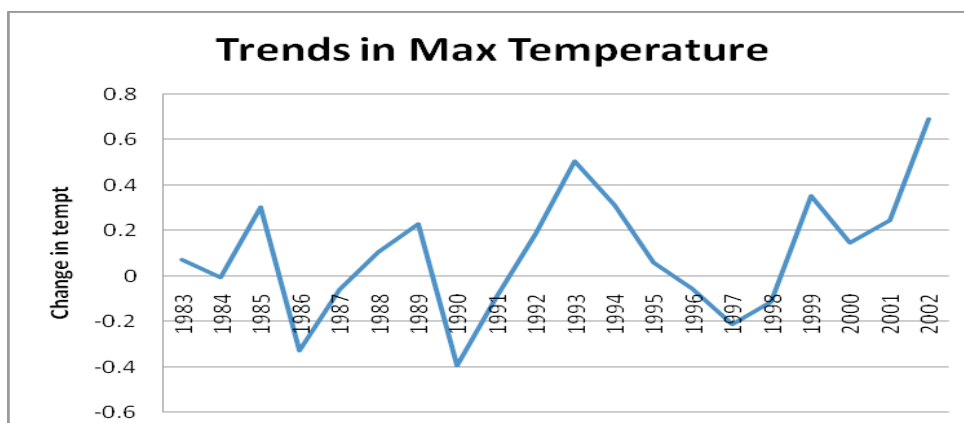


There have been consecutive droughts in the year 2001-02-03, 2005-06 and 2009-10. It can be seen that on an average, every third year there has been a drought.

**Temperature:**

**Maximum temperature:**

Average maximum temperature for the last 40 years has been analyzed. There have been changes in the temperature but with a zigzag trend where the temperature fluctuations have shown an increasing and decreasing trend. From the year 1998 onwards, there has been an upward trend leading to indications that temperature is rising. It indicates that there will be more heat waves and extreme events in near future making life tough for the farmers in the watershed.

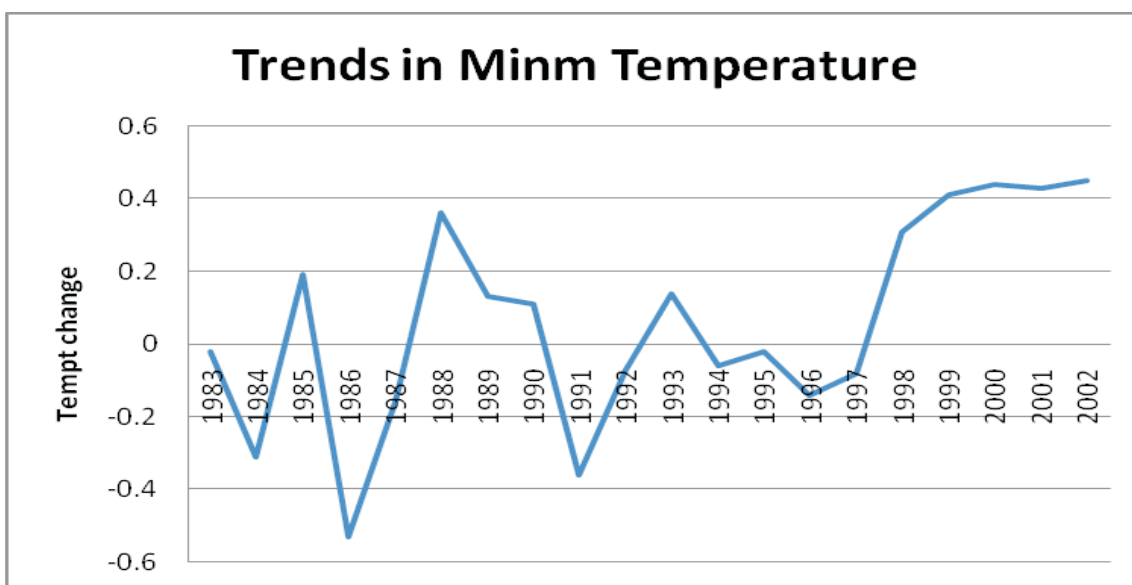


Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg Tempt	Change in Tempt
1983	22.26	25.76	31.34	34.84	36.82	36.77	31.28	29.90	30.11	28.35	25.63	23.49	29.71	0.07
1984	23.42	24.51	32.27	37.05	39.12	32.46	29.64	28.88	29.25	29.89	25.42	23.69	29.63	-0.01
1985	23.37	25.49	32.53	36.66	38.13	35.78	28.78	29.06	29.50	28.75	26.58	24.68	29.94	0.30
1986	23.05	25.55	30.70	35.79	36.68	34.93	29.53	28.74	29.15	27.90	26.71	23.03	29.31	-0.33
1987	22.83	26.37	31.01	35.57	37.15	36.46	29.61	28.33	29.08	28.90	26.06	23.59	29.58	-0.06
1988	23.48	26.37	30.56	36.01	37.65	32.68	29.44	29.41	30.98	29.33	26.55	24.51	29.75	0.11
1989	22.84	26.45	31.86	37.20	38.54	33.42	30.25	29.22	29.78	29.37	25.98	23.53	29.87	0.23
1990	24.70	25.82	28.90	34.86	35.92	34.37	28.90	29.22	29.58	27.97	26.84	23.86	29.25	-0.39
1991	22.58	27.65	31.45	35.37	38.64	33.49	30.68	28.66	29.56	28.63	25.05	22.76	29.54	-0.10
1992	22.57	24.42	32.16	36.32	37.08	34.74	31.18	29.45	29.88	29.38	27.13	23.62	29.83	0.19
1993	24.32	27.62	31.23	35.60	38.75	36.26	30.87	29.47	29.52	29.58	25.30	23.25	30.15	0.51
1994	24.56	25.90	32.34	35.24	38.61	34.78	29.42	28.81	29.52	29.64	26.77	23.82	29.95	0.31
1995	22.15	25.94	30.79	36.37	37.66	36.70	29.93	28.75	28.92	29.16	26.16	23.84	29.70	0.06
1996	23.95	25.09	32.08	34.66	38.81	33.61	29.79	28.32	29.90	29.06	26.91	22.82	29.58	-0.06
1997	22.18	24.76	31.03	33.54	37.50	36.72	29.31	28.75	28.98	29.83	26.98	23.55	29.43	-0.21
1998	22.81	25.55	28.35	34.29	36.73	37.33	29.25	29.20	29.53	30.69	26.34	24.28	29.53	-0.11
1999	22.23	26.66	32.49	37.86	37.88	34.66	29.68	28.81	28.62	30.15	27.41	23.45	29.99	0.35
2000	23.15	24.26	30.41	37.15	37.58	33.50	30.30	29.71	28.73	30.46	28.32	23.84	29.78	0.14
2001	22.76	25.83	31.45	36.05	38.32	32.19	28.56	29.74	30.25	30.45	28.05	24.96	29.88	0.24
2002	23.24	27.00	32.43	36.37	39.12	35.50	31.13	29.14	29.52	29.17	26.59	24.75	30.33	0.69

### MINIMUM TEMPERATURE

The minimum temperature for each year in the last two decades is taken into analysis by considering the average minimum temperature into account. The increase or decrease in minimum temperature results in the temperature changes.

The change in minimum temperature shows an increasing trend suggesting that the increase in minimum temperature may cause prolonged summers and warmer winters. The maximum positive increase in percentage of the minimum temperature is in all the months of the Kharif season which might influence the rainfall occurrence and distribution.



### Forest fire:

Apart from the several tangible benefits forests provide, they are the most valuable resources in regulating the natural balance, affecting the climate and water bodies of the region, preventing air pollution and soil erosion. As per various studies, forest fires have influenced the flora and fauna of the forests and millions of hectares of forests across the world are affected by it every year. Thus, the consequences are adverse leading to deterioration of forest health and wealth. Many researchers have provided details on the negative impacts of forest fires.

The deciduous forests have been observed to be more vulnerable to forest fires. In India, 40% of all the forest fires reported are found to be in deciduous forests. There are many

factors responsible for the start and spread of forest fires, one of them being the anthropogenic factor which has a major influence.

Summer season is favourable for the spread of fires. There are many reasons attributed to the forest fire occurrences. Sometimes, it is accidental or due to negligence. More than 90% forest fires are caused by anthropogenic activity by human beings deliberately (for personal gains or rivalry) or merely due to negligence or by accident.

Forest fires sometimes start due to accidental or unintentional reasons. Some of the instances are as follows: To facilitate collection of non-timber forest produce (NTFP), the collectors usually ignite the fire, which accidentally may spread in the forest due to extreme hot weather, resulting into a major fire. The main non-wood forest product that contributes to forest fires in Jharkhand is the *Mahua* flowers (*Madhuca indica*) collected by the local people. They are boiled with Sal seeds (*Shorea robusta*) to produce a popular local beverage. *Mahua* pickers burn the dry leaves under the trees to get a neat and clean floor to facilitate flower collection. While the objective is only to clear a small circular floor beneath a single tree, these fires often spread out of control due to hot weather. Since the collection of *Mahua* flowers is done during the summer months of March and April, the hot, dry weather due to high temperature, high wind velocity and low relative humidity aggravates the situation. In some cases, the cause of ignition of fire is to increase the production of *Tendu* leaves, to meet the demands of fodder for grazing animals, sometimes as a result of rivalry with the forest staff and to keep wild animals away. Smugglers and illegal loggers of the area many times start forest fires to hide the stumps of illicit felling in order to conceal it.

Among natural causes that originate forest fires in Jharkhand, the prime is in the bamboo mixed forest areas where forest fires may occur due to high wind velocity during summer by the collusion together of clumps of dry bamboos. The major fire spread patterns are related to the special/ particular weather conditions, the topography of the area or potential fuels. The nature of fire, starting from ignition to spread, can be grouped into three types: 1) the ones where it is influenced by topography 2) wind 3) fuel accumulation. Other important parameters related to weather are temperature and moisture. Temperature affects the sparking of forest fires, because heat is one of the three pillars of the fire-triangle. The fallen

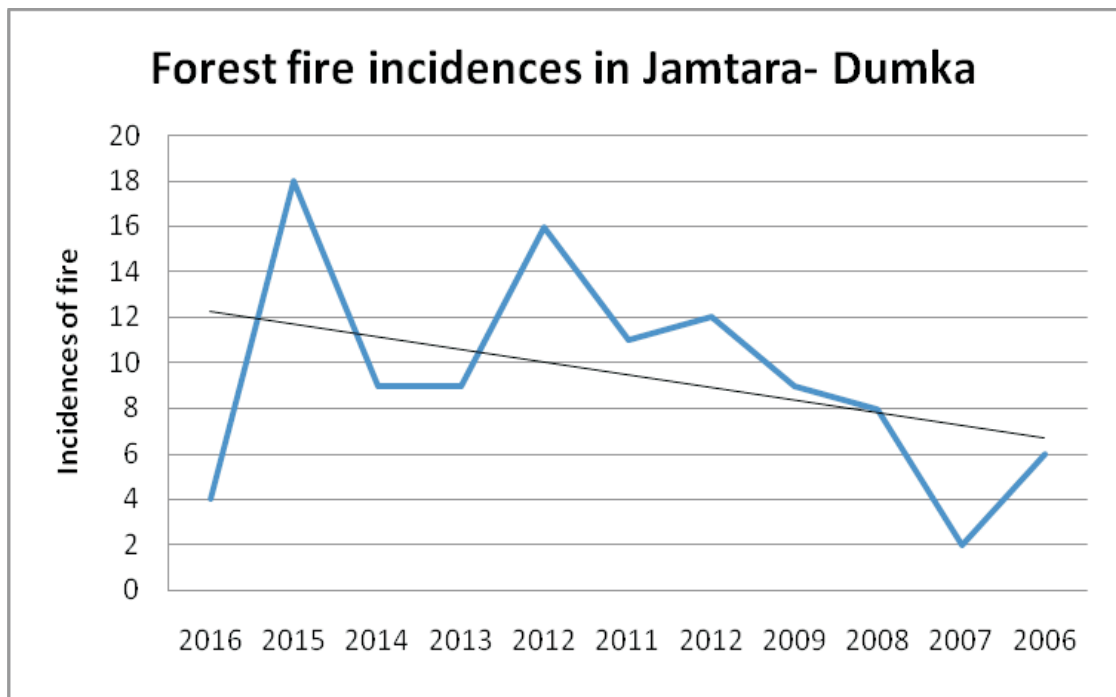
poles, trees and underbrush on the ground receive radiant heat from the sun, which heat and dry up the potential fuels.

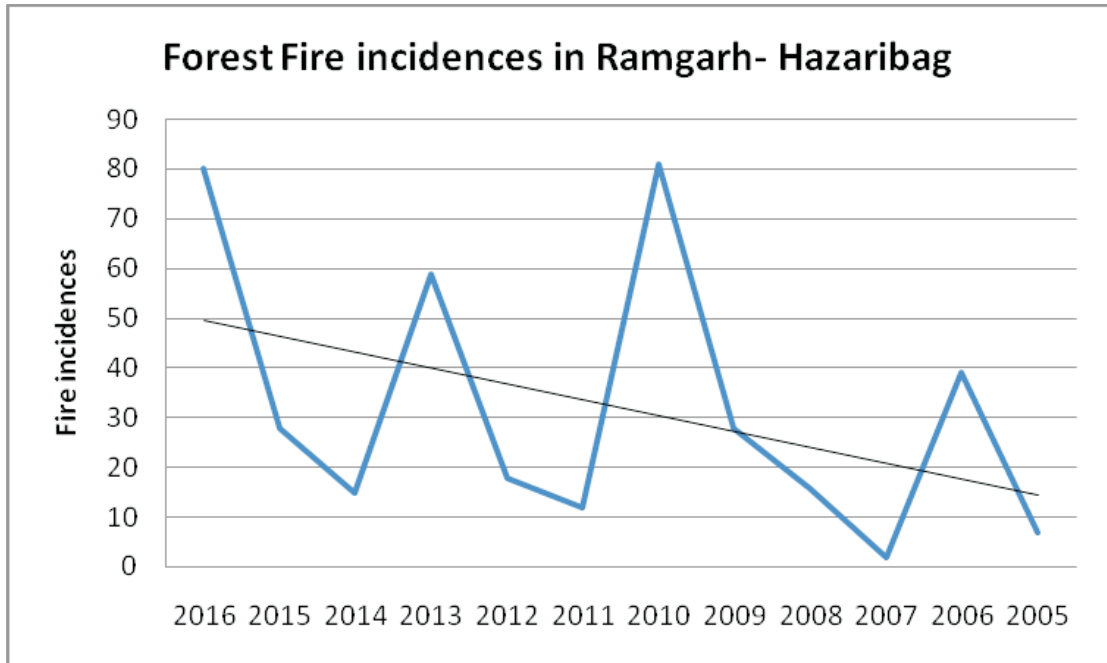
Warmer temperatures allow for fuels to inflame and burn faster, adding to the rate at which a forest fire spreads. For this reason, forest fires tend to rage in the afternoon, when temperatures are the highest.

Wind probably has the biggest impact on a forest fire's behaviour. It is also the most unpredictable factor. Winds supply the fire with additional oxygen, further dry, potential fuel and push the fire across the forest land more rapidly. The stronger the wind blows, the faster the fire spread risk. The speed of the fire and direction do not change during this stage. Due to the wind, the fire is brought closer to fresh fuel accelerating the spread of fire in the direction of the wind. While wind can help the fire to expand, moisture works against the fire. Moisture, in the form of humidity and precipitation, can slow the fire spread and reduce its intensity. The potential fuels can be hard to catch fire if they retain high levels of moisture, as moisture absorbs the fire's heat; When humidity is low in the air, meaning that there is a little amount of water vapour, forest fires are more likely to start. The higher the humidity in air, the fuel is moistened and less risk of ignition. When the air becomes saturated with moisture, it releases the moisture in the form of rain drops. Rain and other precipitations increase the amount of moisture in fuels, which forcibly putting an end to any potential forest fires from breaking out.

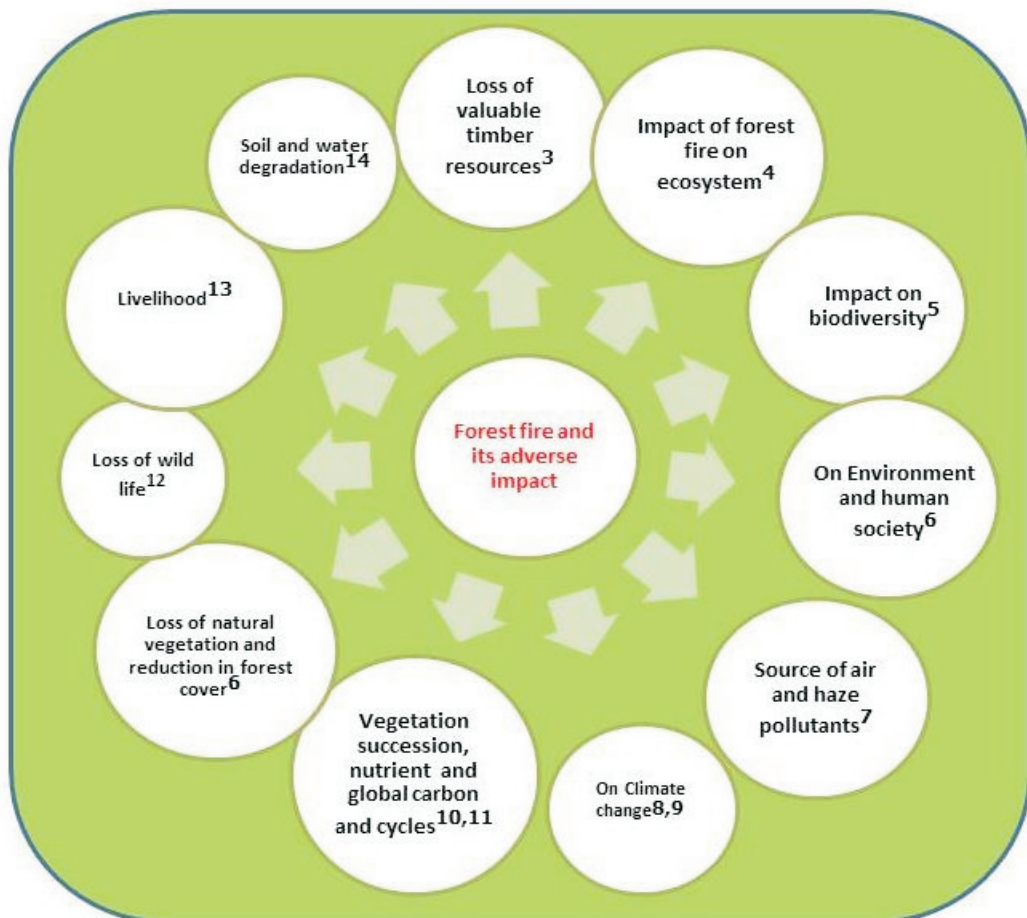
The majority of forest fires occur in between January and June in India. In various biogeographic zones of India, more frequent forest fires occur in between February and May indicating that it is a major concern during the dry season. Approximately 3.73 Mha of forest is burnt annually in India as a result of forest fire. A complete understanding of forest fire regimes is necessary, but hardly any data is available to assist it.







The two graphs based on the data from the Forest Survey of India website show varying degree of fire incidences but the trend line in both landscapes shows increasing trend of forest fires.



**Potential climatic risk:**

The changes in the temperature and rainfall in the watershed area pose following potential-risk for the farmers and communities living in the watershed area. Farmers foresee following risks, also reiterated by the secondary data collected from India Water Portal.

- x Changes in monsoon timings
- x Changes in summer and winter season for long periods
- x Sudden flash floods due to heavy rainfall for lesser rainy days
- x Unseasonal rainfall

**Process of preparation of the DPR:**

The process that followed for preparation of this DPR includes:

1. **Collection of secondary data:** Secondary data has been collected from the Census Survey, 2011 for the respective villages to project biotic pressure on forest due to the socio-economic condition and resultant negative impact on the local forests. The data has also been used for drinking water and water for irrigation to make a reference to the water sector and adaptations needed in the wake of water availability.
  - a. **India Water Portal:** Data has been used for rainfall, temperature, rainy days, maximum and minimum temperature for the two landscapes for the last 100 years from 1901 to 2002 to project the different trends across these indicators.
  - b. **FSI:** Data on forest fires have been collected from the Forest Survey of India website to derive on trends in forest fires. All these data have been annexed with the report.
2. **Reference to the SAPCC:** State SAPCC and vulnerability study conducted by INRM team was also studied for keeping it in line with the two reports accepted by State and Centre.
3. **Sample survey for primary data:** A sample survey has also been collected for getting a sense of the primary ground-level reality so that the plan has understanding of the local situation and adaptation plans are made in accordance with the local challenges.

This has been done by designing a format for collecting data. Survey was conducted by trained surveyors under supervision of a professional.

4. **Conducting PRA exercise:** To get people's perception of the changes and their understanding of the situation, PRA exercises were conducted and findings of the PRA have been largely in conformity with the secondary data from the various government websites regarding the variations in the climate.
5. **Survey for identification of the places of interventions:** A detailed survey for identification of the intervention points has been made to have relevance and to prevent any hindrances when project goes in the implementation phase. All interventions have been made with proper Khata Number, Plot number along with coordinates for the same.
6. **Involving Local forest officers:** Local forest officers, especially rangers, foresters, forest guards and local VFPCs have been taken on board for keeping their perspective. However, this has been limited due to their involvement in other departmental activities as the plantation season was also approaching.
7. **Sharing it with the villagers and getting it passed through Gram Sabha:** The Plan, thus prepared has been shared with the villagers and passed in their Gram Sabha so that it has got their acceptance. Passing it through the Gram Sabha also has benefits in resource generation as it may not be possible to initiate all activities selected through the funds from NAFCC, and hence can be supplemented with the funds from other Government Programmes.
8. **Sharing it with the Forest department:** Once the Draft Plan was ready, it was shared in a meeting with the Forest department officers. Suggestions from the officers were taken into account and then the plan was finalized after discussions. The meeting was also participated by the concerned representatives of UNDP.

## 1.2 Project / Programme Objectives

The project objectives are:

- x To enhance capacities and providing support services for facilitating Adaptation
- x To improve forest micro-climate through Soil and moisture conservation (SMC) & Water Harvesting (WH)
- x To enhance gender-sensitive and climate-resilient livelihood systems
- x To bring about small wood use-efficiency and alternative material use
- x To bring about Energy use-efficiency and Alternative Energy use

## 1.3 Details of Project/ Programme Executing Entity:

### Name and other details

The EE (Forest Department, Government of Jharkhand) is part of the main line departments of the government and has presence through the Divisional offices across Jharkhand.

Office: - Addl. PCCF, CAMPA,

Block- A, Van Bhawan,

Doranda, Ranchi-834 002

*Available technical manpower for the proposed project implementation:*

### Technical Manpower

Project will be executed through the Divisional Forest Officers (DFOs) concerned under the State Department of Forest, Environment & Climate Change. Since the Department has shortage of man power, support from civil societies, NGOs, etc. with defined roles will be garnered for implementation of the project.

#### a) *Three largest Climate Change Adaptation Projects handled (if already implemented)*

Though department has been doing many activities in line with the mandate of the department touching upon climate change adaptation with Central and State funds, this will be an initiative in integrated manner to address the issues of climate change from the adaptation perspective.

The Department has trained personnel to carry out the project, but as mentioned above, for improving the quality of the project, it may take support from civil societies, NGOs, etc. having desired technical knowhow for implementation of the project across locations.

*b) Three largest community based NRM based projects handled*

One GEF-funded Eco Development Project in Palamau Tiger Reserve, a community based NRM project has been implemented by the Forest Department in the State. 29% of the State's geographical area along with its forests and wildlife is under the control and management of the Department. The Department has implemented several programmes involving communities through Village Forest Committees/ Eco Development Committees. Currently, the Department is implementing Integrated Watershed Management Project (IWMP).

*c) Three largest Climate Change Adaptation / NRM projects of State / Central Government*

No specific Climate Change Adaptation Project has been implemented by the Forest Department in the State. However, besides the on-going IWMP, the Perspective Plans of four L-2 Landscapes under Green India Mission have also been approved, the implementation of which will begin shortly.

*d) Comment of availability of suitable infrastructure for implementation proposed projects (vehicles, computers, required software/ tools, etc.)*

Department has offices at the Range and Division level with all facilities adequate for their functioning. However, the Department may put part of the budget for having additional infrastructure in form of computers with peripherals along with motorcycles for facilitating movement of the staff members besides some part for the repair, maintenance and fuel.

*e) Whether Executing Entity (EE) was blacklisted, barred from implementation of projects, faced any charges / legal cases related to mismanagement of project and funds. (Please list any such incidences and reasons):*

Note: The Executing Entity (EE) for the Project will be the State Govt. Department of Forests.

#### 1.4 Projected Calendar:

Milestone	Date
Project Start Date	01/07/2017
Completion of First Annual Cycle	30/06/2018
Completion of Second Annual Cycle	30/06/2019
Midterm Review	01/07/2019
Completion of Third Annual Cycle	30/06/2019
Completion of Fourth Annual Cycle	30/06/2020
Final Review	01/03/2021

## 2. PROJECT JUSTIFICATION:

### 2.1 Component-wise details and justification of the project components

#### *i. What is the business-as-usual development for the targeted sector?*

Business-as-usual development was carried out previously through various projects / schemes as under:

State CAMPA: Under the provisions of Forest Conservation Act, 1980 various agencies that got permission to use forest land for non-forestry purposes paid for compensatory afforestation and also the Net Present Value of the land as per orders of Hon. Supreme Court. This money is with Ad- Hoc CAMPA Committee of GOI and State share is released to State CAMPA on yearly basis. Different forestry and other activities are undertaken in this program.

Rashtriya Krishi Vikas Yojana (RKVY): RKVY, launched in 2007, provides 'additional central assistance' to Central Government and State schemes related to agriculture; Among the projects funded by RKVY are region-specific agriculture research, preparation of district agriculture plans taking into account local needs and conditions and implementation of various sub-schemes on agriculture and allied activities. Apart from these, various rural development programmes implemented are follows:

Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)

Accelerated Rural Water Supply Programme (ARWSP)/ National Rural Drinking Water Supply Programme (NRDWP)

Integrated Watershed Management Programme (IWMP/ DPAP/Hariyali)

However, in all these programmes we do not see any major improvement in quality of life of the beneficiaries in the region. With several initiatives taken for Soil and Water Conservation, promotion of agriculture and livelihood activities, the climate change issues faced in the project areas are still unaddressed.

The traditional soil and water conservation measures and farming have been followed in the two landscapes for rainfed areas based on the current climate scenario. The farmers generally adjust the sowing date for adapting to moisture-stress. In most cases, they migrate



to nearby towns/cities during years of crop failures leaving the land barren. This has implication on social development as a whole.

### **Justification**

The project will support farmers in applying appropriate water management practices, ensuring that agricultural production can withstand the stresses caused by climate change. This includes upgrading of rainfed and irrigated agriculture through applying rainwater harvesting systems and complementary interventions-climate resilient agronomic practices / techniques etc. The programme also envisages crop-diversification and diversification of livelihood. These components are not traditionally part of the conventional programme and the assistance is sought for such additionalities for climate change adaptation.

(ii) *What are the specific adaptation activities to be implemented to reduce the climate change vulnerability compared to the business-as-usual situation?*

Sl.No.	Component	Output	Outcome	Justification
1	Capacity building & Support Service for Adaptation	<p>Awareness generation among villagers of the target landscapes as well as forest and other concerned official about climate change and need for adaptation and mitigation through low carbon lifestyle and practices.</p> <p>Methods and approaches to promote the adoption of SLM practices and agro-ecosystems (Forest and cropping) are identified, developed and validated through participatory action-research.</p> <p>The quality of services provided to rural communities enhanced, particularly through inter-sectoral approaches that build on local knowledge and innovations for improved agro-ecosystems management.</p>	<p>Capacity and knowledge are enhanced at all levels about the climate change and challenges posed by it and for the promotion of and technical support for sustainable management of land, forests and agro-ecosystems in the landscapes.</p>	<p>Climate change is more social than technical and, hence, building capacities to take on challenges for communities in two landscapes will be more important, as ultimately, the proposed activities have to be inculcated in their habit to sustain it.</p>

2	<p>Forest Micro Climate Improvement through Soil and moisture conservation (SMC) &amp; Water Harvesting (WH)</p>	<p>SMC in approx. 4000 ha of forests.</p> <p>Approx. 105 water storage structures in forests and nearby forest boundaries.</p>	<p>Run off reduced by 25% of the baseline; Onset of forest fires delayed/ fire season reduced by approx. 15 to 30 days with negligible fire incidence.</p> <p>Increased incidences of forest fires have been mainly because of early leaf shading due to loss of moisture from forest soils and consequently, the leaves do not decompose. It catches fire very fast and spreads in wild very fast.</p>
3	<p>Gender sensitive and climate resilient livelihood systems</p>	<p>Approx. 6000 farmer families adopt crop-intensification Technology over a total of approx. 4000 ha crop field.</p> <p>Approx. 3400 families adopt crop-diversification over a total of approx. 2000 ha crop field.</p> <p>Approx. 1250 families adopt forest-based livelihood system.</p>	<p>Increased crop production by 50% of the baseline.</p> <p>Increase in alternate/additional employment by 20% of the baseline.</p> <p>Crop-intensification has double benefit of enhanced production, productivity and reduced cost for cultivation and reduced emission of GHGs. Diversification is important from nutritional security and from point of view of reducing risk of farmers due to extreme weathers.</p>

4	Small wood use-efficiency and alternative material	Approx. 2970 families adopt small wood use-efficiency and alternative material for enhancing durability of small wood used in houses and agricultural/other domestic equipment.	Reduced requirement of small wood by 25% approx. of the base line.	People from both the landscapes use poles for repairing of houses and it gets rotten fast. To improve the shelf life of these wood poles, it will be treated and used for construction.
5	Energy use-efficiency and Alternative Energy	Approx. 8000 families use improved cook stove and 100 family groups use <i>gobar</i> -gas for cooking and 6000 families use solar-lantern for home lighting (with knowledge to operate and maintain devices).	Dependency on wood and fuel-based energy systems reduced by 40% approx. of the base line.	The energy efficient cook stoves will save 40% of wood consumption and will reduce biotic pressure on forests for fuel wood and will also reduce health risk due to indirect inhalation of smoke.

The projected trend clearly indicates less availability of water and land but production needs to be optimized. Reduced production and productivity of the assets and resources may lead to higher food insecurity and social unrest. There could be over grazing and more extraction of ground water. This may further compound the problem of depleting ground water table. The provisioning services and eco system services will be affected. Thus, it is imperative to build resilience among communities through different measures, as given below –

**1) Soil Conservation:** Soil is mostly lost due to erosion by water. Almost 65% of the total geographical area is exposed to forces of erosion. Most of the soil is lost from the upper ridges where slope is higher compared to the middle ridge and valley. Erosion in the upper ridges makes soil unfit for cultivation. It starts as sheet erosion and as it progresses to form gullies in the valley, it poses dangers to the land of the valleys as well as is a severe threat to the food security in the long run.

Erosion also affects productivity of the land as the top layer (5-6 inches) is the most fertile part of the soil, which when lost, ultimately hampers production. Soil gets deposited in the valleys after erosion where it increases the humus content that deteriorates soil quality by causing water logging due to higher moisture holding capacity. So, erosion causes loss of soil in the upper ridges and water logging in the lower ridges due to more water coming to the valleys and higher silt content. It makes soil unfit for cultivation of the second crop.

With the number of rainy days getting lesser and rains during monsoons becoming erratic, soil erosion is going to be more severe. It will also pose flood-like situations in the lower ridges. With this landscape receiving an average of 1200 mm of rain, measures to reduce the velocity of water after its saturation time would have to be implemented to reduce the pace of erosion.

x **Measures:** For reducing soil erosion, measures like contour trenches, field bundings, loose boulder structures, gully plugs, gabions and live check dams need to be taken. Vegetative measures like plantations of bamboo along the gullies will be adopted. Grasses as undercover in the plantations will be taken up for reducing soil erosion and improving fodder availability.

All these measures will be taken based on the suitability of the site for the particular intervention. Treatment will begin from the ridge line area, starting with staggered contour trenches on the hills having more than 5% slopes. Places where gully formation starts will be treated in a series starting with loose boulder structure, followed by gully plugs and culminating at Gabions along the gully. Live check dams will be built to protect soil from gully erosion in the future.

Plantations for timber and horticultural plants will be done based on the suitability of the site. High density plantation for horticultural plants will be demonstrated at one or two places. In these plantations, grasses will be used as under cover. A variety of *Dinanath spp.* grass will be planted; and on the bunds, *stylothamata* can be planted for improving stability and fodder for animals.

In timber plantations, saplings of Teak (*Tectona grandis*), Shisham (*Dalbergia sisoo*), Karanj (*Pongania pinnata*) and Gamhar (*Gmelina arborea*) will be used along with fruit plants such as Mango (*Mangifera indica*), Guava (*Psidium guava*) and Lemon (*Citrus pp*). Fodder trees like subabool (*Leucanea leucocephala*) will also be planted. However, multipurpose trees will be given priority over the general plants for increasing cost benefit ratio.

- 2) **Water conservation:** This landscape receives an average of 1200 mm of rain. But most of this rain water is lost due to inadequate water storage and harvesting structures and causes negative impact on the health of the landscape. It causes erosion in the upper ridges and floods in the valleys. The water, if stored properly, can be a boon for the farmers and people living in this area.

With proper water storage structures and measures to treat soil erosion, percolation of water will increase which will recharge the surface and ground water sources. This will also increase the base flow thus making seasonal nalas and rivulets perennial in the long run. Further, it will also improve the soil moisture regime of the landscape area and more water will be available for different purposes.

Availability of water for harvesting and number of water harvesting structures will contribute to enhanced cropping intensity, which will further increase food and fodder

availability. Water availability also ensures good quality of milch animals and brings improvement in the productivity of animals.

On the bunds of the Ponds and other earthen structures, grasses will be sown for reducing chances of bunds getting eroded by rains. Some plants on the lower side of the ponds will also be planted for increasing green cover. Plants of green manuring species will be used on the bunds of the ponds.

- 3) **Check dams** will be built on the main drainage line for storage of water. This will not only recharge base flow of the drainage line but also ground water table. From the check dams, either irrigation channel will be carved or a lift irrigation system will be installed.
- 4) **Infusion wells:** Abandoned dry wells in the village can be used for recharging ground water by allowing the run off to directly pour in to them. By applying some treatment for arresting the silt, these wells can be used as seasonal water body for irrigation and ground water recharge.
- 5) **Summer ploughing:** After crop harvesting raised during monsoon season, the bulk density of the soil increases due to soil compaction. This impedes the movement of air, water, and nutrients in the soil profile. Ploughing in advance, i.e., in the mid-summer for kharif crops is known as summer ploughing. Summer ploughing helps to kill weeds, hibernate insects and other disease-causing organisms by exposing them to the summer heat. To capture some amount of rainfall effectively in the soil column, the hard topsoil can be opened up. Ploughing the soil in advance of the start of the monsoon season (summer ploughing) help in opening the hard topsoil, which can lead to increased rate of infiltration besides reducing soil borne pests, diseases and weeds and controlling soil erosion.
- 6) **Earthen dams:** These structures are constructed across natural drainage line to collect and impound surface runoff from catchment during monsoon. These also facilitate percolation of stored water into the soil substrata for raising groundwater level. Earthen Dams can be built on the small drainage lines with lesser slopes where water comes from small catchment.

- 7) **Gabion:** Gabions are constructed with stones/ rubbles bound together with a binding wire. An apron is made on the downstream side of the gabion to resist scouring. Concrete masonry work is done on apron and foundation for stability of the structure and maximum groundwater recharge. 20 m long structure is proposed with 1 m height and 1m keying on each side.
- 8) **Polythene lining:** Polythene lining is proposed on the upstream side of water impounding structures like earthen embankments to control seepage and percolation losses. The stored water could be utilised for critical irrigation to crops. Polythene sheets of ~200 microns would be used as lining material for the purpose.
- 9) **Crop coverage:** Currently crop coverage is limited due to inadequate water storage and harvesting structures. Most of the crop coverage has been during monsoon and after harvesting paddy, greenery is limited to perennial timber and fruit plants. In monsoon, almost 80% of the total area comes under cover.

The problem with crop coverage is not only irrigation but lack of planning and understanding among communities about different soil types and varieties of crop as per the land capability. Experience of pest management is also limited. Farmers are aware of use of vermi-compost and other manures but are not practicing them. Understanding about the importance of soil testing is also limited as also knowledge about soil treatment.

For covering 80% of the area under crop coverage, more structure need to be constructed for storage and irrigation. Crop planning will be done with the respective user groups. Further, planning for soil testing and land treatment for making it suitable for cultivation is also required. Farmers need to be exposed to better practices for improving productivity without much damage to the local micro climate of soil. Mechanization of agriculture to limited extent is possible which should be done to increase crop coverage. Training on dry land farming can also be chosen for increasing crop coverage. Diversification of crops based on farmers' interest will also help in increasing crop coverage.

- 10) **Animal Husbandry:** Currently, animals in the landscape area include nondescript cows, indigenous goats, country birds and other animals like oxen that are used for



ploughing fields. Farmers also keep large herds with less productivity. Also, farmers are unaware about the improved breeds of different animals that are more productive and less expensive. Farmers are also not aware about the feeding and disease management. Housing management is also an issue as some of the diseases are due to the improper housing of animals. Availability of green fodder is also a concern as water storage structures are limited and fodder trees are also almost absent.

Measures like Artificial Insemination in milch animals can be adopted. For that, training to village youth in coordination with BAIF or any other competent organization can be arranged. Cultivation of crops like sweet corn and baby corn can be promoted for getting dual benefit of income and fodder together. Camps can be organized for deworming and vaccination of animals.

Further, improved breed of animals can be introduced. This can be done for goats and other small ruminants. Similarly, in poultry, improved breeds of birds like Banraj and Divyayan red can be introduced for meat and egg.

Introduction of new fodder varieties of perennial nature like Hybrid Napier can be a good trial; since perennial, they can be adopted easily by the farmers. Farmers can dedicate small land for cutting of grass and fodder can be made available to them on a sustained basis.

Fisheries in ponds can be a good option for livelihood for the families. Farmers can be trained to use seasonal ponds for fishery.

Duckery farming can also be promoted. Khaki Campbell variety of ducks can be used as these ducks demand less water and can survive even in mud.

- 11) Livelihood activities for asset-less people:** Asset-less people in the landscape area mostly earn wages by working in other's fields and/or local market. The main problems that exist in such situations are related to payment of wages and health of farmers at risk.

For such asset-less people, rearing poultry can be a good option as it requires less land and fetches good price in the market. Rearing of goats can be also a good option as these families can get better returns by investing less money and time on the activity.

Providing vocational training to the asset-less people will also help them in getting gainful engagements at the local market in Jamtara and Ramgarh along with nearby cities in Jharkhand.

- 12) Community based organization and social capital base:** Though SHGs have been actively present in the villages, village health and education committees are hardly active.

More families need to be included in the SHG fold so as to make all the families be part of one or other community based organization.

- 13) Capacity building:** Capacity building of landscape committee and community is important for the success of the activities. Training needs can be identified and imparted based on the specific groups of members. For instance, SHGs need trainings like membership training, leadership training, book keeping training, and activity based training and training on market linkage; for village health committees, training on preventive and promotive health care will be important. Training on national rural health missions its objective and accessibility to the government facility can be important training to health committees. Village education committee needs to be trained for improving quality of education for the students in the village level schools.

- 14) Seed Bank:** Paddy, Pulses and vegetables are the major crops in the project areas of Jharkhand. Seed Replacement Rate (SRR) in the project areas is less. Seed Bank can be developed to increase the SRR and also to act as a source for planting in case seed-reserves elsewhere are destroyed. It would store quality seeds, including local species like a gene bank. This would help in conserving the biodiversity in the project area and around. The seed bank will be managed by the community.

- 15) Use of high yielding and drought tolerant varieties:** High yielding varieties with drought resistant and temperature tolerant character are highly suitable for the selected landscape as it experiences frequent droughts.

- 16) Need based fertilizer application:** Soil test based and crop requirement based fertilizer application would improve crops yield besides maintaining soil health.

- 17) Growing alternate crops / fodder sorghum during SWM:** Based on the quantum of rainfall received during SWM, minor millet crops like Millet can be grown which are

drought hardy and need less water. Instead of keeping the land fallow, a fodder sorghum crop can be grown to create fodder reserve for the animals.

- 18) Inter-cropping / Mixed Cropping / Rotational Cropping:** Intercropping is the practice of growing two or more crops in proximity. The common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources that would otherwise not be utilized by a single crop. Planning for intercropping will be done carefully taking into account local soil type, climate, and varieties of crops.
- 19) Promotion of Alternate Fodder:** The land area available per household / per capita for cultivation is expected to decline in future due to change in socio economic characteristics and induced impact owing to climate variability. Under such context, allocating sizable area of land for fodder production would lead to additional stress on cultivation of food crops. Hence, alternate (conventional and non-conventional) fodder crops will be promoted to meet the challenges of future fodder requirements. Azolla will be promoted as an alternate fodder which doubles its biomass in 10 days with very less water requirement. Its consumption will also increase omega fatty acid content in the animal products.
- 20) Integrated Farming System:** Under the changing climatic conditions, frequent crop failures are common due to increased frequency of extreme weather events. Growing crops and animal together will help in increasing the adaptive capacity of the community by raising the productivity, profitability and sustainability of the farm. Integrated farming system will help in efficient recycling of by-products from one component to another, which will also confirm environmental safety. It will also support in income and employment generation throughout the year.
- 21) Soil Nutrient Management:** Variability in rainfall and intense rain in short duration results in soil erosion. This negatively affects the soil organic matter content as a result of which imbalance in soil nutrient affects crop production and productivity. The project will minimize this risk and adapt to the situation by managing organic matter content in the soil through application of vermin-compost and/or bio-fertilizers at a frequent interval. Vermin-compost contains adequate quantities of N, P, K and several micronutrients, essential for plant growth (Banaet *al.*, 1993) that will maintain soil

health. Vermi-compost is a preferred nutrient source for organic farming. It is eco-friendly, non-toxic, consumes low energy input for composting and is a recycled biological product (Edwards, 1998). Bio-fertilizers such as *Azospirillum* / *Phospobacterum* will also be applied, as required, to soil to increase the availability of nutrients to the plants. Alternatively, green manure crops such as *Sesbania* can be grown during the SWM period with minimum rainfall and incorporated into the soil at the age of 40 days when the crop is in peak flowering stage. This will increase the water holding capacity of the soil by increasing organic matter content.

- 22) Micro Irrigation (Drip irrigation / Micro sprinklers):** Micro-irrigation refers to low-pressure irrigation systems that spray, mist, sprinkle or drip. Drip irrigation is the targeted application of water directly into the root zone. Fertilizers and chemicals when used properly can provide greater benefits such as higher revenue from increased yields (up to 80%) and increased quality, decreased water costs, decreased labour costs, decreased energy costs, decreased fertilizer costs, decreased pesticide costs and improved environmental quality. Micro irrigation reduces water use by 40 – 60 % and enhances efficient use of available water, thereby minimizing losses. In a water scarce situation, which is more frequent in rainfed situations, efficient water management of available water is highly essential. Adoption of micro irrigation will be helpful contextually. It will reduce wastage of water, help standing crop survive and increase production in an environment friendly manner.
- 23) Compost Pit:** Composting converts complex materials into simple inorganic element as available nutrient. Materials put into soil without conversion takes away all energy and available nutrients from the soil affecting the crop. Composting is beneficial to farmers for several reasons. It allows for the recycling of kitchen waste and creation of a natural fertilizer for garden plants and vegetables. Composting is an effective and environmental-friendly solution for turning yard and kitchen waste into a beneficial soil amendment.
- 24) Kitchen Garden:** A kitchen garden is where herbs and vegetables are grown around the house for household use. Since early times, a small plot near the house is usually used for growing a variety of vegetables according to the season. Local varieties such

as radish, broad leaf mustard, chilli, beans, pumpkins etc. are all grown in the kitchen garden.

- 25) Biogas (Application of bio-slurry):** Biogas is a clean, non-polluting and low-cost fuel. It contains about 55% to 75% methane. The dung is mixed with water (4:5) and loaded into the digester in a biogas plant. The gas generation takes place slowly and in two stages. In the first stage, the complex, organic substances contained in the waste are acted upon by a certain kind of bacteria, called acid formers and broken up into small-chain simple acids. In the second stage, these acids are acted upon by another kind of bacteria, called methane formers and produce methane and carbon dioxide, which is inflammable. Biogas can be produced from cattle dung and other organic matter by a process called "anaerobic digestion" in a biogas plant. The digested material, which comes out of the plant is an enriched manure.
- 26) Improved cook stove:** Improved/ smokeless portable cook stoves with better thermal efficiency will be introduced to minimize fuel wood consumption and drudgery/ health hazard for women. This would not only support efficient usage of locally available biomass as fuel but also save cooking time for women; the time saved could be utilized for other productive purposes.
- 27) Solar Home Lighting and Solar Pumping System:** There are certain remote villages/ hamlets that are yet to be grid-connected; many do not have regular/ quality electricity supply. Considering long sunshine hours available, solar home lighting systems could be introduced for domestic purposes. The irregular power supply often pushes the farmer to over irrigate or irrigate prior to schedule, pump in to a temporary storage or even to an open well for later use. Usage of solar pumping systems could address this issue to a great extent. The system would be promoted for selected households with available water source.

Increased adaptation to climate change through climate resilient farming system approach and diversification of livelihoods is envisaged through afforestation & pasture land development, climate resilient farming/livelihoods and energy efficient systems. Activities proposed under afforestation & pasture land development would facilitate regeneration of pasture/fodder land in the landscape area and would

provide continuous supply of fodder to the animals reared by the farmers in the project area. This would act as a major driver for diversification of livelihood from the climate sensitive cropping alone and provide the community with supplementary source of income.

*(iii) Please justify with regards to components as on the concrete adaptation activities of the project, and how these activities contribute to climate resilience?*

### **Component–I: Capacity Building & Service Support for Adaptation**

Capability of forest-dependent communities and forest officials will be developed through proper capacity building and training programmes to orient them with climate change issues and equip them to handle the same. This will happen through the access to information which is related to climate change. This will make them change their thought process, the practices, planting times, nursery raising of appropriate robust species as envisaged in the NAPCC and SAPCC for reactive as well as proactive adaptation. Through the training and other programmes they will become aware about their contribution to climate change impacts. Accordingly they will adapt to make necessary changes and modifications to reduce carbon foot prints at individual as well as community level.

**Weather stations:** Two weather stations, one each in the two landscapes, will be installed. It will be used for building adaptive capacity among communities by informing them about the changes and trends in the climate related information. Community representatives will be trained for operating weather station and recording data needed for the future projections. It will be also used for planning crops in the landscape.

## Component–II: Forest Micro Climate Improvement through Soil and moisture conservation (SMC) & Water Harvesting (WH)

**Soil and moisture conservation (SMC) work:** Reports from FSI on Jharkhand clearly indicates that the quality forest area is shrinking hence forests are becoming more vulnerable to changing climate patterns. Further, due to rise in temperature and reduced number of rainy days, stress on water is increasing with early onset of arid regime. It is thus degrading soil texture and making it prone to erosion causing siltation of the existing water bodies and further increasing the water stress. Early arid regime causes pre-ponement of the leaf shading in deciduous forest/ species, thereby prolonging the fire season. It is well known that the forest fire leads to loss of regeneration, biodiversity and resources that support livelihood besides making soil more fragile and prone to erosion. Soil and moisture conservation activities will improve the soil moisture regime and help in increasing natural regeneration of the existing species and will also facilitate the associates and under storey to grow. It will make forest denser and hence will improve the quality of forest. Soil and moisture conservation activities will also reduce soil erosion and improve the impounding capacities of existing water bodies. Reduced volume and speed of run-off will also help in percolation of water thus improving the ecosystem services of the forest.

All outcomes of the activity are related to NAPCC and SAPCC along with the poverty reduction policies of the central and state government.

**(b) Water storage and harvesting structures:** Low cost water storage structures will be built as part of the drainage line treatment. Small water storage structures like Dova and water absorption trenches will be built to serve the dual purpose of water holes for wild animals and to work as natural fire lines inside the forest and around forest boundaries. Cattle proof trenches will also be constructed as and when required to prohibit domesticated animals enter forests.

### Specific Activities to implement the measures:

- x Site selection for construction of percolation pond and other recharge/ harvesting structures - completed;
- x Construction of farm pond/tank in feasible areas within the landscape;

- x Orientation of farmers on periodicity and timing of field operations like deep tillage, crop planning, maintenance of structures, etc.

Activities proposed above will facilitate in improvement of soil and water regime, better crop productivity and resultant increase in the income of farmers, which is the main outcome as envisioned. Activities which envisage harvesting of run-off water like farm pond, earthen embankment, masonry check dam etc., would be beneficial for providing life saving irrigation to crops during critical periods. Small structures like recharge pit, catch pit and well recharge pit would enable recharging of ground water by catching rain water. Summer/deep ploughing would maintain the soil moisture and prevent excess evaporation.

### **Component–III: Gender sensitive and climate resilient livelihood systems**

**Crop Intensification:** Jharkhand has been largely a food insufficient state, dependent on rain-fed farming and needs to improve the productivity of land/ production. This can happen with intensification methodology. Intensification also reduces GHG emission from paddy fields as well as reduces losses due to lodging of crops besides improving straw yield and hence the fodder availability for animals. Intensification will be promoted in all possible crops under the project.

The combination will be decided depending upon the choice of the crops as per taste and food habit from community. A combination of impact of climate change and projected trends in the shift of crops will be used to arrive at a mix of crops to be use for cultivation.

**Crop Diversification:** Crops will be diversified and methodology of relay cropping will be used. This will reduce exposure of the soil to the forces of erosion. It will also improve resilience by improving the risk bearing capacity of farmers. Mixed farming under diversification will improve the nutritional security along with the food security. It will help the labour force in competitive wage market.

Having more crop per unit will also help in building resilience by reducing exposure of soil. It will also improve the soil texture of the field.

**Forest based livelihood systems:** Among the forest-based livelihood systems, project intends to promote Lac culture and sericulture systems and MFPS with value chain, leaf plate making with market linkage and promotional plans, nursery raising and grafting from plus trees and sustainable collection of medicinal plants.



***Specific Activities to implement the measures:***

- x Promotion of intensification methodology and diversification of crops with wide base of germplasm
- x Promoting agro-forestry, agro – horticulture and forage crops species
- x Promotion integrated farming covering soil treatment through organic means;
- x Demonstration of micro-irrigation operation system in-situ;
- x Grass seeding in pasture and silvi-pasture system;
- x Promotion of energy efficient systems.

Increased adaptation to climate change through climate resilient farming system approach and diversification of livelihoods is envisaged through afforestation & pasture land development, climate resilient farming/livelihoods and energy efficient systems. Activities proposed under afforestation & pasture land development would facilitate in regeneration of pasture/fodder land in the watershed area and would provide continuous supply of fodder to animals reared by the farmers in the project area. This would act as a major driver in diversification of livelihood from the climate sensitive cropping alone and provide the community with supplementary source of income. Promotion of climate resilient farming system is expected to be attained through demonstration of short duration and low water demanding varieties of maize and wheat; best package of practices including seed treatment, integrated nutrient management, integrated pest management, organic farming; demonstration of minor millet which are hardy species against adverse weather; establishment of seed bank, especially for minor millets; demonstration of water conservation technologies etc. Livelihood diversification is a proven method for climate resilience among communities who are dependent on climate sensitive sectors like agriculture for their livelihood. Activities proposed under this include promotion of vegetable/kitchen garden, animal husbandry, backyard poultry, mushroom etc.

**Component–IV: Small wood use-efficiency and alternative material**

***Small wood use-efficiency and alternative material:*** Families on forest fringes use small woods for repairing of houses, hay storage platforms, etc. On an average, 30 to 40 poles are required to repair a house with two rooms. Usual cycle for repair is 3 to 4 years besides a

few occasional ones. If these small woods are treated scientifically, their durability may increase up to 8 years. It will have a great bearing on the adaptive capacities of communities and will help in improving biodiversity and quality of forests. Even use of alternatives like iron pipes and concrete poles may be promoted.

It is evident from the data collected that most of the households are either semi-permanent or temporary. The houses require frequent repairing as the wood quality decays after one or two rainy seasons and people approach forests for wood. People prefer Sal poles as it is more robust. However, they are not much aware that Sal seedlings are viable for just a week and take twelve years to get established as plant. Secondly, it is a part of climax forest and cutting down the poles further degrades the forest quality and creates eminence of the associated species like Plash. Treatment of small woods will improve the life of poles and people will flock less to forest to get poles for repairing.

#### **Component–V: Energy use-efficiency and Alternative Energy**

**Energy saving devices:** Energy saving devices like improved cook stoves, gohar gas plants and solar based home lighting systems will be promoted to reduce dependency on fuel wood from forest, fossil fuel for energy for cooking and lighting. These energy saving devices will have mitigating effect besides making the life of women easier.

Women in the landscape villages spend much of their time sourcing for basic resources, such as firewood, water and fodder for animals. They also do household chores inside unventilated, smoke filled rooms. Lack of water within easy reach (15-20 minutes' walk from the home) and indoor smoke pollution increases drudgery and reduces quality of life.

Energy saving activities such as improved cook stoves, biogas unit and solar lighting proposed under the project will ease the life of women and improve their socio-economic status. These measures will reduce the time spent on gathering firewood and covering long distance for water. The time saved could efficiently be used for increasing the adaptive capacity of the households.

Adaptation benefit is derived from improvement of the quality of life of women in vulnerable households. Increased income and use of clean energy will lead to increased resilience of households and community levels. Higher resilience will also improve their ability to face climatic stresses and weather-related disasters.

Most of the villages in the area are either not grid connected or power supply is irregular. Hence farmers find it difficult to provide life-saving irrigation during critical periods of the crops, especially during drought years. Demonstration of solar pump is definitely helpful in lifting water for life saving irrigation, thereby saving the crop from failure due to inadequate/low rainfall and consequent drought.

Adaptations in agriculture sector will involve following sub activities in line with the main activities that has been mentioned in the sub group intensification and diversification in crop systems.

- x Promoting crop technologies (e.g. better heat and drought-resistant crops);
- x Enhancing seed banks;
- x Encouraging transfer or adoption of locally important innovations (e.g. water harvesting systems);
- x Avoiding monocultures;
- x Reducing the risk of crop failure (e.g. by advising farmers to grow drought-resistant food crops such as millet or sorghum);
- x Providing opportunities to reduce direct dependence on natural factors such as precipitation and runoff and reduce vulnerability to climatic variations and natural disasters;
- x Improving irrigation systems;
- x Protecting fields from water erosion;
- x Using management practices that reduce dependence on irrigation in order to decrease water consumption without reducing crop yields;
- x Changing tillage practices (e.g. zero tillage on formerly overused/depleted land);
- x Improving knowledge on agricultural crop and livestock management and on drought and flood management;
- x Increasing agricultural productivity.

All these adaptation are in line with the National Mission on Sustainable Agriculture.

## 2.2 Details on Economic, social and environmental benefits project / programme

*(Reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations)*

Activity	Social	Economical	Environmental
Contour trenches	x Will make people work in groups for better cooperation  x Will improve adaptive capacity of communities by having sub surface flow for longer period	x Will create additional opportunity for wage employment	x Will reduce soil erosion x Will improve water percolation x Will improve soil moisture regime and help decomposition of leaves for reducing the fore incidences  x Will also promote regeneration of plants by arresting seeds of the forest plants
Gully plugs	x Will make people understand importance of reducing velocity of run off for checking gully formations	x Will generate wage employment for the locals	x Will reduce soil erosion x Will improve water percolation x Will arrest gully formation and advancement of gullies
Loose boulder check dams	x Will generate awareness about the reduction in erosion and how farmers can check erosion by use of the local materials	x Will generate wage employment and will also create avenues for creating local materials for use in the structures	x Will reduce soil erosion x Will improve water percolation x Will also promote regeneration of plants by arresting seeds of the forest plants
Water harvesting	x Will create assets at the	x Will generate wage	x Will improve ground water condition

Activity	Social	Economical	Environmental
structures (Ponds, Ahars, Check dams)	village level and will also make people use the stored water for various purposes  x Will improve adaptive capacity by bringing additional area under irrigation	employment  x Will bring additional area under irrigation for increasing cropping intensity  x Will improve income by having additional avenues of income generation in form of fishery, duckery and others	x Will help storing additional run off for better adaptability and improved access to water resources by communities  x Will reduce dependency on forest for the people on the fringes
Weather stations	x Will make people have localized information on weather and climate	x Will reduce vulnerability by observing trends and planning for crops and livelihoods	x Will help in making adaptation choices better for the communities by using the climate information
Crop intensification	x Will improve food and nutritional security by enhancing production and reducing vulnerability to climate extremes	x Will improve income by reducing cost of cultivation and increasing production	x Will reduce use of resources like water x Will reduce use of chemicals x Will reduce soil and water pollution due of use of chemicals x Will also improve the eco system services
Crop diversification	x Will improve nutritional security by	x Will improve income by having more	x Will reduce risk of farmers by widening of the bio diversity

Activity	Social	Economical	Environmental
	widening of food base x Will help adapt better due to different weather tolerant species in cultivation	value fetching crops x Will help in getting better returns per unit area	x Will also help in reducing dependency on outside source for inputs x Will reduce use of chemicals and hence soil and water pollution
Forest based livelihood systems	x Will let people know sustainable management of the forest in their village	x Will enhance income of the family	
Energy saving devices	x Will help in reducing dependency on fossil fuels x Reduce respiratory tract infections x Will reduce eye related infections x Will also help in improvement in quality of life	x Will save money from the savings on the fossil fuels x Will also save expenses on the health related issues x Will also save time in collection of fuel wood	x Will reduce emission from the burning of fossil fuels and wood as source of energy x Will protect forest by savings on wood x Will improve soil moisture regime by having plant cover improved

### 2.3 Sustainability of intervention

i) *How will the project assure that the benefits achieved through investments are sustained beyond the lifetime of the project?*

**Sustaining capacity building measures:** Capacity building measures can be sustained by involving communities in activities that use trainings for practical applications. Events will be organized round the year and trainings will be applied to as many activities as possible to

build in their habit. Department will also use the built-in capacity in other departmental programmes for replication of the interventions in other areas.

***Sustaining SMC works:*** Benefits of the SMC works will be reflected in the enhanced provisioning ecosystem and regulatory services and community will take charge of increasing it in and outside forest area for the benefit.

***Sustaining crop intensification:*** Intensification will help in reducing the cost of cultivation and increasing yield. It will help in reducing domestic drudgery, and help in establishing a more resilient cropping system. Farmers will be involved in intensification in all possible crops which will keep them involved round the year. The benefits thus derived will make farmers sustain the intervention.

***Sustaining crop diversification:*** Diversifications will help in enhanced productivity of the land. It will also help in getting nutritional security and encourage them adopt crop rotation for better management of land and optimum utilization of available resources at their disposal.

***Sustaining forest-based livelihood systems:*** Forest-based livelihood systems with value chain and marketing support will be sustained as the end to end solution will be available to community. It will also help in protecting, preserving, and propagating host plants as well as other useful plants for economic and environmental benefits.

***Sustaining small wood (poles, etc.) use-efficiency:*** Through scientific treatment-based increased durability of small wood, the villagers will be encouraged to use small wood. This will help in time and energy saving and minimizing risk in fetching small woods frequently.

***Sustaining energy saving devices:*** Energy saving devices will help in reducing domestic drudgery and reduced requirement of firewood and kerosene. It will also help in increasing savings at the family level and will improve the stake of women in decision making.

## 2.4 Analysis of the cost-effectiveness of the proposed project / programme:

*Cost effectiveness will compare alternative options available and how the proposed components/ intervention are best for given climatic conditions. It will also depict how the community preferred the selected interventions and their views / concerns are addressed while designing the project / programme. The proposal should compare to other possible interventions that could have taken place to help adapt and build resilience in the same sector, geographic region, and/or community.*

Activity	Current expenses	Proposed expenses	Savings
Soil and moisture conservation activities	In absence of the soil and moisture conservation activities, farmers face problems with less availability of water for irrigation. Also, due to absence of deep ploughing mechanism, frequent irrigation is required due to hardening of soil.	Methodology of contour trenches, gully plugs, loose boulder structures and deep ploughing helps farmers reduce expenses on life saving irrigation due to loosening of soil particles.	One hectare of ploughing costs around Rs. 1,000. While, if a farmer goes for even two life irrigation, it will costs around Rs. 2000/ha hence farmer will save at least Rs.1000/ha
Water storage structures	In the absence of any water storage structures, farmers are able to cultivate only one crop while the land remains unproductive for whole year.	By investing an amount of Rs. 3.10 lakh, at least 3300 Cum water will be stored. It can also be used to have second crop along with Fish rearing.	One additional crop with productivity of minimum 20 Q/ha for vegetables at a cost of Rs.15/Kg with fish of 200 Kg can fetch an income of Rs. 63,000/year along with intangible benefits like reduced soil erosion and other uses by communities.
Energy saving devices	People use fuel wood as a source of energy and it costs them in monetary terms as well as in terms of time, for collection of fuel wood	Use of solar lights can reduce expenses on fossil fuel.  Use of improved cook stoves with 60% efficiency will save time in collection.	It will save at least Rs. 45/family/month. It will also save 60% time used for collection. Gobar Gas plants will save 100% time in collecting fuel wood.
Intensification and diversification	People use traditional method of cultivation, which is not only costly, but result in high emission with lodging as a challenge	Cost will be reduced; per unit productivity will be enhanced and emission will be reduced.	Will save 40% of cost of cultivation and reduce emission by close to 43% in Paddy alone along with improving yield by approximately 50%.



## 2.5 Weighting of project activities:

*How much funding will be allocated to 'investment activities', 'capacity building activities' and 'project management activities', respectively?*

Type of activity	List of Activities		Funding requirement (Amount in Lakhs INR)
Investment activities	1	Contour trenches, Gully plugs, LBCDs	807.36
	2	Water storage and harvesting structure	426.05
	3	Paddy, Wheat, Mustard, Millets	221.40
	4	Cereals+ Pulses, Cereals+ Vegetables	157.83
	5	Tassar, Lac, Leaf plate making and others	85.80
	6	Use of pre-treated small wood (poles, etc.)	140.00
	7	Cook stoves	114.40
	8	Gobar gas plants	30.00
	9	Solar lights	136.50
	10	Kitchen Garden	131.25
Capacity Building & Support Service activities	1	Training	60.64
	2	Weather Station for two landscapes	20.00
Project management activities	1	EE cost	84.75
	2	IE cost	73.51
	3	DPR cost	10
		<b>Total project cost</b>	<b>2499.49</b>

## 2.6 Alignment with the National and State Action Plans and other Policies / Programmes:

*(Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist)*

National Action Plan on Climate Change emphasizes on aligning the measures to promote national development objectives with co-benefits for addressing climate change effectively. It also advocates strategies that promote the adaptation to Climate Change and enhancement of ecological sustainability of India's development measures; The State Action Plan for Climate Change in line with NAPCC, focuses on enhancing carbon sink in forests and other ecosystems, while being informed by sensitivity to the ecological nature and value of resources.

**Alignment with the NAPCC and JAPCC:** The proposed activities are in accordance with different missions under NAPCC and priorities set by JAPCC for forestry, agriculture and energy sectors in particular. The activities will help attain the following objectives:

- x Improvement/ Checking degradation in forest quality (*National Mission for Green India*);
- x Biodiversity Conservation (*National Mission for Green India*);
- x Improvement in productivity of land resources (*National Mission for Sustainable Agriculture*);
- x Reduction in biotic pressure on forest for small wood, fuel, fodder, etc. (*National Mission for Green India; National Mission on Enhanced Energy Efficiency*);
- x Scientific practices in livelihood systems (*National Mission for Sustainable Agriculture*);
- x Diversification in livelihood systems (*National Mission for Sustainable Agriculture*);
- x Adaptive capacities across gender;
- x Access to information for climate adaptation (*National Mission on Strategic Knowledge for Climate Change*).

## 2.7 Component Wise Technical Standards:

*(Describe how the project / programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, standards related to pollution control, etc. The details need to be provided for each of the interventions proposed)*

Activity	Technical standard	Application in project	Monitoring
Water harvesting structures	As advised by Central Research institute for Dry land agriculture	Design as per the prescribed norms and site specific requirement	Engineers will book MB and all payment will be made on the basis of work done
	Standard prescribed by central soil and water conservation research and training institute		
	SOR of the water resources department – Government of Jharkhand and Development section – Department of forest	Cost norms as per SOR	
Intensification and diversification	Norms as set by the BAU and outcomes of the research projects of ICAR	As per the cost norms set by Market Applied for improving production and reducing risk of the farmers	Technically qualified and trained staff will keep the data of the activities on regular basis for easy monitoring
Plantation and other tree based interventions	Norms as set by forest department and KVKs	Applied for block plantations and for agro-forestry models	Records of plantations and growth will be monitored by an expert on periodic basis
Animal husbandry based interventions	As per prescription of the BAU	Applied for promoting fish-cum-duck farming Goatry and poultry farming	Income records of the participant families
Energy saving devices	Norms set by ISI	As set by JREDA	Use of fossil fuel records and wood for energy purposes
Weather station	Norms set by ISI	Recording localized climate data and using it for climate projections	Monitored by KVKs and FD itself

## 2.8 Duplication Check:

*(Describe if there is duplication of project / programme with other funding sources, if any)*

The department is implementing different projects in the state with the help of the state and central government. Programmes like IWMP under PMKSY and MGNREGA has some components similar to the proposed interventions. However, to reduce the chances of duplicity, survey has been done for the interventions and coordinates have been taken for each interventions proposed along with the land details like Khata number and plot number. The proposed project is new for the department and requires improved skills. Hence, training has been proposed in this project

The area has been selected keeping in mind that no other programme overlaps in the same area. Convergence will be part of the project. But works done through convergence will have different set of functioning and will be reported to the concerned agency along with the proposed project activities.

There is no duplicity of the project. Moreover, the department is not getting support for the same project from any other source or any project of the same nature.

## 2.9 Details on Stakeholder Consultation:

Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations).

Stakeholder approaches, in general, emphasize on the importance of ensuring that the decisions are analysed and exactly how. The actions taken as a result of this analysis are driven by those who are affected by climate change and those who would be involved in the implementation of adaptations. The stakeholder approaches presented here represent a way of analyzing institutional and organizational context of the adaptation strategy planning process more than they the specific tools to be applied to an assessment.

Villages Consulted	Date	Participation	Objective	Outcome
Tokisud	24/02/2017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Most of the people are aware about the adaptation fund programme
	25/02/2017	PRI members and villagers	Getting list of intervention	Finalize intervention list
Palu	24/02/2017	PRI members and villagers	Conducting PRA after briefing about the adaptation fund programme.	Most of the people are aware about the adaptation fund programme
	25/02/2017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Palani	26/02/2017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	27/02/2017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members

Villages Consulted	Date	Participation	Objective	Outcome
Koto	26/02/2017	PRl members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	27/02/2017	PRl members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRl members
Lem	28/02/20017	PRl members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	01/03/20017	PRl members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRl members
Kurbij	28/02/20017	PRl members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	01/03/20017	PRl members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRl members
Bicha	02/03/20017	PRl members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	03/03/20017	PRl members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRl members
Talpur Taltanr	02/03/20017	PRl members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	03/03/20017	PRl members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRl members
Hariharpur	04/03/20017	PRl members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	05/03/20017	PRl members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRl members
Batuka	04/03/20017	PRl members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme

Villages Consulted	Date	Participation	Objective	Outcome
	05/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Osam	06/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	07/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Kirigara	06/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	07/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Ichapiri	08/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	09/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Dparidih	08/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	09/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Solea	10/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	11/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Bartua	10/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	11/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Haphua	14/03/20017	PRI members and villagers	Briefing about adaptation fund	Villagers are aware about the adaptation fund programme

Villages Consulted	Date	Participation	Objective	Outcome
			programme and conducting PRA	
	15/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Terra	14/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	15/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Ukrid	16/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	17/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Rocha	16/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	17/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Sahitanr	16/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	17/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Barowa	18/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	19/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Palta	18/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	19/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members



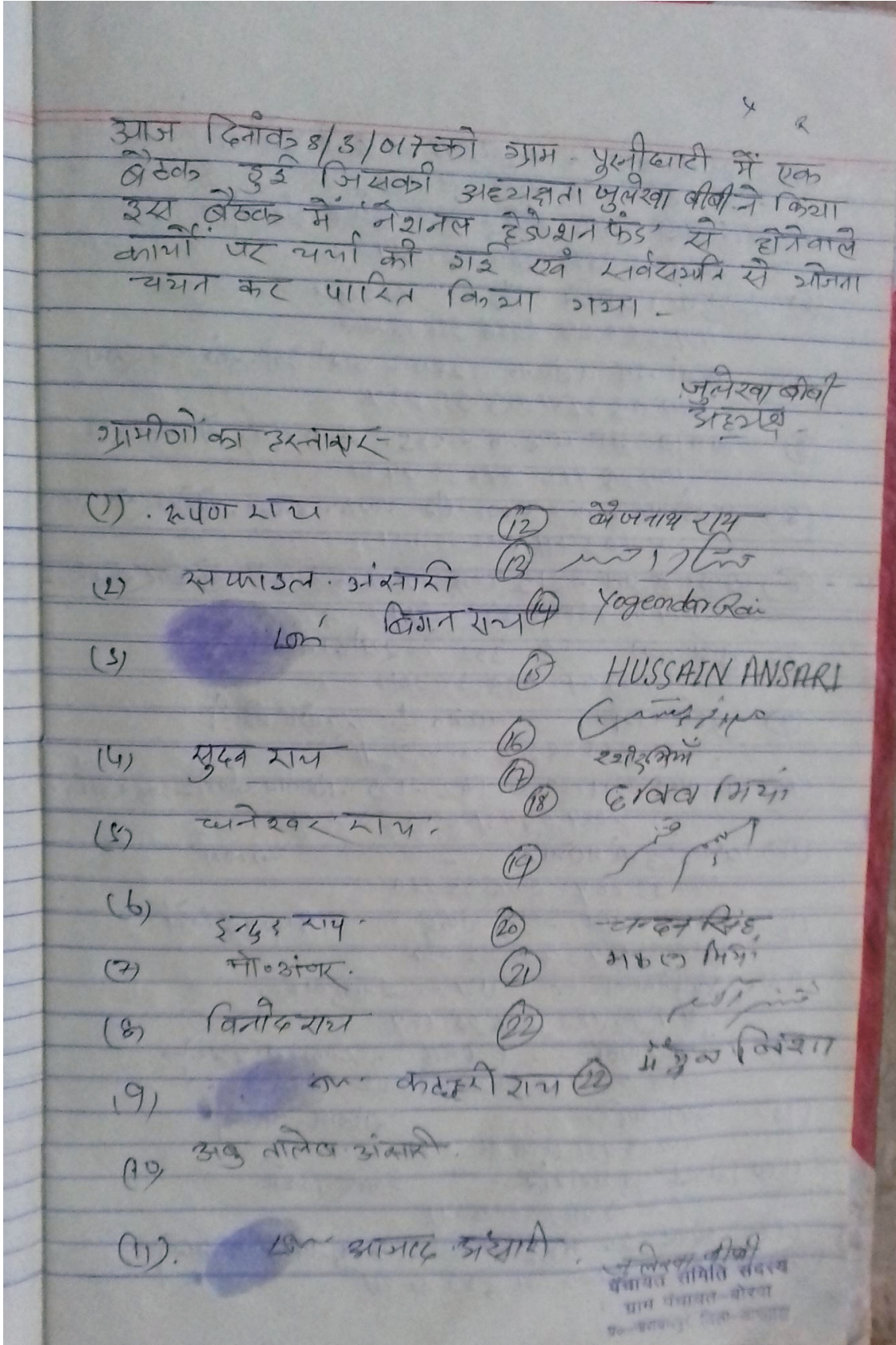
Villages Consulted	Date	Participation	Objective	Outcome
Madhuban Phutaha	20/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	21/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Bhaiyadi	20/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	21/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Paharpur	22/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	23/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Narayanpur	22/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	23/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Raghunathpur	24/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	25/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Barowa	24/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	25/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members

Villages Consulted	Date	Participation	Objective	Outcome
Palta	26/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	27/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Madhuban Phutaha	26/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	27/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Bhaiyadi	28/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	29/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Lakhanpur	28/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	29/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Daldala	30/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	31/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Bhagabandh	30/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	31/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members

Villages Consulted	Date	Participation	Objective	Outcome
Ledhariya	24/02/2017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	25/02/2017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Birsinghpur	24/02/2017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	25/02/2017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Mahtodi	26/02/2017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	27/02/2017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Purnighati	26/02/2017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	27/02/2017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Matuadi	28/02/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	01/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Ghortari	28/02/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	01/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Godtamar	02/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme

Villages Consulted	Date	Participation	Objective	Outcome
	03/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Kumargariya	02/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	03/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Ratanpur	04/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	05/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Chitarpur	04/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	05/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Marichbad Purma Nagar	06/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	07/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Kenduatant	06/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	07/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Thekbahar	08/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	09/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Mahuadabar	08/03/20017	PRI members and villagers	Briefing about adaptation fund	Villagers are aware about the adaptation fund programme

Villages Consulted	Date	Participation	Objective	Outcome
			programme and conducting PRA	
	09/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Rautdih	10/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	11/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Jobriasadhaurnitahr	10/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	11/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members
Naudihani	14/03/20017	PRI members and villagers	Briefing about adaptation fund programme and conducting PRA	Villagers are aware about the adaptation fund programme
	15/03/20017	PRI members and villagers	Getting intervention list	Finalize the intervention list with the villagers and PRI members



- ①. झाम खान -  $2\frac{1}{2}$  एकड़ - अली दुर्गा.  
 NY 03 078 E086 35 203
- ②. नालाख न्या  $\frac{18}{223}$  - दुर्गा अली.  
 NY 03 482 E086 35 924
- ③. कुप मरमति -  $\frac{1}{4}$  - अली दुर्गा.  
 NY 03 626 E086 35 852
- ④. कुशा न्या - खोरे नो - 284 - दामि देवी - खोरे दुर्गा.  
 NY 03 596 E086 35 857
- ⑤. नालाख न्या खोरे नो - 285 - सुपम राय - खोरे दुर्गा.  
 NY 03 492 E086 35 442
- ⑥. गाँववाल न्या - 400 फीट - खोरे नो - 300-11, योगेन्द्र राय - दुर्गा.  
 NY 03 491 E086 35 721
- ⑦. झाम खान -  $1\frac{1}{2}$  एकड़ - खोरे नो - 110<sup>th</sup> - खोरे दुर्गा.  
 NY 03 831 E086 35 547
- ⑧. कुशा न्या - 8 332 - शिवी मित्रों -  
 NY 03 661 E086 35 361
- ⑨. कुशा मित्रों - खोरे नो  $\frac{1}{2}$  - खोरे दुर्गा.  
 NY 03 563 E086 35 771
- ⑩. गाँववाल न्या - 300 फीट - खोरे नो, खोरे नो - 300<sup>th</sup> - खोरे दुर्गा.  
 NY 03 431 E086 35 243
- ⑪. सिंघाई कुप मरमति - - - -  
 NY 03 884 E086 35 520
- ⑫. झाम खान -  $1\frac{1}{2}$  एकड़ - - -  
 NY 03 184 E086 35 538
- ⑬. कुप मित्रों - 117 - खोरे नो -  
 NY 03 433 E086 35 184
- ⑭. पाँचा रोपण - - 1 एकड़ - खोरे नो -  
 NY 03 468 E086 35 122
- ⑮. कुप सिंघाई - - - -  
 NY 03 431 E086 35 833
- ⑯. सिंघाई कुप मरमति - - - -  
 NY 03 847 E086 611
- ⑰. सिंघाई कुप मरमति - - - -  
 NY 03 281 E086 35 961

(18) नाली नया - 200 फीट - इरीख  
 24 02 985 8086 35 282

(19) विंयाई कुप निर्माता - उमा र नो - 825 - 81  
 24 02 080 8086 35 784

(20) नाली निर्माता उमा र नो - 824 - 25  
 1424 02 991 8086 35 555

(21) ~~शुक्ल~~ कुडा का उमा र नो - 825 - 31  
 1424 02 952 8086 35 784

(22)

जुलैरवा कीकी  
 पंचायत समिति सदस्य  
 ग्राम पंचायत - बोस्वा  
 प्रो - नारायणपुर, जिला - जामताड़ा



ENHANCING CLIMATE RESILIENCE OF FORESTS AND ITS DEPENDENT COMMUNITIES IN JHARKHAND



## **2.10 Learning and knowledge management component to capture and disseminate lessons learned, for the proposed project**

The department has its own website to host different schemes and related developments in the state. For the projects, the department will have a dedicated segment in its website for showcasing good practices related to each of the project component.

Secondly, there will be a dedicated person for collection of related data, compilation and interpretation of the same for the larger benefit of the communities in the proposed project area. Data related to each intervention mentioning pre- and post-situation will be captured. The data will then be converted into information and best practices will have case study with process documentation report.

The outcome of the process documentation will be used for providing raining and extension in other areas. These will also be hosted on the website of the department. The knowledge gathered through this project will be essential for building skill sets for the state forest department and also for NABARD as this is the first of its kind project in the state. The transfer of knowledge generated through the project is crucial since this will be the first climate change adaptation project targeting the forestry sector that takes into account current as well as future climate change scenarios. The project is expected to generate crucial learnings in terms of building climate resilient adaptation options. The knowledge will include adaptation techniques at the department level, farm level, best practices, benefits of early warning information through weather stations, sustainable agricultural practices that enhance adaptation ability and resilience; and other policy recommendations and technical guidelines produced by the project. Data related to different aspects of the project (by activity, outcome, benefit, impact etc.), focusing on adaptation and resilience parameters, will be captured through various means like (1) systematic independent studies such as benefits of intensification, etc.; (2) periodic data on weather and crop advisory services; (3) monitoring reports generated by internal and external monitors; (4) feedback during exposure visit/training; and (5) regular review meeting. Generated knowledge / learning will be scientifically recorded on regular basis in the form of

reports, data, proceedings, registers, photo, video clippings etc. Generated knowledge / learning will be disseminated in the following ways:

- a. Peer learning seminars / workshops in both the project landscapes and at state level;
- b. Wider dissemination of the operational manual in Hindi and local language of both the landscapes;
- c. Hosting best practices in the existing departmental websites on climate change adaptation and resilient measures.

### **2.11 Sustainability of the project/programme outcomes has been taken into account during the designing of the project / programme**

Sustainability of any intervention is a product of social, economic and environmental components. For the proposed interventions, all three have been considered. Communities' deliberations have been accorded top priority. Concerns like improved productivity and production, diversification in livelihood systems and integration of components in agriculture and allied sectors have been given due consideration. During designing of the project, various views of different stakeholders consulted in different phases of proposal development and sustainability parameters have been taken into account. Sustainability of the project outcomes, beyond the life of the project is ensured through different strategies that are proposed in this project. The strategies, to be taken up (as discussed in this proposal), focus on different sustainability parameters. The outcome is assumed to be achieved through participatory and community ownership approach. Capital investments, to be incurred under the project, will have revenue generating options for its sustenance. The community infrastructures will be managed and maintained by the community, once they realise the benefits of the initiatives. For sustainability, the project will take two-prong approach – firstly, sustenance of the process by the community upon realising the benefits of adaptation measures; and secondly, accessing resources from Government and other agencies, under different schemes / programme and managing / maintaining the project outcome and building upon it further.

The study further reveals that the long term sustainability of the program can be achieved if there is an improvement in the income level of the beneficiaries. The dynamic model show that it is possible only if the programme can generate profit over its lifespan. The study further emphasizes on the importance of comprehensive approach of programme for its long term sustainability and significant impacts on the society. Examining contextually, the proposed intervention will sustain for a longer period as it will, directly and indirectly, benefit the target mass, and support them enhancing their income. Apart from that, as the strategy to be adopted is comprehensive and integrated, it can be safely said that the project will sustain even after its life. However, sustainability parameters of the project and key elements that would contribute towards sustainability of project outcomes are discussed below.

**Physical sustainability of different structures:**

**Formation of user groups:** It is the first step towards achieving sustainability of the structures. These user groups will comprise the beneficiaries falling under the command area of the structures. Since each structure has its own user group, opening a separate account for all the groups pose a problem. The project has designed a strategy for avoiding these complications.

Accounts will be opened in the name of the major user group and the other user groups will maintain an account of their own at the village level. The amount collected for all the user groups will be deposited in the account of the major user group. Amount will be withdrawn for repairing based on the approval of the Gram sabha for the maintenance of the structure.

Gram Sabha and the SHGs from the respective villages will monitor the developments at the village level.

**Training regarding technical aspects and maintenance of the structures:** Village youth will be trained on the technical aspects of the structures as well as on the maintenance of the structures. They will be put in charge of the technical maintenance of the structures. They will assess the structures from time to time and report to the Gram Sabha and the user groups regarding the maintenance requirements of the structures. They can design low cost maintenance strategy for the structures and convey viability of structures to people.

**To generate resources for post project maintenance of the structures:** User groups will function on the concept of SHGs. These groups will deposit the initial amount for the account opening and then, as resolved by the Gram Sabha in coordination with the different user groups formed, will deposit a fixed percentage of the additional income generated for the repair and maintenance of the groups. The groups will also get the KCC for the operation and implements related to the agriculture. These may be linked with the main line financial institutions for availing the additional credit after the project period. The groups will generate resources by inter-loaning the fund accumulated.

**To make Gram Sabhas responsible for the physical structures:** As the ownership plan of the structure, Gram Sabhas and other village-level organizations will be made responsible for the sustainability of the structures. Gram Sabha, in consultation with the technically trained youth, will monitor the status of the structures for the desired purpose.

**To make people accountable for monitoring:** Active participation of the community for planning, implementation and post project management of the structures will be ensured. The community will monitor the status of the structure and will report to Gram Sabha if repair and maintenance works are not done on time.

**To design effective mechanism for conflict resolution at the village level between the different user groups:** An effective mechanism is in the process of development for the conflict resolution among the different user groups. It is in the process and it will take time for people to understand the complexities of recharge and exploitation of the ground water as we have done less work on it. It will be developed within a month as meetings with the user groups are in the process.

#### **Ecological sustainability:**

Working with the watershed concept has repercussions on the environment, ecology and microclimate of the area. The microclimate involves biotic and abiotic factors in the proposed area. Among the abiotic main resources are land, water & soil and among the biotic factors

prime are human, animal and forests. For making the impact of the watershed sustainable we need to work on all these aspects.

**Land resources** – Activities planned for land resources are as follows:

- x Land reclamation
- x Increasing productivity of the land
- x Maintaining productivity of the land
- x Developing low input sustainable agricultural practices at the village level
- x Implementing various engineering structures like Gully Plugging, creation of check dams, erection of loose boulder structures etc. for reduction of erosion and protection of the land
- x Gram Sabhas and Panchayat Samitis are to take charge of these activities in close coordination with the SHGs.

**Water resources** – Judicious use of water is one of the biggest challenges at present. Concept of the watershed can be a solution to this problem. The project will address the issue by striking a balance between the recharge and exploitation of ground water.

For ground water recharge, the project proposes to build Ahars, Gully plugs, Check dams. For exploitation of the water, irrigation channels and drinking well are also proposed.

Different user groups formed for utilization of water will take charge of the structures and decide on the modalities of the payment for financial sustainability of the groups.

**Livestock resources** – These activities will be promoted with the help of the SHGs. The SHGs will be selected based on the need, present level of skill, availability of the resources and measures to sustain these resources. SHGs will take charge of the animal husbandry related activities.

The small animals will be sold to the adjoining interested groups for the activity. This will reduce the cost of purchase and help in developing an interdependent, self-sufficient society.

For big animals, insurance cover can be provided for reducing the risk involved in rearing along with different training for the management of the animals.

We have already negotiated with the United India Insurance Company for insurance coverage to the animals.

**Improvement in ecology and environment-** All the above activities will lead to improvement of the ecology and environment of the proposed watershed area. These activities along with plantation will lead to greater biodiversity of the area. The different measures for control of erosion and water storage will increase the recharge of water, leading to increase in the water table. These increased water table will result into more water availability for longer period in the area.

**Social Sustainability:**

**Making different user groups formed work:** The different user groups along with the village level institutions will be formed. These will be responsible for the proper implementation of the project and post-project maintenance of the assets created during the project period.

**Making Gram Sabha accountable:** The Gram Sabha will be made accountable for the various operations related to the project. These Gram Sabhas will be trained for the management of the resources around the village.

**Building the social capital** – (collaborative action, spread to nearby villages, trust built)

- x Regular meeting of the Gram Sabha and guidance to be provided
- x Effective participation of Panchayat leaders
- x Ensuring increased income & satisfactory village fund

**Financial sustainability:**

In order to bring financial sustainability and reducing complexities of operations, accounts will be opened in the name of the major groups existing in the village. Other groups will deposit their contribution in the account of the major group.

User groups will be formed and held responsible for the maintenance and operation of the Pond. People will deposit a sum of minimum Rs 10 to 15 per acre depending on the resolution

of the user group. For the villages where people will be charging a sum of Rs. 15 per acre, the additional Rs. 5 will be kept for purchase of the seed and other required inputs, as and when desired.

For the Ahars, people have decided to submit Rs. 5 per month per beneficiary as maintenance charges. On an average, an Ahar has 50 persons in the command area of the structure. Therefore, an average amount of Rs. 250 per month can be collected for repairing of Ahar. On an average, life of the Ahar is about 50 years; thus, enough funds can be generated for the repair and maintenance of the Ahar in these many years.

For the irrigation, people have decided to deposit 5% of the additional income generated towards maintenance of the well. The increase can be calculated from the impact study data and the statements of the people themselves.

The environmental protection measures for developing resilience and adaptation to climate variability will improve the environment of the landscape. Organic manure, is a key input for maintaining plant nutrient, will enhance soil health. Carbon sequestration through agro-forestry models will have a positive impact and will be sustainable source of eco-system service for the community. The management and maintenance will be taken care by the community. The water harvesting structures, percolation tanks, sunken ponds etc. will help not only to arrest run-off and minimize water loss, but will also maintain the soil moisture regime. Overall, it will reduce plant morbidity and mortality rate. The better harvest structures will provide better return on investment, even during dry spells, for the farmers. Agri-horticulture will ensure environmental and economic benefits for the target mass.

The project activities will prepare the landscape area to be better resilient and adaptive to the extremes of climate change. The adaptation activities will not only result in better water availability and ground water recharge but also concentrate on sustainable water use in the form of micro irrigation, community-based irrigation management, etc. Judicious use of available water through scientific water management practices and increment in ground water level will certify increased water availability in the future, benefitting the local environmental



concerns. Agro-forestry will be helpful in minimising community dependency on the local forest and support long-term eco-system services.

The focus of traditional watersheds is only on current Soil Water Management (SWM) measures. The climate forecast data obtained by setting up Automatic Weather Station and crop advisory based on the weather data, will be integrated in the design parameters so that watersheds remain resilient even in aggravated climate scenario.

### 2.12 Provide an overview of the environmental and social impacts and risks identified as being relevant to the project / programme

Checklist of environmental and social principles	Description	Potential impacts and risks – further assessment and management required for compliance
<i>Compliance with the Law</i>	The project complies with Environment (Protection) Act, 1986 and Forest Conservation Act, 1980 Further the project complies with state Panchayat Raj and Gram Swaraj Act  <b>No further assessment required for compliance</b>	None
<i>Access and Equity</i>	The project provides fair and equitable access to the project beneficiaries and will not be impeding access to any of the other requirements like health clean water, sanitation, energy, education, housing, safe and decent working conditions and land rights.  The proportion of benefits that will flow to each category of landholder will be determined in consultation with the Village forest Committees.	None
<i>Marginalized and Vulnerable Groups</i>	The Technical assessment and Baseline and Project Benefit Assessment includes identification of impact on marginalised groups.	None
<i>Human Rights</i>	The project does not foresee any violation of human rights  <b>No further assessment required for compliance</b>	None
<i>Gender Equity and Women's Empowerment</i>	Project would ensure participation by women fully and equitably, receive comparable socio-economic benefits and that they do not suffer adverse effect.	None
<i>Core Labour Rights</i>	Payments to labour under the project will be made as per Government approved norms duly following minimum wage rate	None

Checklist of environmental and social principles	Description	Potential impacts and risks – further assessment and management required for compliance
	<p>and hence ensuring core labour rights.</p> <p><b>No further assessment required for compliance</b></p>	
<i>Indigenous Peoples</i>	<p>Will take care of the tribals and will be given priority while deciding the project inputs</p> <p><b>No further assessment required for compliance</b></p>	None
<i>Involuntary Resettlement</i>	<p>The project does not displace any community and hence issue of resettlement does not arise.</p> <p><b>No further assessment required for compliance</b></p>	None
<i>Protection of Natural Habitats</i>	<p>Project does not affect any of the natural habitats.</p> <p><b>No further assessment required for compliance</b></p>	None
<i>Conservation of Biological Diversity</i>	<p>The project will improve bio-diversity values.</p> <p><b>No further assessment required for compliance</b></p>	None
<i>Climate Change</i>	<p>The project is basically for enhancing the adaptive capacity of the rainfed farming systems and livelihoods against adverse impact of climate change and is not expected to contribute to GHG emissions.</p> <p><b>No further assessment required for compliance</b></p>	None
<i>Pollution Prevention and Resource Efficiency</i>	<p>Project is not expected to create any environmental pollution and aims for higher resources efficiency for better management of available natural resources like water, soil, plantation species (locally available), etc.</p>	
<i>Public Health</i>	<p>No adverse impact on public health related issues is envisaged</p> <p><b>No further assessment required for compliance.</b></p>	None
<i>Physical and Cultural Heritage</i>	<p>No adverse impact on cultural heritage related issues is identified.</p> <p><b>No further assessment required for compliance</b></p>	None
<i>Lands and Soil Conservation</i>	<p>Catchment area treatment is envisaged to help in land and soil conservation and will not create any damage to land&amp; soil resources.</p> <p><b>No further assessment required for compliance</b></p>	None

### 3. IMPLEMENTATION ARRANGEMENTS

#### 3.1 Describe the arrangements for project / programme implementation

- i. *Who will implement the project and what are their comparative advantages and capacity compared to other potential implementing institutions?*

The project will be implemented by the respective DFOs under the guidance of the State Forest Department (SFD). Since there are components that require diversified skill sets and dedicated technical man power, the Department will involve the services of third party agency/society, having relevant experience in the planning of climate change issues. The cost of the services will be met from the project execution cost budgeted in the project.

As SFD has comparative advantage of being the nodal State Department for climate change as well as the state implementing agency for the Green India Mission under NAPCC, its services can be availed for the proposed project. A system to plan and implement GIM under the MoEF&CC guidelines has been developed in SFD which gives it a competitive advantage over the other implementing agencies.

#### Key Institutions and their responsibilities for project implementation

Institution	Responsibilities
State Forest Department	Convening of SLSC meetings, funds release & co-ordination with MoEF&CC, GoI, project coordination, implementation, supervision and monitoring
Krishi Vigyan Kendras	Crop Advisory services based on Weather data; support for orientation and training to farmers
Third party agencies / Voluntary organisations & JFMC functionaries	Community mobilisation
Local communities	Provide inputs for baseline study, vulnerability assessment and planning
SHGs, FPOs	Implementation of various activities

- ii. *How will the project be coordinated with (and/or mainstreamed into) related development activities of the targeted sector?*

### **NAFCC project implementation arrangement by Forest Department**

The project is proposed to be steered by an Advisory & Review Committee headed by APCCF, Forest Deptt, Jharkhand. The members would include RSSF, CF, DFO of the respective regions, National Bank for Agriculture and Rural Development (NABARD); Agriculture Department, GoJ; APCCF (Projects, Forest Deptt), an expert from BAU, Agency facilitating implementation and four PRI representatives from the two area.

The State level Steering Committee (SLSC) on Climate Change to be constituted, headed by Chief Secretary, having members from key departments. The members will provide an overarching support in endorsing, monitoring & evaluating the project.

The project will have a three tier arrangement for making its implementation in line with the stated objectives and without compromising the quality of implementation.

- x In the first tier, there will be a state office supported by a PMU, headed by a forest officer as decided by the department. Further, the PMU will include at least two people - a technically sound person with orientation in IS and finance; and a technical person having knowledge in climate change and related fields.
- x Second tier will be the office of the DFO. DFOs will head the operational units in two landscapes. The office will be supported by the project facilitating agency. The department will hire the services of a Society, preferably having experience in planning and implementation of climate change related projects in the state. The agency has to provide necessary documents supporting claim for having such experience. The agency will have an agreement with the respective DFOs for facilitation of implementation. The agreement will contain detailed description of the deliverables with timeline and budgetary provisions, as agreed mutually between both the parties. The agency will present the team composition that will be exclusively involved in the implementation of

the project along with requisite qualifications and experience. The team will be placed at the project site or close to the project site for easy movement and monitoring. Each transaction by the agency will have to meet the guidelines of the State Forest Department and will be approved by the Secretary of the Organization or any other competent person deputed by the agency. The team leader will report the progress in implementation to the DFOs on fortnightly basis.

At this level, all the villages in the respective landscape will have their own committees. Villages which have JFMCs will operate through them and others will operate through a committee formed for the purpose of implementing the project. The JFMCs/EDCs/VDCs will have an agreement with the DFO office for the implementation of the project. This will ensure easy transfer of funds to the committees for execution of project. These will also create a sense of ownership among the villagers reading this project.

- x The third tier will be the field level office where the Department, village level committees and the facilitating agency will work together for the success of the project.

Monitoring of the agency will be done by the respective DFOs and CF. The team will keep records ready for review at any given point of time. The office will be responsible for any PRI member from the project area and will address any queries raised regarding the implementation or progress of the project. State level committee will also make field visits to monitor the progress of the project.

The steering committee will meet quarterly for monitoring and reviewing the progress as well as to guide the team in implementation. The agency will present the progress to the state-level steering committee on a half-yearly basis or as and when needed by the department.

The review of the project will be done by the DFOs on a monthly basis. The technical committee involving Rangers, DFO, CF, RCCF, DDM NABARD and PRI members will review the project quarterly. This technical committee will also make suggestion for better implementation within the given frame work.

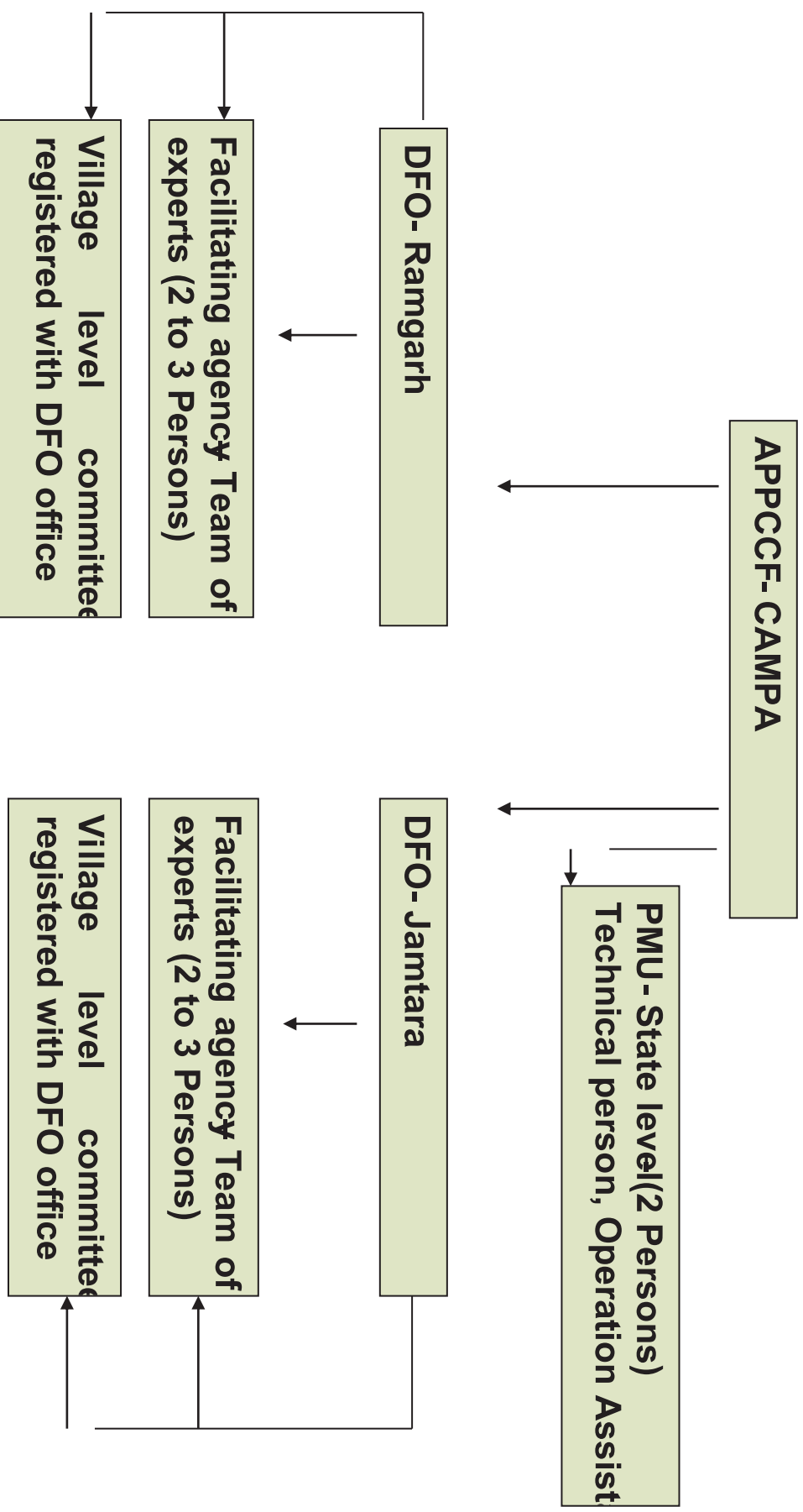
**Fund flow arrangement:**

All the expenses will be reported to the DFO.

**Monitoring:**

Monitoring will be done through a close whatsapp group, a cross-platform instant messaging application that allows smartphone users to exchange text, image, video and audio messages. The group will have all stakeholders and will report daily progress.

Implementation arrangement, fund flow mechanism and monitoring arrangement for the project



**3.2** Describe the measures for financial and project / programme risk management (also include environmental and social risk, if any).

<b>Risk</b>	<b>Rating (High/ Medium/ Low, etc.)</b>	<b>Mitigation Measure</b>
Financial	Low	Will make provisions in the next year plan for the respective divisions with components similar to the project.
Project Management	Medium due to multi-sectoral activities	Will take support from a society or will hire field expert
	Community mobilization	Will hire expert with requisite experience.
	Quality of improved cook stoves	Will work on models working and agreed by international agencies.
Social risk	Medium Forest rights and concessions	Work with community on reducing dependency on forest.
	Livelihood issues	Work with community for diversifying the source with improvement in production and productivity.
Environmental risk	High Water stress	Work on water use efficiency blended with traditional wisdom of communities.



**3.3** *Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan. (Monitoring and evaluation cost need to be included in executing entity management cost)*

The activity wise budget will be worked out in consultation with NABARD as per MoEF&CC criteria.

**Monitoring and Evaluation:** The Forest & Wildlife Department shall act as a Monitoring and Evaluation (M&E) body. The (M&E) framework is important to assess the implementation process with respect to the targets envisioned, financial resources used and strategies accomplished. Further, Measurable, Reportable, and Verifiable (MRV) frameworks for monitoring adaptation and mitigation will be established at the beginning of this project.

**Inception Report:** A Project Inception workshop will be held within the two months of the start of the project. The workshop will be attended by the members of the Steering Committee and the Advisory & Review Committee. The Inception Workshop will be held for:

- (i) Assisting stakeholders to understand the objectives of the project and visualize their respective roles and responsibilities in the implementation and results of the project.
- (ii) Establishing reporting and communication protocols and acquainting with project decision making structure and processes
- (iii) Presentation of project activities and major milestones and expected outcome of the project
- (iv) Presentation of the annual work plan to the stakeholders along with the indicators, means of verification, and monitoring and reporting frameworks and schedules. The Inception Report will be submitted within one month of holding the workshop.

**Performance Monitoring:** Performance monitoring will be done throughout the project period. The monitoring will be carried out quarterly and the report will be shared with the members of the Advisory & Review Committee. The Performance Monitoring Report will include the following components:

- (a) **Progress Tracking:** Conduct of activities against their time line will be tracked every quarter. The process entails conduct of review meeting and tracking of each activity in terms of its progress and state of implementation. The review will be followed up with finalizing the next quarter plan of activities that will incorporate spill over and inadvertent delays.
- (b) **Risk Management:** Risks will be monitored quarterly and the action taken for managing each risk will be reviewed. The exercise will also include identification of new risks and allocation of responsibility for managing them.
- (c) **Output to Outcome:** Tracking performance monitoring will undertake monitoring and review of output to outcome tracking.
- (d) **Financial Monitoring:** Quarterly financial monitoring will be undertaken to review the progress of financial utilization and for ensuring that expenditure for each head is according to the financial norms specified in the budget and agreed procurement processes. The accounts and audit will be maintained and evaluated as done by the Forest Department for similar projects.

**Project Completion Report:** At the end of the project, a Project Completion Report (PCR) will be prepared and submitted on an agreed format. The report will consolidate all the activities carried out during the project, its achievements, and results along with the evidence of impacts and benefits.

(a) **Audited Statement** A detailed audited statement of accounts will be prepared and submitted in funds received and spent under the project.

No.	Monitoring and Evaluation Plan Activity	Responsible Person	Yr.1	Yr. 2	Yr. 3	Yr. 4	Total	Timeframe
1	Project Inception report	Forest Deptt	First Quarter					Three months
A	Performance monitoring	Forest Department,	4 times	4 times	4 times	4 times	32 days	Quarterly basis
B	Financial monitoring	Designated Finance and audit officer of Forest Department	12 times	12 times	12 times	12 times	48 days	Monthly basis
C	Overall periodic monitoring of the activity	State Steering Committee on climate change	2 times	2 times	2 times	2 times	8	Six monthly review

In addition, there will be monitoring and evaluation mechanisms by the Project Management Unit on a monthly basis to monitor the technical progress of the project activities.

*Include a results framework for the project proposal, including milestones, targets and indicators*

**Goal:** Enhancing Climate Resilience of Forests and its Dependent Communities in Two Landscapes of Jharkhand

Result Frame work for the project					
Component 1 : Capacity building Measures					
Outcome	Indicator	Base line	Target	Source of verification	Risk and assumptions
Installation of weather station at two landscapes	Two weather stations installed	Climatological services not available to farmers	4000 farmers covered under climatological services	Progress report	Data collected and interpreted on regular basis and disseminated
	Number of farmers covered			Interview with farmers	
Capacity Building of farmers for reduced risk	Number of farmers trained and using the skills	farmers are not aware of the climate risk in general	6000 Farmers trained under the two landscapes	Training attendance	Good resource person with requisite skills for knowledge transfer
				Training report	
Component 2: Forest Micro Climate Improvement through Soil and moisture conservation (SMC) & Water Harvesting (WH)					
Soil moisture regime in two landscapes improves	Moisture available in the soil	Forest and farmers are vulnerable due to poor soil moisture regime	shifting of fire season by 15 days and reduced vulnerability of farmers	MB of the work done	Labor available during the working season and JFMICs willing to cooperate with department

Soil health improved	Improvement in soil texture	Poor soil texture	Improvement in organic carbon	Soil test report	Samples taken properly
Increased water availability through the water storage structures	105 water storage structures constructed in two landscapes	80% rainfall is lost as run off due to less water storage structures	25% reduction in run off from the two landscapes	structures created, Additional area brought under irrigation	Rainfall do not change drastically and labour available for work

**Component 3: Gender sensitive and climate resilient livelihood systems**

Improved climate resilient livelihood promoted	Number of farmers adopting proposed measures for reducing climate change impacts	Farmers are not aware of the climate resilient farming systems	Farmers use resilient measures for farming	6000 farmers are skilled with resilient measures	Farmers are willing to adopt and adapt to the proposed measures
Improved Food security	Increased production for staple crops	productivity of very less and cost of cultivation high	40% improvement in the productivity	Farmers adopting intensification	Farmers are willing to adopt intensification and diversification of crops with mechanisation of farming
				Production records	
				Reduction in migration	

Forest based livelihood systems developed	Forest are maintained for getting suitable supply of raw materials	Currently farmers use less sustainable method for collection	Collection of forest produce without causing damage to forest	Survey of forest area and reduction in fire incidences	Farmers adopt proposed measures and adopt it
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**Components 4 : Small wood use-efficiency and alternative material use**

Reduction in felling of poles for house repairing	Number of families using treated poles for housing	No treatment for use as housing material	25% reduction in use of poles from the base line of 40 poles / household	number of poles used in the repairing of houses	Chemicals used for treatment are available at affordable rates and on time
<b>Component 5: Energy use-efficiency and Alternative Energy</b>					
Use of Improved cook stoves by poor families	Number of families using improved cook stoves	All families use traditional cook stoves	8000 families use improved cook stoves for cooking	Procurement of cook stoves	Families use cook stoves on regular basis and it becomes a habit in course of time
	Reduction in respiratory and eye related infections	Presence of eye related and lung related diseases in families		families using cook stoves	
				Reduction in consumption of wood	
Use of Gobar Gas plants	Number of plants constructed	None of the families are having Gobar gas plants	100 families will have Gobar gas plants installed and operational	Number of plants installed	families maintain cattle on sustained basis with improved quality of breed, feed and housing management
Use of Solar lights	Number of families using solar lights as source of lighting	None of the families are using solar lighting systems	6000 families use solar light as main source of lighting	Procurement receipts	Families adopt to the light and use of solar panels

**3.5** *Include a detailed budget with budget notes, a budget on the Implementing Entity management fee use and an explanation and a breakdown of the execution costs*

Component	Activity/ Intervention	Total cost (Lakh INR)
<b>I. Capacity building &amp; Support Service for Adaptation</b>	Trainings etc. (all interventions and climate change adaptation)	<b>60.64</b>
	Weather Station for two Landscapes	<b>20</b>
	<b>Component-I Total</b>	<b>80.64</b>
<b>II. Forest Micro Climate Improvement through SMC &amp; WH works</b>	Contour trench, Gully plugging, LBCDs	807.36
	Water storage structure	426.05
	<b>Component-II Total</b>	<b>1233.41</b>
<b>III. Gender sensitive and climate resilient livelihood systems</b>	Crop Intensification (Paddy, Wheat, Mustard, Millets, etc.)	221.4
	Crop Diversification (Cereals + Pulses, Cereals + Vegetables)	157.83
	Forest-based livelihood systems (Tasar, Lac, Other MFPs including medicinal plants, Leaf plate making etc.)	85.8
	<b>Component-III Total</b>	<b>465.03</b>
<b>IV. Small wood use efficiency</b>	Use of pre-treated of small wood (poles, etc.)	<b>140</b>
<b>V. Promoting energy use-efficiency and Alternative Energy</b>	Cook stoves	114.4
	Gobar gas plants	30
	Solar lamps/ lights	136.5
	Kitchen Garden	131.25
	<b>Component-V Total</b>	<b>412.15</b>
<b>PROJECT COST TOTAL</b>		<b>2334.5</b>
Project execution cost	Preparation of DPR	10
	Administrative cost	84.75
	<b>Project execution cost Total</b>	<b>94.75</b>
Project cycle management cost/fee	Administrative cost of NIE	73.51
<b>TOTAL COST</b>		<b>2499.49</b>

**3.5 (a) Include a disbursement schedule with time-bound milestones at the component level**

Instalment	Percentage	Amount*	Year	Milestones
First	20	49990000	1 <sup>st</sup> year	Project Initiation, inception workshop, Baseline Survey, orientation etc.
Second	30	749500000	2 <sup>nd</sup> year	Progress implementation, monitoring & review by steering committee
Third	35	87482500	3 <sup>rd</sup> year	Project implementation, monitoring & review by steering committee
Fourth	15	37492500	4 <sup>th</sup> year	Project implementation, monitoring & review

\*Assumptions:

SI No	Major Activities	Year 1				Year 2				Year 3				Year 4				Year 5					
		Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4		
1	Awareness about climate change																						
2	Awareness about Adaptation programme																						
3	Weather station at Narayanpur and Patratu																						
4	Strengthening of the JFMCs																						
5	Training to JFMC members																						
6	Training on Financial literacy																						
7	Climate change and agriculture																						
8	Monitoring of the soil health																						
9	Improving Ground water percolation in relation to agriculture																						
10	Capitalising on Assets, Abilities and opportunities																						
11	Concept of organic farming																						







- b. These trainings will result in increased level of understanding among the general masses and will help in adapting to climate change.
- c. The training on agri and allied activities will help in reducing GHG emissions from the conventional agricultural practices like traditional paddy cultivation and rearing large number of less productive cattle.
- d. Trainings on self-evaluation and monitoring will help in creating ownership among communities for the project and will also help in creating village level institutions that can work on entitlement mode.
- e. Training on sustainability will help in creating financial discipline among the villagers for putting them in a positive cycle of development.

## **2. Natural resource management - Forest micro climate improvement**

- a. A total of 1,720 Ha of forest will be put under SMC measures of contour trenches for improving the percolation and soil moisture regime in the forest area. This will help in setting the decomposition of leaf litter fast and will reduce incidences of fire. This will also create additional wage employment to the tune of 1,08,274 person days at the current rate of Rs. 221.66/day.
- b. A total of 1,000 Ha of land mass outside the forest area will be put for field bunding to reduce soil erosion and for making it suitable for cultivation or for doing plantations. This activity will create additional wage employment of 93,116 person days of wage employment at the current rate.
- c. Water absorption trenches will help in storing 2,100 cum of run-off water along with creating wage employment of 27,790 person days.
- d. Activities like loose boulder check dams, gully plugs, gabions will help in reducing velocity of runoff and widening of nalas in the forest. It will also help in improving soil moisture regime and will also help in flow of water for longer periods in the different rivulets. These activities will generate wage employment of 19,518 person days.

Together these activities will reduce run-off from an area of 2,720 Ha and will help in generating 2,48,698 person days of wage employment across the two landscapes.

### **3. Plantations and agro forestry:**

- a. 117 Ha will be put under horticulture plantations across the two landscapes. The land area will be planted with approximately 46,800 plants which will bear fruit to the tune of 2,34,000 kg with a potential to generate an income of Rs. 46,80,000 per year along with a potential of carbon sequestration of minimum 234 tons CO<sub>2</sub> equivalent. It will also generate wage employment of 14,780 person days.
- b. 74 Ha will be put under silvi-pastoral system which will help in getting fodder for the animals and will reduce biotic pressure on forest due to grazing. It will also help in improving natural regeneration reducing damages due to trampling of seedlings. The land will produce approximately 135 tons of grasses along with facilitating sequestration of 128 tons of CO<sub>2</sub> equivalent. It will generate 6,677 person days of wage employment.
- c. 50 Ha of agro forestry will help in generating additional volume of fuel wood along with putting additional area under green cover. It will also facilitate sequestration of 100 tons of CO<sub>2</sub> equivalent. It will generate wage employment of 11044 days.
- d. Reforestation in 37 Ha will help in facilitating sequestration of 74 tons of CO<sub>2</sub> equivalent. It will also generate 2,004 person days of wage employment.

These activities will put in an additional 432 Ha under green cover along with facilitating natural regeneration in the forest. These activities will also help in facilitating sequestration of 864 tons of CO<sub>2</sub> equivalent and in generating 34,503 person days of wage employment.

### **4. Livelihoods and production enhancement**

- a. On farm livelihood systems will help in improving productivity and production along with reducing GHG emissions from the cultivation. It will help in reaching out to approximately 5,380 farmers across the two landscapes. Productivity will increase

to the tune of a minimum of 25% of the base productivity which will show in the base line survey.

- b. Allied livelihood activities will help in reaching out to 2,810 families through different activities and will ensure an income of Rs. 2,500/cycle with a minimum of three cycles per year.

#### **5. Treatment of wood:**

The activities will reduce the consumption of poles for house repairing and maintenance by increasing the cycle of repairing from every three year to six years.

#### **6. Energy efficiency:**

- a. Improved cook stoves will improve energy efficiency by at least 40%. The emissions will be reduced by 1,16,80,102 tons of CO<sub>2</sub> equivalent per year assuming that each family consumes 15 Kg of wood per day.
- b. Gobar gas plants will help in mitigating emissions on to the tune of 9.98 Tons of CO<sub>2</sub> per plant. Hence, through the project, Gobar gas plant will reduce emission to the tune of 532 tons of CO<sub>2</sub> equivalent.
- c. Through solar home lights, emission will be reduced to the extent of 405 tons of CO<sub>2</sub> equivalent.

#### **7. Knowledge management**

- a. Base line and vulnerability analysis will help in fixing the benchmark for the project.
- b. EIA and case studies will help in keeping track of the project and will also help in replication of the activities elsewhere.

<b>3.7 Head wise Budget details</b>		
<b>SI No</b>	<b>Budget head</b>	<b>Cost in Lakhs INR</b>
1	Capacity Building	80.64
2	Forest Micro Climate Improvement	1233.41
3	Crop Diversification and Intensification	258.48
4	Gender Sensitive and Climate Resilient Livelihood Development	206.55
5	Small Wood Efficiency	140.00
6	Promoting Energy Use-Efficiency and Alternative Energy	412.15
7	Administrative Cost	65.00
8	Monitoring	3.50
9	Evaluation	3.50
10	Knowledge Management	22.75
11	NIA Cost	73.51
	<b>Grand Total</b>	<b>2499.49</b>

PHYSICAL FINANCIAL PLAN FOR PATRATU LANDSCAPE (All Costs in Lakhs INR)																					
			2017-18		2018-19		2019-20		2020-2021		2021-2022		Total								
		Unit cost	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin							
<b>Component -1</b>	<b>Capacity Building</b>	<b>Awareness generation</b>	Awareness about climate change	Families	0.003	200	0.6	200	0.6	200	0.6	20	0	0.6	0	0	800	2.40			
			Awareness about Adaptation programme	Families	0.002	200	0.4	200	0.4	200	0.4	200	0.4	20	0	0.4	0	0	800	1.60	
			<b>Installation of Weather stations</b>	Weather station at Patrattu	Number	10,000	1	10	0	0	0	0	0	0	0	0	0	0	0	10,000	
				<b>Institution Building</b>					0												
				Strengthening of the JFMCs	Families	0.025	42	1.029	42	1.029	42	1.029	42	1.029	0	0	0	0	0	126	3.09
			<b>Accounts management</b>						0												
				Training to JFMC members	Families	0.003	63	0.189	63	0.189	63	0.189	63	0.189	0	0	0	0	0	189	0.57
				Training on Financial literacy	Members	0.003	102	0.306	105	0.315	105	0.315	105	0.315	0	0	0	0	0	312	0.94
			<b>Participatory planning and Monitoring</b>						0												
				Climate change and agriculture	Families	0.003	200	0.6	200	0.6	200	0.6	200	0.6	0	0	0	0	0	600	1.80
				Monitoring of the soil health	Families	0.001	490	4.9	0	0	0	0	0	0	0	0	0	0	0	490	4.90
			<b>Water Management</b>						0												
				Improving Ground water percolation in relation to agriculture	Families	0.003	63	0.189	63	0.189	63	0.189	63	0.189	0	0	0	0	0	189	0.57
			<b>Livelihood and microenterprises</b>																		
				Capitalizing on Assets, Abilities and opportunities	Families	0.025	42	1.05	42	1.05	42	1.05	42	1.05	0	0	0	0	0	126	3.15
			<b>Production enhancement</b>																		
				Concept of organic farming	Families	0.025	25	0.625	25	0.625	25	0.625	25	0.625	0	0	0	0	0	75	1.88
	Concept of INM and IPM	Families	0.025	20	0.5	0	0	40	1	0	0	0	0	0	0	0	60	1.50			
	<b>Operation of weather station</b>																				

Component -2	Natural Resource management	Forest Micro Climate improvement through SMC and WH works	Training on operation of weather station	Members	0.050	21	1.05	0	0	21	1.05	0	0	0	0	0	0	0	42	2.10		
			<b>Monitoring</b>	Monitoring according to indicators set for outcome including financial	Members	0.025	21	0.525	0	0	21	0.525	0	0	0	0	0	0	0	42	1.05	
			<b>Evaluations</b>	Self-evaluations based on monitoring indicators	Members	0.003	21	0.063	0	0	21	0.063	0	0	0	0	0	0	0	0	42	0.13
			<b>Convergence</b>	Training on Convergence and resource generation	Members	0.025		0	0	0	0	0	0	0	42	1.05	42	1.05	84	2.10		
			<b>Consolidation and post project management programme</b>	Concept of sustainability and running an institution	Families	0.050		0	0	0	0	0	0	0	0	0	21	1.05	21	1.05		
				Training by Forest department	Families	0.025	42	1.05	0	0	42	1.05	0	0	0	0	0	0	84	2.10		
				<b>Sub Total-1</b>				<b>23.076</b>			<b>4.997</b>		<b>8.685</b>		<b>2.05</b>		<b>2.1</b>		<b>40.91</b>			
				Horticulture	ha	0.700	0	0	2	1.40	2	1.40	2	1.40	2	1.40	1	0.70	7	4.90		
				Silvi Pastoral plantation	ha	0.500	0	0	1	0.50	1	0.50	1	0.50	1	0.50	1	0.50	4	2.00		
				Agro-forestry	ha	0.300	0	0	1	0.30	1	0.30	1	0.30	1	0.30	1	0.30	4	1.20		
				Afforestation	ha	0.300	0	0	10	3.00	10	3.00	10	3.00	7	2.10	7	2.10	37	11.10		
				<b>Sub Total-2</b>				<b>0</b>		<b>5.2</b>		<b>5.2</b>		<b>5.2</b>		<b>3.6</b>		<b>19.20</b>				
				Farm Bunding	ha	0.240	0	0	150	36.00	200	48.00	20	48.00	0	0.00	550	132.0	0			
				Contour trench	ha	0.120	0	0	400	48.00	400	48.00	40	48.00	20	24.0	140	168.0	0			
				Water absorption trenches	ha	0.440	0	0	20	8.80	20	8.80	20	8.80	10	4.40	70	30.80	0			
				<b>Sub Total-3</b>				<b>0</b>		<b>92.80</b>		<b>104.8</b>		<b>104.8</b>		<b>28.4</b>		<b>330.8</b>		<b>0</b>		
				Loose boulder checks	ha	0.120	60	7.20	60	7.20	60	7.20	60	7.20	60	7.20	0	0	240	28.80		
				Composite Loose boulders	ha	0.200	20	4.00	20	4.00	20	4.00	20	4.00	20	4.00	0	0	80	16.00		







			Documentation of Success Stories	0.500	0	0	1	0.5	1	0.5	1	0.5	1	0.5	0	0	3	1.50
			Knowledge dissemination events/workshop	No	0.500	1	0.5	0	0	0	1	0.5	0	0	1	0.5	3	1.50
N/A Cost	N/A cost																	1210. 80
																		36.76
																		11.30

PHYSICAL FINANCIAL PLAN FOR NARAYANPUR LANDSCAPE (All Costs in Lakhs INR)																			
				2017-18		2018-19		2019-20		2020-2021		2021-2022		Total					
				Phy	Fin	Phy	Fin	Phy	Fin	Ph Y	Fin	Ph Y	Fin	Phy	Fin				
				Unit cost															
Component -1	Capacity Building	Awareness generation	Awareness about climate change	Families	0.003	100	0.3	100	0.3	78	0.234	0	0	0	0	278	0.83		
			Awareness about Adaptation programme	Families	0.002	100	0.2	100	0.2	100	0.2	0	0	0	0	300	0.60		
			Installation of Weather stations																
			Weather station at Patratu	Number	10.000	1	10	0	0	0	0	0	0	0	0	0	0	10.00	
			Installation Building					0				0							
			Strengthening of the JFMCs	Families	0.025	54	1.35	54	1.35	54	1.35	54	1.35	0	0	0	162	4.05	
			Accounts management					0				0							
			Training to JFMC members	Families	0.003	15	0.045	0	0	15	0.045	0	0	0	0	0	30	0.09	
			Training on Financial literacy	Members	0.003	3	0.009	0	0	3	0.009	0	0	0	0	6	0.02		
			Participatory planning and Monitoring					0				0							
			Climate change and agriculture	Families	0.003	200	0.6	150	0.45	100	0.3	0	0	0	0	450	1.35		
			Monitoring of the soil health	Families	0.001	350	3.5	0	0	0	0	0	0	0	0	350	3.50		







			Solar lanterns	Families	0.025	500	12.5	100	25	100	25	500	12.5	0	0	300	75.00	
			Solar Street lights	No	0.320	20	6.4	20	6.4	14	4.48	0	0	0	54	17.28		
			Kitchen garden	Families	0.025	500	12.5	500	12.5	500	12.5	500	12.5	0	0	200	50.00	
			<b>Sub Total-6</b>													<b>211.28</b>		
Admini stration and Moni torin g	Administrative Cost			Rs./year			<b>4.00</b>		<b>5.00</b>		<b>5.50</b>		<b>6.00</b>		<b>7.0</b>	<b>0</b>	<b>27.50</b>	
		Monitoring					<b>0.35</b>		<b>0.35</b>		<b>0.35</b>		<b>0.35</b>		<b>0.3</b>	<b>5</b>	<b>1.75</b>	
			Evaluation					<b>0.35</b>		<b>0.35</b>		<b>0.35</b>		<b>0.35</b>		<b>0.3</b>	<b>5</b>	<b>1.75</b>
		Preparation of DPR						<b>5.00</b>		<b>0.00</b>		<b>0.00</b>		<b>0.00</b>		<b>0.0</b>	<b>0</b>	<b>5.00</b>
			Knowledge management															
			Base line and vulnerability study	No	7.500	1	7.50	0	0	0	0	0	0	0	0	0	7.50	
			Project Completion Report	No.	0.300	0	0	0	0	0	0	0	0	1	0.3	1	0.30	
			Environment Impact assessment Studies.	No.	0.500	0	0	0	0	0	0	0	0	1	0.5	1	0.50	
			Documentation of Success Stories		0.500	0	0	1	0.5	1	0.5	1	0.5	0	0	3	1.50	
			Knowledge dissemination events/workshop	No	0.500	1	0.5	0	0	1	0.5	0	0	1	0.6	3	1.65	
NIA Cost	NIA cost																<b>36.75</b>	
																	<b>1288.69</b>	

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