

**State: Bihar**

**Agriculture Contingency Plan for District: Muzaffarpur**

<b>1.0 District Agriculture profile</b>				
<b>1.1</b>	<b>Agro-Climatic/Ecological Zone</b>			
	Agro Ecological Sub Region (ICAR)		Eastern Plain, Hot Subhumid (moist) Eco-Region (13.1)	
	Agro-Climatic Zone (Planning Commission)		Middle Gangetic Plain Region (IV)	
	Agro Climatic Zone (NARP)		North West Alluvial Plain Zone (BI-1)	
	List all the districts or part thereof falling under the NARP Zone		Zone 1 (Muzaffarpur, Saran, Sivan, E. Champaran, Gopalganj, W.Champaran, Sitamarhi, Seohar, Vaishali, Darbhanga, Madhubani and Samastipur)	
	Geographic coordinates of district headquarters		Latitude	Longitude
			26 <sup>0</sup> 04' – 26.07' N	84 <sup>0</sup> 5' – 85 <sup>0</sup> 5'E
	Name and address of the concerned ZRS/ ZARS/ RARS/ RRS/ RRTTS		Zonal Research Station, Dholi	
Mention the KVK located in the district		KVK, Muzaffarpur		

<b>1.2</b>	<b>Rainfall</b>	Normal RF(mm)	Normal Rainy days (number)	Normal Onset ( specify week and month)	Normal Cessation (specify week and month)
	SW monsoon (June-Sep)	1010.5	46	2 <sup>nd</sup> week of June	4 <sup>th</sup> week of September
	NE Monsoon(Oct-Dec)	79.6	03	1 <sup>st</sup> week of October	2 <sup>nd</sup> week of October
	Winter (Jan- Feb)	28.5	00		
	Summer (Mar-May)	80	8		
	Annual	1198.6	57		

<b>1.3</b>	<b>Land use pattern of the district</b> (latest statistics)	Geographical area	Cultivable area	Forest area	Land under non-agricultural use	Permanent pastures	Cultivable wasteland	Land under Misc. tree crops and groves	Barren and uncultivable land	Current fallows	Other fallows
		Area ('000 ha)	315	219		56.1	0.2	0.3	12.7	4.6	1.07

# Source: - SREP, District Agriculture Office, Muzffarpur

1.4	Major Soils	Area ('000 ha)	Percent (%) of total
	Sandy Soils	3.337	0.92
	Coarse Sandy Loam Soils	83.140	23.13
	Fine Sandy Loam Soils	57.820	16.08
	Clayey Soils	3.347	0.93
	Saline/ Calcareous Soils	211.812	58.92

1.5	Agricultural land use	Area ('000 ha)	Cropping intensity %
	Net sown area	219	130.1%
	Area sown more than once	66	
	Gross cropped area	285	

1.6	Irrigation	Area ('000 ha)		
	Net irrigated area	81.0		
	Gross irrigated area	81.2		
	Rainfed area	138		
	<b>Sources of Irrigation</b>	Number	Area ('000 ha)	Percentage of total irrigated area
	Canals – (Gandak Project)	01	2.5	3.08
	Tanks	194	2.9	3.6
	Open wells			
	Bore wells	33845	66.4	81.8
	Lift irrigation schemes			
	Micro-irrigation			
	Other sources (please specify) well etc.		9.6	11.8
	Total Irrigated Area		81.1	
	Pump sets	54000		
	No. of Tractors	6870		
	<b>Groundwater availability and use* (Data source: State/Central Ground water Department /Board)</b>	No. of blocks/ Tehsils	(%) area	Quality of water (specify the problem such as high levels of arsenic, fluoride, saline etc)
	Over exploited			
	Critical			

	Semi- critical			
	Safe	15		
	Waste water availability and use			
	Ground water quality	Ground water has some percentage of Iron in this district		
*over-exploited: groundwater utilization > 100%; critical: 90-100%; semi-critical: 70-90%; safe: <70%				

### 1.7 Area under major field crops & horticulture (as per latest figures of 2009-10 )

1.7	Major field crops cultivated	Area ('000 ha)							
		<i>Kharif</i>			<i>Rabi</i>			Summer	Grand total
		Irrigated	Rainfed	Total	Irrigated	Rainfed	Total		
Rice	11.9	107.4	119.3	-	-	-	-	119.3	
Wheat	-	-	-	62.5	33.6	96.1	-	96.1	
Maize	4.3	8.8	13.1	4.3	10.6	14.9	-	28	
Pulses	-	-	-	-	9.2	9.2	-	9.2	
Oilseeds	-	-	-	-	4.5	4.5	-	4.5	

Source: - SREP, District Agriculture Office, Muz

Horticulture crops - Fruits	Area ('000 ha)		
	Total	Irrigated	Rainfed
Litchi	7.5	4.5	2.9
Mango	8.9	5.8	3.1
Banana	4.9	3.5	1.4
Citrus	0.5	0.2	0.3
Guava	1.0	0.6	0.4
<b>Horticulture crops -</b>	<b>Total</b>	<b>Irrigated</b>	<b>Rainfed</b>

<b>Vegetables</b>			
Potato	10	10	
Cauliflower	3.6	3.6	
Cabbage	2.7	2.7	
Onion	2.4	2.4	
Tomato	3.4	3.4	
Chilli	1.7	1.7	
Bottle gourd	1.3	1.3	
Ladies finger	2.7	2.7	
Brinjal	2.7	2.7	
<b>Medicinal and Aromatic crops</b>	<b>Total</b>	<b>Irrigated</b>	<b>Rainfed</b>
Mentha	0.002		0.002
Lemon Grass	0.001		0.001
Citronella	0.35		0.35
Mari gold	0.001	0.001	
Plantation crops	<b>Total</b>	<b>Irrigated</b>	<b>Rainfed</b>
<b>Fodder crops</b>	<b>Total</b>	<b>Irrigated</b>	<b>Rainfed</b>
Barseem	0.7	0.7	

	Oat	0.1		0.1
	Sorghum	0.9		0.9
	Napier	0.8		0.8
	Total fodder crop area	1.1		1.1
	Grazing land			
	Sericulture etc			

Source- DAO, Muzaffarpur

<b>1.8</b>	<b>Livestock</b>	<b>Male ('000)</b>	<b>Female ('000)</b>	<b>Total ('000)</b>
	Non descriptive Cattle (local low yielding)	48.6	93.9	142.5
	Crossbred cattle	24.1	74.9	99.0
	Non descriptive Buffaloes (local low yielding)	21.7	150.0	171.7
	Graded Buffaloes	6.9	59.4	66.3
	Goat	117.3	282	399.3
	Sheep	3.3	3.5	6.8
	Others (Pig)	13.5	5.7	19.2
	Commercial dairy farms (Number)			

<b>1.9</b>	<b>Poultry</b>	<b>No. of farms</b>	<b>Total No. of birds ('000)</b>
	Commercial		187.5
	Backyard		17.3
<b>1.10</b>	<b>Fisheries</b>		

<b>A. Capture</b>						
<b>i) Marine</b>	<b>No. of fishermen</b>	<b>Boats</b>		<b>Nets</b>		<b>Storage facilities (Ice plants etc.)</b>
		<b>Mechanized</b>	<b>Non-mechanized</b>	<b>Mechanized (Trawl nets, Gill nets)</b>	<b>Non-mechanized (Shore Seines, Stake &amp; trap nets)</b>	

	<b>ii) Inland</b> (Data Source: Fisheries Department)	<b>No. Farmer owned ponds</b>	<b>No. of Reservoirs</b>	<b>No. of village tanks</b>		
		2000	931	1541 (Govt.)		
<b>B. Culture</b>						
		<b>Water Spread Area (ha)</b>	<b>Yield (t/ha)</b>	<b>Production ('000 tons)</b>		
	<b>i) Brackish water</b>					
	<b>ii) Fresh water</b> (Data Source: Fisheries Department)	2820 (Govt.)	0.5	14.000		

Source: - SREP, District Agriculture Office, Muz & District Animal Husbandry & Fishery Officer, Muzaffarpur

### 1.11 Production and Productivity of major crops (Average of last 5 years: 2004-08)

1.11	Name of crop	Kharif		Rabi		Summer		Total		Crop residue as fodder ('000 tons)
		Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	
<b>Major Field crops (Crops identified based on total acreage)</b>										
	Rice	150.7	1567					150.7	1567	
	Maize	19.7	1500	95.4	6400			115.1	3950	
	Wheat			162.1	2100			162.1	2100	
	Pulses					6.3	0.7	6.3	0.7	
	Oil Seeds			5.4	1150			5.4	1150	
<b>Major Horticultural crops (Crops identified based on total acreage)</b>										
								Production('000 t)		
	Litchi							55.8		
	Mango							93.7		
	Guava							12.5		
	Banana							201.6		
	Lemon							4.7		
	Papaya/Aonla etc.							12.3		

<b>1.12</b>	<b>Sowing window for 5 major field crops</b> (start and end of normal sowing period)	<b>Rice</b>	<b>Pigeonpea</b>	<b>Wheat</b>	<b>Maize</b>	<b>Lentil</b>
	Kharif- Rainfed	2 <sup>nd</sup> week of June	3 <sup>rd</sup> week of June - 2 <sup>nd</sup> week of July	-	3 <sup>rd</sup> week of May-2 <sup>nd</sup> week of June	-
	Kharif-Irrigated	2 <sup>nd</sup> week of June - 3 <sup>rd</sup> week of June	-	-	-	-
	Rabi- Rainfed	-	-	4 <sup>th</sup> week of October - 1 <sup>st</sup> week of November	-	2 <sup>nd</sup> week of October - 1 <sup>st</sup> week of November
	Rabi-Irrigated	-	-	2 <sup>nd</sup> week of November - 2 <sup>nd</sup> week of December	2 <sup>nd</sup> week of October - 3 <sup>rd</sup> week of November	2 <sup>nd</sup> week of Oct. – 2 <sup>nd</sup> week of Nov.

<b>1.13</b>	<b>What is the major contingency the district is prone to? (Tick mark)</b>	<b>Regular</b>	<b>Occasional</b>	<b>None</b>
	Drought		✓	
	Flood	✓		
	Cyclone			✓
	Hail storm			✓
	Heat wave	✓		
	Cold wave		✓	
	Frost		✓	
	Sea water intrusion			✓
Pests and disease outbreak		✓		

<b>1.14</b>	<b>Include Digital maps of the district for</b>	Location map of district within State as Annexure I	Enclosed: Yes
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	Mean annual rainfall as Annexure II	Enclosed: Yes
	Soil map as Annexure III	Enclosed: Yes

## Annexure I

### Agro climatic Zones of Bihar

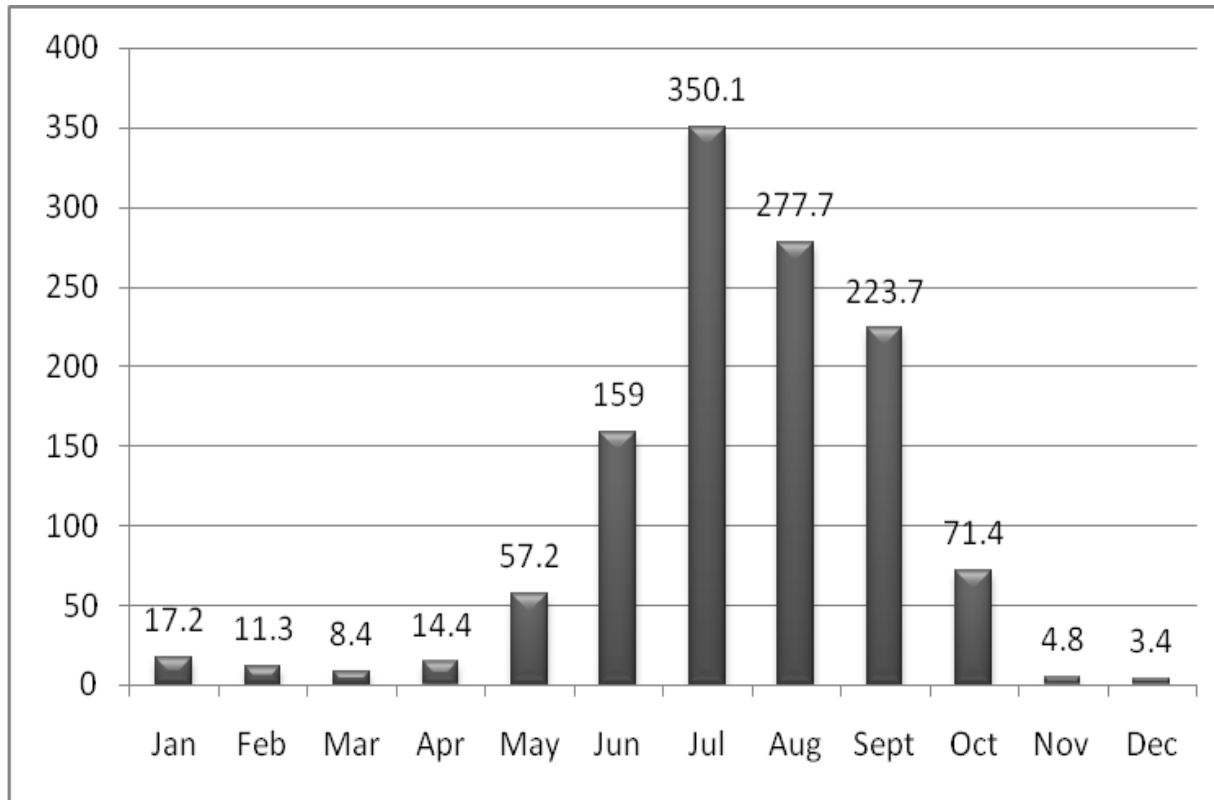


Source: krishi.bih.nic.in

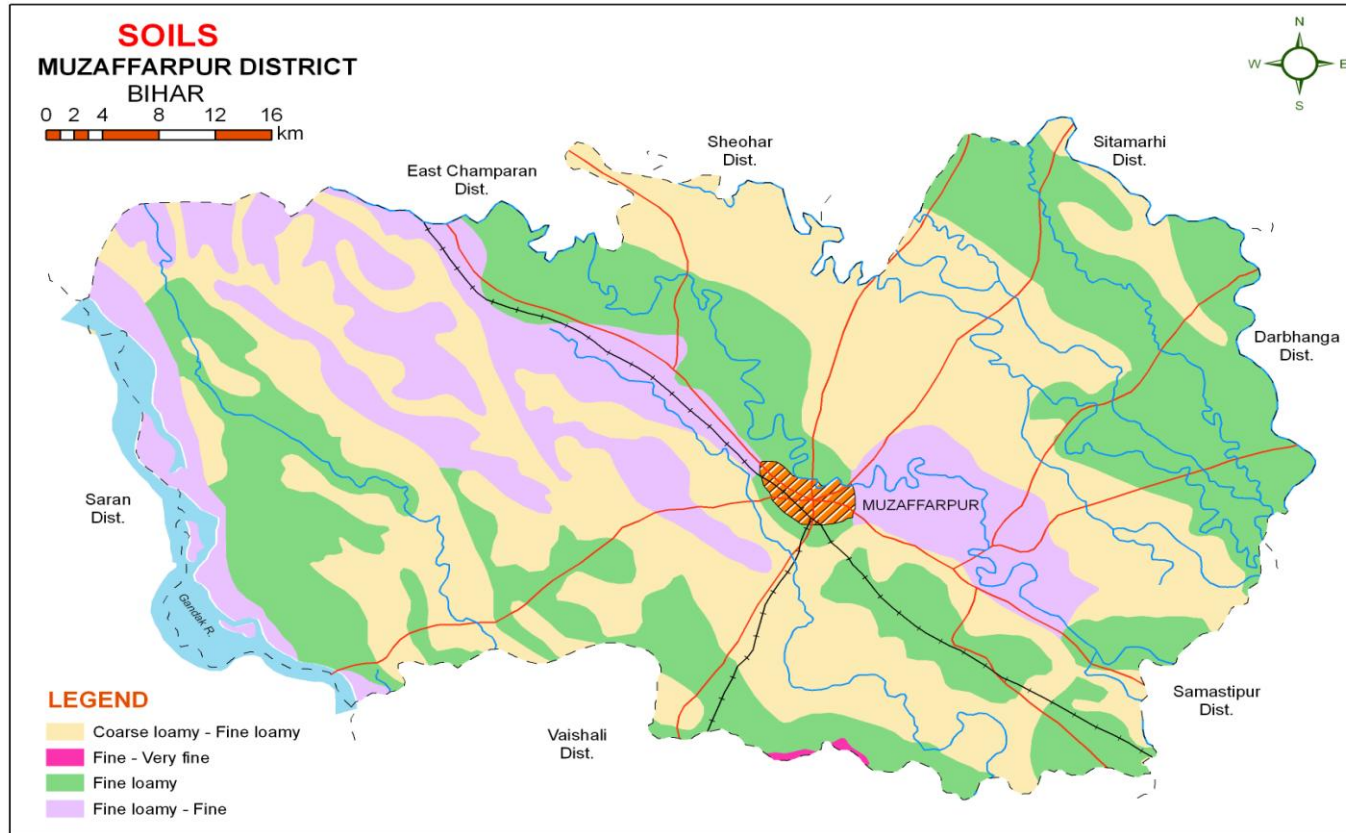


## Annexure II

### Mean annual rainfall (mm)



### Annexure-III



Source : NBSS& LUP, Regional Centre, Kolkata

## 2.0 Strategies for weather related contingencies

### 2.1 Drought

#### 2.1.1 Rain fed situation

Condition	Major Farming situation	Normal Crop / Cropping system	Suggested Contingency measures		
			Change in crop / cropping system including variety	Agronomic measures	Remarks on Implementation
Early season drought (delayed onset)					
Delay by 2 weeks  1 <sup>st</sup> week of July	Up land	Rice-Wheat Pigeonpea-Greengram	Early Rice – Wheat Pigeonpea – Greengram	Normal package of Practices, Direct sowing of rice	-
	Medium land	Rice- Wheat	Rice-Wheat		
	Lowland	Rice – Wheat	Rice – Wheat Medium to long duration		

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change in crop/cropping system	Agronomic measures	Remarks on Implementation
Early season drought (delayed onset)					
Delay by 4 weeks  3 <sup>rd</sup> week of July	Upland Fine loamy soils	Pigeonpea-Greengram	Early Rice – Wheat Pigeonpea – Greengram  Rice- Prabhat, Dhanlaxmi, Richharia, Turanta Saroj Pigeonpea – Bahar, Pusa-9	-	Seeds from RAU, Pusa, NSC, TDC , BRBN etc.
		Rice-Wheat	Rice-Wheat  Rice- Prefer Medium to short duration varieties like Saroj (100-110d), Birsa Dhan-201 (100-115d)	•Direct seeding of rice with medium duration drought tolerant varieties with pre emergence herbicide application under sufficient soil moisture conditions followed up with a post-emergence weedicide application 20-25 days later for effective	

				<p>weed management.</p> <ul style="list-style-type: none"> <li>• Raise staggered community nursery preferably with medium duration varieties in mid and lowlands</li> <li>▪ Normal sowing of rice can be used with enhanced NPK to boost the early vegetative growth in late plantings under sufficient moisture</li> <li>▪ Interculture for timely weed control in direct seeded rice</li> </ul>	
	Medium land	Rice – Wheat	<p>Rice-Wheat</p> <p>Direct sowing / 20d old dapog seedlings with medium to short duration varieties – BR34, Rajendra Dhan-201(130-135d), Rajendra Bhagwati,</p>	<ul style="list-style-type: none"> <li>• Where field is moist, direct seeding of medium duration varieties (125 days) can be done during second fortnight of July in midlands. Post-emergence herbicide application use is essential</li> </ul>	
	Lowland	<p>Rice – Wheat</p> <p>Makhana (in ponds) Var. local</p>	<p>Rice- Direct/ dapog seedlings with Rajshree, Santosh , Sita, Rajendra Suwasni, Rajendra Sweta, Swarna sub-1</p>	<ul style="list-style-type: none"> <li>• Use mat nursery/ dapog nursery , mat nursery (dapog method) can be raised for quick availability of young seedlings for transplanting of medium duration varieties by first fortnight of August in mid and Lowlands</li> </ul>	

				<ul style="list-style-type: none"> <li>• Raise staggered community nursery preferably with short duration varieties in mid and lowlands</li> <li>• Transplant with 30-35 days old seedling may be used with 3-4 seedling per hill with close spacing.</li> <li>• Enhanced dose of nitrogen with full basal dose of NPK at the time of transplanting to boost the early vegetative growth in late plantings under sufficient moisture</li> <li>• Timely interculture for weed control in direct seeded rice</li> <li>• Life saving irrigation</li> </ul>	
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Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change in crop/cropping system	Agronomic measures	Remarks on Implementation
Early season drought (delayed onset) Delay by 6 weeks 1 <sup>st</sup> week of August	Upland Fine loamy soils	Rice-Wheat Pigeonpea-Greengram	Early Rice – Wheat Blackgram/ Finger millet-Wheat  Blackgram - T-9, Navin, Pant Urd-30 , Pant Urd-19  Finger milletRAU 7&8 Coimbatore-1 Rice- Prabhat, Dhanlaxmi,	Direct sowing of Rice, Application of Potassic fertilizer at vegetative stage, Dapog seedlings can be used under moist conditions	Seeds from RAU, Pusa, NSC, TDC , BRBN etc.

			Richharia, Turanta Saroj	
	Medium land	Rice – Wheat	Rice (Short duration)-Wheat Blackgram/ Finger millet-Wheat  Blackgram- T-9, Navin, Pant Urd-30 , Pant Urd-19 Finger milletRAU 7&8	Interculture
			Rice (Short duration)-Wheat Rice- Prabhat, Dhanlaxmi, Richharia, Turanta Saroj	<ul style="list-style-type: none"> <li>• Mat nursery (dapog method)/ Community nursery can be raised for quick availability of young seedlings for transplanting of medium duration varieties by first fortnight of August</li> <li>• Direct seedling of Rice</li> <li>• Raise staggered community nursery preferably with medium duration varieties in mid and lowlands</li> <li>• Enhanced basal dose of NPK to boost the early vegetative growth</li> <li>• Application of fertilizers especially phosphorous and potash to be ensured under late transplanted conditions in severely affected districts</li> <li>• Life saving irrigation</li> </ul>
	Lowland	Rice-Wheat-Greengram	Rice (Short Duration)-Wheat Rice- Prabhat, Dhanlaxmi, Richharia, Turanta, Saroj  If dry spell continues, direct seeding of short duration rice varieties (100 days) can be done in midlands by first fortnight of August and extra short duration (70-75 days) up to 25 <sup>th</sup> August	

Condition	Major Farming situation <sup>a</sup>	Normal Crop/cropping system <sup>b</sup>	Suggested Contingency measures		
			Change in crop/cropping system <sup>c</sup>	Agronomic measures <sup>d</sup>	Remarks on Implementation <sup>e</sup>
Early season drought (delayed onset) Delay by 8 weeks 3 <sup>rd</sup> week of August	Upland Fine loamy soils	Rice-Wheat	Early Rice – Sept. Pigeonpea  Rice- Prabhat, Dhanlaxmi, Richharia, Turanta, Saroj	<ul style="list-style-type: none"> <li>Moisture conservation</li> <li>Inter cultivation</li> <li>Sowing of <i>rabi</i> crops such as Wheat, Lentil, Chickpea, Pea, Mustard (Pusa Mahak, RAU TS17), Linseed (Garima) and Vegetables</li> </ul>	Seeds from RAU, Pusa, NSC, TDC , BRBN etc
	Medium land	Maize-Wheat	Sesame –Rabi maize Sesame-Late Wheat Sesame – Krishna, Pragati	<ul style="list-style-type: none"> <li>Supply of contingency crop seeds of Toria, Maize (QPM varieties, Swann composite-65-70 days; HM-4 hybrid baby corn), Arhar (Bahar, NDA1, Pusa 9), Urd (Navin and T9), Cowpea and Horsegram need to be ensured for taking up of sowing in September in midlands</li> <li>Fodder varieties of Jowar, Maize, Bajra in combination with legumes (cowpea and horsegram) can be taken up wherever feasible to meet the fodder requirements in deficit rainfall districts</li> </ul>	
		Pigeonpea – Greengram	September Pigeonpea-Greengram Sept.Pigeonpea–Pusa-9, Sharad Narendra Arhar-I		
		Rice-Wheat	Direct seeded rice (DSR) with short duration (80-90 days) varieties (Turanta dhan, Prabhat, Anjali, Vandana, CR-Dhan-40 etc.) can be taken up in midlands till the end of August subject to availability of at least one assured	<ul style="list-style-type: none"> <li>Direct seeding of rice</li> <li>Mat nursery (dapog method)/ Community nursery can be raised for quick availability of young seedlings for transplanting of medium</li> </ul>	

			<p>irrigation</p> <p>Early Rice-Prabhat, Dhanlaxmi, Richharia, Turanta</p>	<p>duration varieties by first fortnight of August</p> <ul style="list-style-type: none"> <li>• Use of 20 days old dapog seedling in rice.</li> <li>• Enhanced basal dose of NPK in rice to boost early vegetative growth</li> <li>• Supply of contingency crop seeds of Toria, Maize (QPM varieties, Swann composite-65-70 days; HM-4 hybrid baby corn), Arhar (Bahar, NDA1, Pusa 9), Urd (Navin and T9), Cowpea and Horsegram need to be ensured for taking up of sowing in September in midlands</li> <li>• Fodder varieties of Jowar, Maize, Bajra in combination with legumes (cowpea and horsegram) can be taken up wherever feasible to meet the fodder requirements in deficit rainfall districts</li> </ul>	
	Lowland	Rice- Potato	<p>Rice-Potato/Wheat</p> <p>Rice- Rajshree, Santosh , Sita Rajendra Suwasni, Rajendra Sweta</p>	<ul style="list-style-type: none"> <li>• Double transplanting of rice (karuhan) can be done with 30 + 45 days old seedlings of long duration or photosensitive varieties up to 30<sup>th</sup> August with close planting (40-45 hills per square meter)</li> <li>• Application of organic manure and vermi compost initially for Rice and other crops.</li> <li>• Sowing of <i>rabi</i> crops such</li> </ul>	



				<p>as Wheat, Lentil, Chickpea, Pea, Mustard (Pusa Mahak, RAU TS17), Linseed (Garima) and Vegetables can be taken up on time for maximizing productivity from lowlands with support from the government for timely supply of inputs and in a way <i>rabi</i> production would compensate the production loss during <i>kharif</i>.</p> <ul style="list-style-type: none"> <li>• Fodder varieties of Jowar, Maize, Bajra in combination with legumes (cowpea and horsegram) can be taken up wherever feasible to meet the fodder requirements in deficit rainfall districts</li> </ul>	
		Rice-wheat-Green gram	<p>Sept. Pigeonpea-Greengram Sesame-Rabi maize Pigeonpea – Bahar, Pusa-9, Narendra Arhar-I Sesame – Krishna, Pragati</p>	<p>Normal practices for Sesame, Pigeonpea</p>	

Condition			Suggested Contingency measures		
Early season drought (Normal onset)	Major Farming situation	Normal Crop/cropping system	Crop management	Soil nutrient & moisture conservation measures	Remarks on Implementation
Normal onset followed by 15-20 days dry spell after sowing leading to poor germination/ crop stand etc.	Upland	Rice-Wheat  Rice- Prabhat, Dhanlaxmi, Richharia, Turanta, Saroj	<ul style="list-style-type: none"> <li>• Gap filling</li> <li>• Thinning</li> </ul>	<ul style="list-style-type: none"> <li>• Timely interculture for weed control in direct seeded rice</li> <li>• Mulching</li> <li>• Conservation tillage</li> <li>• Life saving irrigation</li> </ul>	-
	Medium land	Maize-wheat  Maize - Shaktiman-1,2,3,4, 5 Suwan, Ganga-11, Deoki, Pusa early hybrid Maka-3	<ul style="list-style-type: none"> <li>• Gap filling</li> </ul>		
		Pigeonpea-Greengram  Pigeonpea – Bahar, Pusa-9 Narendra Arhar-I	<ul style="list-style-type: none"> <li>• Pre-sowing irrigation</li> <li>• Higher seed rate</li> <li>• Gap filling through Dapog nursery</li> </ul>		
	Lowland	Rice-Wheat-Green gram  Rice- Rajshree, Santosh , Sita, Rajendra Suwasni, Rajendra Sweta	<ul style="list-style-type: none"> <li>• Gap filling through Dapog nursery</li> </ul>		

Condition			Suggested Contingency measures		
Mid season drought (long dry spell, consecutive 2 weeks rainless (>2.5 mm) period)	Major Farming situation	Normal Crop/cropping system	Crop management	Soil nutrient & moisture conservation measures	Remarks on Implementation
At vegetative stage	Upland	Rice- wheat	<ul style="list-style-type: none"> <li>• Gap filling of existing crop</li> <li>• Postponement of top dressing</li> </ul>	<ul style="list-style-type: none"> <li>• Inter culturing</li> <li>• Mulching</li> <li>• Conservation tillage</li> <li>• Foliar spray with (1%) Urea or MOP</li> <li>• Life saving irrigation</li> </ul>	
	Medium land				
	Lowland				

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Condition			Suggested Contingency measures		
Mid season drought (long dry spell)	Major Farming situation	Normal Crop/cropping system	Crop management	Soil nutrient & moisture conservation measures	Remarks on Implementation
At flowering/ fruiting stage	Rice – Wheat	Rice	<ul style="list-style-type: none"> <li>• Adopt IPM practices</li> <li>• Foliar application with 2% Urea or MOP</li> </ul>	<ul style="list-style-type: none"> <li>• Interculture</li> <li>• Mulching</li> <li>• Conservation tillage</li> <li>• Life saving irrigation</li> </ul>	

Condition			Suggested Contingency measures		
Terminal drought (Early withdrawal of monsoon)	Major Farming situation	Normal Crop/cropping system	Crop management	Rabi Crop planning	Remarks on Implementation
	Upland	Rice – wheat/ maize / Vegetables	<ul style="list-style-type: none"> <li>• Foliar spray with (1%) Urea or MOP</li> <li>• Adopt IPM practices</li> <li>• Mulching</li> <li>• Life saving irrigation</li> </ul>	<ul style="list-style-type: none"> <li>• Open the furrow during evening and left furrow open overnight and plank in the next morning before sunrise for growing of early rabi crops like wheat, Rabi Maize/Pulses /Oilseeds/ Vegetables</li> </ul>	-
	Medium Land				
	Lowland				

### 2.1.2 Drought - Irrigated situation

Condition			Suggested Contingency measures		
	Major Farming situation	Normal Crop/cropping system	Change in crop/cropping system	Agronomic measures	Remarks on Implementation
Delayed release of water in canals due to low rainfall	Not applicable				
Limited release of water in canals due to low rainfall					

Condition	Suggested Contingency measures			
	Major Farming situation	Normal Crop/cropping system	Change in crop/cropping system	Remarks on Implementation
Non release of water in canals under delayed onset of monsoon in catchment				

Condition	Suggested Contingency measures			
	Major Farming situation	Normal Crop/cropping system	Change in crop/cropping system	Remarks on Implementation
Lack of inflows into tanks due to insufficient /delayed onset of monsoon	Upland, Medium Land , Lowland	Rice-Wheat	Short duration of Rice – Pigeonpea	Direct sowing of rice, Life saving irrigation, Mulching, Application of organic manure and vermicompost

Condition	Suggested Contingency measures			
	Major Farming situation	Normal Crop/cropping system	Change in crop/cropping system	Remarks on Implementation
Insufficient groundwater recharge due to low rainfall	Upland, Medium Land , Lowland	Rice-Wheat	Short duration of Rice – Pigeonpea	Life saving irrigation, Mulching, Application of organic manure and vermi compost

## 2.2 Unusual rains (untimely, unseasonal etc) (for both rainfed and irrigated situations)

Condition	Suggested contingency measure			
	Vegetative stage	Flowering stage	Crop maturity stage	Post harvest
Continuous high rainfall in a short span leading to water logging				
Rice, Maize, Pigeonpea, vegetables	Provide drainage	Provide drainage		

<b>Horticulture</b>	Provide drainage	Provide drainage		
Mango	Provide drainage	Provide drainage	Provide drainage	Safe storage and transportation
Litchi	Provide drainage	Provide drainage	Provide drainage	
Banana	Provide drainage	Provide drainage	Provide drainage	
Guava	Provide drainage	Provide drainage	Provide drainage	
<b>Heavy rainfall with high speed winds in a short span<sup>2</sup></b>				
Rice	Replanting with Dapog nursery seedling , Gap filling, Kharuhan (double transplanting) method			
Maize	Earthing up			
Pigeonpea	Earthing up			
Vegetables	Grow nursery on raised bed and poly tunnel			
<b>Horticulture</b>				
Mango Litchi Banana Guava	Re planting	Provide wind breaks to reduce the wind speed	Provide wind break	
<b>Outbreak of pests and diseases due to unseasonal rains</b>	<b>Vegetative stage</b>	<b>Flowering stage</b>	<b>Crop maturity stage</b>	<b>Post harvest</b>
Rice	<ul style="list-style-type: none"> <li>❖ Seedling treatment with granular insecticide – Cartap hydrochloride or phorate 10G or carbofuran 3G.</li> <li>❖ Maintain shallow water in nursery beds</li> <li>❖ Providing good drainage.</li> </ul>	<ul style="list-style-type: none"> <li>❖ Use copper fungicides against Bacterial leaf blight.</li> <li>❖ Split application of N fertilizer (3-4 times)</li> </ul>	<ul style="list-style-type: none"> <li>❖ Harvest at physiological maturity</li> </ul>	<ul style="list-style-type: none"> <li>❖ Proper drying and safe storage</li> </ul>

Maize	<ul style="list-style-type: none"> <li>❖ Drainage, and yellowing mainly due to nitrogen deficiency apply N split doses</li> <li>❖ Application of granular insecticides viz. Thimet 10g, or Carbofuran 3g. in whorl of maize</li> </ul>	<ul style="list-style-type: none"> <li>❖ Foliar blight control through Mancozeb @ 2.5g/l Or Zineb/ Maneb @ 2.5-4 g/lit of water (2-4 applications at 8-10 days interval)</li> </ul>	<ul style="list-style-type: none"> <li>❖ Cob harvesting from standing crop</li> <li>❖ Harvest at physiological maturity</li> </ul>	<ul style="list-style-type: none"> <li>❖ Storage in safe places like farmer warehouse/tent covering of produce</li> <li>❖ Ensure 10-12% moisture in grains before storage</li> <li>❖ Proper drying</li> </ul>
Pigeonpea	<ul style="list-style-type: none"> <li>❖ Provide drainage</li> <li>❖ Seed treatment with 1 g carbendizim +2g thiram/kg seed.</li> </ul>	Provide drainage	Provide drainage	<ul style="list-style-type: none"> <li>❖ Proper drying</li> <li>• Storage at safe place and transportation</li> </ul>
<b>Horticulture</b>				
Vegetables	<ul style="list-style-type: none"> <li>• Drainage management</li> </ul>	<ul style="list-style-type: none"> <li>• Drainage management</li> </ul>	<ul style="list-style-type: none"> <li>• Drainage management</li> </ul>	

<p><b>Mango</b></p>	<p><b>Anthracnose:-</b> The foliar infection can be controlled by spraying of copper oxychloride (0.3%)</p> <p>Use bio control agent viz <i>Streptosporangium pseudovulgare</i></p> <p><b>Bacterial canker:</b> Regular inspection of orchards, sanitation and seedling certification are recommended as preventive measures. Mango stones for raising seedlings (root stock) should always be taken from healthy fruits. Use of wind-breaks helps in reducing brushing/ wounding and thus reduces the chance of infection.</p>	<p><b>Anthracnose:-</b> Apply Carbendazim/ Thiophanate methyl (1g/lit) to control of Anthracnose. Blossom infection can be controlled effectively by spraying of Bavistin (0.1%) at 15 days interval.</p> <p><b>Mango powdery mildew:</b> Spray wettable sulphur(0.2%) &amp; calixin or karathane (0.1% ) during second week of December</p>	<p><b>Mango powdery mildew:</b> Prune diseased leaves and malformed panicles harbouring the pathogen to reduce primary inoculum load.</p> <p>Spray wettable sulphur (0.2%) when panicles are 3-4" in size</p> <p>Spray dinocap (0.1%) 15-20 days after first spray. Spray tridemorph (0.1%) 15-20 days after second spray.</p> <p>Spraying at full bloom needs to be avoided.</p> <p><b>Mango bacterial canker:</b> Three sprays of Streptocycline (200 ppm) at 10 days intervals reduce fruit infection.</p> <p>In severe infection, spraying of Streptocycline (300 ppm) or copper oxychloride (0.3%) is more effective.</p>	<p>Harvest at proper time</p> <p><b>Anthracnose:-</b> Pre-harvest sprays of hexaconazole (0.01%) or Carbendazim (0.1%) at 15 days interval should be done in such a way that the last spray falls 15 days prior to harvest.</p> <p>Diseased leaves, twigs, and fruits, should be collected and burnt to avoid the spread for next season</p>
<p>Litchi</p>	<p>Fruit Fly: Monitor adult fruit flies emergence by using methyl eugenol or sex pheromone traps.</p>	<p>Fruit Fly: First Spray delta menthrin 0.0025% plus molasses 0.1% . after 10-12 days spray fenthion 0.05% + molasses 0.1% followed by dimethoate 0.045% + molasses 0.1% if required</p>	<p>Harvest at proper time</p>	<p>Fruit Fly: Collect all fallen infested fruits and put in a drum covered with fine wire mesh. Harvest fully matured fruits one week earlier to escape egg laying</p>
<p>Banana</p>	<p>Provide drainage</p>	<p>Provide drainage</p>	<p>Harvest at proper time</p>	
<p>Guava</p>	<p>Provide drainage</p>	<p>Provide drainage</p>	<p>Harvest at proper time</p>	

## 2.3 Floods

Condition	Suggested contingency measures			
	Seedling / nursery stage	Vegetative stage	Reproductive stage	At harvest
<b>Transient water logging/ partial inundation<sup>1</sup></b>				
Rice	<ul style="list-style-type: none"> <li>• Provide drainage</li> <li>• Re transplanting through dapog nursery seedlings</li> <li>• Gap filling</li> </ul>	<ul style="list-style-type: none"> <li>• Provide drainage</li> <li>• Gap filling</li> <li>• 40-45 days old seedlings may be used</li> <li>• Kharuhan (double transplanting) mehod</li> </ul>	<ul style="list-style-type: none"> <li>• Provide drainage</li> <li>• Harvest at physiological maturity</li> <li>• Lentil as paira crop can be taken</li> </ul>	Storage at safer place
Maize	<ul style="list-style-type: none"> <li>• Provide drainage</li> <li>• Re sowing</li> <li>• Gap filling</li> </ul>	<ul style="list-style-type: none"> <li>• Provide drainage</li> </ul>	<ul style="list-style-type: none"> <li>• Provide drainage</li> <li>• Harvest at physiological maturity</li> </ul>	Storage at safer place
Pigeonpea	<ul style="list-style-type: none"> <li>• Provide drainage</li> <li>• Re sowing</li> <li>• Gap filling if needed</li> </ul>	<ul style="list-style-type: none"> <li>• Provide drainage</li> </ul>	<ul style="list-style-type: none"> <li>• Provide drainage</li> <li>• Harvest at physiological maturity</li> </ul>	Storage at safer place
<b>Horticulture</b>				
Mango Litchi Banana Guava	<ul style="list-style-type: none"> <li>• Re planting</li> <li>• Gap filling</li> <li>• Provide drainage</li> </ul>	<ul style="list-style-type: none"> <li>• Drenching with copper fungicides</li> <li>• Provide drainage</li> </ul>	<ul style="list-style-type: none"> <li>• Drenching with copper fungicides</li> <li>• Provide drainage</li> </ul>	
<b>Continuous submergence for more than 2 days<sup>2</sup></b>				
Rice	<ul style="list-style-type: none"> <li>• Gap filling,</li> <li>• Re sowing</li> </ul>	<ul style="list-style-type: none"> <li>• Replanting through Kharuhan (double transplanting) method by 3-4 seedlings per hill</li> <li>• Short duration rice variety</li> </ul>	<ul style="list-style-type: none"> <li>• Toria/Late wheat if completely damaged</li> </ul>	Storage at safer place
Maize	<ul style="list-style-type: none"> <li>• Re sowing</li> </ul>	<ul style="list-style-type: none"> <li>• Re sowing or gap filling</li> </ul>	<ul style="list-style-type: none"> <li>• Toria/Late wheat if completely damaged</li> </ul>	Storage at safer place



## 2.4 Extreme events: Heat wave / Cold wave/Frost/ Hailstorm /Cyclone

Extreme event type	Suggested contingency measure <sup>r</sup>			
	Seedling / nursery stage	Vegetative stage	Reproductive stage	At harvest
<b>Heat Wave</b>				
Maize	Provide irrigation	Provide irrigation	Provide irrigation	
Pigeonpea	Provide irrigation	Provide irrigation	Provide irrigation	
Wheat			Provide irrigation (Terminal heat)	
<b>Horticulture</b>				
Mango	Provide irrigation	Provide irrigation	Provide irrigation	
Litchi	Provide irrigation	Provide irrigation	Provide irrigation	
Papaya	Provide irrigation	Provide irrigation	Provide irrigation	
<b>Cold wave</b>				
Wheat, Maize, Mustard, Potato, Pulses		Provide light irrigation , Mulching		
<b>Horticulture</b>				
Vegetables		Provide irrigation, Mulching		
<b>Frost</b>		Provide irrigation, Mulching		
Wheat, Chickpea, Pigeonpea, Lentil		Provide irrigation, Mulching		
<b>Horticulture</b>				
Vegetables		Provide irrigation , Mulching		
Tomato & Potato		Earthing up,		Harvest in dry weather

		Provide irrigation , Mulching		
<b>Hailstorm, cyclone</b>	Not Applicable			

## 2.5.1 Livestock

	<b>Suggested contingency measures</b>		
	<b>Before the event<sup>s</sup></b>	<b>During the event</b>	<b>After the event</b>
<b>Drought</b>			
Feed and fodder availability	Crop residue, dry grasses & fallen leaves are collected . storage of compressed feed block Establishment of fodder bank	Use of urea molasses block, complete feed block& crop residue from fodder bank	Sowing of green fodder and after reach maturity can be use, complete feed block& crop residue from fodder bank
Drinking water	water from rain water harvested ,Digging of pond and bore well, make arrangement for water carrying,	Clean water provided	Harvested rain water can be use
Health and disease management	Supplementation of Min.mix, vaccination & de worming	Anti stress medication, supplementation of Vitamins, MMix.	Deworming with broad spectrum drugs, vaccination
<b>Floods</b>			
Feed and fodder availability	Storage of dry feed & fodder as hay, silage, Sufficient storage of crop residue in fodder bank	Feeding of urea molasses block, complete feed block& crop residue from fodder bank in group feeding, Use of nonconventional feedstuffs	Use of urea molasses block, complete feed block& crop residue from fodder bank
Drinking water	Clean water should be supply, makes arrangement for water carrying	Fresh/chlorinated water provided	Harvested rain water can be use, Install hand pump for clean water,
Health and disease management	Supplementations of Min.mix, vaccination & de worming	Shifting of animals at higher place . Disposal of dead carcass, sanitation of farm shades, rescue operation, use of broad spectrum de wormer (esp.Liverfluke), MMix, anti stress drugs.	Clean & sanitize farm shades, milk parlor, dairy equipments, use of broad spectrum de wormer (esp.Liverfluke), MMix, anti stress drugs.
<b>Cyclone</b>	Not Applicable		
<b>Heat wave and cold wave</b>			
Shelter/environment management	Make arrangement for Insulation upon roof & window cover with Jute bags, planting of trees at boundary of sheds.	Insulation upon roof & window cover with Jute bags, plastic sheets	Remove bags from window,
Health and disease management	Storage of Min.mix, vitamins essential medicines, make arrangement for	Bathing of animals, Supplementation of anti stress drugs, Min.mix, vitamins essential medicines should	supplementation of mineral mixture vitamin, Anti stress drug

	bathing animals in heat waves	be provided	should be provided
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<sup>s</sup> based on forewarning wherever available

## 2.5.2 Poultry

	Suggested contingency measures			Convergence/link ages with ongoing programs, if any
	Before the event <sup>a</sup>	During the event	After the event	
<b>Drought</b>				
Shortage of feed ingredients	Storage of feed ingredients like maize sorghum, bajra, un conventional feed stuffs	Feeding of stored pellets, feed ingredients like maize jowar, bajra, un conventional feed stuffs	Feeding of pellets, feed ingredients like maize, Jowar, Bajra, un conventional feed stuffs	
Drinking water	Digging of small pit to store water, rain water harvest	Clean fresh water should be given	Clean fresh water should be given	
Health and disease management	Storage of anti stress drugs, vitamin, mineral mixture	Proper medication with anti stress, anti coccidial, vit should be given	Proper medication with anti stress, anti coccidial, vit should be given	
<b>Floods</b>				
Shortage of feed ingredients	Storage of feed ingredients like maize sorghum, bajra, un conventional feed stuffs etc.	Feeding of stored pellets, feed ingredients like crushed maize sorghum, bajra, un conventional feed stuffs. Azzola feeds can be also given	Feeding of pellets, feed ingredients like crushed maize sorghum, bajra, un conventional feed stuffs. Azzola feeds can be also given	
Drinking water	Identified alternate water and power sources for water supply , storage of chlorine tab for water treatment	Clean / chlorine treated water should be provided	Fresh water should be given	
Health and disease management	Storage of anti stress drugs, vitamin mineral mixture	Evacuation of litter pit , proper medication along with anti coccidial, anti stress, vits. keep attention on litter of poultry houses, continuously stirring/ replacement of litter materials	Supplementation of mineral mixture, ani stress, anti coccidial drugs	

<b>Cyclone</b>				
<b>Heat wave and cold wave</b>				
Shelter/environment management	Provision of roof insulation, hanging of jute bags on window, planting of tree nearby shade of poultry farm	Supplementation of Vit. Complex, mineral mixture and anti coccidial drugs and ad-lib. Fresh water should be provided	Supplementation of Vit. Complex, mineral mixture and anti coccidial drugs and ad-lib. Fresh water should be provided	
Health and disease management	Storage of essential medicine like antistress,	Disinfecting poultry houses and shed Supplementation of Vit. Complex, mineral mixture and anti coccidial drugs and ad-lib. Fresh water should be provided	Make arrangement for fresh water, Vit. Complex and Vit. E supplementation	

<sup>a</sup> based on forewarning wherever available

### 2.5.3 Fisheries/ Aquaculture

	Suggested contingency measures		
	Before the event <sup>a</sup>	During the event	After the event
<b>1) Drought</b>			
A. Capture			
B. Aquaculture			
(i) Shallow water in ponds due to insufficient rains/inflow	(i) Thinning of population (ii) Arrangement of water supply from external resource	Partial harvesting Addition of water Stocking of air breathing fishes	Maintenances of remaining stock till favorable condition achieved If not feasible, total harvesting or transfer of fishes may be done. Preparation of the pond for next crop.
(ii) Impact of salt load build up in ponds / change in water quality	Regular monitoring of water quality parameter. Arrangement of aeration Addition of water from external resource	Arrangement of aeration. Addition of water Monitoring of water quality Reduction of manuring according to water level.	
<b>2) Floods</b>			
A. Capture			
B. Aquaculture			
(i) Inundation with flood water	(i) Elevation/ Renovation of pond dyke. (ii) Sale of Table/marketable size fishes	Collection of naturally bred seeds (Spawn /fry /fingerling) from flooded water Stocking in nursery ponds for	-Retain the water in pond immediately after flood through repairing of damaged dyke etc. -Netting of pond -Removal of unwanted, predatory/weed fishes

	(iii) construction of earthen nursery ponds in upland areas	rearing	-Sell of large size fishes
(ii) Water contamination and changes in water quality	Arrangement of regular water quality monitoring		
(iii) Health and diseases	(a) Use lime/ potassium permanganate Arrangement of CIFAX and medicines & chemical stock		-Sampling of fishes and water for disease analysis - Liming, use of drugs/ medicine if required in consultancy of fisheries experts
(iv) Loss of stock and inputs (feed, chemicals etc)	Raising the height of dyke by fencing with net and bamboo poles to prevent loss of stock	Arrangement of advance size fingerling/ yearlings for stocking	Stocking of large size fingerlings carp Fertilization of pond and regular feeding of fish Harvesting and sale of fish
(v) Infrastructure damage (pumps, aerators, huts etc)	Repairing/ arrangement of alternate safe place to keep pumps aerators etc.	A regular water on the flood and infrastructure facilities.	Re establishment of the infra structural facility.
<b>3. Cyclone / Tsunami</b>			
<b>4. Heat wave and cold wave</b>			

<sup>a</sup> based on forewarning wherever available