

State: Bihar

Agriculture Contingency Plan for District: Nalanda

1.0 District Agriculture profile				
1.1	Agro-Climatic/Ecological Zone			
	Agro Ecological Sub Region (ICAR)	Northern Plain, Hot Subhumid (Dry) Eco-Region (9.2)		
	Agro-Climatic Zone (Planning Commission)	Middle Gangetic Plain Region (IV)		
	Agro Climatic Zone (NARP)	South Bihar Alluvial Plain Zone (BI-3)		
	List all the districts falling under the NARP Zone* (*>50% area falling in the zone)	Aurangabad, Gaya, Jahanabad, Patna, Arwal, Rohtash, Nalanda, Bhojpur, Buxar, Bhabhua, Nawada		
	Geographic coordinates of district headquarters	Latitude	Longitude	Altitude
		25 ^o 13' N	85 ^o 17'E	60 m
	Name and address of the concerned ZRS/ ZARS/ RARS/ RRS/ RRTTS	Agricultural Research Institute, Patna		
	Mention the KVK located in the district with address	Harnaut, Nalanda		
Name and address of the nearest Agromet Field Unit (AMFU, IMD) for agro-advisories in the Zone	Agricultural Research Institute, Lohia Nagar, Patna.			

1.2	Rainfall	Normal RF(mm)	Normal Rainy days (number)	Normal Onset	Normal Cessation
	SW monsoon (June-Sep)	851	48	3 rd week of June	3 rd week of October
	NE Monsoon (Oct-Dec)	58	4		
	Winter (Jan- Feb)	28.1	2		
	Summer (Mar-May)	40	3		
	Annual	977.9	57		

SOURCE: D.A.O. Office, Biharsharif Nalanda

1.3	Land use pattern of the district (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)	234.9	191.1	4.2	3.5	8.3	11.5	3.5	3.3	3.3	6.0

SOURCE: D.A.O. Office, Biharsharif Nalanda

1.4	Major Soils	Area ('000 ha)	Percent (%) of total
	Sandy Soils	44.756	18.61
	Coarse Sandy Loam Soils	40.538	16.86
	Fine Sandy Loam Soils	62.171	25.86
	Clayey Soils	92.908	38.65
	Saline/ Calcareous Soils	0.00	0.00

1.5	Agricultural land use	Area ('000 ha)	Cropping intensity %
	Net sown area	191	160.3%
	Area sown more than once	95.9	
	Gross cropped area	321	

1.6	Irrigation	Area ('000 ha)		
	Net irrigated area	93.5		
	Gross irrigated area	134.1		
	Rainfed area	48.9		
	Sources of Irrigation	Number	Area ('000 ha)	Percentage of total irrigated area
	Canals		10.4	7.75
	Tanks	20	1.2	0.8
	Open wells	508	78.2	58.3
	Bore wells	25200	21.2	15.8
	Lift irrigation schemes		1.5	1.1
	Micro-irrigation	-	-	-

Other sources		21.6	16%
Total Irrigated Area		134.1	100%
Pump sets	37180		
No. of Tractors	2685		
Groundwater availability and use* (Data source: State/Central Ground water Department /Board)	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	20	100%	
Wastewater availability and use			
Ground water quality	Good		

*over-exploited: groundwater utilization > 100%; critical: 90-100%; semi-critical: 70-90%; safe: <70%

SOURCE: D.A.O. Office, Biharsharif Nalanda & NABARD,Nalanda

1.7. Area under major field crops & horticulture

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	-	-	146	-	-	-	-	146	
Maize	-	-	2.2	-	-	3.5	2	9.3	
Pulses	-	-	2.2	-	-	28.5	-	44.9	
Oil seeds	-	-	-	-	-	9.5	-	9.5	
Wheat	-	-	-	-	-	97.5	-	97.5	

	Horticulture crops -	Area ('000 ha)		
	Fruits	Total	Irrigated	Rainfed
	Mango	2.96	√	
	Guava	1.5	√	
	Lemon	0.4	√	
	Banana	1.5	√	
	Papaya	0.38	√	
	Horticulture crops – Veg- etables	Total	Irrigated	Rainfed
	Potato	26.8	√	
	Onion	8.16	√	
	Brinjal	6.84	√	
	Okra	2.94	√	
	Cauliflower	3.34	√	
	Medicinal and Aromatic crops	Total	Irrigated	Rainfed
	Plantation crops	Total	Irrigated	Rainfed
	Fodder crops	Total	Irrigated	Rainfed
	Berseem	0.72		
	Sorghum	0.4		
	Total fodder crop area	1.12		

	Grazing land			
	Sericulture etc	-	-	-

SOURCE: D.A.O. Office, Biharsharif Nalanda

1.8	Livestock	Male ('000)	Female ('000)	Total ('000)
	Non descriptive Cattle (local low yielding)	7.935	23.794	31.729
	Improved cattle	-	-	-
	Crossbred cattle	26.970	152.830	179.80
	Non descriptive Buffaloes (local low yielding)	33.71	247.20	280.91
	Descript Buffaloes			
	Goat	68.948	84.271	153.219
	Sheep	4.336	5.30	9.636
	Others (Camel, Pig, Yak etc.)			
	Commercial dairy farms (Number)			

1.9	Poultry	No. of farms	Total No. of birds ('000)
	Commercial		445.142
	Backyard		239.691

1.10	Fisheries (Data source: Chief Planning Officer)						
	A. Capture						
	i) Marine (Data Source: Fisheries Department)	No. of fishermen	Boats		Nets		Storage facilities (Ice plants etc.)
			Mechanized	Non-mechanized	Mechanized (Trawl nets, Gill nets)	Non-mechanized (Shore Seines, Stake & trap nets)	
	ii) Inland (Data Source: Fisheries Department)	No. Farmer owned ponds		No. of Reservoirs		No. of village tanks	
		905		1175		225	
	B. Culture						
			Water Spread Area (ha)		Yield (t/ha)	Production ('000 tons)	

	i) Brackish water (Data Source: MPEDA/ Fisheries Department)	-	-	-
	ii) Fresh water (Data Source: Fisheries Department)	2641.62	3.6	9.509

Source: D.A.H. Office, Bihar Sharif (Nalanda)

1.11 Production and Productivity of major crops

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)	
Major Field crops (Crops identified based on total acreage)										
	Maize	9.35	4250	12.688	5320	16.702	4600	122.89	4733	147.468
	Rice	528.6	3620			-	-	528.6	3620	644.892
	Wheat	-	-	205.6	2211	-	-	317.16	3250	371.07
	Chickpea	-	-	8	1333	-	-	10.516	1230	14.93
	Lentil	-	-	17	1133	-	-	22.411	1150	30.254
	Mustard	-	-	3.0	1015	-	-	11.793	1240	30.662
	Moong	-	-	-	-	11.731	825	11.731	825	18.886
Major Horticultural crops (Crops identified based on total acreage)										
	Fruits							53.5	21000	
	Cauliflower	-	-	64.34	19224			64.34	19224	
	Cabbage	-	-	39.09	20471			39.09	20471	
	Tomato	-	-	36.94	19800			36.94	19800	
	Onion	-	-	-	-	221.27	27100	221.27	27100	
	Potato	-	-	634.88	26100			634.88	26100	

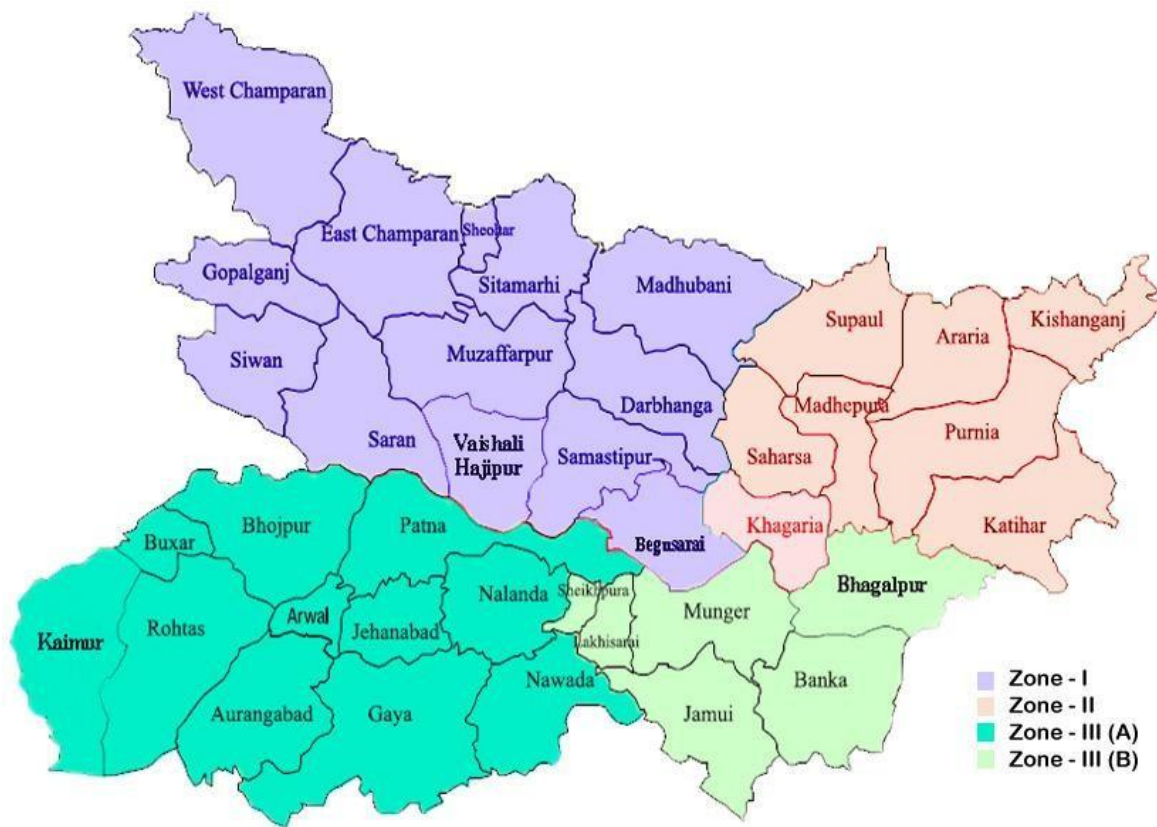
1.12	Sowing window for 5 major field crops	Rice	Maize	Pulses	Wheat	Mustard
	Kharif- Rainfed	3 rd week of June - 4 th week of June	3 rd week of June - 4 th week of June	-	-	-
	Kharif-Irrigated	1 st week of June - 4 th week of June	4 th week of June – 1 st week of July	-	-	-

	Rabi- Rainfed	-	1 st week of October – 1 st week of November	1 st week of October - 1 st week of November	1 st Nov. – 20 th Nov.	3 rd week of October – 2 nd week of November
	Rabi-Irrigated	-	1 st week of October - 1 st week of November	1 st week of November - 1 st week of December	3 rd week of November - 4 th week of December	3 rd week of October – 2 nd week of November

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

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

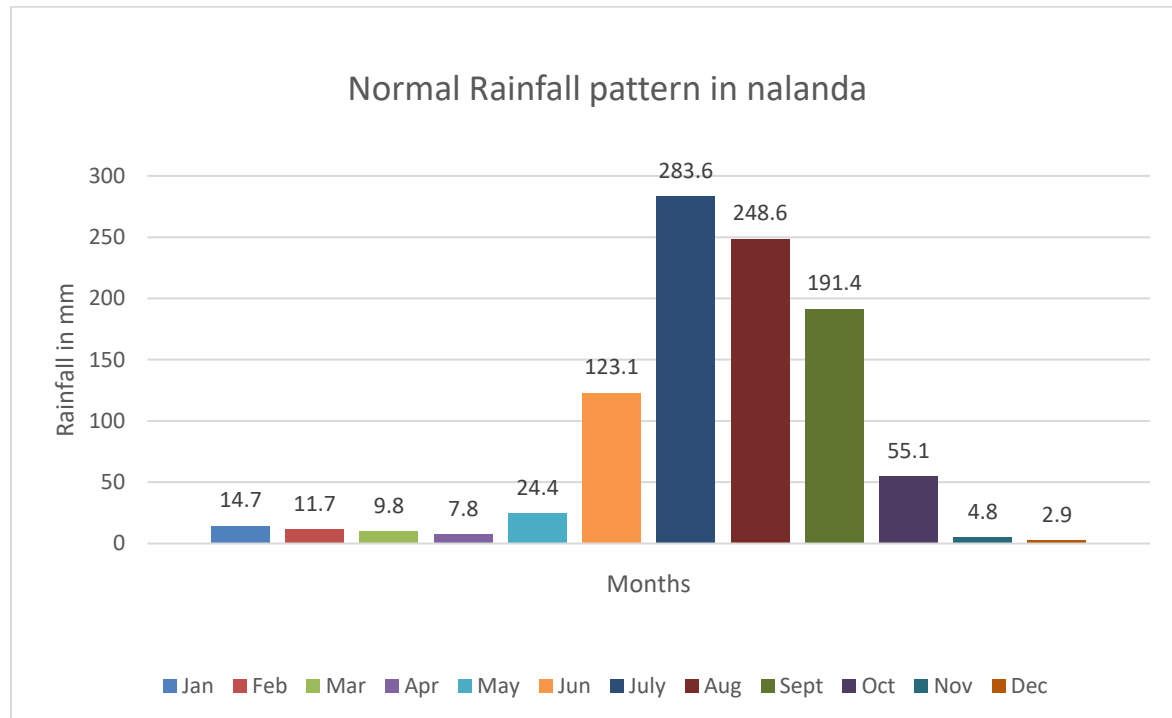
Annexure I
Agro climatic Zones of Bihar



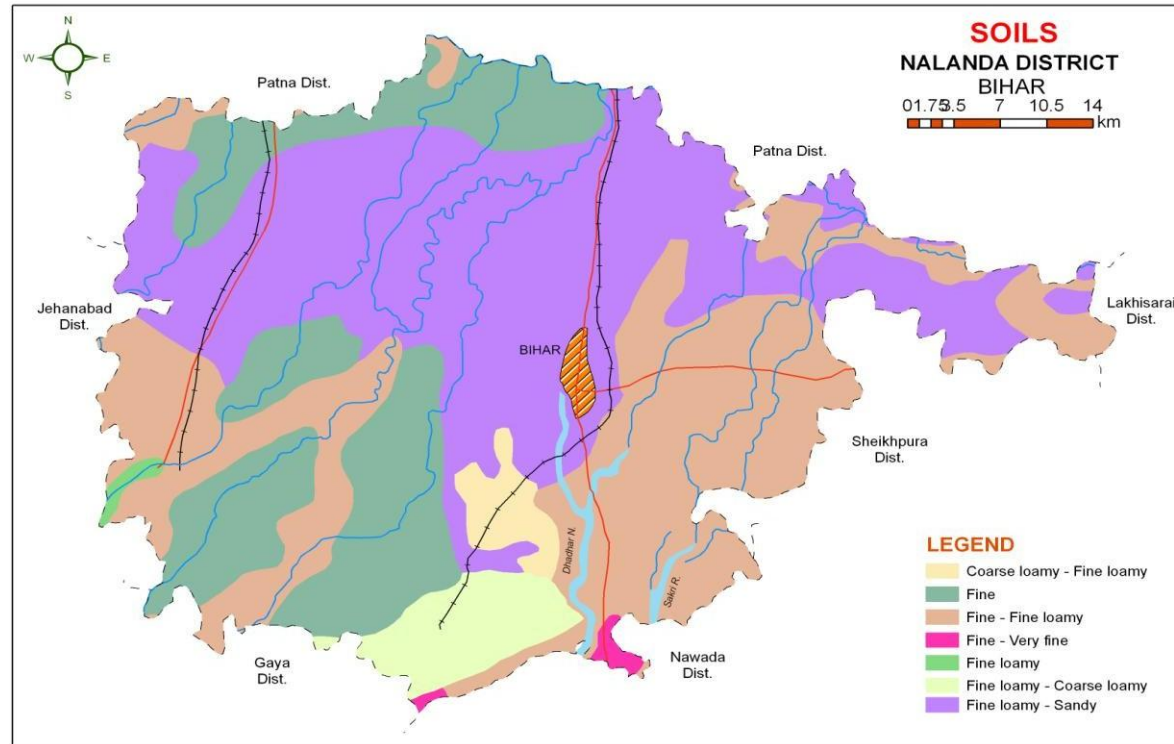
Source: krishi.bih.nic.in

Annexure-II

Normal Rainfall Pattern in Nalanda



Annexure-III



Source : NBSS& LUP, Regional Centre, Kolkata

2.0 Strategies for weather related contingencies

2.1 Drought

2.1.1 Rainfed 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 st week of July	Upland	Rice –Wheat Rice-Chickpea Rice-Vegetables Rive-Lentil Rice-Mustard	Rice –Wheat Rice-Chickpea Rice-Vegetables Rive-Lentil Rice-Mustard	<ul style="list-style-type: none"> Adopt normal package of practices Interculture for timely weed control in direct seeded rice Groundwater to be used for life saving irrigation to upland crops and trans-planted rice	-
	Medium land and Low land	Rice –Wheat Rice – Pulses Rice – Oilseeds Rice – Vegetables Rice – Potato	Medium duration Rice-Wheat Rice – Lentil Rice – Linseed Rice – Vegetables Rice – Mustard Rice – Potato		

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 rd week of July	Upland	Rice –Wheat Rice-Chickpea Rice-Vegetables Rice-Lentil Rice-Mustard	Short duration Rice – Wheat Rice – Lentil/ Rice – Linseed Rice – Mustard/ Rice – Potato Rice – Vegetables Rice- Prefer Medium to short duration varieties like Sabour deep (110-115d), Sabour kuwar (115-120d) Pigeonpea – Bahar, Narendra	<ul style="list-style-type: none"> 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 weed management. 	Seeds from BRBN, BAU, Sabour, NSC, TDC

			<p>arhar-I Blackgram- T-9, Pant 30 Maize – Deoki . Ganga -2</p>	<ul style="list-style-type: none"> • Normal sowing of rice can be used with enhanced NPK to boost the early vegetative growth in late plantings under sufficient moisture • Interculture for timely weed control in direct seeded rice
	Medium land	Rice –Wheat	<p>Rice-Late Wheat Direct sowing / 20d old dapog seedlings with medium to short duration varieties – Sabour Harshit(120-125d), Neelam(120-125d), Rajendra Bhagwati, Sabour Ardhjal(120-125d), Rajendra Suwasni, Santosh, R. Kasturi, Sita</p>	<ul style="list-style-type: none"> • 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 • 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 low lands • Raise staggered community nursery preferably with short duration varieties in mid and lowlands • Transplant with 30-35 days old seedling may be used with 3-4 seedling per hill with close spacing.
	Lowland	<p>Rice –Wheat Rice – Pulses Rice – Oil seeds Rice – Vegetables Rice – Potato</p>	<p>Rice- Wheat Rice – Lentil Rice – Linseed Rice – Vegetables Rice – Mustard Rice – Potato</p> <p>Rice- Direct/ dapog seedlings with Sabour Shree, Sabour sampanna, Sabour Heera, Rajendra Sweta, Swarna Sub-1</p>	

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 st week of August	Upland	Rice –Wheat Rice-Lentil Rice-Vegetables Rice-Linseed Rice-Mustard	Short duration Rice - Wheat Rice: Prabhat, Susk Samrat, sabour Deep	Life saving irrigation	Seeds from BRBN, BAU, Sabour, NSC, TDC
	Medium land	Rice –Wheat Rice-Pulses Rice-Vegetables Rive-Oil seeds Rice-Potato	Rice (Short duration)– Wheat Rice- Prabhat, Susk Samrat, Sabour Harshit, Turanta Saroj Blackgram/ Finger millet-Wheat Blackgram- T-9, Navin, Pant urd-30, 19 Finger millet- DB-7, BR-5, BR-10, Coimbatore-1, RAU-8	<ul style="list-style-type: none"> • 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 • Direct seedling of Rice • Raise staggered community nursery preferably with medium duration varieties in mid and lowlands 	
	Lowland	Rice –Wheat Rice-Pulses Rice-Vegetables Rice-Oil seeds Rice-Potato	Rice (Short duration) – Wheat Rice- Sabour Narendra dhan, Rajendra Neelam If dry spell continues, direct seeded 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 th August	<ul style="list-style-type: none"> • Enhanced basal dose of NPK to boost the early vegetative growth • Application of fertilizers especially phosphorous and potash to be ensured under late transplanted conditions in severely affected districts • Life saving irrigation 	

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change in crop/cropping system	Agronomic measures	Remarks on Implementation
Delay by 8 weeks 3 rd week of August	Upland	Rice –Late Wheat Rice –Lentil Rice –Vegetables Rice –Linseed Rice –Mustard Rice-Pigeonpea	Blackgram/Horsegram - Rabi Maize Blackgram -Wheat Blackgram/Horsegram - Vegetables Blackgram/Horsegram -Lentil Blackgram/Horsegram - Potato Blackgram/Horsegram – Rai/ Blackgram-Vegetables Sesame-Wheat Sesame-Potato Blackgram- Pant U -31&19	<ul style="list-style-type: none"> • Moisture conservation • Inter cultivation • Sowing of <i>rabi</i> crops such as Wheat, Lentil, Chickpea, Pea, Mustard (Rajendra suflam-1), Linseed (Garima) and Vegetables • Life saving irrigation 	Seeds from BRBN, BAU, Sabour, NSC, TDC
	Medium Land	Rice –Wheat Rice –Pulses Pigeonpea –Oilseeds Pigeonpea – Vegetables Pigeonpea –Potato	Rice (Short duration)- Wheat Rice-Lentil Rice-Vegetables Sesame-Maize Sesame-Wheat Direct seeded rice (DSR) with short duration (80-90 days) varieties (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 irrigation Rice: Prabhat, Dhanlaxmi, Richharia	<ul style="list-style-type: none"> • Direct seeding of rice • 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 • Use of 20 days old dapog seedling in rice. • Enhanced basal dose of NPK in rice to boost early vegetative growth • 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 	

				<p>September in midlands</p> <ul style="list-style-type: none"> 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
	Lowland	<p>Rice– Wheat Rice – Pulses Rice– Vegetables Rice – Oil seeds Rice – Potato</p>	<p>Rice (Short duration)- Wheat/Lentil/ Chickpea Rice: Prabhat, Dhanlaxmi, Richharia</p>	<ul style="list-style-type: none"> Double transplanting of rice (karuhan) can be done with 30 + 45 days old seedlings of long duration or photosensitive varieties up to 30th August with close planting (40-45 hills per square meter) Application of organic manure and vermi compost initially for Rice and other crops. Sowing of <i>rabi</i> crops such as Wheat, Lentil, Chickpea, Pea, Mustard (Rajendra Suflam-1), 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>. 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

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Crop management	Soil nutrient & moisture conservation measures	Remarks on Implementation
Early season drought (Normal onset)					
Normal onset followed by 15-20 days dry spell after sowing leading to poor germination/crop stand etc.	Upland Medium land Lowland	Rice –Wheat Rice-Lentil / Chickpea Rice-Vegetables Rice-Linseed Rice-Mustard Rice: Prabhat, Dhanlaxmi, Richharia, Turanta, Sabour Harshit, Sabour Deep	Gap filling, Inter cultivation, Weed management	Mulching for moisture conservation, Life saving irrigation	Seeds from BRBN, RAU, Pusa, NSC, TDC

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Crop management	Soil nutrient & moisture conservation measures	Remarks on Implementation
Mid season drought (long dry spell, consecutive 2 weeks rainless (>2.5 mm) period)					
At vegetative stage	Upland Medium land Lowland	Rice –Wheat Rice-Lentil /Chickpea Rice-Vegetables Rice-Linseed Rice-Mustard Rice: Prabhat, Dhanlaxmi, Richharia, Turanta, Sabour harshit, Sabour Deep, Rajendra Neelam	Life saving irrigation, Inter cultivation	Mulching for moisture conservation; Life saving irrigation at critical stages	

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Crop management	Soil nutrient & moisture conservation measures	Remarks on Implementation
Mid season drought (long dry spell)					
At flowering/ fruiting stage	Upland Medium land Lowland	Rice –Wheat Rice-Lentil /Chickpea Rice-Vegetables Rice-Linseeds Rice-Mustard	Life saving irrigation, Weed management	Mulching for moisture conservation, Life saving irrigation	

Terminal drought (Early withdrawal of monsoon)	Major Farming situation	Normal Crop/cropping system	Crop management	Rabi Crop planning	Remarks on Implementation
	Upland Medium land Lowland	Rice –Wheat Rice-Lentil /Chickpea Rice-Vegetables Rice-Linseed Rice-Mustard	Life saving irrigation Inter cultivation, Weed management, Mulching	Wheat/ Rabi Maize/ Pulses /Oilseeds/ Vegetables etc.	

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					
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	Agronomic measures	Remarks on Implementation
Lack of inflows into tanks due to insufficient /delayed onset of monsoon	Upland Medium land Lowland	Rice – Wheat Rice- Lentil Rice- Chickpea Rice- Oilseeds Rice-Vegetables	Cucurbits-Wheat Sesame-Wheat Horsegram-Wheat Blackgram-Wheat	Mulching for moisture conservation	Seeds from BRBN, RAU, Pusa, NSC, TDC

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change in crop/cropping system	Agronomic measures	Remarks on Implementation
Insufficient groundwater recharge due to low rainfall	Upland Medium land Lowland	Rice – Wheat	Short duration Rice – Wheat Pigeonpea /Horsegram/ Blackgram/Sesame-Wheat	Mulching, Use of FYM/ compost/vermi compost	Seeds from BRBN, RAU, Pusa, NSC, TDC

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		
Horticulture	Provide drainage	Provide drainage		
Mango, Litchi, Banana, Guava,	Provide drainage	Provide drainage	Provide drainage	Safe storage and transportation
Heavy rainfall with high speed winds in a short span²				
Rice	Replanting with Dapog nursery seedling, Gap filling, Kharuhan (double transplanting)			
Maize	Earthing up			
Pigeonpea	Earthing up			
Vegetables	Grow nursery on raised bed and poly tunnel			
Horticulture				
Mango, Litchi, Banana, Guava,	Re planting	Provide wind break	Provide wind break	
Outbreak of pests and diseases due to unseasonal rains				

Rice	❖ Seedling treatment with granular insecticide – Cartap hydrochloride or Fipronil 0.3G.	❖ Use copper fungicides against Bacterial leaf blight. ❖ Split application of N fertilizer (3-4 times)	❖ Harvest at physiological maturity	❖ Proper drying and safe storage
	❖ Maintain shallow water in nursery beds ❖ Providing good drainage.			
Maize	❖ Drainage, and yellowing mainly due to nitrogen deficiency apply N split doses ❖ Application of granular insecticides viz. Cartap hydrochloride 4 G in whorl of maize	❖ 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)	❖ Cob harvesting from standing crop ❖ Harvest at physiological maturity	❖ Storage in safe places like farmer warehouse/tent covering of produce ❖ Ensure 10-12% moisture in grains before storage ❖ Proper drying
Pigeonpea	❖ Provide drainage ❖ Seed treatment with 1 g carbendizim +2g thiram/kg seed.	Provide drainage	Provide drainage	❖ Proper drying • Storage at safe place and transportation
Horticulture				
Vegetables	• Drainage management	• Drainage management	• Drainage management	

Mango	<p>Anthracnose:- 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>Bacterial canker: 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>Anthracnose:- 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>Mango powdery mildew: Spray wettable sulphur(0.2%) & calixin or karathane (0.1%) during second week of December</p>	<p>Mango powdery mildew: 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>Mango bacterial canker: 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>Anthracnose:- 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>
Litchi	<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>
Banana	Provide drainage	Provide drainage	Harvest at proper time	
Guava	Provide drainage	Provide drainage	Harvest at proper time	

2.3 Floods

Condition	Suggested contingency measures			
	Seedling / nursery stage	Vegetative stage	Reproductive stage	At harvest
Transient water logging/ partial inundation¹				
Rice	<ul style="list-style-type: none"> • Provide drainage • Re transplanting through Dapog nursery seedlings • Gap filling 	<ul style="list-style-type: none"> • Provide drainage • Gap filling • 40-45 days old seedlings may be used • Kharuhan (double transplanting) method 	<ul style="list-style-type: none"> • Provide drainage • Harvest at physiological maturity • Lentil as paira crop can be taken 	Storage at safer place
Maize	<ul style="list-style-type: none"> • Provide drainage • Re sowing • Gap filling 	<ul style="list-style-type: none"> • Provide drainage 	<ul style="list-style-type: none"> • Provide drainage • Harvest at physiological maturity 	Storage at safer place
Pigeonpea	<ul style="list-style-type: none"> • Provide drainage • Re sowing • Gap filling if needed 	<ul style="list-style-type: none"> • Provide drainage 	<ul style="list-style-type: none"> • Provide drainage • Harvest at physiological maturity 	Storage at safer place
Horticulture				
Mango, Litchi, Banana, Guava,	<ul style="list-style-type: none"> • Re planting • Gap filling • Provide drainage 	<ul style="list-style-type: none"> • Drenching with copper fungicides • Provide drainage 	<ul style="list-style-type: none"> • Drenching with copper fungicides • Provide drainage 	
Continuous submergence for more than 2 days				
Rice	<ul style="list-style-type: none"> • Gap filling, • Re sowing 	<ul style="list-style-type: none"> • Replanting through Kharuhan (double transplanting) method by 3-4 seedlings per hill • Short duration rice variety 	<ul style="list-style-type: none"> • Toria/Late wheat if completely damaged 	Storage at safer place
Maize	<ul style="list-style-type: none"> • Re sowing 	<ul style="list-style-type: none"> • Re sowing or gap filling 	<ul style="list-style-type: none"> • Toria/Late wheat if completely damaged 	Storage at safer place
Horticulture				
Mango	<ul style="list-style-type: none"> • Provide drainage 			
Guava	<ul style="list-style-type: none"> • Provide drainage 			
Banana	<ul style="list-style-type: none"> • Provide drainage 			
Sea water intrusion³	Not Applicable			

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

Extreme event type	Suggested contingency measure ^r			
	Seedling / nursery stage	Vegetative stage	Reproductive stage	At harvest
Heat Wave^p				
Maize	Provide irrigation	Provide irrigation	Provide irrigation	
Pigeonpea	Provide irrigation	Provide irrigation	Provide irrigation	
Wheat			Provide irrigation (Terminal heat)	
Horticulture				
Mango	Provide irrigation	Provide irrigation	Provide irrigation	
Litchi	Provide irrigation	Provide irrigation	Provide irrigation	
Papaya	Provide irrigation	Provide irrigation	Provide irrigation	
Cold wave^q				
Wheat		Provide irrigation , Mulching		
Maize		Provide irrigation , Mulching		
Mustard		Provide irrigation , Mulching		
Potato		Provide irrigation , Mulching		
Pulses		Light irrigation , if soil is sandy, Mulching		
Horticulture				
Okra		Provide irrigation, Mulching		
Brinjal		Provide irrigation, Mulching		
Chili		Provide irrigation , Mulching		

Tomato		Provide irrigation ,Mulching		
Bottle gourd		Provide irrigation , Mulching		
Frost		Provide irrigation, Mulching		
Wheat		Provide irrigation, Mulching		
Chickpea		Provide irrigation , Mulching		
Pigeonpea		Provide irrigation , Mulching		
Lentil		Provide irrigation , Mulching		
Horticulture				
Okra		Provide irrigation , Mulching		
Brinjal		Provide irrigation , Mulching		
Chilli		Provide irrigation , Mulching		
Tomato & Potato		Earthing up Provide irrigation , Mulching		Harvest in dry weather
Hailstorm	Not Applicable			

2.5 Contingent strategies for Livestock, Poultry & Fisheries

2.5.1 Livestock

	Suggested contingency measures		
	Before the event ^s	During the event	After the event
Drought			
Floods			

Feed and fodder availability	<ol style="list-style-type: none"> 1. Advance planning for cultivation of fodder tree 2. Storage of Improved Quality Fodder 3. Conservation & Storage of <ul style="list-style-type: none"> • Feed & Fodder • Hay & Silage: — Preserve the fodder in the form of hay from Berseem & other grasses as well as silage from <ol style="list-style-type: none"> (a) Maize- harvesting at well developed cob. (b) Sorghum - at flowering stage. (c) Oat (d) Hybrid Napier – 40-45 day old. (e) Water hyacinth mixing with Rice straw in ratio of 4:1 with 70 kg molasses /ton of clean water hyacinth. (f) Potato leaves mixing with wheat straw in ratio of 7:1 and should be supplemented with 3% molasses. Hay: – <ul style="list-style-type: none"> • Berseem/Lucerne and other grasses. • Bales of hay and other dry fodder should be stored in dry places at a height of last flood level and covered with asbestos sheet or polythene sheet. 4. Development & storage of: – <ol style="list-style-type: none"> (a) Complete Feed Block (CFB) (b) Urea-Molasses-Mineral-Block (U.M.M.B) 5. Development of Fodder Bank 	<ol style="list-style-type: none"> 1. Feeding of Complete Feed Block 2. Feeding of Urea-Molasses-Mineral-Block & Fodder 3. Feeding of stored Hay/Silage/Improved Quality Fodder 4. Feeding of Tree leaves some of which are as follows: <ol style="list-style-type: none"> 1. Bamboo leaves 2. Neem 3. Bargad 4. Peepal 5. Seesam 6. Subabul <p>Use of unconventional feed stuff:</p> <ol style="list-style-type: none"> (i) Aquatic Plants – water hyacinth (i) Lotus (ii) Aquatic weeds 	Production of forage crops <ol style="list-style-type: none"> 1. Balanced feeding of Animal supported with little higher concentrate mixture 2. Cultivation of fodder Rabi maize if water stagnated upto Nov/ December 3. Sorghum/Cowpea 4. Maize in September
Drinking water			
Health and disease management	Veterinary Preparedness with Med-	Animal safety, Health camp and	Sanitation, deworming, treatment,

	<p>icines, Vaccines and provision for mobile ambulatory van.</p> <ul style="list-style-type: none"> • Vaccination <p>During flood stress becomes an incriminating factor for the precipitation of diseases in livestock and poultry.</p> <p>So, necessary vaccination of livestock and poultry should be done against economically important contagious disease.</p> <p>This will be helpful not only to check epidemic in animals, but also to reduce the probability of zoonoses in human beings.</p> <p>Care should be taken for mass vaccination of livestock and poultry with a view to covering 80% of livestock population in order to achieve herd immunity.</p> <p>Mass vaccination should be conducted by a team of Department staff with proper maintenance of detailed Inoculation Register.</p> <p>Pro-active steps should be taken to receive and stock the required doses of vaccines against different diseases for their use in face of Flood.</p>	<p>Treatment</p> <p>Important Suggestions for animal and Poultry safety</p> <p>During flood, all efforts should be made to rescue most of the livestock and poultry as carefully as possible.</p> <p>The people should be made conscious through announcement with the help of mikes or other means of communication, so that they may escape with their livestock and poultry to safe area.</p> <p>The fisherman or the people who knows swimming should be deputed for the rescue of drowning and floating animals and birds.</p> <p>During flood do not leave halter or headstalls on animals.</p> <p>Do not tie animals together when releasing.</p> <p>Report the location, identification and disposition of livestock and poultry to authorities handling the disaster.</p> <p>Health camp and treatment</p> <p>Water borne diseases are one of the most common phenomena during the flood</p> <p>Diarrhoeal diseases outbreaks can</p> <p>Report the location, identification and disposition of livestock and poultry to authorities handling the disaster.</p>	<p>health camps Culling of Sick animals and disposal of carcass</p> <p>Maintenance of Sanitation: Adequate attention is to be paid to disinfect the premises of temporary sheds with the help of bleaching powder, phenol, carbolic acid etc. In no case the carcass/ cadaver should come in contact with healthy animals rehabilitated in sheds. Arrangements should be made accordingly.</p> <p>De-worming after the flood: Immediately after flood, the animals like cattle, buffalo. Sheep, goat, pig, dog and poultry need to be de-wormed with suitable broad spectrum anthelmintics. This will enable the animals to regain proper health.</p> <p>In water logged area, snails can be introduced as biological control measures against snails to protect livestock from parasitic disease.</p> <p>Treatment of sick animals: The Disposal of Carcass: the disposal of dead animals and birds are to be</p>
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		<p>Health camp and treatment</p> <p>Water borne diseases are one of the most common phenomena during the flood</p> <p>Diarrhoeal diseases outbreaks can occur after drinking contaminated water.</p> <p>Diseases that can occur during flood should be given special attention and accordingly medicines should be available in the health camp for the following mentioned diseases.</p> <p>Salmonella spp. Escherichia coli Giardiasis Amoebiasis Rotavirus Leptospirosis Scabies Black leg Malignant Edema Foot rot Anthrax Botulism Tetanus Red water Black disease Entertoxemia Liver fluke Amphistomiasis Brooders pneumonia</p> <p>Treatment of Non infectious Arrangement should be made for the treatment of drowning and</p>	<p>done by Animal Husbandry Department. Accordingly, necessary arrangement should be made for prompt and easy disposal of carcasses during the Flood and Post-Flood period.</p> <p>Carcasses of animals affected by the disease are the chief source of soil infection. They harbour the germs in large numbers and liberate them from both artificial and natural body openings into the surrounding soil.</p> <p>Methods of Carcass disposal to be adopted</p> <p>Burial</p> <p>Burning</p> <p>Composting</p> <p>Vulturing</p> <p>s. Health Camp after the flood:</p> <p>Protection of livestock from outbreaking and communicable diseases be made. Health camps are to be organised in Flood affected areas to restore the normal breeding capa-</p>
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		traumatic injuries, aspiration pneumonia, lameness and other surgical cases in the health camp. Disinfection of livestock premises and Poultry shed Disinfection of livestock premises and the temporary sheds should be done with the help of bleaching powder, phenol, carbolic acid etc	bility of breedable population as well as to restore the normal health of livestock and poultry.
Cyclone			
Heat wave and cold wave			

2.5.2 Poultry

	Suggested contingency measures			Convergence/linkages with ongoing programs, if any
	Before the event ^a	During the event	After the event	
Drought				
Floods				
Shortage of feed ingredients				
Drinking water				
Health and disease management	Vaccines to be used for different animals and Poultry Cattle and Buffalo Hemorrhagic Septicemia Vaccine Black Quarter Vaccine FMD Vaccine Anthrax Vaccine as per endemicity. Sheep and Goat Hemorrhagic Septicemia Vaccine			

	<p>PPR Vaccine FMD Vaccine Goat pox Vaccine Enterotoxemia Vaccine Anthrax Vaccine as per endemicity</p> <p style="text-align: center;">Pigs</p> <p>Hemorrhagic Septicemia Vaccine PPR Vaccine FMD Vaccine Goat pox Vaccine Enterotoxemia Vaccine Anthrax Vaccine as per endemicity.</p> <p style="text-align: center;">Dogs</p> <p>Rabies Vaccine</p> <p style="text-align: center;">Poultry</p> <p>Mareks disease vaccine RDV (F₁ & R₂B), FPV, IBRV & IBDV</p> <p style="text-align: center;">(Annexure-1)</p> <ul style="list-style-type: none"> • Medicines <p>All Districts should be earmarked for flood.</p> <p>An inventory of required medicines to treat the affected livestock in case of eventualities should be made.</p> <p>The Govt. should take steps to procure sufficient quantity of essential life saving medicines.</p> <p>List of life saving Medicines</p> <p>Corticosteroids Nikethamide Antibloat Adrenaline Antihistaminic Antidotes for common poisoning Antisnake venom</p>			
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	<p>Broad spectrum antibiotics Anti-inflammatory Antipyretic and Analgesics Fluids and Electrolytes</p> <ul style="list-style-type: none"> • Mobile Veterinary Clinics <p>Mobile Veterinary Clinics should be kept ready at Veterinary Hospital or Veterinary Camps so that immediate treatment of injured and affected animals may be done.</p> <p>For this MVC must have adequate drugs like antibiotic, analgesic, dewormer, ointment, antsnake venom and emergency health care facilities along with trained personnel.</p> <p>A good no. of mobile clinic teams should be planned consisting dedicated and experienced technical workers with allotment of area of operation.</p> <p>The teams should be kept in readiness having required stock of medicines and equipment to work in any adverse situation.</p> <p>A telephone directory should be maintained at the District level by collecting the telephone nos. of Vets, Para-Vets, NGOs / youth clubs / societies, volunteers etc. to collect feedback and plan the activities during the emergency.</p> <p>An emergency kit for poultry should be made ready well in advance. The Poultry kit should have Cage, mask, mash, pellet feed trough, waterers,</p>			
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	detergents, poultry vaccines, Veterinary drugs, workers protection uniform etc.			
Cyclone				
Heat wave and cold wave	Adequate and suitable measures for safety of animal lives			
Shelter/environment management				
Health and disease management				

2.5.3 Fisheries/ Aquaculture

	Suggested contingency measures		
	Before the event ^a	During the event	After the event
1) Drought			
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	(i) Partial harvesting (ii) Addition of water (iii) Stocking of air breathing fishes	(i) Maintenances of remaining stock till favorable condition achieved (ii) If not feasible, total harvesting or transfer of fishes may be done. (iii) Preparation of the pond for next crop.
(ii) Impact of salt load build up in ponds / change in water quality	(i) Regular monitoring of water quality parameter. (ii) Arrangement of aeration (iii) Addition of water from external resource	(i) Arrangement of aeration. (ii) Addition of water a. Monitoring of water quality b. Reduction of manuring according to water level.	
2) Floods			
A. Capture			

B. Aquaculture			
(i) Inundation with flood water	(i) Elevation/ Renovation of pond dyke. (ii) Sale of Table/marketable size fishes (iii) construction of earthen nursery ponds in upland areas	Collection of naturally bred seeds (Spawn /fry /fingerling) from flooded water Stocking in nursery ponds for rearing	-Retain the water in pond immediately after flood through repairing of damaged dyke etc. -Netting of pond -Removal of unwanted, predatory/weed fishes -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 (b) 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.
3. Cyclone / Tsunami			
4. Heat wave and cold wave			