UN Climate Technology Centre and Network (CTCN), an operational arm of UNFCCC

Ministry of Forests and Environment, Government of Nepal

Customized weather and climate information system for climate-resilient agriculture in Nepal

Contract No.: UNEP/2022/339 (Umoja # 4700023937)

Report on mapping of stakeholders and establishing a stakeholder working group

6th April 2023

Acknowledgements

This Technical Assistance (TA) awarded by the UN-CTCN to RMSI a firm based in New Delhi (India) is duly acknowledged.

The study team would like to acknowledge and express heartfelt gratitude to Ms. Clara Landeiro (Regional Manager, Asia-Pacific, UN-CTCN) for providing her valuable support and directions in this project. We are also grateful to Mr. Sharad Babu Pageni (Under Secretary, CCMD, Ministry of Forests and Environment, Govt. of Nepal) and Dr. Buddi Poudel (Joint-Secretary and Chief, Ministry of Forests and Environment, Govt. of Nepal) for their guidance and support.

We would like to extend our sincere gratitude to Mr. Dhiraj Pradhananga (Project Proponent) from The Small Earth Nepal (SEN) for his support from the very onset of the TA.

Finally, we would like to extend our special thanks to all other stakeholders for providing necessary data and information required for the project and extending their full cooperation in this TA.

Table of content

List of Acronyms

3SF	3S Foundation
AITC	Agriculture Information and Training Center
AKC	Agricultural Knowledge Centre
API	Application Programming Interface
CCMD	Climate Change Management Division
CTCN	Climate Technology Centre and Network
DHM	Department of Hydrology and Meteorology
DOA	Department of Agriculture
KKC	Krishi Knowledge Centre
MOALD	Ministry of Agriculture and Livestock Development
MOFE	Ministry of Forests and Environment
NARC	Nepal Agricultural Research Council
NDE	National Designated Entity
NFGF	National Farmers Group Federation
PP	Project Proponent
SEN	The Small Earth Nepal
SWG	Stakeholder Working Group
TA	Technical Assistance
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change

1 Report on the mapping and establishment of the Stakeholder Working Group (SWG)

1.1 Technical Assistance (TA) title

Customized Weather and Climate Information System for Climate-Resilient Agricultural System in Nepal.

1.2 Technical Assistance (TA) objective

Objective of the study is to develop an Application Programming Interface (API) for the automatic dissemination of location-specific customized 3-days weather forecast to the farmers in a user-friendly language through appropriate dissemination mechanisms that will be tested in selected communities in Nepal. The study envisages to customize the weather and climate information products being issued by the Department of Hydrology and Meteorology (DHM) to the needs of the local farmers. The assignment will adopt a participatory approach with the objective to bridge the ever-existing gaps between the weather/climate change science and their users.

Please note that this report highlights on the mapping and establishment of the Stakeholder Working Group (SWG),

1.3 Mapping and establishment of SWG

At first project team identified the relevant stakeholders and subsequently established a SWG in consultation with the National Designated Entity (NDE) and Project Proponent (PP). Following the establishment of the SWG, a physical meeting was conducted in Kathmandu details of this meeting has been provided in the below given sections.

1.4 Date and time of the SWG meeting

3rd April 2023 (Monday) from 08.30 AM to 2.00 PM (Nepal time)

1.5 Venue of the SWG meeting

Hotel Himalaya, Kupondole Height, Lalitpur, Kathmandu, Nepal

1.6 Objective of the first SWG meeting

The aim of this first SWG meeting was to have a face-to-face interaction with the stakeholders, explain the objective of the study in detail, anticipated outcomes, and expected support required from the SWG. During the meeting we will raise the fact that community/province should be selected in Nepal to test the API that will be developed under this assignment. The agenda of the SWG meeting is furnished in **Annexure - 1**.

1.7 Meeting Proceedings

1.7.1 Opening and Welcome remark by the CTCN-National Designated Entity (NDE)

Mr. Sharad Babu Pageni (MOFE/CCMD) opened the SWG meeting and welcomed all the participants. In his remarks, he thanked the stakeholders for making it possible to attend this meeting. He assured the SWG members to provide his full support during this TA implementation. He noted the growing demand for weather forecast and associated customized agro-met advisories services by the stakeholders who are involved in the agricultural sector including farming communities. Furthermore, he underscored the importance of this type of API which will be developed under this assignment.

1.7.2 Introduction of SWG members

Following the opening of the meeting, all the participants introduced themselves. Below given are the names and affiliation of the members who attended this meeting and the members who were unable to attend because of some other commitments. Contact details of the selected SWG members and invitee members have been furnished in **Annexure - 2**. Furthermore, roles of the selected SWG members have been provided in **Annexure – 3.**

A. <u>Attendees (refer Annexure - 4 for the attendance sheet and Annexure - 7 for some meeting photographs):</u>

1. Mr. Sharad Babu Pageni, Ministry of Forests and Environment (MOFE)/ Climate Change Management Division (CCMD)
2. Ms. Shila Gnyawali, Ministry of Forests and Environment (MOFE), CCMD
3. Mr. Saroj Kanta Adhikari, Agriculture Information and Training Center (AITC)
4. Ms. Nicky Shree Shrestha, The Small Earth Nepal (SEN)
5. Mr. Govind Kumar Jha, Department of Hydrology and Metrology (DHM)
6. Mr. Shiva Sundar Ghimire, Department of Agriculture (DOA)
7. Mr. Pancha Kaji Shrestha, National Farmers Group Federation (NFGF)
8. Mr. Lakshya Bahadur Chaudhary, Ministry of Agriculture and Livestock Development (MOALD)
9. Mr. Rameshwar Rimal, Nepal Agricultural Research Council (NARC)
10. Ms. Sunita Nhemaphuki (3S Foundation, NGO)
11. Dr. Uttam Singh (RMSI)
12. Dr. Rajendra Uprety (RMSI
13. Dr. Sujata Tamang (RMSI)

B. <u>Apologies (i.e., persons who did not attend after confirmation due to some unavoidable reasons):</u>

1. Ms. Binu Maharjan, Department of Hydrology and Metrology (DHM), (Staff College training)
2. Ms. Deepa Shrestha, Krishi Knowledge Centre (KKC), Lalitpur.

1.7.3 Presentation by the Project Proponent (PP) on Technical Assistance (TA) background

Ms. Nicky Shree Shrestha from The Small Earth Nepal (SEN) presented on TA background and RMSI involvement with this project and its roles. Power Point Presentation of this presentation is given in **Annexure - 5**.

1.7.4 Presentation by RMSI on detailed TA objective, scope of work, methodological approach, and expected outcomes

RMSI team presented the overview of the project which highlighted on the project objective, scope of work, proposed technical methodology, team members' profile, project outcome, roles & input required from the SWG members, and RMSI experiences in other countries in similar projects and their projects' performances in those countries. Power Point Presentation of this presentation is given in **Annexure - 6**.

1.7.5 Q&N and discussion session

Following the presentation, there had been Q&N and discussion session during which following key points were discussed:

- Reliable weather information at the appropriate time availability is very important. Hence, end user friendly access to weather forecast based customized products should be considered while implementing this TA.
- Dissemination through mobile SMS is only suitable for short information. Hence, for detail location and crop specific weather forecasts and associated agro-met advisories other dissemination mechanisms should be explored.
- Farming, crop insurance, and weather forecast are interconnected so they should be integrated together appropriately and try to link more and more farmers by using appropriate means of communication.
- It will be useful to link the weather forecast system with local governments, FM radios, and other active audio/visual media/communications.
- Department of Hydrology and Metrology (DHM) is very much open to provide reliable and updated weather-related information if concerned institutions approach formally. DHM is planning to increase the short-term weather forecast from existing 3-day to 5-day in near future. However, it is very important to consider sustainability of the new-system.
- Information on the weather forecast and crop-specific advisories must be in the local language. The audio message such as IVRS system will be more useful for many farmers who are unable to read and write.
- There should be feedback mechanism in the new system for the continuous improvement in the system as per the requirements.
- For the piloting to test the developed Application Programming Interface (API), project team should consider agroecological diversity which will be discussed latter.

- We need to review the past experiences (positive/negative) of similar projects and think about new system sustainability.

1.7.6 Decisions taken during the meeting

A. Selection of SWG chairman and secretary - SWG members unanimously selected Mr. Saroj Kanta Adhikari [Agriculture Information and Training Center, (AITC)] as a SWG chairman and Mr. Govind Kumar Jha [Department of Hydrology and Metrology (DHM)] as a SWG secretory.

B. To support this project implementation, SWG can invite other invitees if necessary, such as SWG will invite a local farmer's group representative as an invited member from the next SWG meeting in consultation with Agricultural Knowledge Centre (AKC), Lalitpur.

C. During the SWG meeting, proposed piloting sites were discussed but the selection of the communities to test the API (piloting sites) that will be developed under this TA will be decided in the next SWG meeting.

D. Dr. Uttam (RMSI) will send the Questionnaire for "Weather Forecast and Agro-met Service Provider" and "Questionnaire for Weather Forecast and Agro-met Service Users" to all SWG members for providing their inputs. It should be noted that these two questionnaires have already been send to the SWG members at the time of drafting this report.

E. Dr. Uttam addressed SWG members' queries and comments and on behalf of NDE Mr. Sharad Babu Pageni thanked all participants.

1.7.7 Concluding Remarks

Mr. Sharad Babu Pageni (MOFE/CCMD) delivered the closing remark before successfully ending the first SWG meeting. In his remarks, he focused on the quality of the project, completion on time, usefulness, and practicability to farmers and timely reporting of the project to NDE. He thanked the stakeholders for the enthusiastic participation in this useful meeting which will help to bring all the relevant stakeholders on one platform and provide their guidance for the successful implementation of this important study for the country. He assured his full support throughout the project duration. Finally, this meeting ended with positive note.

Annexure - 1: Agenda of the SWG meeting

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Customized Weather and Climate Information System for Climate-Resilient Agricultural System in Nepal

Stakeholder Working Group (SWG) Meeting Programme

Date: 3rd April 2023 (Monday); **Venue:** Hotel Himalaya, Kupondole Height, Lalitpur, Kathmandu

Time	Activity	Responsibility
08.30 – 08.45	Registration	RMSI
08.45 – 09.00	Introduction	All participants
09.00 – 09.15	SWG meeting opening	NDE (Ministry of Forests and Environment)
09.15 – 10.00	Health Break	RMSI
10.00 – 10.30	Presentation on Technical Assistance (TA) Background	Project Proponent (PP) – The Small Earth Nepal
10.30 – 11.30	Presentation on objective of the TA, milestones, anticipated outputs, and role of the SWG	RMSI – Dr. Uttam Singh
11.30 – 12.00	Q&N and Discussion	All participants
12.00 – 12.45	Selection of the community/province to test the API that will be developed under this TA	NDE/PP/SWG/RMSI
12.45 – 13.00	Selection of SWG lead	Members of SWG
13.00 – 13.15	Closing remark	Selected lead of the SWG
13.15 – 14.00	Lunch and departure	RMSI
Facilitators will be RMSI's national experts: Dr. Rajendra Uprety and Dr. Sujata Tamang		

Contact for any query: Dr. Rajendra Uprety (Email: upretyr@hotmail.com; M: +977-9842050835) / Dr. Sujata Tamang (Email: sujutamang@gmail.com;+977-9841444353) / Dr. Uttam Singh (Email: uttam.singh@rmsi.com; M: +91-9968179986).

Annexure - 2: Contact details of SWG members and invitee members

Sr. #	Name of the SWG	Organization	Telephone	Email
		SWG members		
1	Mr. Sharad Babu Pageni	Ministry of Forests and Environment (MOFE)/ CCMD	9841484987	sbpageni@gmail.com
2	Ms. Shila Gnyawali	Ministry of Forests and Environment (MOFE), CCMD	9849852716	shila.gnyawali.2022@gmail.com
3	Mr. Saroj Kanta Adhikari	Agriculture Information and Training Center (AITC)	9841728004	sarojkantaadhikari@gmail.com
4	Ms. Nicky Shree Shrestha	The Small Earth Nepal (SEN)	9841622510	nicky@smallearth.org.np
5	Ms. Binu Maharjan	Department of Hydrology and Metrology (DHM)	9841899373	Maharjan.binu@gmail.com
6	Mr. Govind Kumar Jha	Department of Hydrology and Metrology (DHM)	9846265433	govind.met79@gmail.com
7	Mr. Pancha Kaji Shrestha	National Farmers Group Federation (NFGF)	9851222779	panchakajishrestha@gmail.com
8	Ms. Deepa Shrestha	Krishi Knowledge Centre (KKC), Lalitpur	9851150071	sdipa908@gmail.com
9	Mr. Ramshwar Rimal	Nepal Agricultural Research Council (NARC)	9851044130	rameshwarrimal@gmail.com
10	Ms. Sunita Nhemaphuki	3S Foundation NGO	9851140610	sunita@agrinepal.com
		Invitee members		
1	Mr. Shiva Sundar Ghimire	Department of Agriculture (DOA)	9841373902	ghimiresss@yahoo.com
2	Mr. Lakshya Bahadur Chaudhary	Ministry of Agriculture and Livestock Development (MOALD)	9841500385	lakshyachau@gmail.com

Annexure - 3: Roles of the SWG members

Sr. #	SWG member	Organization	Roles of the SWG members
1	Mr. Sharad Babu Pageni	MOFE	• To provide overall guidance and oversight of RMSI implementation of the project. • To facilitate in arranging data and information from different departments in Nepal. • To introduce RMSI team with the relevant stakeholders and institutions in Nepal. • To provide technical guidance wherever will be required during the project implementation. • To review the deliverables and provide feedbacks. • To provide deliverables' approval.
2	Ms. Shila Gnyawali	MOFE	
3	Mr. Saroj Kanta Adhikari	AITC	• To lead the SWG as a chairman of the group. • To provide technical guidance wherever will be required during the project implementation. • To support RMSI team during pilot testing of the developed Application Programming Interface (API). • To review the deliverables and provide deliverables' acceptance.
4	Ms. Nicky Shree Shrestha	SEN	• To provide necessary support to RMSI including facilitation to connect RMSI with the relevant stakeholders and institutions in Nepal. • To provide technical guidance wherever will be required during the project implementation. • To review the deliverables and provide feedbacks. • To provide deliverables' approval.
5	Ms. Binu Maharjan	DHM	• To provide all meteorological related data and information including NWP 3-day weather forecasts products of DHM. • Detailed configuration of High-Performance Computer (HPC) system where WRF model is installed and run. • To provide inputs on how many weather variables (e.g., rainfall, maximum temperature, minimum temperature, relative humidity, etc.) are used to generate agro-met advisories. • To provide technical guidance to RMSI team during project implementation. • To review the deliverables and provide feedbacks.
6	Mr. Govind Kumar Jha	DHM	

Sr. #	SWG member	Organization	Roles of the SWG members
7	Mr. Pancha Kaji Shrestha	NFGF	• To provide technical guidance wherever will be required during the project implementation. • To support RMSI team during pilot testing of the developed API.
8	Ms. Deepa Shrestha	KKC, Lalitpur	• To provide relevant agricultural related information such as types of crop are grown in different province/district, cropping calendar, etc. • To provide technical guidance wherever will be required during the project implementation. • To support RMSI team during pilot testing of the developed API.
9	Mr. Ramshwar Rimal	NARC	• To provide agricultural related data and information. • To provide inputs on what types of agro-met advisories are generated and disseminated to the farming communities. • To share approach on how NARC prepare agro-met advisory bulletins and subsequently how they disseminate the bulletin to the users. • To provide technical guidance to RMSI team during development of API. • To review the deliverables and provide feedbacks.
10	Ms. Sunita Nhemaphuki	3SF	• To provide technical guidance wherever will be required during the project implementation including API development mechanism. • To support RMSI team during pilot testing of the developed API. • To review the deliverables and provide feedback.

Annexure - 4: attendance sheet of the participants

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Attendance sheet for UN-CTCN project SWG meeting held on 3rd April 2023 at Hotel Himalaya, Lalitpur, Kathmandu, Nepal

Sr. #	Name	Organization	Address	Telephone	Email
1	Pancha Kaji Shrestha	NFGE, Nepal	Ktm, toKhan-1	9851222779	Panchakaji.shrestha@gmail.com
2	Dr. Rajendra Uprety	RMSI	Biratnagar, Nepal	9852070301	uprety@hotmail.com
3	Nicky Shree Shrestha	SEN	Gurasko	9841622510	nicky@smallearth.org.np
4	Shila Gnyawali	MoFE, CCMD	Singhadurbar, KTM	9841852716	shila.gnyawali.2022@gmail.com
5	Shaad Babu Pageri	MoFE/CCMD	" "	9841484987	[redacted]sbpageri@gmail.com
6	Saroj Kanta Adhikari	MoALD-AITC	Lalitpur	9841728004	sarojkantaadhikari@gmail.com
7	ShivaSundar Ghimire	DOA	Lalitpur	9841373902	ghimiresss@yahoo.com
8	Lakshya Bahadur Chaudhary	MoALD.	Singhdurbar Kathmandu	9841500885	lakshyacsu@gmail.com

CTCN

United Nations Nations Unies

RMSI

Attendance sheet for UN-CTCN project SWG meeting held on 3rd April 2023 at Hotel Himalaya, Lalitpur, Kathmandu, Nepal

Sr. #	Name	Organization	Address	Telephone	Email
9	Govind Kumar Jha	Department of Hydrology & Meteorology (DHM)	Babarmahal, Kathmandu	9810626533	govind.mcl 45 @ gmail.com
10	Rameshwar Rimal	Nepal Agricultural Research Council (NARC)	Khumaltar, Lalitpur	9851044130	rameshwarrimal@gmail.com
11	Sunita Nhemaphuki	3S Foundation	New Baneshwor	9851140610	sunita.nhemaphuki@gmail.com
12	Sujata Pomang	Forest Action Nepal	Bagdol, Lalitpur	9841000353	sujatamang@gmail.com
13	Dr. Uttam Singh	RMSI	Noida, India	+91-9968179958	UTTAM.SINGH@RMSI.COM
14					
15					
16					

Annexure - 5: Slides of the PPT being used by SEN during the SWG meeting presentation

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Submission of the technical assistance (TA)

- SEN, a non-government organization filled in a *Technology Concept Submission Form*.
- Developed an application in close consultation with its national focal points to the Adaptation Fund (Designated Authority) and the CTCN NDE (Series of meeting held).
- The application was endorsed by the Designated Authority and the NDE of the country prior to an official submission.
- The NDE of Nepal signed the application before online submission to UNEP-CTCN (Jan 2021).
- The TA Response Plan was signed on October 2021 by the Proponent, CTCN and NDE.

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Roles played by NDE

- Ensured that requests submitted to the CTCN reflect their national circumstances and priorities.
- Ensured that support provided by the CTCN is well coordinated at the national level with other processes that address climate change.
- Facilitated support to the country from the CTCN by:
  - Serving as National Focal Point on CTCN activities.
  - Supporting the articulation and prioritization of requests and proposals.
  - Managing the national submission process of technical assistance requests to the CTCN.

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Overview and Problem statements

1. Nepal is one of the world's most climate vulnerable countries mainly due to its weak technical and financial capability to respond to increased climate change variability.
2. Particularly threatens Nepal's agriculture sector which are highly dependent on water resources and other climate-sensitive resources.
3. Nepal's agricultural sector alone employs over two-thirds of the labor force and contributes to roughly one-third of the country's GDP.
4. Food insecurity

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Specific technology barrier

1. Lack of dissemination mechanism to the end users about the weather forecast produced by the national bodies.

Requirement

1. Bridging the ever-existing gaps between the weather/climate change science and their users and to establish the possibility of utilizing the science of weather and climate in the daily lives of the farmers for managing climate risks.

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Project Aim

To develop **climate resilient agriculture systems** through customization and dissemination of weather forecasts to small-holder farmers in a user-friendly language.

Major targeted beneficiaries:

1. Smallholder farmers including women farmers, ethnic minority
2. Policy makers
3. Meteorological Forecasting Division, Department of Hydrology and Meteorology

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Major aspects focused by the project

1. Promote proactive decision making by developing an **application programming interface (API)** for the automatic dissemination of weather forecast to the selected farmers of the village through **mobile SMS**.
2. **Weather information boards** (Digital/manual) will be installed in the selected locations to provide an updated three-day weather forecast (today, tomorrow and the day after tomorrow).
3. **Community learning centres (CLCs)** will be established with the participation of local communities for providing agrometeorological knowledge, relevant to the local people, including the launch of mobile application by DHM.

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Possible implementation sites

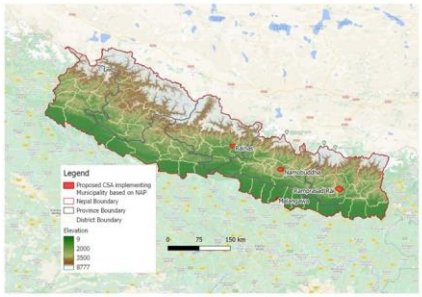


Figure: Map of Nepal showing the study area of the project

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Major Activities

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Outputs

Output 1: Development of implementation planning and communication documents

Output 2: Map Stakeholders and establish a stakeholder working group

Output 3: Diagnose the existing system and define the needs

Output 4: Design an application programming interface (API) for the automatic dissemination of location specific customized 3-days weather forecast

Output 5: Design the interface to disseminate location-specific customized 3-days weather forecast to farmers using identified communication mechanisms including mobile and Internet-based SMS

Output 6: Test the designed API and identified communication mechanisms including mobile- and Internet based SMS technologies in the selected communities

Output 7: Deploy the system in the selected communities, build capacity of local government, farmers and civil society, and develop strategy for upscaling the system

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Outcome

TA financed by the UNEP-CTCN AFCIA programme could facilitate the implementation and replication of a weather forecasting system in Nepal, supporting to achieve the goal and the strategies of NAP, NDC and National Climate Change Policy of the country.

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Alignment with National Strategies

1. The project will test a customized set of weather forecast products for smallholder farmers for increased access to climate-smart agricultural technologies which falls under the coverage of the Nationally Determined Contribution (NDC) - **Agriculture, Forestry and Land Use (AFOLU).**

1. The project strengthens and establishes **Public Weather Services (PWS), including the Agro-Meteorological Information System**, which falls under the Key policy priorities of Nepal on adaptation

TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES

Alignment with National Strategies

3. The project focuses on thematic area (**Agriculture and Food Security**) and cross-cutting area (**Research, Technology Development and Extension**) under the adaptation priorities as per the National Climate Change Policy (2019).

3. The project will integrate **Gender Equality and Social Inclusion (GESI)** target of NDC through involvement of women, children, youth, indigenous peoples and marginalized groups in consultations and workshops at national, district and village levels in order to incorporate their voices into the development of the customization and dissemination mechanism and climate-change-related policy.


पुरुन्चौर मौसम पूर्वानुमान सूचना पाटी
LATITUDE : 28°17'30.9"N | LONGITUDE : 28°17'30.9"N | ALTITUDE : 1140M
हिजो
आज
भोलि
पर्सि


TOGETHER WE STAND FOR SUSTAINABLE LIFESTYLES
THANK YOU


Customization of Weather Information and Climate Services to Smallholder Farmers
A Pilot Project, Seti Watershed, Kaski
Puranchaur, Kaski
USAID
Thank you

Annexure - 6: Slides of the PPT being used by RMSI during the SWG meeting presentation

United Nations Nations Unies

Customized weather and climate information system for climate-resilient agricultural system in Nepal

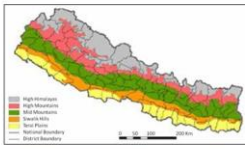
Dr. Uttam Singh, Dr. Rajendra Uprety, and Dr. Sujata Tamang

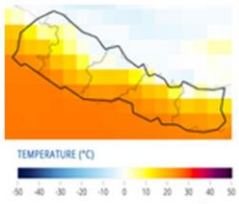
RMSI

3rd April 2023

Background of the study

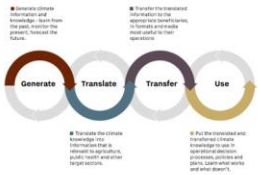
- Nepal is one of the world's most **climate vulnerable countries** mainly due to its weak technical and financial capability to respond to increased climate change variability.
- Increased climate variability in future will further **increase the frequency & severity of the climatic hazards** which will cause increased risk to vulnerable sectors.
- Climate change already reflects in **erratic rainfall**, which negatively affects agricultural sector which employs about 65% of total employment and contributes to nearly 26.5% of the country's GDP.
- Hence, **managing risk** with variable climate is a key to successfully develop the climate resilient agricultural system under the face of climate change.



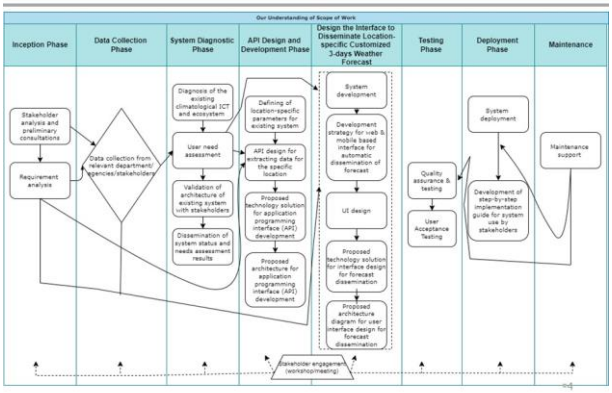


Objective of the study

- Although lots of climate and weather data and information are available at national agencies such as DHM in Nepal but this country lacks a formal system to disseminate to the relevant decision-maker in rural and remote areas which hinders the agricultural systems to be climate-smart and more productive.
- Hence, there is need to develop an application programming interface (API) for automatic dissemination of location-specific **customized 3-days weather forecast** to farmers in a user-friendly language through appropriate dissemination mechanisms that will be tested in selected communities in Nepal.



Scope of the study



Stakeholder analysis and establishment of SWG

- The key to the success of the project would be to involve the key institutions stakeholders and potential users of customized weather and climate information products for the farming communities to meet their requirements. Following are the relevant institutions:
  - Ministry of Forests and Environment;
  - Department of Hydrology and Meteorology (DMH);
  - Ministry of Agriculture and Livestock Development (MoALD);
  - Nepal Agricultural Research Council (NARC);
  - Krishi Gyan Kendra (KGK);
  - NGOs;
  - Farmers' association, etc.
- A working group of 10 persons will be created comprised of professionals in the agricultural sector, climatology, meteorology, early warning services, representatives of farmers, and mix of male, female, youth.

Inception meeting with SWG, meteorologists, and forecasters

- Following the formation of SWG, we will conduct one inception meeting with them to introduce the team of experts, the goals, milestones, anticipated outputs, and role of the SWG.
- Communities will be selected in Nepal to test the our developed API in consultation with the SWG.

Diagnose the existing climatological and meteorological information system in Nepal

- Project team will assess the existing status of climate/weather data provider (e.g., DHM) and agro-met service provider [i.e., jointly by DHM and Nepal Agricultural Research Council (NARC)]. Following are the key parameters, which we will review through bilateral interviews and meetings with the relevant working group stakeholders:
  - Institutional structure, governance and its mandate;
  - The current process of generating weather forecast data of different ranges;
  - Understating of the data being generated using NWP) and WRF-EMS models;
  - Current infrastructure including architecture of existing Meteorological Information System, skills, and resources available;
  - Climate data management system currently in use, if any;
  - Existing climate data, products, and services and associated data formats;
  - Data access and security requirements;
  - Meteorological including weather forecasted data dissemination mechanisms;
  - Quality control and quality assurance issues;
  - Manpower strength and their training requirements;
  - Documents on the current systems and future requirements;
  - User Interface availability and future requirements.

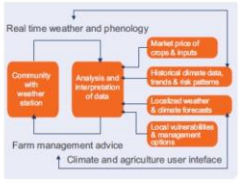
*7

Meetings with the SWG, meteorologists, and weather forecasters to validate the architecture of the existing system

- A meeting will be organized with the SWG and in presence of meteorologists and forecasters to validate the architecture of the existing system.
- Besides, based on the information obtained, the team will undertake a SWOT analysis of the existing institutional architecture, capacity assessment (existing and potential), process of quality assurance, and access conditions and protocols. The process would help identify major bottlenecks (in terms of technical capacity, infrastructure and ICT) and develop a vision to strengthen DHM capacity in providing user-specific tailored weather/climate information to end users so that users can apply these services in their practical purposes such as farming practices.

Weather and climate service users' need assessment

- User needs assessment will be conducted with the agencies that use weather forecast information and customized products in their operational activities (e.g., agricultural departments, agricultural cooperative, NGOs which are involved in agricultural sector, etc.) to explore what is required to improve service delivery to meet user needs for each agency.
- To interact with the farmers' organization to assess their needs for the weather forecast information and agro-met services. The needs assessment will be conducted using a structured questionnaire to interview officials of the departments, and farmers' organization.



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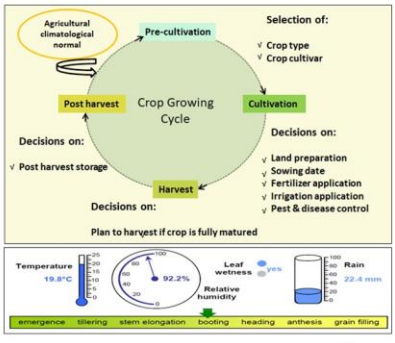
Weather and climate service users' need assessment...contd.

- Do weather forecasts for agricultural sector meet the needs of farmers in terms of decision support?
- How should climatological data be transformed to allow agricultural management?
- How could the current 3-days forecasts be sharpened, improved to have a greater impact on decision-making?
- What are the relevant data for the users and how should they be organized? (Consecutive days of rain in mm, number of days of rain, number of days where it rains more than 20mm, maximum number of days without rain, etc.)
- Is the degree of uncertainty of a data a problem? How can the uncertainty be reduced?
- Who will the information be directed to?
- Should the information system allow farmers to provide timely feedback on the information received, and its performance?
- Etc.

*10

Main decisions to be made for the farming

- Advisories required based on forecasted weather are:
  - ✓ Crop field selection
  - ✓ Crop type selection
  - ✓ Crop variety selection
  - ✓ Sowing time
  - ✓ Fertilizer application
  - ✓ Pesticide application
  - ✓ Irrigation applications
  - ✓ Pests & diseases control
  - ✓ Harvest time
  - ✓ Post harvest conditions



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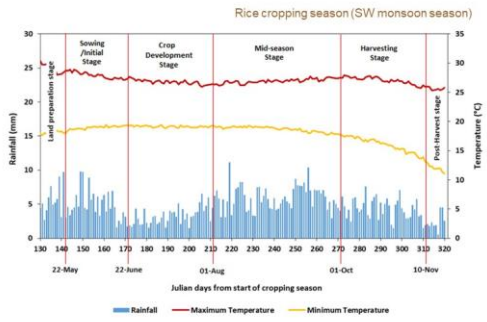
Climatological Normal: Daily temperature and rainfall trends



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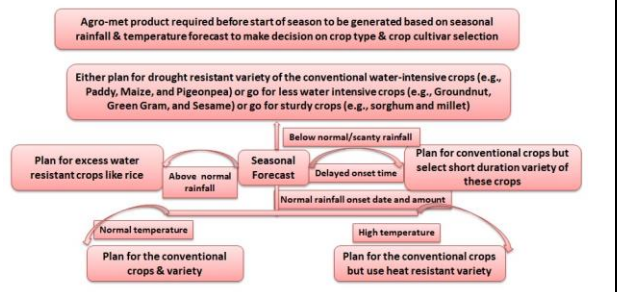
Types of actionable weather forecast-based agro-met advisory
Agro-met product required before start of season to be generated based on seasonal rainfall & temperature forecast to make decision on crop type & crop cultivar selection
Either plan for drought resistant variety of the conventional water-intensive crops (e.g., Paddy, Maize, and Pigeonpea) or go for less water intensive crops (e.g., Groundnut, Green Gram, and Sesame) or go for sturdy crops (e.g., sorghum and millet)
Below normal/scanty rainfall
Plan for excess water resistant crops like rice
Above normal rainfall
Seasonal Forecast
Delayed onset time
Plan for conventional crops but select short duration variety of these crops
Normal rainfall onset date and amount
Normal temperature
High temperature
Plan for the conventional crops & variety
Plan for the conventional crops but use heat resistant variety
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Types of actionable weather forecast-based agro-advisory...contd...
Agro-met product required after start of season to be generated based on 3-day rainfall forecast to plan for fertilizer & pesticide application
It is ideal time to apply fertilizer & pesticide if require as no rain is expected during next 3 days.
No rain is expected
3-day rainfall forecast
Rain is expected
Application of any fertilizer & pesticide is not recommended even if it is required as rain is expected during next 3 days.
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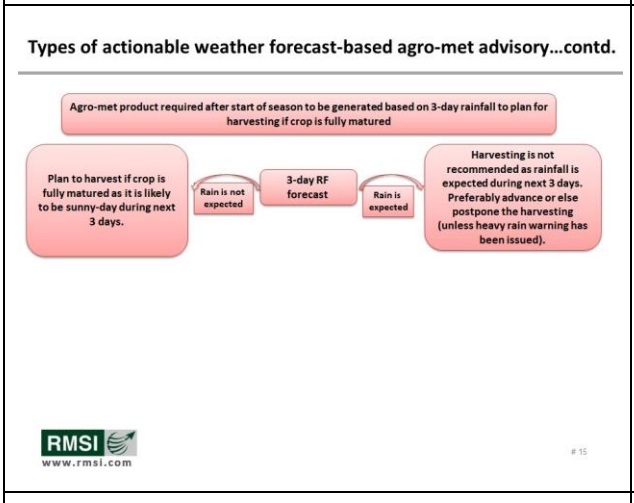
Types of actionable weather forecast-based agro-met advisory...contd.
Agro-met product required after start of season to be generated based on 3-day rainfall to plan for harvesting if crop is fully matured
Plan to harvest if crop is fully matured as it is likely to be sunny-day during next 3 days.
Rain is not expected
3-day RF forecast
Rain is expected
Harvesting is not recommended as rainfall is expected during next 3 days. Preferably advance or else postpone the harvesting (unless heavy rain warning has been issued).
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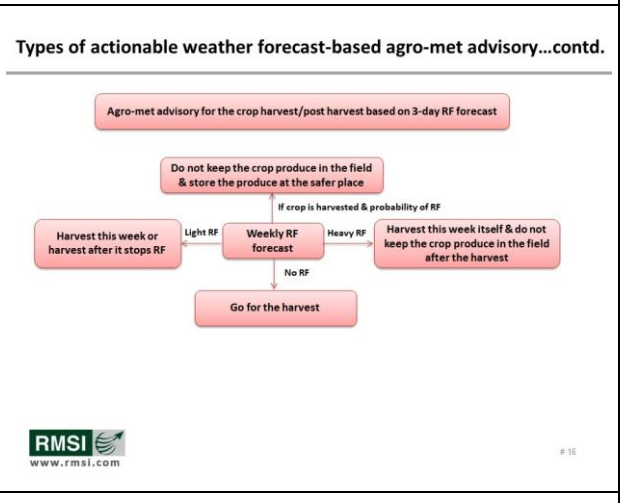
Types of actionable weather forecast-based agro-met advisory...contd.
Agro-met advisory for the crop harvest/post harvest based on 3-day RF forecast
Do not keep the crop produce in the field & store the produce at the safer place
If crop is harvested & probability of RF
Harvest this week or harvest after it stops RF
Light RF
Weekly RF forecast
Heavy RF
Harvest this week itself & do not keep the crop produce in the field after the harvest
No RF
Go for the harvest
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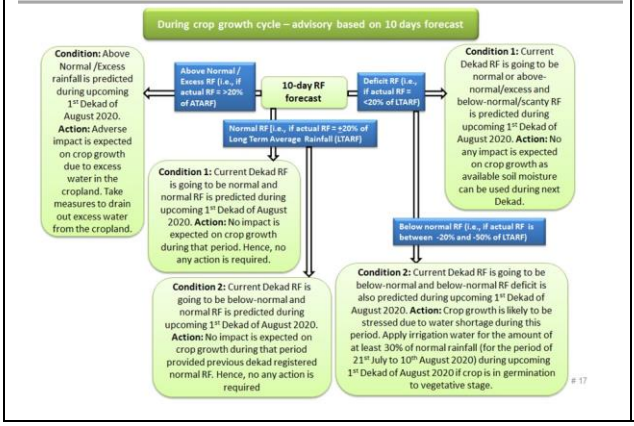
Types of actionable weather forecast-based agro-met advisory...contd.
During crop growth cycle – advisory based on 10 days forecast
Condition: Above Normal /Excess rainfall is predicted during upcoming 1st Dekad of August 2020. Action: Adverse impact is expected on crop growth due to excess water in the cropland. Take measures to drain out excess water from the cropland.
Above Normal / Excess RF (i.e., if actual RF = >20% of ATARF)
10-day RF forecast
Deficit RF (i.e., if actual RF = <20% of LTARF)
Condition 1: Current Dekad RF is going to be normal or above-normal/excess and below-normal/scanty RF is predicted during upcoming 1st Dekad of August 2020. Action: No any impact is expected on crop growth as available soil moisture can be used during next Dekad.
Normal RF (i.e., if actual RF = ±20% of Long Term Average Rainfall (LTARF)
Condition 1: Current Dekad RF is going to be normal and normal RF is predicted during upcoming 1st Dekad of August 2020. Action: No impact is expected on crop growth during that period. Hence, no any action is required.
Below normal RF (i.e., if actual RF is between -20% and -50% of LTARF)
Condition 2: Current Dekad RF is going to be below-normal and normal RF is predicted during upcoming 1st Dekad of August 2020. Action: No impact is expected on crop growth during that period provided previous dekad registered normal RF. Hence, no any action is required
Condition 2: Current Dekad RF is going to be below-normal and below-normal RF deficit is also predicted during upcoming 1st Dekad of August 2020. Action: Crop growth is likely to be stressed due to water shortage during this period. Apply irrigation water for the amount of at least 30% of normal rainfall (for the period of 21st July to 10th August 2020) during upcoming 1st Dekad of August 2020 if crop is in germination to vegetative stage.
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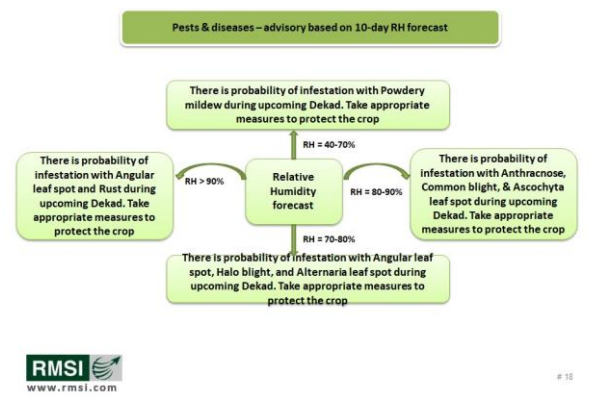
Types of actionable weather forecast-based agro-met advisory...contd.
Pests & diseases – advisory based on 10-day RH forecast
There is probability of infestation with Powdery mildew during upcoming Dekad. Take appropriate measures to protect the crop
RH = 40-70%
There is probability of infestation with Angular leaf spot and Rust during upcoming Dekad. Take appropriate measures to protect the crop
RH > 90%
Relative Humidity forecast
RH = 80-90%
There is probability of infestation with Anthracnose, Common blight, & Ascochyta leaf spot during upcoming Dekad. Take appropriate measures to protect the crop
RH = 70-80%
There is probability of infestation with Angular leaf spot, Halo blight, and Alternaria leaf spot during upcoming Dekad. Take appropriate measures to protect the crop
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Design and develop an API for automatic dissemination of location-specific customized 3-day weather forecast

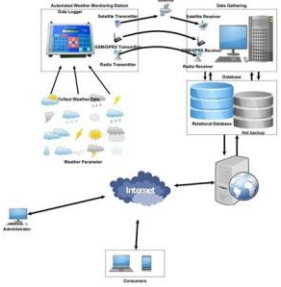
Step-1: Define location-specific parameters for the existing system

Step-2: Design of the system that will extract the data for the specific location

Step-3: Design the localized weather forecast bulletin

Step-4: Develop a framework for the use of this API

Step-5: Stakeholder meetings & technical workshops



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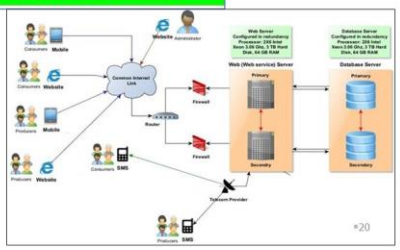
Design the interface to disseminate location-specific customized 3-days weather forecast to farmers

Step-1: Analyzing & Prioritizing the technological options

Step-2: Stakeholder meetings to discuss the conditions of use of the identified communication mechanisms

Step-3: Design & Development of the communication system to enable farmers access the weather forecast

Step-4: Presentation of the developed design to SWG & other selected communities



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Pilot testing of the developed API

- To test through piloting the developed (API) for the automatic dissemination of location-specific customized 3-days weather forecast to farmers in selected one community of Nepal.
- On-site 3 days' demonstration workshop to present the system to the selected local government, local farmers and civil society.
- Capacity building at the selected community to the local government, farmers, & civil society. During this phase RMSI team will oversee updating any bugs, make any amendments to the system, respond to any technical or practical questions from the administrator or the users in an acceptable timeline.
- Conducting meeting with the SWG on the sacling of the developed system to other communities of Nepal.

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Project completion

- Prepare and submit draft project report
- Presentation in front of key stakeholders
- Seek feedback from key stakeholders
- Incorporate the suggestions and corrections
- Submit the final report

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Team composition

Expert in Climate and Meteorological Information System (International Expert — *Dr. Murari Lal*	Agro-meteorologist (International Expert — *Dr. Uttam Kumar Singh*
IT Designer (International Expert 3) — *Ashutosh Singh*	Front End Developer (International Expert 4) — *Lokendra Dixit*
Back End Developer (International Expert 5) — *Abhinav Saxena*	Gender Expert (National Expert 1) — *Sujata Tamang*
Agricultural Engineer / Agro meteorology Expert / Meteorologist (National Expert 2) — *Rajendra Upreti*	

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Thank you

Annexure - 7: Some photographs during the SWG meeting

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