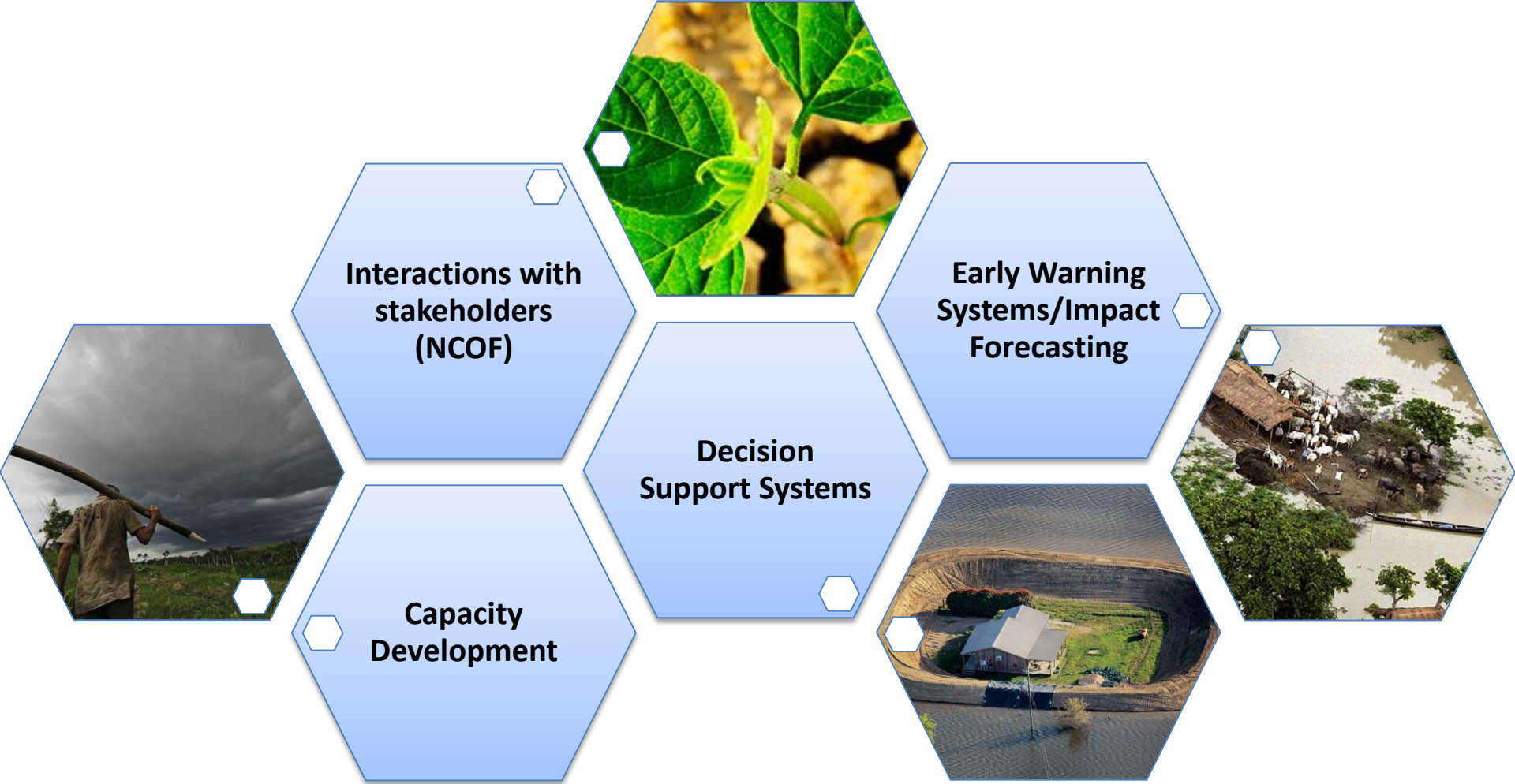


Overview of Strategies and sectors to prioritize the use of climate information

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RIMES

Strategies for enhancing the use of Climate Information



Agriculture – Food security

Health

Water

Ecosystems Services – Bio diversity

Disaster Risks

Energy

Hydropower, Renewables

Infrastructure

Disaster risks

Recommendations

- User awareness workshop of climate information
- Preparation of “Climate of Bhutan” to be taken up on priority basis
- Extended range products to be explored and other new tools like FODAS to be tested.
- Pilot projects with specific climate decision contexts to be identified in sectors

Recommendations (cont.)

- NCOF recognized as ongoing process –and DHMS is taking steps to sustain it through its regular budget
- NCOF frequency – to be held annual for summer monsoon
- NCOF focal points to be identified by key Stakeholders – To be followed by DHMS

1. Overview of sectoral analyses/proposal

SECTOR:	AGRICULTURE	Biodiversity
1. Project /Services	69% of population farmer and employing 56% of total population. Contributes 16% to GDP. Weather and climate information for making decisions in agriculture planning	Climate Sensitivity study in preserving biodiversity with special reference to Agro-biodiversity
2. Description	Provision of climate-based advisory services to farmers growing staple crops as follows: <ul style="list-style-type: none"> • Advisories targeted at specific crops and at different agro-ecological zones. • Forecasts on rain, temperature wind. • Agronomic practices. • Pests and disease management. • Harvests and post harvest practices 	Mountain ecosystems with very diverse micro environments. To preserve this rich biodiversity, sensitivity studies on the effect of climatic parameters on the yield, growth and resistance against pest and diseases specific to a crop variety needs to be conducted. This may include ecological requirements of the existing crops and for the new crops under the changing scenarios.
3. Objective	To achieve food and nutrition security.	Identify climate sensitive areas, sensitive crops and varieties and breeds with reference to the changing climatic scenarios.
4. Benefit	<ul style="list-style-type: none"> • Assist farmers to decide on appropriate farming practices in coping with current climatic risks. • Increased agricultural food productivity and production. • Aid in planning and decision making processes. • Provide information for researchers and extension workers. 	<ul style="list-style-type: none"> • NBC- capacity building for all pattern formulating action plans (NBSAP), • DOA- Policy inputs into the Renewable Natural Resources (RNR) Sector Adaptation Plans (SAPA) and all other related policy documents. • RNRRC- Identify genetic materials for developing new climate resilient varieties and breeds • Farmers- Availability of improved climate resilient crop varieties and breeds. • General Public- Food and Nutrition Security and sustainable utilization of natural resources and preservation of the environment.

1. Overview of sectoral analyses/proposal

SECTOR:	AGRICULTURE	Biodiversity
5. Output	<ul style="list-style-type: none"> • Agromet Advisory Bulletins • Crop Weather Outlooks • Crop yield forecast for planning appropriate interventions • Crop Weather Models, • Crop Weather Calendars • Fortnightly Aridity Anomaly Maps • Warnings for pests and diseases 	Climate sensitive area maps, list of sensitive varieties and breeds.
6. Activities	<ul style="list-style-type: none"> • Constitute a technical working group to co-ordinate the activities. • identification of different agro-climatic zone • identification/establishment of unit responsible for issuing advisory (through research centers). • preparation of format of bulletin • establishment of observatory and communication network • training • involvement of all the stake holders in the field of agriculture • website development • Review meetings with stakeholders. 	<ul style="list-style-type: none"> • Collection of long term series historical data on climate and crops. • Climatic projection for 2030 period. • Downscaling of climate projections for 2030. • Define climate, soil, topography thresholds for target varieties and breeds • Field Surveys. • Biophysical modeling. • Capacity development.

1. Overview of sectoral analyses/proposal

SECTOR:	AGRICULTURE	
7. Inputs	<ul style="list-style-type: none"> • climatic normal of met parameters • real time realised data • medium range forecast • fortnightly/monthly climate outlook • NDVI • other irrigation source • crop input: stage and state • Research and development output • Financial and human resources. 	<ul style="list-style-type: none"> • Historical data on climate. • Historical data on crops and livestock. • Financial resources. • Human Resources. • Tools for analysis and projections. • Logistics. • Soil and DEM
8. Partners	<ul style="list-style-type: none"> • DoA. • RDCs, extension and Local government authorities. • DHMS. • print and broadcast media • telecom service provider • RICB/BIL. 	<ul style="list-style-type: none"> • DoA (RDCs, Extension). • NBC. • DHMS. • Department of Livestock. • College of Natural Resources (CNR). • Ugyen Wangchuck Institute of Conservation and Environment (UWICE).

2. Overview of sectoral analyses/proposal

SECTOR:	ENERGY
1. Project /Services	<ul style="list-style-type: none"> • Historical data/climatological data up to 50 years • Seasonal forecast for the operation and maintenance of Hydropower Plants • Climate projections for planning design of future hydropower plants/transmission & distribution
2. Description	<ul style="list-style-type: none"> • Quality controlled, Time series of meteorological-hydrological variables • Seasonal forecast of rainfall & temperature • Snow melt data and Sedimentation • Information on future climate scenarios in Bhutan for expansion of renewable (Hydropower, wind, solar & biomass energy) energy • Design of Transmission & Distribution structures in Bhutan
3. Objective	<ul style="list-style-type: none"> • Cost effectiveness in planning, design, construction and operation of hydro projects • Optimize management of water resources in context of hydropower operation • Continuous reassessment to maintain optimal balance between power generation & downstream water for community needs & environmental flow • Sector relevant information for energy planning for medium and long term timescale • Guide future investment in Bhutan for energy sector
4. Benefit	<ul style="list-style-type: none"> • Efficient & effective operation of hydropower plants (operating rule and levels) • Increase flexibility in balancing power generation • better risk management/assessment • Increase resilience for preparedness of hazard downstream of dam • Maximize generation of power (using the forecast data) • Sustainable power supply (Augmentation wherever possible) • Reduce the cost of maintenance of hydropower plants (Machine breakdown) • Informed decision for energy investment (economical & political leaders) • Contribute towards achieving the goal of self-sufficiency

2. Overview of sectoral analyses/proposal

SECTOR:	ENERGY		
5. Output	<ul style="list-style-type: none"> Precipitation time series including annual rainfall duration curve Soil moisture, River flow including duration curve, wind, temperature and humidity Soil type, Land use, Glacier volume data Sediment (composition of bed load) including sediment rating curve 	<ul style="list-style-type: none"> Landslide events, Seasonal forecast of river run-off & sediment, Early warning systems Snow melt contributions Future scenarios of all variables Sub-sector climate relevant information on future scenarios, 	
6. Activities	<ul style="list-style-type: none"> downscale of reanalysis combined with in-situ observation for optimal interpolation Evaluate the usefulness of satellite data Improve seasonal forecast, National Climate Outlook Forum (NCOF) products Pilot on applicability of the received data 	<ul style="list-style-type: none"> Model assessment & development Analysis of global/downscaled models, Assessment/inventory of existing global/regionals climatic scenarios Generate output for relevant sub-sectors Estimate uncertainties and communication of the output (collaborate with sub-sectors) 	
7. Inputs	<ul style="list-style-type: none"> Capacity development of DHMS Enhance analytical skills Expertise River run-off model Hydrological models 	<ul style="list-style-type: none"> Sedimentation model Reservoir simulation model Historical data for verification of models Research on combination of different models/ information to have robust data 	
8. Partners	<ul style="list-style-type: none"> International Climate Centers Regional Climate Centers Regional hydro-met Centers ICIMOD, Nepal RIMES, Thailand 	<ul style="list-style-type: none"> WMO IMD, India DHMS, BPC, DHPS, NEC, BEA 	<ul style="list-style-type: none"> Decision makers , researchers, Regulators (BEA, NEC, DoA, DoFPS, etc.) World climate research programs IPCC

3. Overview of sectoral analyses/proposal

SECTOR:	DISASTER RISK REDUCTION	
1. Project /Services	Disaster Information System for Bhutan	Rainfall Run-Off Modeling for Small Catchments
2. Description	<p>Phase 1: A database that integrates information about past hydro-meteorological events, their causes, effects and impacts</p> <p>Phase 2: A system that evaluates impacts of future events, based on historical database</p>	<ul style="list-style-type: none"> • Generation of hydrological behavior of small catchments using 10 days forecast
3. Objective	<ul style="list-style-type: none"> • Understanding individual hazard/disaster • Provide inputs for facilitating disaster statistics • Deriving lessons for guiding mitigation and preparedness, preventing future losses 	<ul style="list-style-type: none"> • Provide guidance on the likely water condition in the coming 10 days • Overall reaction of small catchments of (intensive) rainfall • Provide early warning for preparedness
4. Benefit	<p>Department of Disaster Management: lessons for disaster management, build back better concept</p> <p>Research Institutions: models</p> <p>Insurance Companies: basis for underwriting</p> <p>Environment Commission: input for state of environment reporting, input for baseline</p> <p>Department of Engineering Services: design criteria</p> <p>Development Planners: hazard and risk assessment for feeding into design criteria</p>	<p>Department of Disaster Management: disaster preparedness</p> <p>Public Authorities: reduction of damages and economic losses</p> <p>Department of Engineering Services, Flood Engineering Management Division: design criteria (based on long-term discharge data)</p>
5. Output	<ul style="list-style-type: none"> • Events distribution map • Disaster statistics 	<ul style="list-style-type: none"> • Rainfall discharge model • 10 days water discharge outlook

3. Overview of sectoral analyses/proposal

SECTOR:	Disaster Risk Reduction	
6. Activities	<p>Database design, to include GIS : Database system development</p> <p>Data collection : Data collection guideline (to include data collection methodologies, i.e. from most recent to past) Capacity building in data collection</p> <p>Quality Control Validation of data</p> <p>Data analysis</p> <p>Data dissemination</p>	<p>Model development Model calibration Model testing Translation of model outputs into management strategies</p>
7. Inputs	<p>Dedicated personnel in DHMS, DDM, DES, NEC, DGM Hardware (computer, server) GIS software (open-source) Capacity building of relevant personnel</p>	<p>Dedicated personnel in DES, DHMS (in collaboration with research institutions/universities) Hardware (computer, server) Modeling software Capacity building of relevant personnel</p>
8. Partners	<p>DHMS DDM DES NEC DGM Insurance companies Media</p>	<p>DES DHMS Research institutions/universities DDM NEC DGM</p>

4. Overview of sectoral analyses/proposal

SECTOR:	HEALTH	
1. Project /Services	<ul style="list-style-type: none"> Integrated surveillance or risk monitoring for climate sensitive diseases 	<ul style="list-style-type: none"> Seasonal outlook for malaria control programmes
2. Description	<ul style="list-style-type: none"> Pilot EW info for diarrhoea based on results from initial 4 districts (maybe for internal use) Data collection and research on climate sensitivity for possible expansion to additional 9 districts 	<ul style="list-style-type: none"> Pre-monsoon outlook for vector control programme
3. Objective	<ul style="list-style-type: none"> Reduced incidence of diarrhoeal cases through early warning information to the public and health authorities tested and piloted Strengthened surveillance system Establishment of climate-disease relationships Research results incorporated in EWS 	<ul style="list-style-type: none"> Reduce/prevent malaria outbreaks Resource efficiency and effectiveness of programmes (drainage, spraying, nets, cisterns, treatment preparation) based on expected seasonal rainfall
4. Benefit	<p>The ultimate beneficiaries are affected communities who will experience improved climate-related health outcomes; in the short term the beneficiaries will be health professionals who will gain the knowledge necessary for the establishment of the system.</p>	<p>Increased happiness: The ultimate beneficiaries are the communities, who experience reduced malaria incidence; public health authorities and control programme and post-season surveillance programme benefit through resource optimization</p>
5. Output	<ul style="list-style-type: none"> Diarrhoeal health advisories, backed by communication channels, identified appropriate actions and response plans Strengthened surveillance system (including on-going data collection, databases and analysis) Evidence base (data and analysis) on climate-disease relationships sufficient to support EWS 	<ul style="list-style-type: none"> pre-season outlook including onset, cessation and total precipitation of the monsoon, at the most localized spatial resolution possible Advisories to Community Health Action Groups response and surveillance actions and plans incorporating outlook information