HERIOT WATT UNIVERSITY

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Treading water in a savannah: The reality of water scarcity in East Sumba

Policy Brief

Summary

Water scarcity in rural and remote parts of East Sumba can cause negative impacts to the social wellbeing, public health, and economic productivity of its citizenry. Without access to clean water, communities become prone to water-borne diseases, poor sanitation practices, and sub-standard hygiene. Inadequate water management can also hamper agricultural practices of the many farmers in the district, potentially causing negative and irreversible impacts to their livelihoods. This brief attempts to describe the current situation in East Sumba relating to how water scarcity could negatively impact the region and offer appropriate recommendations and policy response.

It is recognised by national and international governments that water is a basic human right. It replenishes and cleans bodies, irrigates crops, and cleans clothes and homes. It is upheld in the UN's Sustainable Development Goals (SDGs) number 6: "To ensure availability and sustainable management of water and sanitation for all". The Government of Indonesia acknowledges water as an important indicator in measuring prosperity and human development. In a rapidly growing economy and ever expanding populace, water becomes an important prerequisite for better prosperity, improved sanitation and hygiene, and a healthy citizenry both physically and mentally.

In Indonesia, water scarcity remains a recurrent issue, especially for regions located in unfavorable geographic locations with extreme climate conditions. These natural factors dictate that arid regions should require a stable and robust water management infrastructure so that their water needs are met, including for drinking, food preparation, sanitation, irrigation, agricultural practices, industrial activities, sustaining ecosystems, and achieving water resilience. Without them, water scarcity, propelled by the slow-onset impacts of climate change, can lead to unimaginably negative outcomes to the wellbeing of the citizenry and economic productivity. East Sumba could potentially be among the worst hit regions, both economically and socially. Its agricultural sector, the biggest contributor to its GDP, is susceptible to the compounding impacts of water scarcity caused by climate change. Thousands of farmers, which make up the majority of the workforce in the district and the whole island, can potentially lose their livelihoods. Socially, the island's unequal access to clean water and disproportionate distribution of adequate water management infrastructure could potentially have negative impacts to the health and sanitation of its inhabitants. Especially in isolated areas, where access to clean water is little and construction of water infrastructure represents a costly investment.

The region serves as a dire portrayal of how people live under severe limitation of basic service namely energy, water and food. The three aspects are being heralded as priority nexus which deserve undivided attention. As most remote regions are also facing limitations in resources and finance, there should be a sensible policy which explores how water management can potentially augment food and energy development in a proportional and equitable way. This brief attempts to describe the current situation in East Sumba relating to water scarcity and how it could negatively impact the region. It will also trace back policy development in the region from which recommendations could be made for current and future policymakers in order to address the water scarcity issue in Sumba Island, particularly East Sumba.

Sumba Island

Sumba is the third largest island in East Nusa Tenggara after Flores and Timor islands. The province's collection of islands, which also includes Alor and Lembata, has contributed to its nickname: Flobamorata. Sumba is among the most underdeveloped and impoverished regions in Indonesia. It comprises 4 districts: East Sumba, Central Sumba, West Sumba and Southwest Sumba. Historically, the island always had to contend with water security, or rather water scarcity, to sustain livelihood practices and social wellbeing of its people. As a semi-arid region, Sumba has a varied climate which consists of both dry and rainy seasons. It records among the lowest amount of rainfall in the entire country. Each district on the island displays distinct climate characteristics. For example in 2019, out of all 4 districts, East Sumba recorded the lowest amount of average annual rainfall with 650 mm of rainfall.

Figure 1 Map of Sumba Island

Currently, East Sumba requires the most intervention due to its critically high water consumption index (IPA - Indeks Penggunaan Air) which amounts to 480%. The index essentially indicates that water consumption and demand is much more than the currently available water supply. For reference, the index for the other 3 districts on the island are all less than 40%. Despite this, East Sumba has plenty of potential water sources but most are still untapped.

In general, the inhabitants of East Sumba rely upon the following sources for their water needs:

(1) **Piped water**, which is refined water sold and distributed by the water utility company in Sumba, PDAM Matawai Amahu. Piped water is transported to private taps inside households or public taps located in villages where water is sold in retail to communities
(2) **Bottled water**, which are sold at agents or retailers
(3) **Protected and unprotected wells** from which communities could extract for their household or livelihood needs
(4) **Protected and unprotected springs** utilized by the water utility company or directly extracted by communities themselves
(5) **Open surface waters** such as rivers or lakes
(6) **Water trucks**[1], which transport water to communities without public or private piped water systems.

In East Sumba, the development of water extraction, management, and distribution infrastructure is overseen by the local government, specifically **BAPPEDA** (Regional Planning and Development Agency) and **Dinas PU** (Regional Public Works Agency). Other important stakeholders are **PAMSIMAS**, an organization funded by the World Bank and the national government which is often involved in constructing relevant infrastructures for better access to drinking water; and **village officials**, consisting of a council and a board, who act as the catalytic link between stakeholders who construct water infrastructure with the communities whom they are meant to serve.

Clean Water Infrastructure for Rural Households and Isolated Communities

Clean water infrastructure is far more developed in East Sumba compared to its neighbour districts. 19% of its clean drinking water is supplied through public or private pipes constructed by the local government and operated by the PDAM, the water utility company to whom users pay for the water they consume for household, industrial or livelihood purposes. However despite that, clean water pipes are more commonly found in Waingapu than other sub-districts in East Sumba. The low numbers elsewhere suggests that the majority of communities outside of Waingapu still extract drinking water from communal and unprotected sources such as wells, springs, and rivers which accumulates to around 77% of the total water supply in the district. Since the quality of water from unprotected sources are lower than private or public taps and bear more risk of pathogenic or chemical contamination, access to clean water should be increased to prevent diseases and other health related issues.

In some areas in East Sumba, isolated communities who do not have access to neither clean water infrastructure nor unprotected water sources due to large distances and challenging terrain represent the most vulnerable and marginalized communities to whom extra attention should be afforded. If the distance to their closest water source is more than 30 minutes round trip by foot, they are considered equal to not having access to water at all. The long distance to water sources also means extra burden for female members or children who are often tasked with collecting water for the entire household. Families who own vehicles, such as motorbikes, are relieved of the long walks but their vehicles require extra fuel consumption and costs, adding extra financial stress to the family.

The rise in population numbers has made it difficult for the PDAM to maintain its level of service and for the local government to continue the expansion of clean water infrastructure in East Sumba. The challenge becomes greater as the terrain and topography of isolated villages are often extreme and villages are distanced far apart from one another, thereby making expansions of current clean water infrastructure more costly. An alternative is to find new water sources located far from the reach of the current water distribution system from which water could be extracted and distributed. In most cases, policymakers are aware of untapped water sources located throughout their district. These sources represent great potential which can be further developed into a reliable water resource for communities who live in the immediate vicinity. The cost to do this is perhaps markedly lower than the above. However, the downside is the potentially large maintenance costs due to its remoteness, thereby creating risk that it would not be maintained well after being built.

Maintaining the current built infrastructure also requires high costs that are sometimes too demanding for the PDAM and local government, resulting in lower levels of service and consumer satisfaction. Researchers who evaluated the clean water infrastructure development in East Sumba determined that consumers aren't completely satisfied with the PDAM's level of service, pointing out issues such as decreased water pressure at certain times of the day and insufficient amount of water supply. Several causes were identified, such as leaks that exist in the water distribution system and the uneven topography, both of which reduce water pressure. Addressing these causes require more investment and maintenance costs from the local government and PDAM.

Current research suggests that without improvements to the island's clean water infrastructure and general water management, the inhabitants become more vulnerable to shocks such as droughts and heatwaves, and worsening sanitation which could potentially cause diseases and negative effects to public health. The slow-onset impacts of climate change could potentially exacerbate shocks and render them more severe.

Quality of Water and Its Impact to Sanitation and Hygiene

The quality of water is closely tied to sanitation and hygiene. Proper sanitation and hygiene practices require constant and sustained access to clean water, enabling people to drink, wash, bathe, clean, and defecate safely. If the quality of their drinking water intake is poor, it could lead to serious health consequences such as diarrhea and cholera. Without water, defecation and hygiene practices quickly

become severely unsafe. Alternatively, sanitation and hygiene also affects the quality of water, especially if water is extracted from open and unprotected sources, such as rivers, wells, springs, etc. Absence of hygiene and prevalent open defecation practices can lead to unsafe water resources and quality, which can potentially cause waterborne diseases. It is also important to note that the distance between water sources and defecation or toilet discharge sites is a prescient indicator of the impact of sanitation to water quality. In East Sumba, more than 12% of households' toilet discharge is located under 10 meters of the nearest water source. This is concerning and unsustainable, and must be addressed by either providing clean water private or public taps, or by installing safer toilet discharge facilities located farther away from water sources.

In its 2014 study on the potential water supply in Sumba Island, the Ministry of Public Works reported that the quality of water in East Sumba is generally in adherence to the national standard, which is made up of a number of chemical and physical parameters. Water extracted from drilled wells and subterranean rivers are generally safe to drink without prior need for refinement. However, it also reported that water from the Kambaniru river, although it meets the chemical parameters, requires further refinement before the water is safe to drink. Separately, a team of researchers oversaw a study on the water quality in East Sumba using microorganisms such as E. coli and total coliform as indicators/parameters. They determined that in general, open water surfaces have higher amounts of microorganisms than private and public taps. This suggests that although water from unprotected sources is still safe to extract, piped water is the safer alternative for drinking water.

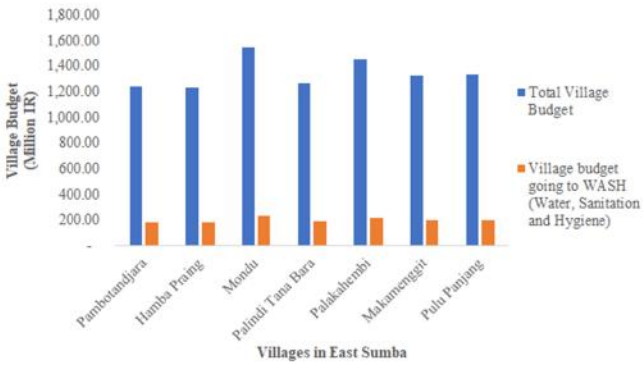

Figure 2 Allocation of Village Budget for WASH, East Sumba (Djohan et al., 2019)

Figure 2 lists several villages in East Sumba and describes the amount of their respective village budgets. The figure also shows how much of the village budget is allocated to water, sanitation, and hygiene, which is not much. The village which allocates most to WASH is Palakahembi Village, around 18% of its annual village budget. The least is Mondu Village, which allocates around 5% of its budget for WASH.

Water for Agriculture in Sumba

Agricultural activities are very much affected by climate variability, especially rainfall patterns and humidity. Increase in surface temperatures caused by climate change forces farmers to adapt their crops' water intake, possibly-requiring more than what is available or accessible to them. Without the presence of a robust irrigation or water circulation structure, it would be much more difficult for farmers to maintain their productivity. Uncertainties in the climate have also caused difficulty for farmers and policymakers in deciding what types of crops would be suitable to grow and when they should begin planting. The decline in rainfall in East Sumba forces farmers and policymakers to develop a new water management strategy to reduce the stress to their crops which mostly consist of rice, maize, and soybeans.

In East Sumba, irrigation is available for 78% of its cultivated agricultural land with varying levels of service. Sub-districts such as Lewa, Pahunga Lodu, and Pandawai are fertile and full of potential but require irrigation improvements to be more productive. In areas without irrigation, farmers rely mostly upon unprotected water sources such as springs, open wells, and surface waters. Farmers also occasionally build makeshift retention basins to collect and store rainwater during rainy seasons for use during long-periods of dry season, but this requires initiative, self-efficacy and capital from farmers. For farmers who are not equipped with the tools or capital, the lack of irrigation structures forces them to travel large distances to transport water for their crops.

However, as it is often the case in other regions in the country, East Sumba policymakers' ability to determine the appropriate measures and make evidence-based decisions for crop water management is hampered by the quality and quantity of data available at their disposal. Local government offices and agencies often suffer from lack of capable human resources, data collection and management tools, and cumbersome bureaucracy. This has caused trouble in managing accurate climate data. Research has identified that despite having better data collection tools than other districts (For example, the Mau Hau meteorological station and 5 rainfall observation stations), East Sumba authorities are still prone to occasional negligence when handling or managing climate data. Climate information and data needs to be communicated regularly with farmers so they are well informed and can take the necessary precautions to manage water for their crops.

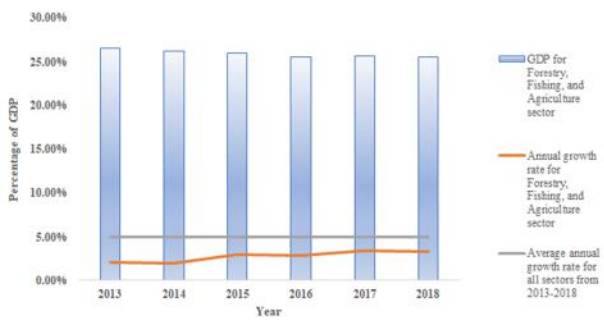

Figure 3 Contribution of the Forestry, Fishing, and Agricultural sector to East Sumba's GDP (RDI, 2020)

Figure 3 shows there has not been any meaningful growth in one of East Sumba's largest economic sectors. The annual growth rate of the sector is almost half of the average annual growth of all sectors from 2013-2018. Avoiding water scarcity could be pivotal in improving the growth of the Forestry, Fishing and Agriculture sector.

Regional Policy Response

We reviewed several regional policy documents to determine to what extent the issue of water scarcity is perceived to be important by the regional governments (both at the provincial and district level). The documents are as follows:

(1) Regional Medium-term Development Plan (RPJMD) 2013-2018 for East Nusa Tenggara Province
(2) Regional Medium-term Development Plan (RPJMD) 2018-2023 for East Nusa Tenggara Province
(3) Spatial and Territorial Planning (RTRW) 2008-2028 for East Sumba District

In RPJMD 2013-2018, the provincial government created active programs which directly focused on developing better irrigation and increased access to clean drinking water. It entrusted the Public Works Agency to carry out these programs and supplied them with a total fund reaching 153 Billion Rupiah for 5 years, of which the most significant proportion was directed to developing the irrigation system (92% of the funds). Sanitation was explicitly addressed in the planning document but its planned development had no connection or accordance with increased access to clean water. In reality, sanitation and access to clean water is closely interlinked.

Unlike the previous period, RPJMD 2018-2023 represents a change in direction for the provincial government. Sanitation was included as a development target, but the irrigation program created in the previous period was discontinued. The development of clean water infrastructure, irrigation, and sanitation were combined under a broad public infrastructure improvement program, called the Infrastructure, Spatial, and Regional Improvement Program, under the responsibility of Dinas PU. Unfortunately, due to their status as derivative programs, clean water, sanitation, and irrigation development for communities lost their importance as essential programs and hence were not used as indicators of the larger program's success. Road length, connectivity, and road quality became the indicators with which the larger program's achievement was measured.

Recommendations and Policy Implications

Based on the information we described in Sections 1 and 2, we recommend the following ideas to be applied in future policy documents:

- **Mainstream climate change into regional policy and spatial planning** in order to integrate existing and future programs from all agencies. Operational targets from each agency can then be set in order to ease practical implementation.
- **Create a dedicated program** in the provincial and district medium development and spatial plans (RPJMD *Provinsi dan Kabupaten* and RTRW) designed to improve clean water provision and distribution, expand irrigation systems, and enhance water management. By doing so, indicators could be set.
- **Set clear indicators** with which the success of a program could be measured and allocate the **appropriate budget and resources** to achieve the program target.

We also have several recommendations outside of policy documents which could be considered in future policy planning.

- **Improve data collection and management capabilities of local governments** in order to promote evidence-based policymaking in regards to development of water provision and management systems.
- **Adopt low cost and low maintenance technological solutions** to increase water access in remote areas where clean water infrastructure has not reached and unprotected water sources are far away, such as fog collection systems, rainwater harvesting, and water filtration.
- **Support community initiatives** which aim to conserve and utilize water for different purposes through subsidies or direct investments to promote water independence, such as farmers who build improvised retention basins to conserve rain water for agricultural use or communities who harvest rainwater for use in dry season.

What 'fog collection systems' are

Fog collection systems are a low-cost and simple technology that extracts water vapour present in fog clouds and produces clean water. They are often used in dry, coastal regions across the globe as an alternative source of clean freshwater

Figure 4 A prototype of fog collection system
Photo provided by Heriot-Watt University

How they operate

A fog collection system is constructed by using a simple frame, a mesh net, and an underlying collection system. They are placed perpendicular to the prevailing wind direction. As the wind passes through, carrying with it a fog cloud, the net system collects fresh water from the fog and deposits it in the collection system.

Benefits of 'fog collection systems'

These systems can help combat severe lack of rainfall and shortage of freshwater during dry seasons to help provide freshwater directly to communities. This is especially pertinent for communities in remotely isolated areas far away from the nearest water source. Yielded water can be used for cooking, cleaning, and other household needs. Maintenance is also relatively simple:

- Routine checks to inspect the mesh net and cable tensions to prevent water loss and maintain structural integrity
- Routine checks for pipes, nets, and drains to remove debris
- Routine checks for storage tank to remove bacteria

Figure 5 Kampung Reti Pakadu sub-village, Mandahu Village

- Most of the sub-village inhabitants do not receive cell-phone coverage. The closest location that has good mobile and internet connection is the Community Health Center (PUSKESMAS – *Pusat Kesehatan masyarakat*) which is 7 km away.

Figure 6 Aerial view of a community settlement in Mandahu Village

- Most access roads in the village are unpaved and consists of gravel and sand. Only some parts of the village's road network are paved with asphalt. The relatively poor condition of the village roads has a negative effect to the inhabitants' mobility.

Figure 7 A spring which provides water for a community in Mandahu village

- The spring serves as the main water source for a community in Mandahu Village. It is located 500 meters away from the nearest household. This is an example of an unprotected spring since it does not have a walled perimeter and water extraction tool or vessel, such as a pail.

Figure 8 A secondary water source

- During the long periods of dry season, the community has to rely on another spring as their secondary water source. The picture shown above is of a new spring found by Mr. Limu, a community official. It is located around 1 km from the current water spring. Distance and road access become the main issues which prevent the community from utilizing this water source.

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Resilience Development Initiative (RDI) is an Indonesian think tank initiative that focuses and contributes to the body of knowledge on sustainable development and resilient studies.

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