CARITAS Schweiz Suisse Svizzera Svizra

Policy Brief
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Weather-Water-Climate Services in Tajikistan

Crossing the last mile for enhanced resilience and well-being

Summary

Tajik Hydromet, the national agency for hydrometeorology, routinely provides general weather forecasts for each of its four regions. This lack of specificity acts as a constraint on effective decision-making for local farmers and limits the efficacy of disaster risk management in rural communities. As a result, food insecurity and vulnerability to natural hazards such as landslides, floods, avalanches and mudflows persist in Tajikistan.

The low density of weather stations in a natural environment characterized by rugged mountainous terrain and a diversity of microclimates is a key obstacle to improving the accuracy and reliability of local weather forecasts. Increasing the density of stations is, however, out of reach for Tajik Hydromet given its limited financial and human resources. By enabling access to high-end automatic weather stations, multilateral and international organizations have supported Tajik Hydromet in improving its observational infrastructure and the associated upgrading of skills, but unfortunately, state budgets for routine repair and maintenance of essential infrastructure continue to be limited. Against this backdrop, there is an urgent need to support the development of a contextually relevant and functional business model that covers the cost of collection and subsequent processing of weather data to deliver reliable local weather forecasts, together with a suite of weather-water-climate-services (WWCS) to meet user demand.

This policy brief advocates for a practical approach where ordinary citizens, supported by private entities, act as custodians for a growing network of low-cost weather stations, thereby facilitating the cost-effective acquisition of essential meteorological data. Moving past the provision of local weather forecasts and into the delivery of user-demanded and fee-based WWCS will permit cost recovery and funding of continued innovation, broad uptake of sustainable land and water use management systems and more effective early warning systems for impending disasters in local communities. This circular value chain of data acquisition to meet the demand for – and expand the supply of – weather-water-climate services would place Tajikistan as one of a handful of countries where citizens substantially contribute to the efficacy of a national hydrometeorological system, and directly benefit from their efforts through enhanced resilience to climate change and improved well-being.

« The combination of sustainable land and water management practices with real time hazard mapping to identify areas at risk of avalanche, landslides or flooding, and with more effective preparatory measures can significantly reduce vulnerability to natural disaster. »

Background

Nationally mandated cropping plans that are heavily focused on cotton, potatoes and wheat affect household food security, as they limit the range of foods produced domestically. In addition, they unintentionally exacerbate exposure to the risks of natural hazards through unsustainable land and water use management practices that increase the rate and extent of soil erosion. More effective crop associations and rotation of crops within a system of sustainable land and water use management practices can significantly improve soil health and productivity thereby limiting erosion. They further permit an expansion in the range of commodities produced while still meeting reasonable national targets for strategic crops. The combination of sustainable land and water management practices with real time hazard mapping to identify areas at risk of avalanche, landslides or flooding, and with more effective preparatory measures can significantly reduce vulnerability to natural disasters.

Achieving these outcomes within an environment of ongoing climate change will require the development of effective weather-water-climate services that are built on a dense network of meteorological observations within local communities. These services include the provision of data and information for decision-making on matters such as optimal time for land preparation, sowing of seed, timing and quantity of irrigation, as well as suitable timing for harvest to avoid both harvest and post-harvest loss. Many of these essential services are either missing or not easily accessible within rural communities where poverty is rampant.

In 2019, a dedicated mission from the World Meteorological Organization (WMO), facilitated by Caritas Switzerland, and welcomed by Tajik Hydromet, confirmed the challenges of limited financial, human and technical resources and documented the gaps in Tajik Hydromet's ability to deliver effective weather-water-climate services. These gaps include the lack of adequately equipped weather stations, and the insufficient density of stations for Tajikistan's complex topography. Protocols and equipment for automated processing of data and information are equally limited, with human resources deemed insufficient to maintain efficacy in forecasting and early warnings.

A 2020 survey administered by Caritas Switzerland in the districts of Muminabad (614 respondents) and Laksh (619 respondents) highlights the impact that extreme weather events such as heavy rain, frost, drought and high temperatures continue to have on well-being within local communities. Eighty-two per cent of the respondents had experienced crop losses of more than 10 per cent from extreme weather events over the past five years. Seventy-five per cent of respondents agreed that more timely and accurate weather forecasts, together with associated recommendations for action, would have helped reduce this loss. The impact of extreme weather events on household well-being and quality of life is also apparent: 53 per cent said that reduced harvests and lower incomes led their household to meet its food needs through the consumption of seeds that had been stored for future planting.

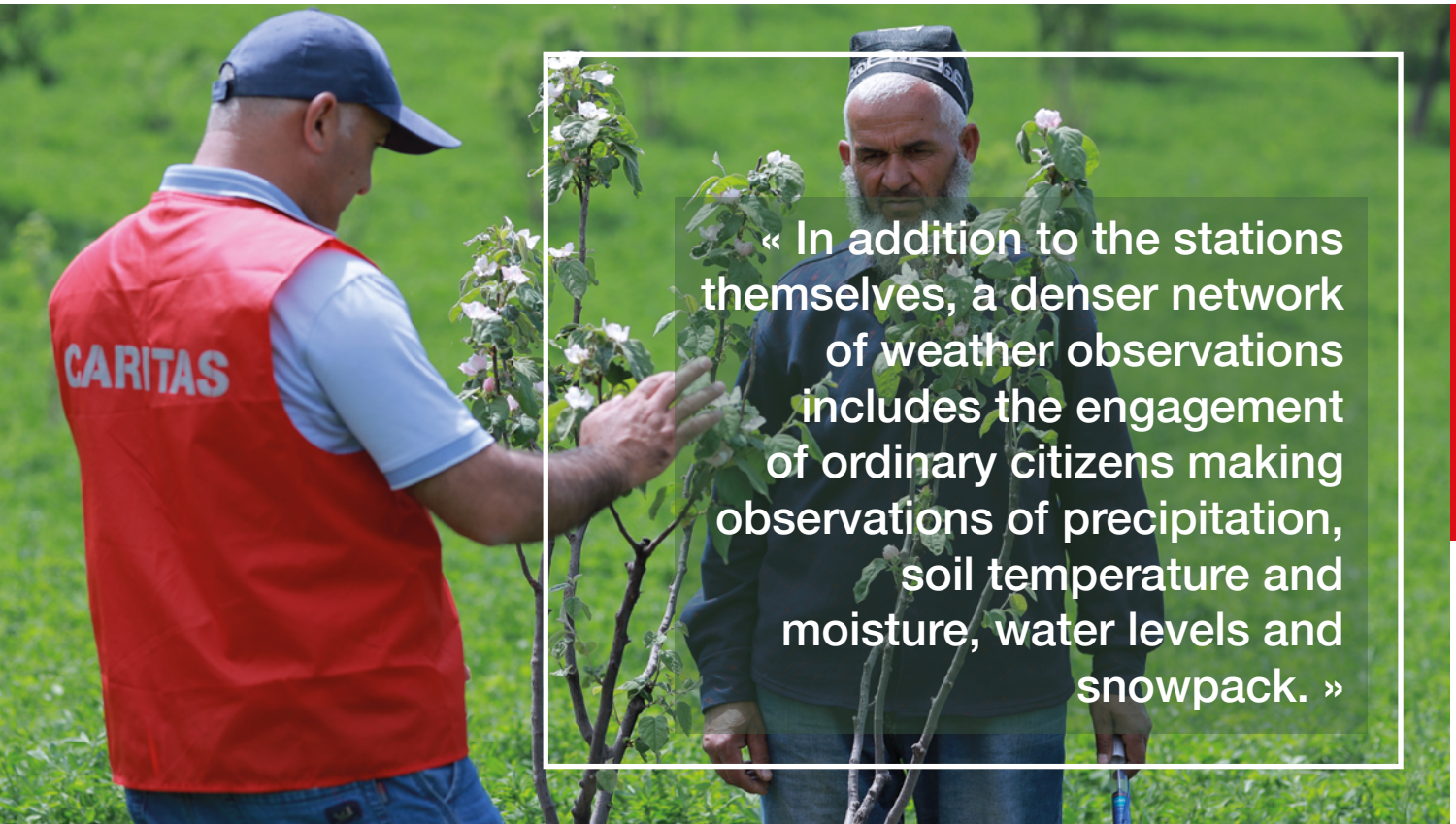
Low-cost weather stations as the basis for effective weather-water-climate services

Tajik Hydromet has welcomed the international community's continued support, which has largely followed a traditional paradigm of installing high-end weather stations at relatively few selected sites. For Tajik Hydromet, however, the operation and maintenance of this equipment has often become a financial burden. Based on this experience, we advocate for the delivery and installation of larger numbers of low-cost and open-source weather stations that are maintained by local farmers and institutions with technical support from private telecom companies. The caretakers of the stations would collect, transmit and store data from these stations according to standard protocols and policies maintained by Tajik Hydromet.

Prototypes of contextually appropriate low-cost micro stations, costing approximately US $150 each, have now been successfully tested in Tajikistan and Switzerland for robustness in a variety of climatic conditions and for accuracy against automated reference stations maintained by the Swiss Meteorological Services (MeteoSwiss). The internal components of these stations, specifically those that require routine replacement such as batteries, are generally available in local markets in Tajikistan. The open-source design allows for aligning data transmissions with Tajik Hydromet requirements, a feature that many commercial weather stations do not offer. Tajik Hydromet prefers to strictly control access to and dissemination of data on a case-by-case basis either through fees or a formal agreement, and this feature is key to their acceptance of the stations.

Our proposition is to install a dense network of low-cost stations in Tajikistan, owned by the national hydrometeorological agency, but managed by private citizens (predominantly farmers) who are remunerated in their role of custodian and caretaker of these stations. Data generated from these stations would be processed by Tajik Hydromet to develop more reliable local forecasts and to support a suite of essential and affordable weather-water-climate services that respond to user demand. This arrangement essentially frees Tajik Hydromet from the administrative and financial burden of having to retain guards to secure physical assets in remote communities. While the underlying business model will require further development and proof of concept, early analyses indicate that the remuneration to custodian farmers, as well as routine repair and maintenance, can be comfortably covered through revenue generated from the fee-based weather-water-climate services provided via smartphone apps or SMS and through affordable fee-for-service technical support by public and private extension agents in districts and local communities.

In addition to the stations themselves, a denser network of weather observations includes the engagement of ordinary citizens making observations of precipitation, soil temperature and moisture, water levels and snowpack. This "citizen science" approach to gathering, using and interpreting data is finding growing recognition globally. We take inspiration from examples in Europe[1] and North America[2] where citizens have shown enthusiasm in collecting and submitting snow and weather data that is now used effectively by national weather services, insurers, individual and commercial farmers, teachers and students. In our conceptualization of circular information flows, the observing citizen simultaneously contributes to, and benefits from, the weather-water-climate services.



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Understanding weather-water-climate services

The term "service" can mean different things to different people. As a simplification, we refer to a service as a process through which value is delivered to a user. This may, for example, come in the form of information to support effective action, advice or a recommendation, through the supply of a good (such as irrigation water) or as an input into a process – snowfall monitoring for reducing vulnerability to disaster risk through effective early warning systems. Effective weather-water-climate services permit local communities and farmers to realize the value without having to worry about the underlying technology or science. Weather-water-climate services, when conceived contextually and jointly between developers and end-users, can engender greater resilience to ongoing weather and climate change while enabling users to seize opportunities to adopt alternative practices that respond to new conditions whether favourable or unfavourable. This necessarily requires technical capacity and effective communications across the whole spectrum of stakeholders – developers, end-users and policymakers – who are able to provide a supportive and enabling environment for sustained innovation.

Weather-water-climate services for small-holder farmers and communities include technical advice and recommendations on the most suitable time to plant and harvest crops (based on soil moisture and temperature), when and how much to irrigate (based on crop growth stage), and how to react to a forecast for frost or extreme temperatures so as to reduce loss and maximize productivity. Services for governmental institutions and farmer or water user associations can include scientific, evidence-based advice on the efficient delivery and application of irrigation water, can establish protocols for forecasting natural disaster risks, and can guide the selection of more nutritious crop mixes that may reduce the need to expand land areas under production of nationally strategic crops. In addition, effective weather-water-climate services provide policymakers the recognized climate science necessary to evaluate and develop sectoral strategies and where necessary, to reform existing policies and regulations to enhance adaptation to climate change.

The integration of climate science into national, subnational and district processes supports development planning. The suite of services offered will adapt to the shifts in priorities and user demand in light of the changes in climate and economic conditions.

The World Meteorological Organization estimates that the benefits derived from modernization of national meteorological and hydrological services in the areas of early warning and response, improved forecasts for extreme events and improved information to support sustainable intensification of agricultural production systems can range from 2 to 14 times the cost of investment within Europe and Central Asia.[3] Achieving these returns is very much dependent on the willingness and ability to pay for services at levels that can financially sustain continued innovation to expand the range of services and to improve the efficiency in the delivery of these services. The 2020 survey implemented by Caritas Switzerland revealed that 84 per cent of respondents would be willing to pay for more reliable and accurate weather information that is specific to their localities. While this response does not provide an indication of how much they would be willing to pay, the need and demand for more reliable forecasts is clear.

Efficacy in the delivery of these forecasts and services through electronic means (SMS, smartphone apps, online systems) will require investments in infrastructure and equipment as well as knowledge and familiarity with modern communication systems in rural communities. Ninety per cent of respondents stated that they would prefer to receive more reliable and localized forecasts and extreme weather alerts through an SMS application, and 70 per cent of the respondents report that they do not use a smartphone and still maintain an analog handset. This apparent challenge to providing essential weather-water-climate services is also an opportunity for national telecom companies to assist in the delivery of these services by expanding telecommunication services and access through greater, and affordable, uptake of smartphones and platforms.

1- https://eu-citizen.science/project/118#

2- https://www.cocorahs.org/Content.aspx?page=aboutus

3- World Meteorological Organization (2015). Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services. WMO-No. 1153. Available at: https://library.wmo.int/doc_num.php?explnum_id=3314

« Caritas Switzerland has assembled a consortium of reputable Swiss and international partners to support Tajik Hydromet, the Committee of Emergency Situations and Civil Defense (CoES) and the Ministry of Agriculture in the development of a suite of contextually relevant, affordable, accessible and sustainable weather-water-climate services. »

Essential partnerships

The need to work across the full spectrum of national to rural stakeholders in order to establish a national system for weather-water-climate services – and to deliver those services across the last mile to rural communities – requires a dedicated consortium of national and international partners. In leading a Swiss-inspired response to the challenges faced by Tajikistan, Caritas Switzerland has assembled a consortium of reputable Swiss and international partners to support Tajik Hydromet, the Committee of Emergency Situations and Civil Defense (CoES) and the Ministry of Agriculture in the development of a suite of contextually relevant, affordable, accessible and sustainable weather-water-climate services.

The Swiss Agency for Development and Cooperation, MeteoSwiss and the Swiss-based WSL Institute for Snow and Avalanche Research have all committed to support Tajik Hydromet, CoES and the Ministry of Agriculture in developing the necessary systems and approaches – as outlined in this brief – that are required to enhance greater well-being and resilience to climate change within local communities. Further technical and institutional support will come from the European Center for Medium-Range Weather Forecasts, the International Center for Agricultural Research in the Dry Areas, and the World Meteorological Organization. The latter has entered into a formal partnership with Caritas Switzerland to jointly promote the provision and uptake of weather-water-climate services in Tajikistan under its global mandate to “provide world leadership and expertise in international cooperation in the delivery and use of high-quality, authoritative weather, climate, hydrological and related environmental services by its Members, for the improvement of the well-being of societies of all nations.”[4] Greater diversity in partnerships, both international and national, is expected over time.

4- https://public.wmo.int/en/about-us/vision-and-mission

Recommendations

1 Increase the density of coverage by weather stations through low-cost, yet effective infrastructure that is supported by citizen scientists

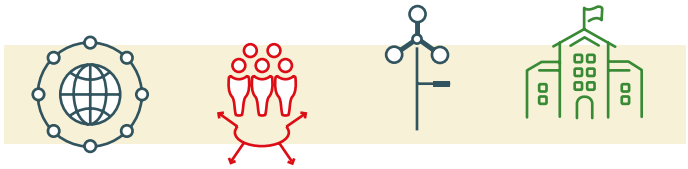
The consortium of national and international partners proposes to install 500 low-cost weather stations in nine districts of Khatlon Oblast and Rasht Valley over the 2021–2025 period. Site selection, and thereby the spacing of stations, will be undertaken jointly by all partners to ensure that siting takes into account elevation, heterogeneity of the landscape, agricultural production systems, and areas prone to risk of natural hazards, among other considerations. An analysis of the number of stations required for full national coverage – post 2025 – will be undertaken on the basis of a better understanding of density requirements gained in the first phase.

Together with automated data gathered through the low-cost stations, an arsenal of manual data submitted from field sites maintained by farmers, schools and public entities will further increase the coverage of weather observations. Low-cost manual rain gauges, soil thermometers and tensiometers will provide additional data to be submitted through national telecom companies in an effective SMS system overseen by Tajik Hydromet.

2 Effectively involve commercial entities and individual citizens in the private sector in a national innovation system that expands the breadth, quality and sustainability of weather-water-climate services

Through engaging with telecom companies, Caritas Switzerland and Tajik Hydromet seek to jointly develop, test and roll out a functional business model that addresses the installation of stations, routine repair and maintenance, and remuneration for siting stations on farmer fields, and that sets out an affordable fee structure for weather-water-climate services. The economic benefits – improved agricultural productivity and income and the reduction in losses from natural disasters – are expected to generate funds to sustain (and possibly expand) the system in the long term.

Citizen involvement in the proposed weather-water-climate services scheme is a powerful way to engage the farmers and the communities being served. In turn, the effectiveness of these citizen scientists depends on the capacity of the consortium to provide them with sufficient training to succeed. The consortium will also need to work effectively with district administrations to support the efficient and timely delivery of irrigation water, a system that will benefit from effective weather-water-climate services and efficiencies generated in water use and water productivity. Equally important will be input into annual and five-year district development plans that benefit from contextually relevant weather-water-climate services that enhance well-being within rural communities.



3 Establish and convene an annual national climate forum that sets the agenda for effective weather-water-climate services with broad and equitable access

Building on successful experience globally and with support from the World Meteorological Organization, Caritas Switzerland offers to partner with Tajik Hydromet to hold the first national climate forum for Tajikistan in early 2023. This forum will then convene annually to ensure the appropriate dissemination of information on weather, water and climate. This forum will also coordinate among relevant initiatives and stakeholders across sectors and entities.

This brief focuses on how weather-water-climate services benefit the agriculture sector, but these services also offer value to many other sectors. Ensuring broad and equitable access to weather-water-climate services and effective coordination across sectors and governmental ministries will require a dedicated platform or venue. Similarly, the development of river basin organizations will require coordination with development partners to ensure that weather-water-climate services align with strategies developed and outcomes envisioned with national partners.

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