Disaster Mitigation of Dry and Clean Water Crisis in Dana Sub-District Watopute District Muna Regency

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Abstract. In the Southeast Sulawesi region, the area most frequently experiencing drought and clean water crises is Dana Sub-District, Watopute District, Muna Regency. This disaster was caused by physical and social factors. This study aims to describe the mitigation efforts of drought and clean water crisis in the Dana Sub-District, Watopute District. This research uses descriptive qualitative research methods. The population in this study were all the heads of families in Dana Sub-District, totaling 604 people. The sample in this study was selected using simple random sampling technique where the sample was randomly selected as much as 10% of the total population, so the sample in this study was 60 people. The results showed that the drought and water crisis in the Dana Sub-District, Watopute District occurred due to climate change and geomorphological conditions of the area as well as the lack of cooperation in the community in paying water bills. The peak of drought and clean water crisis in this region often occurs from July to November. To overcome this, various efforts have been made by the community, for example taking water from rivers and springs, buying clean water, and collecting water in storage tanks. Furthermore, the local government has also issued several policies, namely the development of the District Capital City Drinking Water Supply System and procurement of water pumps from springs, but according to the local community these government policies have not been effective. Furthermore, water dropping is also not maximally done because the community is less cooperative in paying water bills.

1. Introduction
Climate change is one of the issues that is of concern to the global community today. Indicators of climate change are marked by the increasing number of extreme climatic events in both intensity and distribution[1]. Based on global data, about 75-80% of the increasing tendency of natural disasters is related to the phenomenon of climate change[2]. These natural disasters include floods, flash floods, landslides, tropical storms, hurricanes, rainstorms, blizzards, sandstorms, tornadoes, orography (strong winds), extreme temperatures, heat waves, cold waves, frost, fire forests, drought, and etc[3].

One of the most serious natural disasters in Indonesia is drought. Undang-Undang No. 24 of 2007 concerning Disaster Management explains that drought is a condition of water availability that is far below the need for water for life, agriculture, economic activities and the environment. He further explained that drought is a dry period that is longer than normal and causes water availability to be far below water demand[4].

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Drought natural disasters are commonly called creeping disasters. Drought often gets less attention even though it has a serious impact on food security, forest fires, and can even cause death. This is because the formation of these natural disasters tends to be slow, has indirect consequences, often goes undetected, and can occur over a long period of time from months to years[5], [6], [7]. Furthermore, drought is classified into 4 categories, namely meteorological drought, agricultural drought, hydrological drought, and socio-economic drought [8], [9], [10].

In general, drought in Indonesia occurs as a result of the El Niño-Southern Oscillation (ENSO) which occurs as a result of changes in sea surface temperature (SST) in the Pacific Ocean[11]. The effect of ENSO in Indonesia is rainfall that is higher than normal (La Niña) and rainfall below normal (El Niño)[7],[12].

The National Disaster Management Agency (BNPB) noted that from January to August 2019 there had been 60 drought incidents in Indonesia. Furthermore, the Meteorology, Climatology and Geophysics Agency predicts that the 2019/2020 rainy season will be delayed in 254 season zones in Indonesia. There are 7 areas affected by drought, namely West Java, Central Java, Special Region of Yogyakarta, East Java, Bali, West Nusa Tenggara and East Nusa Tenggara covering 101 cities, 781 districts and 2,731 sub-district/villages[13].

Particularly in the Southeast Sulawesi region, the area most frequently experiencing drought disasters is the Dana Sub-district, Watupute District. This is as a result of the occurrence of a long dry season or days without rain for more than 60 days from September to November 2019. This drought has made it very difficult for the people of Dana Sub-district to get clean water, so that people must be able to protect and save in water use. Another effort made by the community is to buy water from the Regional Drinking Water Company in the local area, considering that water is a basic and vital need for all living things that cannot be replaced with other resources.

2. Methods

2.1. Time and Location of Research
This research was conducted in October 2019 in Dana Sub-district, Watupute District, Muna Regency.

![Figure 1. Map Of Research Location (Muna District Central Statistics Agency)]
2.3. Population and Sample
The population in this study were all heads of households in Dana Sub-district, Watopute District, Muna Regency, amounting to 604 people. The sample in this study was selected using simple random sampling technique where the sample was randomly selected as much as 10% of the total population, so the sample in this study was 60 people.

2.4. Data Source
The data sources in this study are:
   a. Primary data, sourced from the results of questionnaires and interviews with the community regarding efforts to mitigate drought and clean water crisis in the Dana Sub-district, Watopute District, Muna Regency.
   b. Secondary data, sourced from the National Disaster Management Agency, The Central Statistics Agency, population data from the Watupute District Office, national journals and international journals.

2.5. Data Analysis Technique
The data in this study were analyzed descriptively and in percentage (%). To find out the description of each variable is done as follows:
   a. Creating a frequency distribution table, which is meant to make the research data easy to understand.
   b. Based on the frequency distribution table, the% (percentage) of each item in the questionnaire was determined using the formula:

\[ P = \frac{F}{N} \times 100 \]

Information:
P = Percentage of choices
F = Number of answer frequencies
N = Number of respondents
100 = percentage (%)

3. Methods

3.1. Difficulty Level of Getting Clean Water During the Dry Season
Community responses regarding the level of difficulty in obtaining clean water during the dry season in Dana Sub-District can be seen in Table 1 below.

| No. | Variables       | Frequency (f) | Percentage (%) |
|-----|-----------------|---------------|----------------|
| 1.  | Very difficult  | 38            | 63,33          |
| 2.  | Difficult       | 22            | 36,67          |
| 3.  | Easy            | -             | -              |
|     | **Total**       | **60**        | **100**        |

Table 1 above shows that most of the community, namely 38 people (63.33%), consider it difficult to get clean water during the dry season and no community thinks it is easy.

3.2. Clean Water Dry Period
The period of dry clean water in Dana Sub-District can be seen in Table 2 below.

| No.   | Variables           | Frequency (f) | Percentage (%) |
|-------|---------------------|---------------|----------------|
| 1.    | July - November 2019| 20            | 33,33          |
| 2.    | July - October 2019 | 15            | 25             |
| 3.    | July - September 2019| 13            | 21,67          |
Table 2 above shows that as many as 20 people (33.33%) considered that the dryness of clean water occurred in July-November 2019, while 12 people (20%) thought that the dryness of clean water occurred in the July-August 2019 period.

3.3. The Importance of Mitigation Efforts to Drought and Clean Water Crisis
The response of the community regarding the need for mitigating efforts for clean water drought in Dana Sub-District can be seen in Table 3 below.

| No. | Variables | Frequency (f) | Percentage (%) |
|-----|-----------|---------------|----------------|
| 1.  | Yes       | 56            | 93.33          |
| 2.  | No        | 4             | 6.67           |
| Total |           | 60            | 100            |

Table 3 above shows that as many as 56 people (93.33%) consider that it is necessary to mitigate clean water drought disasters while 4 people (6.67%) think that disaster mitigation is unnecessary.

3.4. Participation in Drought and Clean Water Crisis Mitigation Activities
Community responses regarding participation in drought and clean water crisis mitigation socialization activities in Dana Sub-District can be seen in Table 4 below.

| No. | Variables          | Frequency (f) | Percentage (%) |
|-----|--------------------|---------------|----------------|
| 1.  | Followed           | 24            | 40             |
| 2.  | Never Followed     | 36            | 60             |
| Total |                  | 60            | 100            |

Table 4 above shows that most of the community, namely 36 people (60%) have never participated in any socialization activities for drought and clean water crisis mitigation and only 24 people (40%) have participated in these activities.

3.5. Government Efforts to Mitigate Drought and Clean Water Crisis
The public response to the government's efforts to mitigate drought and clean water crises in Dana Sub-District can be seen in Table 5 below.

| No. | Mitigation Efforts                                                                 | Frequency (f) | Percentage (%) |
|-----|------------------------------------------------------------------------------------|---------------|----------------|
| 1.  | Construction of reservoirs and rainwater collection tanks                           | 23            | 38.33          |
| 2.  | Dropping clean water with a Regional Drinking Water Company’s water tanker         | 13            | 21.67          |
| 3.  | Reforestation                                                                     | 11            | 18.33          |
| 4.  | Education about clean water                                                        | 13            | 21.67          |
| Total |                                                                                | 60            | 100            |

Table 5 above shows that as many as 23 people (38.33%) think that the mitigation efforts carried out by the government should be the construction of reservoirs and rainwater storage tanks (PAH) and 11 people (18.33%) want reforestation activities.

3.6. Community Efforts to Mitigate Drought and Clean Water Crisis
Community efforts in mitigating drought and clean water crises in Dana Sub-District can be seen in Table 6 below.

Table 6. Community Efforts to Mitigate Drought and Clean Water Crisis in Dana Sub-District (Source: Primary Data, 2019).

| No.  | Mitigation Efforts                  | Frequency (f) | Percentage (%) |
|------|-------------------------------------|---------------|----------------|
| 1.   | Take water from the river and springs | 10            | 16.67          |
| 2.   | Buy clean water                      | 27            | 45             |
| 3.   | Hold water in the reservoir          | 23            | 38.33          |
|      | Total                               | 60            | 100            |

Table 6 above shows that at the time of the drought, 27 people (45%) chose to buy clean water while only 10 people (16.67%) took water from rivers and springs.

3.7. Estimated Cost of Purchasing Clean Water

The costs incurred by the community to buy clean water in Dana Sub-District can be seen in Table 7 below.

Table 7. The Estimated Cost Spent by The Community to Buy Clean Water in a Week in Dana Sub-District (Source: Primary Data, 2019).

| No.  | Mitigation Efforts     | Frequency (f) | Percentage (%) |
|------|------------------------|---------------|----------------|
| 1.   | Rp.5000- Rp.50.000     | 28            | 46.67          |
| 2.   | Rp.50.000 - Rp.100.000 | 18            | 30             |
| 3.   | > Rp.100.000           | 14            | 23.33          |
|      | Total                  | 60            | 100            |

Table 7 above shows that as many as 28 people (46.67%) spent around Rp. 5,000-Rp. 50,000 while 14 people (23.33%) spent about > Rp. 100,000 to buy clean water.

4. Discussion

Drought and clean water crisis are global challenges for today’s modern society. In general, drought can be defined as a temporary reduction in water supply or humidity that is significantly below the normal or expected volume for a specific period of time. Drought can also be interpreted as a condition where there is a lack of water, in this case it is usually connoted with a lack of rain water[14]. Natural disasters, drought and water shortages, are not only caused by physical environmental factors but can also be caused by socio-cultural factors.

Based on the results of monitoring in 2019 by the Kendari Meteorology, Climatology and Geophysics Agency, it shows that the Southeast Sulawesi region generally experiences days without rain in the long category, very long to [15]. This phenomenon has an impact on drought and clean water crises in several regions in Indonesia, including Dana Sub-District, Watopute District, Muna Regency.

Watopute District is very vulnerable to drought and difficulty in getting clean water. Apart from being caused by climate change and atmospheric phenomena, disasters in the region are caused by geomorphological conditions. Watopute Subdistrict is a karst topographic area, where so far the karst is seen as an arid, rocky area, and always faces problems with water resources, especially during the dry season[16],[17].

Groundwater flow in the karst region, does not follow the groundwater flow equation in general. The water flow system on the karst is unique, the water flow is controlled by a conduit (cavity) that forms an underground “river”. Further explained, karst areas are formed by solid but easily soluble rocks such as limestone, dolomite, gypsum, anhydrite, and some other rocks that are impermeable (can not escape water), so without cracks and cavities, karst is difficult to store and drain air. Karst stores water for only a short time (low storage) and its porosity is low[18].

According to the people of Watopute District, drought and the peak of clean water shortages in their area often occur from July to November. To overcome this, various efforts have been made by the
community, for example taking water from rivers and springs, buying clean water, and collecting water in storage tanks.

In the area of Watopute District, there is a river and a spring at Tumbulaha Tombi, but the distance is about 2-3 meters from community settlements, the terrain is winding, the roads are landslide and steep, so that the dominant community buys clean water to meet their needs. Most people spend around Rp. 5,000,-50,000, - per day to buy water. This budget is included in the high category if it is accumulated in a month’s water usage. Furthermore, the community also holds water in a storage tank, especially when the rainy season arrives and at the time of dropping clean water by Regional Drinking Water Company.

Rain water harvesting is defined as a method of collecting or storing rainwater or surface runoff during high rainfall for further use when rainwater is low. There are 2 categories of rain water harvesting techniques, namely: 1) roof top rain water harvesting; and 2. techniques for harvesting rainwater (and surface runoff) using reservoir structures, such as trench dams, reservoirs, ponds, reservoirs, and so on. Rain water harvesting is an important agenda for Global Environmental Water Resources Management in the context of overcoming water imbalances during the rainy and dry seasons (lack of water), lack of clean water supply for the world’s population, and overcoming floods and droughts[19].

The drought disaster and clean water crisis in the Watopute District area make the people in the area really want and urge the government to make efforts to mitigate the disasters they experience because water is a vital human need and therefore must be available in order to survive[20]. But on the other hand, drought has not become a priority for BPBD and Muna Government because there are no victims. So far, local governments have focused more on emergency measures and less on disaster anticipation and mitigation efforts. Dry clean water is still considered a less dangerous event than other natural disasters such as floods and fires[21].

Actually, there have been several policies that have been carried out by the Watopute District government and the Muna Regency government, including the construction of the District Capital City Drinking Water Supply System which is planned to drain all residents’ houses in one village and the provision of water pumps from springs, but according to the local community this government policy is not yet effective. Furthermore, water dropping is also not maximally carried out because according to the President Director of the Tirta Dharma Muna Drinking Water Company, the community is less cooperative in paying water bills so that the company temporarily stops services[22].

Drought disasters and clean water crisis are complex problems, so it needs cooperation between stakeholders and the local community. In addition to policies issued by the government, other efforts can be made to mitigate drought and clean water crises in Karst topographic areas such as in Watopute District, namely conservation of karst hills by identifying types of karst in watershed catchments; engineering by controlling groundwater extraction; maintaining infiltration or increasing groundwater infiltration in areas disturbed by human activities through infiltration wells, injection wells, reservoirs, absorption lakes, and mining engineering so that groundwater infiltration increases. Furthermore, reforestation can also be carried out as an effort to restore hydrological, geomorphological and biochemical functions. With forests, it is expected that the geomorphological process in the form of limestone dissolution will be able to take place naturally again. Forests produce CO₂ in the soil which when reacting with H₂O will dissolve limestone (CaCO₃). With the karstification process as in natural conditions, it is hoped that cracks will form near the surface that can store groundwater[16].

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