POLICY BRIEF | JULY 2024

Climate resilient rural water supply in Indonesia

How resilient are Indonesia's rural water supply systems to climate change?

KEY MESSAGES

- Climate change is expected to increase the frequency of intense rainfall events, storms and areas of drought in Indonesia, directly impacting rural water services
- At least 12,000 to 14,000 (34-46%) of PAMSIMAS rural water systems are at risk from key climate hazards including flooding, water shortages and sea-level rise.[2]
- District-level government needs to play a strengthened role to support villages and community-based groups managing rural water supply
- More effective strategies are needed to protect water resources on which rural water supply depends, including through land-use management and effective water allocations mechanisms
- Strengthened monitoring of climate resilience at national, provincial and district level combined with relevant policy and regulatory changes can support improvements in resilience of the service

Community-based groups managing rural-water supply systems require more responsive funding, training and institutional support to achieve safe, resilient and sustainable rural water services

More than 25 million people in Indonesia rely on community-managed rural water supply systems.[1] These systems are vulnerable to climate hazards such as floods, storms and droughts. Climate change is expected to increase the frequency and intensity of these events and cause uncertain long-term effects on water resources.[2]

This policy brief is based on the research project *"Future proofing a basic social service: climate-resilient community-based rural water supply"* (2023-2024). The recommendations require coordinated action from respective ministries, including Bappenas, Ministry of Public Works, Ministry of Health, Ministry of Home Affairs, Ministry of Villages and Ministry of Environment and Forestry as well as district and village governments.

METHODOLOGY

- Country risk profile based on secondary data including Aqueduct, WRI (2023), INARISK, BNPB (2022), SIDIK, Ministry of Environment and Forestry (2023), SIGI, Ministry of Public Works, PAMSIMAS MIS (2021, 2022, 2023), SUSENAS (2022) and SKAM-RT, Ministry of Health (2020)
- Piloting of a rural water supply climate resilience monitoring and assessment tool (RWS-CRMAT) with 34 water schemes in five provinces (East Nusa Tenggara, Special Region of Yogyakarta, West Java, Sleman, West Kalimantan, Riau) and online with seven other provinces
- A policy and regulatory review, institutional analysis through qualitative research in Garut, West Java and regular stakeholder engagement with Bappenas, Ministry of Public Works

Policy recommendation

1

Improve disaster preparedness and response at village and regency level to reduce impacts of climate events on water supply systems and improve inclusivity.

Our study found that at least 12,000 to 14,000 (34-46%) of PAMSIMAS rural water systems are at risk from key climate hazards including flooding, water shortages and sea-level rise, and observed detrimental impacts on systems of all types across five provinces. There are multiple straightforward actions that can support rural water supply managers to avoid or reduce disruption of water services due to climate events. This includes early warning systems (EWS), technical training, safe water storage, formation of village response teams and establishment of village emergency spare-parts stockpiles and improving adaptation policy and planning.

At present, community-based management groups (KPSPAMs) do not receive early warning of impending climate events. Such warning could support these groups to take preventive action, such as securing pipe infrastructure, closing off parts of a water supply system, shutting down electrical supply to pump or warning customers to prepare back-up water supplies.

Provision of technical training for KPSPAMs, specifically including women and young people, on maintenance and repairs is essential. This will reduce disruptions and downtime and reliance on external technicians; the effort could include standardisation and certification of KPSPAM personnel through BNSP. As an interim measure, technical bodies (Balai) for drinking water and sanitation in the public works ministry and provincial bodies (regional settlement infrastructure body) could provide training to KPSPAMs. The Ministry of Public Works and local government public works agency should also provide an accessible repository of digitised technical designs for Pamsimas systems. Broader training on managerial aspects would also improve fee collection, supporting availability of funding reserves to finance repairs, and promoting anticipatory actions such as adding safe household water storage.

Beyond reliance on KPSPAMs for disaster response, broader response teams at village level could increase available skills, human resources and expertise, ideally accompanied by supportive village regulations for PAMSIMAS, and integrated into disaster risk programs (e.g. Proklim, Destana).

Preparing village and regency emergency stockpiles that include spare parts, pipes, water filtration kits, and other supplies can be included in budgets from Village Development Plan (RKP Desa) and the Village Budget (APBDes, village funds). KPSPAM in the form of BUMDes or especially LKD will have more access to village budget, however, other forms of KPSPAM could also access budget if some assets belong to the village government under mutual arrangement.

Public works agencies at district level (Dinas PU) should establish a warehouse consisting of stockpiles of pipes and other supplies that could be used for CBO in the event of disaster. An inventory of supplies should be kept, such that depleted supplies in the stockpiles can be regularly replenished each year and maintained through the regional budgeting process.

> "There is a facilitator .[...].. during the construction period. However, after PAMSIMAS started operating, there was no longer any technical assistance from [them or] other parties."

Figure 1: Pipe stockpile at public works office, Garut district, West Java to support quick recovery after disasters

Policy recommendation

2

Provide more responsive funding mechanisms to support preventive action that reduces damage, as well as for disaster response and major repairs.

Funding is key to preparedness and response. Two types of funding are required due to climate impacts on rural water supply services, for preventive action and for disaster response. However, neither of these is easily available to KPSPAMs especially if they are not a part of a village (that is, not established as LKD or BUMDes).

KPSPAMs should ideally proactively invest to increase resilience of their water scheme infrastructure, such as through securing pipes, adjusting water source intakes and other similar actions. At present no KPSPAMs participating in this research had received any financial support that would enable such actions from the district level, although there are cases where limited support had been provided from village governments, and where they had used their own funds from fee collection.

Emergency funds need to be made more easily available in a timely manner to KPSPAMs, (e.g. through Unexpected Funds (Articles 68 and 69 of PP No. 12/2019 and MOHA Regulation 77/2020), or other emergency funding mechanisms. This should include funding mechanism that could supports back-up water supply at times of disruption, increased storage as well as to supporting rapid repairs. The approach also needs to consider that major damage to a water system can occur during an event that does not meet the formal criteria for a disaster (based on Law No. 24/2007 on Disaster Management; MoF Regulation 173/pmk.05/2019; BNPB Reg 4/2020, MOHA Reg 46/2008 and MOHA Reg 77/2020).

In order to cover events that could not be categorised as disaster, the approval process for accessing funds for major repairs should be simplified and expedited. Due to regional financial regulation on grant (belanja hibah) KPSPAM likely have to wait for the subsequent annual budget to seek funding for major repairs, and some (e.g. cooperatives) may not be eligible. In Eastern Indonesia and small islands, several water systems were non-functional for periods of years after a climate disaster caused damage. KPSPAM which are established as LKD may have better access to village funds if and when it is available.

“Also, for village government, we never got [financial] assistance because it is not the highest priority issue.”

Figure 2: Minor repairs to pipework for groundwater source system in Dumai, Riau

Policy recommendation

3

Careful land-use management and water resource management will reduce climate impacts on water sources on which rural water supplies depend, preventing erosion, depletion and source water quality deterioration.

"Villagers want to use river water but significant funds are required to build a water treatment unit, because the river is polluted by waste from oil palm plantations."

Land-use policies and practice have direct impacts on water resources used for rural water supply systems. This includes both agricultural, mining, plantation, industry, tourism as well as housing and settlements.

Authorities should promote sustainable agricultural practices that minimize soil erosion and landslide risks which impact rural water systems, and avoid commercial crop cultivation on steep slopes and plastic mulching that results in excess run-off during heavy rain. Such arrangements should also consider competing demands on water resources and ensure sufficient supply for RWS, including in dry season.

There is a need to establish clear guidelines on government roles to rehabilitate critical lands and other lands in catchment areas to ensure protection of water resources. Where possible, critical catchment areas should be converted to customary forests, involving transfer of forest management from state to the relevant community.

Mining activities in Southeast Sulawesi (Wawonii Island) and elsewhere disturb the land and cave systems. In karst areas, it can lead to increased turbidity and contaminate spring water sources. Elsewhere palm plantations and other industry pollute water sources. Careful assessments of relevant water systems are needed prior to allowing mining activities.

Figure 3: Repaired bridge protecting and improving surface water in KPSPAMS Mikti Binankit, Sukawening District, Garut Regency, near the KPSPAMS Mukti Binangkit spring

4

Increase monitoring of climate risks and resilience of rural water supply schemes at national and district level, and combine with effective inclusive external support mechanisms.

"When the rain comes, the pump and the spring are covered by mud. The pump was broken and people had to get water manually – either by walking, bike or tanker. If people have money, they use [buy] water from the tanker. If you want to save money you have to take water by yourself and walk 2km, there and back."

At present, national sustainability monitoring of rural water supply systems by Ministry of Public Works and Housing includes functionality and cost-recovery, however, does not include climate resilience. Suggested questions include disruptions to water quality and quantity due to climate events, environmental aspects such as water resources availability, and aspects such as availability of emergency services plans. For more details on recommendations for national monitoring, see Policy attachment 1.

For district governments looking to monitor climate resilience more extensively, the rural water supply climate resilience monitoring tool (RWS-CRMT) (see Figure 4) and rural water supply climate resilience assessment tool (RWS-CRAT) developed through this project or similar tool can be used. Such monitoring data can inform targeted planning for support to KPSPAMs to improve resilience, including gender and inclusion aspects. The monitoring tool can also be used by KPSPAMs to self-assess and improve resilience.

District governments should establish dedicated external support units either in the form of UPTD (Regional Technical Implementation Units) dedicated to Pamsimas, UPTD PU Kecamatan (Sub-districts), or other relevant institutions as a part of wider, inclusive support to rural water supply as an essential social service.

As national government evolves monitoring approaches for rural water supply, it will be important to evolve the 2023 Bappenas framework for climate resilience in water and sanitation to incorporate strengthened institutional support to community-management providers and clear institutional roles, as well as evolving the ten dimensions of climate resilience (see Policy attachment 2).

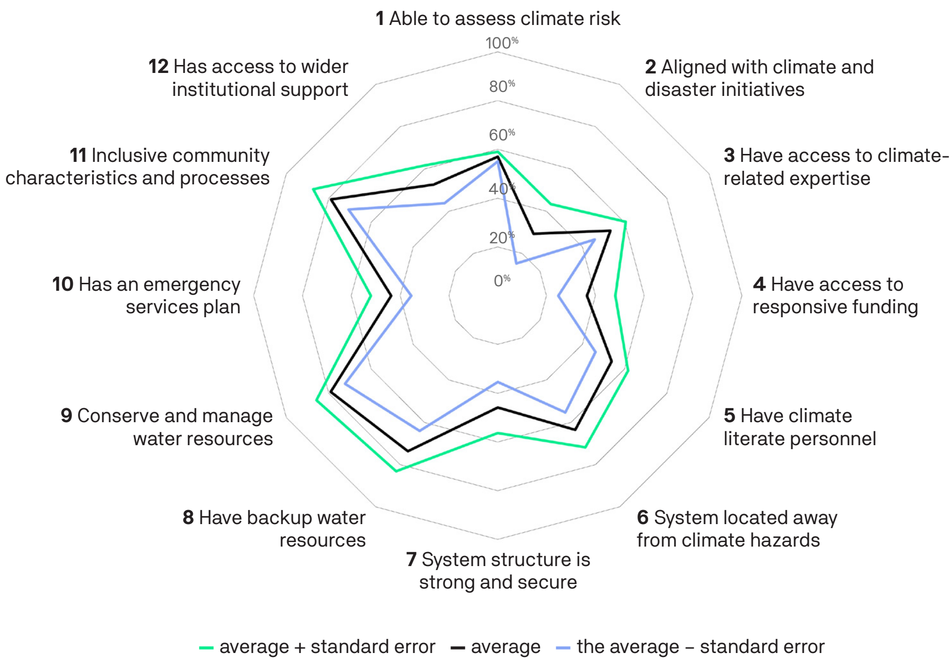

Figure 4: Results of rural water supply climate resilience monitoring tool (RWS CRMT) for 34 water systems (Daniel et al., 2024, in preparation)

Policy recommendation

5

Integrate climate resilience in planning documents at national, regency and village level for both new and existing systems, accounting for varied exposure, vulnerability and capacity to respond to climate hazards.

New and existing rural water supply systems require different actions to improve climate resilience. Typical issues observed in this research for different system types included:

- Groundwater: pump issues, solar panels destroyed by storms, declining levels due to drought
- Surface water: Poor source water quality due to flooding, damaged intake infrastructure
- Springs: Drying due to drought, damage to intakes and catchment due to flooding
- Piped distribution: Damage due to landslides, storms and floods.

For new systems, such as those in PAMSSANIMAS (the evolution of PAMSIMAS program commencing in 2024), the following practices are proposed (see Policy attachment 3 for more detailed recommendations for PAMSSANIMAS):

- Before construction and during selection, consider climate aspects and potential conflicts with competing land uses and water resource use, as both will need specific strategies and resources to address them.
- During site planning, secure alternative water sources, land tenure and prepare for emergencies. Assess climate risks and design infrastructure accordingly.
- In community workplans and for village and district government, include climate-resilient water safety plans, educate community on disaster preparedness.
- Post-construction, keep communication with local facilitators, establish early warning systems, and conduct disaster training. Monitor financial sustainability and adaptation to local climate trends, ensuring water quality and emergency preparedness through regular practices and alternative water source connections.

Below are some actions to improve resilience in design, construction and management.

Example actions to support climate resilience of rural water infrastructure for different system types

For all types of system, consider increasing water storage capacity and identifying additional water sources to supplement existing sources. Fire buffer zones are recommended for forest fire-prone areas. Installation of lightning prevention systems can protect electrical equipment during storms or backup power sources (e.g. solar). In addition for specific system types, further actions are proposed, depending on the hazards faced:

- **Spring source systems**
  For landslide-prone areas, install secure distribution piped systems as appropriate below or above the surface. Improve drainage systems, check water quality and clear pipe network areas to reduce the chance of landslide damage.
- **Groundwater source systems**
  Maintain wells and complete regular water quality testing, increasing monitoring frequency during droughts and floods. Have back-up pumps. Construct water supply infrastructure above flood level to prevent inundation during floods. Incorporate infiltration holes that can relieve pressure under heavy rain conditions.
- **Surface water source systems**
  Implement low-cost treatment such as filtration and chlorination to maintain water quality. Ensure water quality monitoring, particularly for pollutants entering surface water and increase frequency around flood events. Construct flood retention structures to prevent flood impacts.

"Every year there are floods and storms with lightning. The electronics [for the pump] were affected. We tried to handle the problem, but it happened again."

Figure 5: Water storage tanks for surface water system in Sintang, Kalimantan

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Policy recommendation

5

A key point is to shift away from the previous standardised funding allocations in PAMSIMAS program, given the asymmetric funding requirements in different locations due to different unit costs, system complexity and needs, including to ensure climate resilient infrastructure based on expected exposure to hazards in a given area.

RISPAM (water-supply master plan for various providers) should cover rural water supply systems and their needs, including to support climate resilience. RISPAM should incorporate climate projections, map the risks of both climate and land use activities to rural water supply and plan responses, including for additional water sources where required, and complement with water safety plans.

Due to the multi-sectoral nature of climate change and climate adaptation, risks to rural water supply due to land use activities should also be considered in other planning instruments, including land use and zoning; catchment planning and land rehabilitation; cropping pattern and planting arrangement plan as well as river basin management plan. Bappeda should lead a climate-sensitive regional planning framework supported by other agencies and ensure that climate resilience of rural water supply systems in its region is properly addressed in their mid-term development plan (RPJMD) and enumerated in the regional budget (APBD). This should include consideration of shared water catchments across administrative boundaries. Detailed roles and functions of each agency at the provincial, regency and village level are needed to support climate resilience for rural water supply.

For more detailed information on the policy recommendations outlined in this policy brief, please see Policy attachment 4 (English) or Policy attachment 5 (Bahasa Indonesia).

FURTHER READING

[1] Daniel, D., Al Djono, T. P., & Iswarani, W. P. (2022). Factors related to the functionality of community-based rural water supply and sanitation program in Indonesia. Geography and Sustainability, 4(1). https://doi.org/https://doi.org/10.1016/j.geosus.2022.12.002

[2] Daniel, Wulangtyas, A. H., Satriani, Devi, E. F., Willetts, J., & Kumar, A. (2023). Community-based rural water supply : Indonesia country risk profile. https://doi.org/10.13140/RG.2.2.11374.59204

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https://www.uts.edu.au/isf/explore-research/international-development/water-sanitation-and-hygiene-wash/climate-change-and-wash

RESEARCH TEAM

- **UTS:** Juliet Willetts, Avni Kumar, Leanne Casey
- **CRPG:** AlAfghani, Mohamad Mova, Paramita, Dyah Muhajir, Bahagia Mohamad Aftaf
- **UGM:** D. Daniel, Adhin Harum Wulaningtyas, Elsa Febriana Devi, S. Satriani
- **UI:** Cindy Priadi, Rioneli Ghaudenson, Sucipta Lakono, Danisha, Amalina Az Zahra, Kamilia Insani, Elzavira Felaza

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