

**State: Goa**  
**Agriculture Contingency Plan for District: South Goa**

1.0 District Agriculture profile

1.1	Agro-Climatic/Ecological Zone				
	Agro Ecological Sub Region (ICAR)	Central and south Sahyadris, hot moist, subhumid to humid eco-subregion (19.2) and Konkan, Karnataka and Kerala coastal plain hot humid to perhumid (19.3)			
	Agro-Climatic Zone (Planning Commission)	Western Coast Plains and Ghat region (XII)			
	Agro Climatic Zone (NARP)	South Konkan Coastal Zone			
	List all the districts or part thereof falling under the NARP Zone	Ratnagiri and Sindhudurg			
	Geographic coordinates of district headquarters	<b>Latitude</b>	<b>Longitude</b>		<b>Altitude</b>
		15.28° N	73.98° E		10 m
	Name and address of the concerned ZRS/ ZARS/RARS/RRS/RRTTS	---			
	Mention the KVK located in the district	Krishi Vigyan Kendra, Margao, Dist. South Goa, Goa- 403601			
	Name and address of the nearest District Agro-Met Unit for agro- advisories in the zone	DAMU, Krishi Vigyan Kendra, Margao, Dist. South Goa, Goa- 403601			
1.2	Rainfall	<b>Normal RF (mm)</b>	<b>Normal Rainy days (number)</b>	<b>Normal Onset (specify week and month)</b>	<b>Normal Cessation (specify week and month)</b>
	SW monsoon (June-Sep):	2285.3	61	First week of June (23 <sup>rd</sup> SMW)	Second week of October (41 <sup>st</sup> SMW)
	NE Monsoon (Oct-Dec):	---	---	-	-
	Post monsoon showers (Oct.- Dec)	173.0	15	-	-
	Winter (Nov-Feb)	42.9	14	-	-
	Summer (Mar-May)	96.5	14	-	-
	Annual	2597.7	104	-	-

Source: IMD, Pune

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 (ha)	218905	63864	93562	19017	919	36097	359	-	5087	-

Source: Directorate of Agriculture, Govt. of Goa, 2017-18

1.4	Major Soils (common names like red sandy loam deep soils (etc.))	Area (ha)	Percent (%) of total
	Very shallow (0-25 cm)	8611	4.2
	Shallow (25-50 cm)	96928	47.1
	Moderately shallow (50-75 cm)	15841	7.6
	Moderately deep (75-100 cm)	20893	10.1
	Deep (100-150 cm)	50978	24.8
	Very deep (>150 cm)	12819	6.2

Source :-NBSS & LUP, Nagpur 2016

1.5	Agricultural land use	Area (ha)	Cropping intensity %
	Net sown area	63864	117.53
	Area sown more than once	11200	
	Gross cropped area	75064	

Source – Directorate of Agriculture, Govt. of Goa -2017-18

1.6	Irrigation	Area ('000'ha)		
	Net irrigated area	20.3		
	Gross irrigated area	20.3		
	Rainfed area	41.1		
	Sources of Irrigation	Number	Area ('000'ha)	Percentage of total irrigated area
	Canals	6	4.32	21 %
	Tanks	200	10.4	51.2 %
	Open wells	164	2.83	13.9 %
	Bore wells	20	1.54	14%
	Lift irrigation schemes	25	0.01	
	Micro-irrigation	--	1.3	
	Other sources (please specify)	--	-	
	Total Irrigated Area		20.31	
	Pump sets	--		
No. of Tractors	--			

Source – North Goa District Irrigation Plan Under PMKSY 2016-17; Statistical Hand Book of Goa 2016-17, Directorate of Planning, Statistics and Evaluation, Porvorim Goa; Agriculture at a Glance 2016; Directorate of Economics and Statistics and <https://eands.dacnet.nic.in/>

	Groundwater availability and use* (Data source: State/Central Ground water Department /Board)	No. of blocks/ Tahasils	(%) area	Quality of water (specify the problem such as high levels of arsenic, fluoride, saline etc)
	Over exploited	--	--	

	Critical	--	--	
	Semi- critical	--	--	
	Safe	6	--	Arsenic and fluoride within permissible limit
	Wastewater availability and use	--	--	
	Ground water quality	Ground water in general is of good quality and potable		
*over-exploited: groundwater utilization > 100%; critical: 90-100%; semi-critical: 70-90%; safe: <70%				

Source: Groundwater Information Booklet South Goa 2013 Central Ground water Board

#### 1.7 Area under major field crops & horticulture etc.

1.7	Major Field crops cultivated	Area (ha)					
		<i>Kharif</i>		Rabi		Summer	Total
		Irrigated	Rainfed	Irrigated	Rainfed		
	Rice	--	14765	7620	--	-	22385

	Horticultural crops – Fruits	Total Area (ha)				
	Mango	3928				
	Cashew	19161				
	Other fruit crops	2266				
	Horticulture crops – Vegetables					
	Okra, Brinjal, Chilli and Leafy vegetables etc.	4078				
	Plantation crops					
	Coconut	16968				
	Arecanut	1310				
	Fodder crops (2001-02)	3.9				

	Pulses (Cowpea, Green gram) (2016-17)	--	17	1314	--	--	1331
	Sugarcane	781		--	--	--	781

Source:- Directorate of Agriculture, Govt. of Goa 2017-18

<b>1.8</b>	<b>Livestock</b>	<b>Male</b>	<b>Female</b>	<b>Total</b>
	Non descriptive Cattle (local low yielding)	10,059	9,437	19,496
	Crossbred cattle	998	6,964	7,962
	Non-descriptive / Graded Buffaloes	2,737	10,088	12,825
	Goat	2365	4722	7,087
	Sheep	13	11	24
	Others (Camel, Pig, Yak etc.)			34,972
	Commercial dairy farms (Number)			
<b>1.9</b>	<b>Poultry</b>	No. of farms	Total No. of birds	
	Commercial	2	104969	
	Backyard	-		

Source : Livestock Census-2012

<b>1.10</b>	<b>Fisheries (Data source: Chief Planning Officer) Data for whole Goa</b>						
	<b>A. Capture</b>						
	<b>i) Marine (Data Source: Fisheries Department)</b>	<b>No. of fishermen</b>	<b>Boats</b>		<b>Nets</b>		<b>Storage facilities (Ice plants etc.) Number of processing unit</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>	
		10545	1142	1524	12300		33
<b>ii) Inland (Data Source: Fisheries Department)</b>	No. Farmer owned ponds		No. of Reservoirs		No. of village tanks		
	<i>Data are not available</i>		5		<i>Data are not available</i>		

<b>B. Culture</b>			
	Water Spread Area ('000'ha)	Yield (t/ha)	Production (tons)
i) Brackish water (Directorate of Fisheries, Govt. of Goa)	0.04 lakh ha	0.1	4765
ii) Fresh water (Data Source: Directorate of Fisheries, Govt. of Goa)	0.03 lakh ha	NA	180

### 1.11 Production and Productivity of major crops

1.11	Name of crop	<i>Khariif</i>		<i>Rabi</i>		Summer		Total		Crop residue as fodder ('000 tons)
		Production (t)	Productivity (kg/ha)	Production (t)	Productivity (kg/ha)	Production (t)	Productivity (kg/ha)	Production (t)	Productivity (kg/ha)	
Major Field crops (Crops to be identified based on total acreage)										
	Rice	39680	2720	24280	2720	--	--			
	Pulses (Cowpea, Greengram)	13	765	1036	788	--	--			
	Sugarcane	35642	46109			--	--			

Source: DACNET 2016-17

Major Horticultural crops (Crops to be identified based on total acreage)										
								Production (t)	Yield (t/ha)	
	Mango									
	Cashew							7959	0.42	
	Coconut							86980000 nuts	5128.84 nuts/ha	
	Arecanut							2204	1.70	
	Black pepper							190	0.36	
	Banana							15978	10.87	

Source: DACNET 2016-17

1.1	Sowing window for 5 major field crops	Rice	Pulses	Groundnut	Sugarcane
2	Kharif-Rainfed	1 <sup>st</sup> week to 2 <sup>nd</sup> week of July	--	--	--
	Kharif Khazan broadcast	3 <sup>rd</sup> week of June to 1 <sup>st</sup> week of July			
	Kharif-Irrigated	--	--	--	3 <sup>rd</sup> Week of May to 1 <sup>st</sup> week of June
	Rabi- Rainfed	--	2 <sup>nd</sup> week of November to 1 <sup>st</sup> week of December	--	--
	Rabi-Irrigated	2 <sup>nd</sup> week of November to 1 <sup>st</sup> week of December	2 <sup>nd</sup> week of November to 1 <sup>st</sup> week of December	2 <sup>nd</sup> week of November to 1 <sup>st</sup> week of December	

1.13	What is the major contingency the district is prone to? (Tick mark)	Regular	Occasional	None
	Drought	--	✓	--
	Flood	--	✓ (June to August)	--
	Cyclone	--	✓	--
	Hail storm	--	✓	-
	Heat wave	--	-	✓
	Cold wave	--	--	✓
	Frost	--	--	✓
	Sea water intrusion	✓	-	--
	Pests and disease outbreak (specify for major pests and diseases)			
	1. Rice	Gandhi bug, Bacterial leaf blight, Sheath rot	BPH, Blast, False smut	
	2. Sugarcane	Shoot borer, Red rot, Mosaic	Wooly aphid, Eye spot, Pokkah boeng, smut, wilt	
	3. Groundnut	Pod borer, Dry root rot, Early and late leaf spot, Rust	Crown rot, Stem rot	
	4. Mango	Hopper, fruit fly, Powdery mildew, Anthracnose, Sooty mould	Mealy bug, Die back, Red rust	
12.	5. Cashew	Tea mosquito bug, Cashew stem and root borer	Thrips, Aphids, Apple and nut borer, leaf miner and Webber	
	6. Coconut	Rhinoceros beetle, Eriophyite mite, Red palm weevil, Bud rot, Stem bleeding	Black headed caterpillar, Rugose spiraling whitefly, Ganoderma wilt, Leaf rot	--



	7. Areca nut	Fruit rot/Koleroga	Foot rot (Anaberoga)	
	8. Black pepper	Foot rot (Quick wilt), Slow decline	Pollu beetle, Thrips, Mealy bug	
	9. Banana	Pseudostem rhizome weevil, Sigatoka leaf spot, Bunchy top	Leaf roller, Panama wilt	

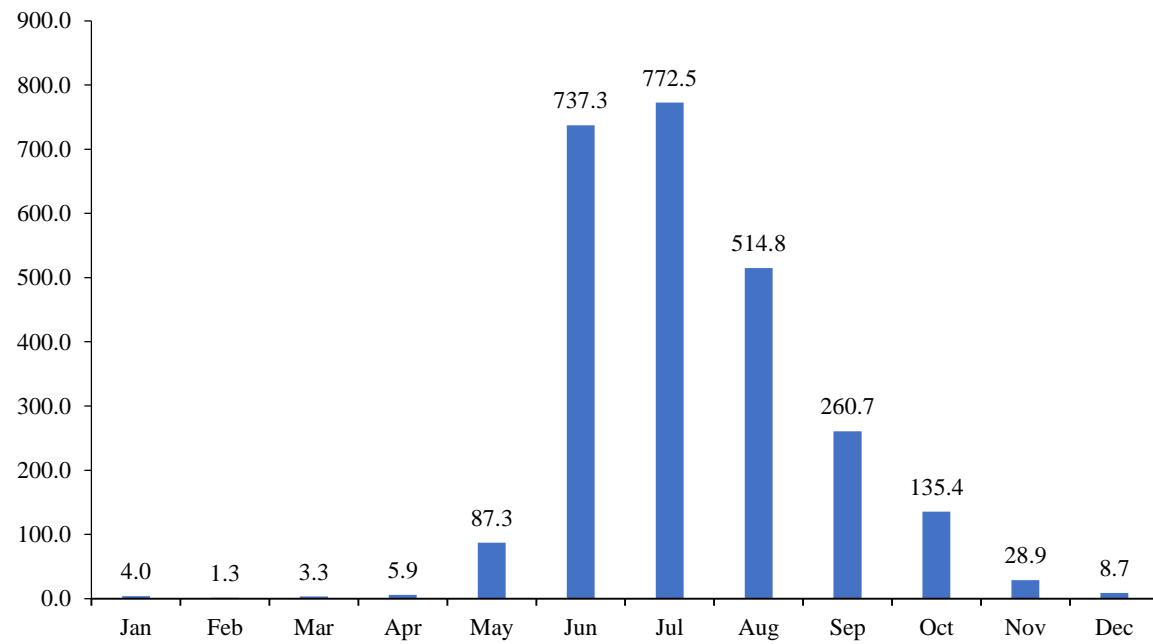
1.14	Include Digital maps of the district for	Location map of district within State as Annexure I	Enclosed: Yes
		Mean annual rainfall as Annexure 2	Enclosed: Yes
		Soil map as Annexure 3	Enclosed: Yes, legend missing

Annexure I- Location map



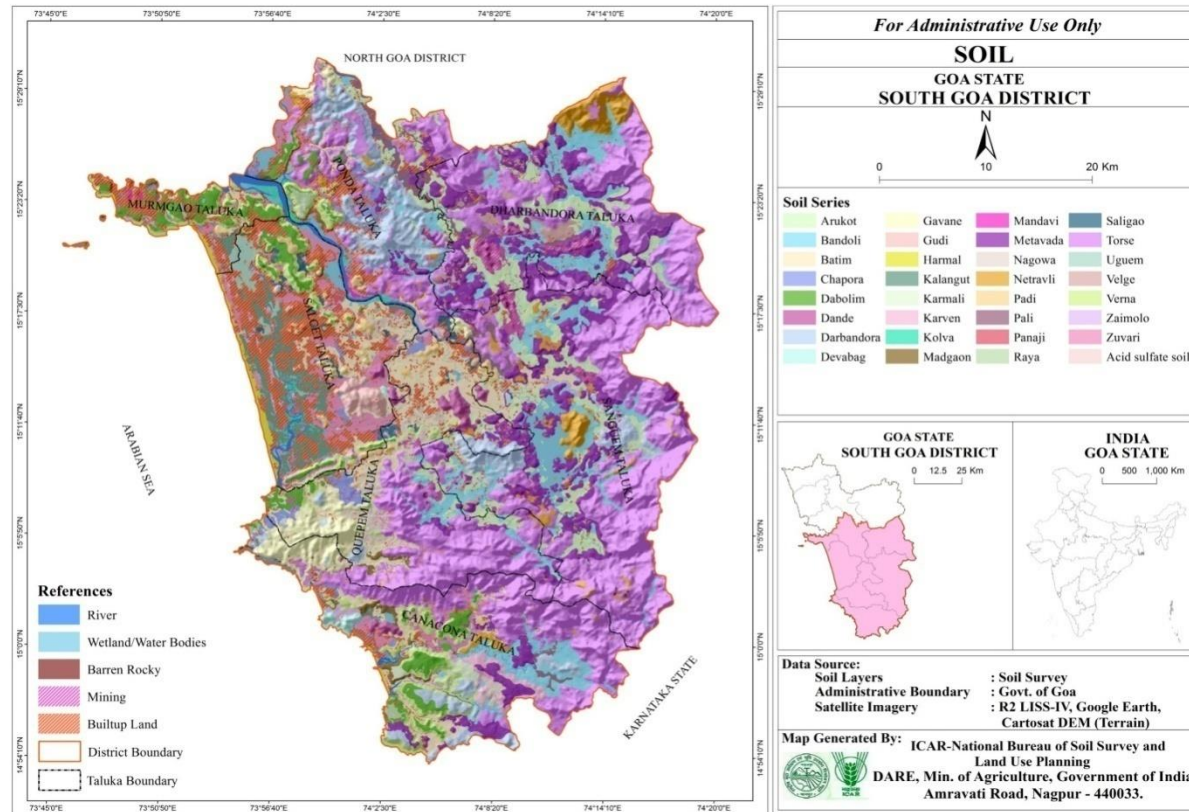
## Annexure - 2

### South Goa



**Fig: Mean monthly rainfall (mm) of South Goa District.**

### Annexure - 3



Soil map of South Goa district (Source: NBSS & LUP, Nagpur)

## 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
Delay by 2 weeks (3 <sup>rd</sup> week of June)	Upland (Terrace Sorad) shallow to moderately deep	Rice-pulses	Prefer medium duration variety (Jyothi, Goa dhan-4)	<ul style="list-style-type: none"> <li>• Prepare the seedlings by nursery with irrigation</li> <li>• Broadcasting of sprouted seeds under puddled condition</li> </ul>	Procure the seed from reliable source like ICAR-CCARI, Department of Agriculture
	Mid-land (Morad) moderately deep to deep	Rice-groundnut	Prefer medium duration variety (Jyothi, Goa dhan-4)	<ul style="list-style-type: none"> <li>• Prepare the seedlings by nursery with irrigation</li> <li>• Broadcasting of sprouted seeds under puddled condition</li> <li>• SRI method of rice cultivation</li> </ul>	Procure the seed from reliable source like ICAR-CCARI, Department of Agriculture
		Sugarcane	No change		

	Low land deep to very deep soils	Rice-Rice	Prefer medium duration variety (Goa dhan-1,2,4)		
	Coastal lowlands deep to very deep soils (Khazan)	Rice-Fallow	In case of failure of germination use mid late duration variety (Goa dhan-1,2,4)		
<b>Condition</b>			<b>Suggested Contingency measures</b>		
<b>Early season drought (delayed onset)</b>	<b>Major Farming situation</b>	<b>Normal Crop / Cropping system</b>	<b>Change in crop / cropping system including variety</b>	<b>Agronomic measures</b>	<b>Remarks on Implementation</b>
** Delay by 4 weeks (1 <sup>st</sup> week of July)	Upland (Terrace Sorad) shallow to moderately deep	Rice-pulses	--	Dapog/mat nursery raising/sowing of sprouted seed	
	Mid-land (Morad) moderately deep to deep	Rice-groundnut	--	--	
		Sugarcane	No change	Irrigation as per requirement	
	Low land deep to very deep soils	Rice-Rice	--	--	
	Coastal lowlands deep to very deep soils (Khazan)	Rice-Fallow	--	--	

Note :- \*\* Generally such type of situation has not occurred during past years

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 at the time of transplanting	Upland (Terrace Sorad) shallow to moderately deep	Rice-pulses	NA	NA	NA
	Mid-land (Morad) moderately deep to deep	Rice-groundnut	NA		
		Sugarcane	NA		
	Low land deep to very deep soils	Rice-Rice			
	Coastal lowlands deep to very deep soils (Khazan)	Rice-Fallow	NA	--	--

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Crop management	Soil nutrient & moisture conservation measures	Remarks on Implementation
<b>Mid-season drought (long dry spell, consecutive 2 weeks rainless (&gt;2.5 mm) period)</b>					
At vegetative stage	Upland (Terrace Sorad) shallow to moderately deep	Rice-pulses	--	--	
	Mid-land (Morad) moderately deep to deep	Rice-groundnut	--	--	
		Sugarcane	--	--	
	Low land deep to very deep soils	Rice-Rice	--	--	
Coastal lowlands deep to very deep soils (Khazan)	Rice-Fallow	--	--		

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Crop management	Soil nutrient & moisture conservation measures	Remarks on Implementation
<b>Mid-season drought (long dry spell)</b>					
At flowering/ fruiting stage	Upland (Terrace Sorad) shallow to moderately deep	Rice-pulses	--	Protective irrigation	



	Mid-land (Morad) moderately deep to deep	Rice-groundnut	--	Protective irrigation	
		Sugarcane	--	Protective irrigation	
	Low land deep to very deep soils	Rice-Rice	--	Protective irrigation	
	Coastal lowlands deep to very deep soils (Khazan)	Rice-Fallow	--	Protective irrigation	

### 2.1.2 Irrigated situation

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change in crop/cropping system	Agronomic measures	Remarks on Implementation
Delayed release of water in canals due to low rainfall	Low land	Rice (Rabi season)	NA		
		Sugarcane	No change		

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change in crop/cropping system	Agronomic measures	Remarks on Implementation
Limited	Low land	Rice (Rabi season)	NA		

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change in crop/cropping system	Agronomic measures	Remarks on Implementation
release of water in canals due to low rainfall		Sugarcane		NA	

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change in crop/cropping system	Agronomic measures	Remarks on Implementation
Non release of water in canals under delayed onset	Low land	Rice (Rabi season)		NA	
		Sugarcane		NA	

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	Mid land	Sugarcane	NA	<ul style="list-style-type: none"> <li>• Change in irrigation interval</li> <li>• Alternate ridge and furrow irrigation</li> </ul>	

## 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
<b>Continuous high rainfall in a short span leading to water logging</b>				
Rice (lowland)	Drain out excess water	----	Drain out excess water and harvest the crop before lodging	Immediate threshing and drying in shed
Sugarcane	No contingency measures required			
<b>Horticulture</b>				
Cashew (Hilly and mid lands)	No contingency measures required	--	--	-----
Arecanut (Foot hills)	No contingency measures required	--	--	
Coconut (Foot hills)	No contingency measures required	--	--	-
Mango (Hilly and mid lands)	No contingency measures required	--	--	--
Banana (Mid lands)	No contingency measures required			
Black pepper (with Arecanut or coconut)	No contingency measures required			
<b>Heavy rainfall with high speed winds in a short span</b>				
Rice	----	----	Drain out water and harvest the crop at maturity immediately if lodging take place	Immediate threshing and drying in shed

Sugarcane	Drain out excess water Tie the sugarcane at grand growth stage	Drain out excess water		
Horticulture				
Cashew	Windbreaks along the border	<ul style="list-style-type: none"> <li>• Spray with Chloropyriphos @ 5ml/lit water to avoid stem borer infestation and spray Carbendazim + Mancozeb based composite fungicide @ 2 g/lit of water to avoid disease incidence.</li> <li>• Apply Bordeaux paste containing Chloropyriphos @ 10ml/l on cut surface and trunk.</li> </ul>	Spray with any recommended systemic insecticide	Proper drying of harvested nuts
Arecanut	Replanting is recommended (deep planting at the bottom of 1m <sup>3</sup> of pit with one-year old seedlings)	Spraying of Bordeaux mixture @1% for panicle  Soil application of boron @ 50 g/palm	Spraying of Bordeaux mixture @1% for panicle	Proper drying of harvested nuts
Coconut	Replanting is recommended (deep planting at the bottom of 1m <sup>3</sup> of pit with one-year old seedlings)	Soil application of boron @ 50 g/palm		
Mango	Prune the broken branches and treat with protective chemicals  Wind breaks along the border as a	Prune the broken branches and treat with protective chemicals	Prune the broken branches and treat with protective chemicals	Prune the broken branches and treat with protective chemicals

	preventive measure		Fruit drop at 50% maturity stage – Minimal processing for dehydrating cut raw fruits  Fruit drop in advanced maturity stage - Proper handling of fruits for ripening	
Banana	Proper earthing up and propping is to be done for local tall varieties after six months of planting (precautionary measure)	<ul style="list-style-type: none"> <li>• Drain out excess water</li> <li>• Propping with bamboo</li> <li>• Flowers of broken plant may be used as vegetable</li> <li>• Earthing up</li> </ul>	<ul style="list-style-type: none"> <li>• Drain out excess water</li> <li>• Propping with bamboo</li> <li>• Fruit of broken plants may be used as vegetable.</li> <li>• Earthing up</li> </ul>	
Black pepper	Uprooted/damaged vines can be used for propagation purpose	Uprooted/damaged vines can be used for propagation purpose	<ul style="list-style-type: none"> <li>• Berries can be harvested for drying or processing of green pepper</li> <li>• Uprooted/damaged vines can be used for propagation purpose</li> </ul>	
Cucurbitaceous crop, solanaceous crops and okra	<ul style="list-style-type: none"> <li>• Drain out excess water</li> <li>• Earthing up</li> <li>• Row covering with polythene film</li> </ul>	<ul style="list-style-type: none"> <li>• Drain out excess water</li> <li>• Earthing up</li> <li>• Prophylactic protective spray against diseases and pest</li> </ul>	<ul style="list-style-type: none"> <li>• Drain out excess water</li> <li>• Earthing up</li> </ul>	-----
Outbreak of pests and diseases due to unseasonal rains				
Rice (rabi)			Sheath rot-Spray Mancozeb @ 0.2%	

Arecanut		Spraying of Bordeaux mixture @1% for panicle		
Mango			Harvest before the rains, hot water treatment of harvested fruits	
Black pepper	Drain the water and apply biocontrol formulation @50g/plant	Drain the water and apply biocontrol formulation @50g/plant	Drain the water and apply biocontrol formulation @50g/plant	Drain the water and apply biocontrol formulation @50g/plant
Cucurbitaceous crop, solanaceous crops and okra	Drain the water and spray systemic fungicide	Drain the water and spray systemic fungicide	Drain the water and spray systemic fungicide	Drain the water and spray systemic fungicide

### 2.3 Floods

Condition	Suggested contingency measure			
	Seedling / nursery stage	Vegetative stage	Reproductive stage	At harvest
<b>Transient water logging/ partial inundation</b>				
Rice	<ul style="list-style-type: none"> <li>If washed out re-sowing of nursery by using mat nursery/sowing of sprouted seed on puddled field</li> </ul>	<ul style="list-style-type: none"> <li>Drain out excess water</li> </ul>	<ul style="list-style-type: none"> <li>Drain out excess water</li> </ul>	<ul style="list-style-type: none"> <li>Drain out excess water.</li> <li>Immediate harvesting, threshing and drying in shed</li> </ul>
<b>Horticulture (Vegetables)</b>				
Cucurbitaceous crop	Not applicable	Not applicable	Not applicable	Not applicable
Solanaceous crops	Not applicable	Not applicable	Not applicable	Not applicable
Okra	Not applicable	Not applicable	Not applicable	Not applicable
<b>Continuous submergence</b>				

<b>for more than 2 days</b>				
Rice	<ul style="list-style-type: none"> <li>• If washed out re-sowing of nursery by using mat nursery/ sowing of sprouted seed on puddled field</li> </ul>	<ul style="list-style-type: none"> <li>• Drain out excess water</li> <li>• Apply second dose (40%) of nitrogen after submergence is over</li> </ul>	<ul style="list-style-type: none"> <li>• Drain out excess water</li> </ul>	<ul style="list-style-type: none"> <li>• Drain out excess water.</li> <li>• Immediate harvesting, threshing and dry in shed</li> </ul>
<b>Horticulture (Vegetables)</b>				
Cucurbitaceous crop	Not applicable	Not applicable	Not applicable	Not applicable
Solanaceous crops	Not applicable	Not applicable	Not applicable	Not applicable
Okra	Not applicable	Not applicable	Not applicable	Not applicable
<b>Sea water intrusion</b>	Not applicable	Not applicable	Not applicable	Not applicable
Rice (Khazan)	<ul style="list-style-type: none"> <li>• Strengthening of creek bund and sea wall to prevent sea water intrusion</li> <li>• Drain out excess water</li> <li>• Recommended salt tolerant varieties as a precautionary measure like Goa Dhan-1, 2, 3, 4</li> <li>• Broadcasting of Goa Bio-1 treated sprouted seeds</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthening of creek bund and sea wall to prevent sea water intrusion</li> <li>• Drain out sea water</li> <li>• Apply 25% excess N as top dressing</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthening of creek bund and sea wall to prevent sea water intrusion</li> <li>• Drain out sea water.</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthening of creek bund and sea wall to prevent sea water intrusion</li> <li>• Immediate harvesting, threshing and drying in shed.</li> </ul>

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

Extreme event type	Suggested contingency measure			
	Seedling / nursery stage	Vegetative stage	Reproductive stage	At harvest
Heat Wave	Not applicable			
Cold wave	Not applicable			
Frost	Not applicable			

Hailstorm	Not applicable			
Cyclone				
Rice			<ul style="list-style-type: none"> <li>• Drain out water and harvest the crop at maturity immediately if lodging take place</li> </ul>	<ul style="list-style-type: none"> <li>• Immediate threshing and drying in shed</li> </ul>
Cashew	Windbreaks along the border	Spray with Chloropyriphos @ 5ml/lit water to avoid stem borer infestation and spray Carbendazim + Mancozeb based composite fungicide @ 2 g/lit of water to avoid disease incidence.	Cashew	Windbreaks along the border
Arecanut	Replanting is recommended (deep planting at the bottom of 1m <sup>3</sup> of pit with one-year old seedlings)	Spraying of Bordeaux mixture @1% for panicle  Soil application of boron @ 50 g/palm	Spraying of Bordeaux mixture @1% for panicle	Proper drying of harvested nuts
Coconut	Replanting is recommended (deep planting at the bottom of 1m <sup>3</sup> of pit with one-year old seedlings)	Soil application of boron @ 50 g/palm		
Mango	Prune the broken branches and treat with protective	Prune the broken branches and treat	Prune the broken branches and treat with protective	Prune the broken branches and treat with



	chemicals  Windbreaks along the border as a preventive measure	with protective chemicals	chemicals  Fruit drop at 50% maturity stage – Minimal processing for dehydrating cut raw fruits  Fruit drop in advanced maturity stage - Proper handling of fruits for ripening	protective chemicals
Banana	Proper earthing up and propping is to be done for local tall varieties after six months of planting (precautionary measure)	<ul style="list-style-type: none"> <li>• Drain out excess water</li> <li>• Propping with bamboo</li> <li>• Flowers of broken plant may be used as vegetable</li> <li>• Earthing up</li> </ul>	<ul style="list-style-type: none"> <li>• Drain out excess water</li> <li>• Propping with bamboo</li> <li>• Fruit of broken plants may be used as vegetable.</li> <li>• Earthing up</li> </ul>	
Black pepper	Uprooted/damaged vines can be used for propagation purpose	Uprooted/damaged vines can be used for propagation purpose	<ul style="list-style-type: none"> <li>• Berries can be harvested for drying or processing of green pepper</li> <li>• Uprooted/damaged vines can be used for propagation purpose</li> </ul>	
Cucurbitaceous crop, solanaceous crops and okra	<ul style="list-style-type: none"> <li>• Drain out excess water</li> <li>• Earthing up</li> <li>• Row covering with</li> </ul>	<ul style="list-style-type: none"> <li>• Drain out excess water</li> <li>• Earthing up</li> </ul>	<ul style="list-style-type: none"> <li>• Drain out excess water</li> <li>• Earthing up</li> </ul>	-----

	polythene film	<ul style="list-style-type: none"> <li>• Prophylactic protective spray against diseases and pest</li> </ul>		
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## 2.5 Contingent strategies for Livestock, Poultry & Fisheries

### 2.5.1 Livestock

	Suggested contingency measures		
	Before the event <sup>s</sup>	During the event	After the event
<b>Lean period for fodder (Mar-June)</b>			
Feed and fodder availability	<p>Harvesting of fodder at regular intervals from CPRs and PPRs and drying and proper storage</p> <p>Store sufficient quantity of dry fodder and concentrate mixture</p> <p>Stored crop residues should be protected from unseasonal rains with supply of silpaulin sheets</p> <p>Non-conventional and alternate sources of feed resources should be explored, collected and stored</p> <p>Encourage farmers with incentives for silage making, hydroponic fodder, production of feed blocks and total mixed ration (TMR) blocks</p> <p>Develop pastoral systems in cashew/coconut/mango plantations</p>	<p>Allow for grazing only in early morning and late evening</p> <p>Judicious use of available feed resources</p> <p>Ensure timely supply of quality fodder, UMMB blocks, other feed resources to the affected area for feeding the livestock</p> <p>Explore the use of all the failed crop material as fodder for livestock</p> <p>Soak the chopped paddy straw in 1 per cent salt/jaggery water before feeding the livestock</p> <p>If necessary fed the livestock with sugarcane tops mixed with legume crop residues/paddy</p>	<p>Allow for grazing as usual</p> <p>Expediting production of fodder from cultivated and fallow lands</p> <p>Application of fertilizer in CPRs to enhance fast growth of forage species</p> <p>Encourage silage, feed blocks and total mixed ration (TMR) blocks production for feeding the animals</p>

	<p>Encourage cultivation of perennial fodder varieties (CO-3/CO-4/CO-5 etc) in cultivated areas</p> <p>Promote short duration fodder varieties like COFS-29/31 in fallow and uncultivated lands and paragrass in water logged areas</p> <p>Supply and propagation of quality seeds/slips of improved fodder varieties like Co-3, CO-4 and 5</p>	<p>straw</p> <p>Use of stored silage, feed blocks and total mixed ration (TMR) blocks</p> <p>Tree fodder from drumstick, subabul to be utilized as supplement for milch animals</p> <p>Supplement mineral and vitamins along with concentrate mixture</p>	
Drinking water	<p>Adoption of conservation measures for clean drinking water storage</p> <p>Water harvesting measures and alternative water sources needs to be identified and adopted</p>	<p>Judicious use of water for the livestock</p> <p>Ensure regular supply of wholesome clean drinking water for livestock</p>	<p>Cleaning of water tanks/water bodies</p> <p>Desilting of water tanks to be taken on priority</p> <p>Ensure regular supply of wholesome clean drinking water for the livestock</p>
Health and disease management	<p>Adoption of standard health management interventions to alleviate impending heat stress</p> <p>Vaccination against FMD in endemic areas</p> <p>Preparation for proper shelter management strategies for vulnerable livestock</p>	<p>Prompt treatment of affected animals for dehydration, electrolytes and other heat stress related disorders</p> <p>Provision for proper animal shelter camps</p> <p>Proper and timely rehabilitation of all affected animals</p> <p>Measures to be taken for control of external parasites</p>	<p>Follow strictly vaccination schedule</p> <p>Maintain hygiene around the animal houses</p>

**Excess rainfall in low lands (NOT MUCH PROBLEM BECAUSE OF GOOD DRAINAGE)-2-3 DAYS IN EXTREME RARE CONDITIONS**

**Supply of dry fodder**

<p>Feed and fodder availability</p>	<p>Store sufficient dry fodder, silage and concentrate mixture for feeding the livestock for 2-3 days</p>	<p>Stall feeding of animals with stored dry fodder and concentrates and do not allow for grazing Ensure timely supply of dry fodder/hay concentrates, mineral mixture etc to the affected areas</p>	<p>Harvest the inundated crops/forage and dry it for future use Apply fertilizer in CPRs for getting higher forage Encourage sowing of paragrass in low lying areas</p>
<p>Drinking water</p>	<p>Store sufficient clean drinking water for drinking of livestock for 2-3 days</p>	<p>Ensure availability of clean and chlorinated water to livestock in order to prevent water borne diseases</p>	<p>If required clean the water bodies/tanks Maintain wholesome and clean water supply to the livestock</p>
<p>Health and disease management</p>	<p>Awareness creation among livestock farmers about the chances of potential diseases affecting livestock during the event Store all the required medicines and vaccines Promote animal shelters with raised platform with slatted floor in areas where inundation of sea water occurs so as to control spread of foot rot, coccidiosis etc diseases</p>	<p>Ensure timely reach of veterinary health services to the affected region Spraying of fly repellants in animal sheds Sprinkle the lime powder in the shed and surrounding areas Prompt treatment of all affected livestock</p>	<p>Proper and timely disposal of animal carcasses Blanket deworming with broad-spectrum anthelmintics and requisite vaccination for potential diseases like FMD in endemic areas Proper hygiene and sanitation of the animal sheds and premises Monitoring and close surveillance on disease outbreaks</p>

<b>Cyclone</b>	NA		
<b>Heat wave and cold wave</b>	N.A	N.A	N.A
Shelter/environment management			
Health and disease management			

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

### 2.5.2 Poultry

	<b>Suggested contingency measures</b>			<b>Convergence/linkages with ongoing programs, if any</b>
	<b>Before the event<sup>a</sup></b>	<b>During the event</b>	<b>After the event</b>	
<b>Lean period/Heat stress (March-June)</b>				
Feeding management	Storing of feed ingredients and mineral mixture in sufficient quantity Vaccination against RD Culling of unproductive birds	Allow for scavenging only in early morning and late evening Supplementation of broken rice/rice bran etc only for productive birds and along with shell grit (calcium) for laying birds.  Supply of concentrate feed and mineral and vitamin mixture on subsidy. Judicious use of available feed and avoiding excess feeding and wastage of the feed.	Allow for scavenging in the day time Supplementation as per requirement to restore health of survived birds.  Treatment of affected birds Proper disposal of carcass	

Drinking water	Rain water harvesting	Sanitation of drinking water Make available wholesome drinking water all the time	Maintain wholesome and clean water supply	
Health and disease management	Deworming and vaccination against RD and fowl pox, IBD	Arrangements should be made so that Veterinary and Para- veterinary personnel can quickly reach the affected farms to provide necessary measures. Mixing of Vit. A, D, E, K and B-complex including vit C in drinking water	Disposal of dead birds by burning / burying with lime powder in pit Maintenance of hygiene and sanitation of poultry house Follow strictly vaccination schedule	
<b>Excess rainfall in low lands</b>				
Shortage of feed ingredients	Birds should be evacuated and taken to higher altitude Shelter on elevated areas Sufficient storage of feed ingredients and mineral mixtures	Use stored feed as supplement Don't allow for scavenging		
Drinking water	Arrangement of clean and hygienic water. Measures should be taken to prevent contamination of water	Sanitation of drinking water and providing wholesome clean drinking water	Sanitation and maintenance of hygiene of drinking water resources	

Health and disease management	Vets and associated persons should be readily available at each district head quarter for flood affecting areas with stock of medicine, mineral mixture and vaccine for poultry. Vaccination against contagious diseases	Immediate veterinary help to the farms Sprinkling of lime in the poultry house If any difficulty in handling large number of birds, slaughtering in humane manner and sent for cold storage to avoid heavy loss.	Disposal of dead birds by burning / burying with lime powder in pit Disposal of poultry manure to prevent protozoal problem Supplementation of coccidiostats in feed Vaccination against RD, IBD and Fowl pox	
Cyclone	NA			
Heat wave and cold wave	NA			

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

### 2.5.3 Fisheries/Aquaculture

	Suggested contingency measures		
	Before the event	During the event	After the event
<b>1) Heat stress (March-May)</b>			
<b>A. Capture</b>			
Marine	<b>Not applicable</b>		
Brackish water			
(i) Reduction in water levels	The water needs to be conserved using efficient	The stock can be harvested immediately, the juvenile and sub-adult stocks can be kept	The pond can be filled with fresh stock of water and water levels can be maintained.

	methodologies. Construction of 1-2 deeper ponds or tanks in the vicinity. Precautionary measures to reduce the evaporation loss during the event	inside the pond. A proportion of the stock (20%) can be even transferred to deeper tanks and ponds (made as contingency measure)	Stock the fish populations with adequate water quality monitoring and maintain reservoir tanks and ponds for recharging
(ii) Changes in water quality	Monitoring and maintenance of biological and physico-chemical properties of water	If there is significant reduction in water quality, feeding has to be stopped immediately to keep the water quality and to prevent excessive eutrophication. The stock has to be harvested and a portion (20%) can be shifted to the reservoir tanks and ponds If required, the aeration and filtration facilities can be operated	Once, the biological and physico-chemical properties of water get restored, the stock can be reintroduced.
(iii) Change in harvest period	Introduce fast growing and ecologically compatible fish species with short culture period	The harvest can be made well in advance and the ponds can be kept for drying and maintenance	The stocking process can be restarted after sufficient water levels are regained in the water body.
(iv) Any other	In situ and Ex situ conservation approaches should be followed for all indigenous, economically and ecologically important species.	In situ methods of conservation using indoor tanks, and ponds have to be followed.	The conserved species once again need to be reintroduced in their original habitats after achieving desired aquatic environment.
(v) Impact of salt load build up in ponds / change in water quality	NA	NA	NA



<b>B. Freshwater</b>			
(i) Shallow water in ponds due to insufficient rains/inflow	Efforts should make to avoid water seepage by using bentonite clay and plastic liners etc. Also artificial oxygenation systems as aerators etc. should be incorporated in aquaculture system.	Water recycling with the aid of potential filtration systems can be applied if available. Provide artificial oxygenation. If water level is too much low, can lead to mass mortality due to environmental stress hence it will be better to harvest the stock immediately.	Construction of small reservoirs or dams should be newly developed in drought prone area. Restock with finger lings of IMC to build up stock.
(iii) Any other	--	--	--

<b>2) Excess rainfall</b>			
<b>A. Capture</b>			
Marine	<p>Emergency and Disaster preparedness mission through Sea walls, Rocks, wave breakers, sand sack walls along the coastline should be prepared. Emergency preparedness alert should be given to all the coastal residents with an emergency kit.</p> <p>Plan of Preventive measures against the epidemiological diseases, like malaria, cholera, <i>dengue</i> etc. among coastal communities.</p> <p>The coastal population should be made aware about Disaster mitigation, transport and locations of emergency camps prior to the Flooding event.</p> <p>Boats and gears should be properly kept safely and anchored at safe locations before the onset</p>	Maintain adequate emergency facilities such as food, water, clothing, shelter and medicines in the emergency camps	<p>National &amp; international financial support for research on the various aspects of the flood will be needed for future strategies.</p> <p>Microfinance to the affected population by Governmental and Non-Governmental Organization to reconstruct their socio-economic status.</p> <p>Control of vector-borne endemic and epidemic diseases.</p> <p>Mangrove plantation &amp; conservation strategies should be adopted in estuarine region for minimizing future risk.</p>

Inland	<p>Early warning systems and evacuation strategy planning for flood prone areas. Emergency preparedness alert should be given to all the coastal residents with an emergency kit.</p> <p>Emphasis should be given on the maintenance of drainage canals, inland water ways, highways, secondary roads and bridges in advance</p>	<p>Aid to populations at the affected zones and shelters.</p> <p>Timely help to populations at the affected zones and shelters.</p> <p>Affected population should be provided with adequate food &amp; medicines in time.</p>	<p>Diversifying course of flooding river to minimize socio-economic losses.</p> <p>Microfinance to the affected population by Governmental and Non-Governmental Organization to reconstruct their socio-economic status.</p>
(i) Average compensation paid due to loss of human life	Not applicable		
(ii) No. of boats / nets/damaged	Not applicable		
(iii) No. of houses damaged	Not applicable		
(iv) Loss of stock	Not applicable		
(v) Changes in water quality	Not applicable		
(vi) Health and diseases	<p>Preventive measures plan of the Health Ministry should be implemented for the prevention of epidemiological diseases, like malaria, cholera, <i>dengue</i>, etc. and vaccination in flood prone area.</p>	<p>Affected population should be provided with adequate food &amp; medicines in time.</p>	<p>Control of vector-borne endemic and epidemic diseases.</p>

<b>B. Freshwater Aquaculture</b>			
(i) Inundation with flood water	The elevation peripheral dykes and bunds of the aquaculture ponds. Providing elevated net fencing on the bunds to the avoid loss of fish during flooding.	Need to harvest the stock as early as possible to minimize economic losses	Drain out excess water, disinfecting and refilling the ponds with water and restocking by adopting standard aquaculture protocols.
(ii) Changes in water quality	Elevating the peripheral dykes of the aquaculture ponds.	Need to harvest the stock as early as possible to minimize economic losses	Drain out all the water from the pond and refill it with good quality water for future crop.
(iii) Health and diseases	Adequate vaccination through feeding and addition of fish stocks prior to flooding event is recommended to minimize the risk.	In situ observations & analysis of health status of cultivable species and stress inducing factors and recommendation of treatments to specific diseases.	Quarantining of culture pond before next stocking.
(iv) Loss of stock and inputs (feed, chemicals etc)	Elevating the peripheral dykes of the aquaculture ponds and good indoor storage facility for inputs.	Early harvest of the stock and transport of inputs to the safer places.	Use new stock. Insure the stock of fish if the stock is of high value
(v) Infrastructure damage (pumps, aerators, huts etc)	Elevating the peripheral dykes of the aquaculture ponds and good indoor storage facility for the pumps & aerators in flood condition.	Transport of the pumps, aerators etc. to the safer places.	Insurance and micro-finance for repair and maintenance of the infrastructure.
(vi) Any other	-	-	-
<b>3. Cyclone / Tsunami</b>			

A.Capture			
Marine	<p>Weather warnings should be made available on an emergency basis to fishermen and coastal residents</p> <p>Emergency and Disaster preparedness mission through Sea walls, Rocks, wave breakers, sand sack walls along the coastline should be prepared. Emergency preparedness alert should be given to all the coastal residents with an emergency kit.</p> <p>The coastal population should be made aware about Disaster mitigation, transport and locations of emergency camps prior to the Flooding event.</p> <p>Boats and gears should be properly kept safely and anchored at safe locations before the onset.</p> <p>Preventive measures for the prevention of epidemiological diseases, like malaria, cholera, dengue etc</p>	<p>Timely aid to coastal populations at the affected zones and provision of shelters.</p> <p>Affected population should be provided with adequate food &amp; medicines in time.</p>	<p>Microfinance to the affected population by Governmental and Non-Governmental Organization to rebuild their socio-economic status.</p> <p>Control of vector-borne endemic and epidemic diseases;</p> <p>National &amp; international financial support for research on the various aspects of the Cyclone/Tsunami will be needed for the planning of future strategies.</p> <p>Mangrove conservation, plantation strategies should be adopted in estuarine/coastal region for minimizing future risk</p>
(i) Average compensation paid due to loss of fishermen lives	---	---	---
(ii) Avg. no. of boats / nets/damaged	---	---	---
(iii) Avg. no. of	---	---	---

houses damaged			
Inland	Timely Communication of weather forecasting to fishermen Encouragement and financial incentives should be given to fishermen to carry safety devices on their fishing crafts.	Timely aid to coastal populations at the affected zones and provision of shelters. Affected population should be provided with adequate food & medicines in time.	Microfinance to the affected population by Governmental & Non-Governmental Organization to rebuild their socio-economic status. Rehabilitation of fishermen communities.
<b>B. Aquaculture</b>			
(i) Overflow / flooding of ponds	Elevating the peripheral dykes of the aquaculture ponds Early warning systems should be developed to minimize future risk.	In very initial stage prior to flooding, need to harvest the stock as early as possible to minimize economic losses. In severe condition nothing can be controlled.	Drain out excess water, disinfecting and refilling the ponds with water and restocking by adopting standard aquaculture protocols.
(ii) Changes in water quality (fresh water / brackish water ratio)	Elevating the peripheral dykes of the aquaculture ponds. Regular monitoring of water quality.	Fresh water from the storage ponds can be utilized for maintaining salinity.	Drain out excess water, after achieving desired water quality, restocking by adopting standard aquaculture protocols.
(iii) Health and diseases	Adequate vaccination of the stocks prior to this is recommended to minimize the risk	In situ observations & analysis of health status of cultivable species and stress inducing factors and recommendation of treatments to specific diseases.	Disinfecting/Quarantining of culture pond before the next stocking.
(iv) Loss of stock and inputs (feed, chemicals etc)	Elevating the peripheral dykes of the aquaculture ponds and good indoor storage facility for inputs.	Early harvest of the stock and transport of inputs to the safer places.	Use new stock.
(v) Infrastructure damage (pumps,	Elevating the peripheral dykes of the aquaculture ponds and Initial provision of good indoor storage facility for pumps and	Transport of the pumps, aerators etc. to the safer places.	Insurance and microfinance with low interest from Govt. for the repair and maintenance of the infrastructure.

aerators, shelters/huts etc)	aerators.		
(vi) Any other	---	---	---
<b>4. Heat wave and cold wave</b>			
<b>A. Capture</b>			
Marine	Not applicable		
Inland	Not applicable		
<b>B. Aquaculture</b>			
(i) Changes in pond environment (water quality)	---	---	---
(ii) Health and Disease management	---	---	---
(iii) Any other	---	---	---

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