# Water quality and water borne diseases in lowland

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# Water quality and water borne diseases in lowland ecosystem of Banyuasin, South Sumatra, Indonesia

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**Abstract.** Water quality and quantity is always an important issue in lowland ecosystem of Banyuasin. Low domestic water supply sanitation is considered as having an important contribution on the high frequency of waterborne diseases in the area. The study aims at recording water borne diseases and the water quality in the lowland area of Banyuasin District. This field research was conducted using a cross-sectional method. Total samples were 210 households in Telang which were observed from July through August 2011. Six water samples were measured for their physical and chemical properties, in addition to 1 water sample for bacteriological test. All respondents used river water for sanitary purposes and 41.4% of them also have dug wells. Those who used river water for sanitation, 68.5 % also consumed purified water for drinking purpose. All water samples are acidic (pH 5,68-6,19) and contain high Iron (1-26,269 Mg/L). Water has yellowish color. The major disease are diarrhea and skin diseases. In the lowland area with the estuarine ecosystem water quality and scarcity are serious problems. This in turn causes the high prevalent of waterborne diseases such as diarea. Low level of education and socio-economic status make it difficult for the local people to overcome these problems. Outside intervention especially government so as to improve the condition is needed.

**Key words** : Water Quality, Water Borne Diseases, Lowland

## Introduction

The spread of infectious diseases associated with human activities, in particular, due to deforestation, human settlements, construction of dams, drainage, and climate change (Slamet, 2007). Climate change will also cause a change in the monsoon season, which led to move more quickly with the trend of the intensity of the rains are more abundant, causing floods and landslides. Flood is a torrent of water that hit an area in particular. The flood water likely to endanger human health, because it there are microorganisms that cause diseases, so it can degrade the quality of the water and the food crisis. Decrease in the quality of the water and food supply crisis led to the emergence of diseases such as malaria, dengue and diarrhea (Ministry of health, 2002).

Health problems in a region can be answered by knowing the patterns of common diseases in the area. In countries or communities which are poor or low socioeconomic status, poor nutritional status, low knowledge, so that the poor health condition of the environment and poor health status. In a society so it will be easy transmission of disease, particularly children, who are particularly sensitive to infectious diseases. The result, many child deaths that occurred a short life expectancy (Slamet, 2007).

Problems related to environmental health are clean water, waste management, disposal of waste water flowing directly on the channel / river and sanitation. This causes siltation of channels / rivers, blocking the channel / river due to waste. In the rainy season is always flooding and cause disease. Protections of groups vulnerable to hazardous environmental conditions are still considered a low priority. However, the impact of environmental risk factors on human health is growing, both in magnitude and diversity. Based on the aspects of sanitation, high rates of disease caused by community-based environment that unmet need for clean water, latrine use remains low, contamination of soil, water, and air as household waste, industrial waste, agricultural waste, transportation, physical and possibly environmental conditions (BTKL PPM Palembang, 2009).

The data showed 48.38% of the public have access to water sources such as water wells, in addition to river water, swamp water, rain water. The water quality of water sources used by people of unknown quality. Based on observations in the initial study conducted by researchers, there are still many people who use the river water, swamp water, rain water for daily life. There are still many people who use river water for daily

living such as bathing, brushing teeth, washing, cooking and others while on the other hand is still a lot to put the toilet on the river bank. This possibility may lead to a change in the status of public health (Ekawati, 2009). Water quality and quantity is always an important issue at the lowland ecosystem of South Sumatera. Low domestic water supply sanitation is considered as having an important contribution on the high frequency of waterborne disease in the area.

Efforts to meet the needs of water by humans can take water from the soil, water surface, or directly from the rain. Of the three sources of water, to the tidal marsh wetlands, the most commonly used is the water of the river. But the water that is widely used that it is incompatible with the terms of the health, as is often the water containing seeds or specific substances that can cause illness which is dangerous for human survival. The water is seen in terms of quality, directly or indirectly pollution affects the quality of the water. According to the considerations for determining the quality of drinking water, the business management of the water used by humans for drinking water and drinking water must be guided by the standards of water quality, especially in the assessment of drinking water products are produced, as well as in systems of planning and processes which will be the source water (Razif, 2001: 4).

### Problems statement.
Water availability and use of clean water for domestic use is a problem in areas where wetland could be a risk factor for the development of new and contagious diseases through the water. Similarly, in the area of wetlands, where the lack of water can cause a variety of diseases, while the source of water in the river, usually water, well water and rainwater. There are no water becomes a problem and continuous rain can also cause problems, some areas will be flooded wetlands/floods, consequently, increase the amount of water that leads to contamination of drinking water, the emergence of various diseases in the toilet, which is located on the Bank of the River, are terminated. These events provide space for discussion of how the water quality and water-borne diseases in the area of wetlands.

### The objective of research
The general objective is To find the disease is transmitted through water and water quality in wetland ecosystems Telang, Banyuasin regency. While the special objective are to found the prevalence of diseases spread by water in the wetlands ecosystems Telang, Banyuasin disrict; to Identify the environmental risk factors in the wetlands ecosystems Telang, Banyuasin; to know the quality of domestic water used by communities in wetland ecosystems Telang, Banyuasin.
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### Research Methods
This study is a descriptive study that describes the distribution of the quality of the water and the incidence of infectious diseases through the water at the lowland ecosystem in the district of Banyuasin, South Sumatera.The design of the study was cross-sectional. The data used are secondary data taken during the period of 3 years, i.e. from 2007-2009. The primary data was obtained from the results questionnaire and observe the environmental conditions in the village of Telang.

### The population
The study was conducted in the village of Telang in Banyuasin and research time in June 2011.

### Sampling procedures
The sample size in each village is determined by Probable Proportional To Size (PPS) • Sampling by the cluster, from Telang Banyuasin taken as a cluster of 3 villages. • Based on a large sample (210), can determine the sample size in each group as shown in Table 1.

Sampling is done in stages as follows: (1) Sampling in the field using rapid survey approach, (2) Determine the starting point of every village in which the starting point determined the crowded center of the village, such as markets, mosques, schools, because this place is situated in the village center, (3) The next step determines the direction the interview goes randomly draw four cardinal directions. Direction runs in a paper written in the selected direction and sweepstakes will run toward the interviewer, and then built a house plan and then taken a house at random to determine who will become the first home visit, (4) After a random number in the home can, then the interviewer can visit the home and conduct interviews and observations, (5) First, ask if the respondent in the last month

have suffered illness, whether the respondents treat the disease, if you answer "Yes" then interviewed the forward and backward. Interviews with yes.

Table 1. Sample size determination based on each village

| No | Desa (Cluster) | Number of household heads | N |
|----|----------------|---------------------------|-----|
| 1 | Telang Jaya | 1083 | 91 |
| 2 | Telang Karya | 606 | 52 |
| 3 | Telang Rejo | 800 | 67 |
| | Total | 2489 | 210 |

## Results and Discussions

Based on existing data for the 10 diseases most Telang Jaya health center in the region are as follows:

Table 2. The biggest disease in the district Banyuasin, in 2007

| No. | Types of diseases | Amount | No. | Types of diseases | Amount |
|-----|-------------------|--------|-----|-------------------|--------|
| 1 | Ispa | 1243 | 6 | Skin Infection | 574 |
| 2 | Gastritis | 931 | 7 | Eye Disease | 474 |
| 3 | Rheumatism | 726 | 8 | Asthma | 472 |
| 4 | Allergic | 614 | 9 | The other intestinal diseases | 462 |
| 5 | Skin diseases | 586 | 10 | Hypertension | 426 |

Source : Dinkes Kab. Banyuasin, 2008

Table 3. The biggest disease in the district Banyuasin, in 2008

| No. | Types of diseases | Amount | No. | Types of diseases | Amount |
|-----|-------------------|--------|-----|-------------------|--------|
| 1 | ISPA | 1558 | 6 | Bronchitis | 556 |
| 2 | Rheumatism | 786 | 7 | Allergic | 532 |
| 3 | Dysentery | 593 | 8 | Eye Disease | 527 |
| 4 | Asthma | 589 | 9 | Skin diseases | 520 |
| 5 | Diarrhea | 573 | 10 | The other intestinal diseases | 470 |

Source : Dinkes Kab. Banyuasin, 2009

Table 4. The biggest disease in the district Banyuasin, in 2009

| No. | Types of diseases | Amount | No. | Types of diseases | Amount |
|-----|-------------------|--------|-----|-------------------|--------|
| 1 | ISPA | 2693 | 6 | Allergic | 849 |
| 2 | Rheumatism | 1633 | 7 | Asthma | 805 |
| 3 | Skin diseases | 1538 | 8 | Gastritis | 770 |
| 4 | Influenza | 1042 | 9 | Diarrhea | 704 |
| 5 | Scabies | 854 | 10 | Dental caries | 646 |

Source : Dinkes Kab. Banyuasin, 2010.

Based on the three tables above, water-borne diseases during the last 3 years occupy 10 of the largest disease.
The results of research that the disease caused by water or spread through the water above the working area of the Telang Jaya public health center can be seen in the table as follows:

### Number of persons in the family

Number of family members who are in the family, which can be seen in the table as follows:

Table 5. Number of family members in the same house in district of Banyuasin

| No | Number of family members | Amount | (%) |
|----|--------------------------|--------|-----|
| 1 | > 4 persons | 103 | 51,0 |
| 2 | ≤ 4 persons | 107 | 59,0 |
| Total | | 210 | 100 |

Based on survey results obtained from 210 family members in the region of Telang with family members who have a family size of <4 people in one house as many as 107 with a percentage of 59.0%.

### Family"s occupation

The occupation families in the region of Telang can be seen in the table as follows:

Table 6. Frequency distribution of  respondents occupation

| No | Pekerjaan Keluarga | Amount | (%) |
|----|--------------------|--------|-----|
| 1 | Merchants | 46 | 21,9 |
| 2 | Factory workers | 8 | 3,8 |
| 3 | Farmers | 141 | 67,1 |
| 4 | Government Employee | 11 | 5,2 |
| 5 | Mechanics | 3 | 1,4 |
| 6 | Drivers | 1 | 0,5 |

Based on survey results obtained from 210 families in Telang, head of the family worked as farmers as many as 141 people with a percentage of 67.1%.

### Head of the family education

Education head of household in the region of Telang can be seen in the Table 7. On the basis of research results from 210 families in Telang, high school-educated head of the family as much as 59 heads of households, the percentage of 28.1%.

Table 7. Frequency distribution of education level of respondents

| No | Pendidikan Kepala Keluarga | Amount | (%) |
|----|----------------------------|--------|-----|
| 1 | Uneducated | 5 | 2,4 |
| 2 | Primary School | 30 | 14,3 |
| 3 | Junior High School | 58 | 27,6 |
| 4 | Senior High School | 51 | 24,3 |
| 5 | College | 59 | 28,1 |
| | Total | 210 | 100 |

### Behavior

Table 8.Frequency distribution of clean and healthy behavior respondents

| No | Behavior | Amount | (%) |
|----|----------|--------|-----|
| 1 | Not Care | 112 | 53,3 |
| 2 | Care | 98 | 46,7 |
| | Total | 210 | 100 |

Based on survey results obtained from 210 families in the region of Telang with families who do not care about the cleanliness of the environment were 112 families with a percentage of 53.3%.

### Water quality

The quality of domestic water in Telang are grouped into two categories: good and bad water quality, physical and chemical quality of water that can be read as follows: on the basis of exam results in 3 villages of health centers serving Telang district the first sample was taken at high tide, with the number of samples taken at the 6 samples. The width of

the river in about 50 meters depth reaches 20 meters, the sample was taken at 15 meters from the shore of the river just behind the houses.

Table 9. Results of the laboratory examination of water samples

| No. | Location | Phisicals Parameters | Standards | Results | Chemicals Parameters | Standards | Results |
|---|---|---|---|---|---|---|---|
| 1 | Telang Karya Village | Muddiness | 25 | 63 | pH | 6,5 - 9,00 | 5,89 |
| | (High Tide) | Color | 50 | 120 | Iron | 1 | 1,7104 |
| 2 | Telang Karya Village | Muddiness | 25 | 62 | pH | 6,5 - 9,00 | 5,68 |
| | (Low Tide) | Color | 50 | 130 | | | |
| 3 | Telang Rejo Village | Muddiness | 25 | 76 | | | |
| | (High Tide) | Color | 50 | 119 | pH | 6,5 - 9,00 | 6 |
| 4 | Telang Rejo Village | Muddiness | 25 | 69 | Iron | 1 | 2,660 |
| | (Low Tide) | Color | 50 | 126 | pH | 6,5 - 9,00 | 5,62 |
| 5 | Telang Jaya Village | Muddiness | 25 | 37 | Iron | 1 | 1 |
| | (High Tide) | Color | 50 | 117 | pH | 6,5 - 9,00 | 6 |
| | | | | | $KMnO_4$ | 10 | 22,12 |
| | | | | | Mn | 0,5 | 0,9928 |
| 6 | Telang Jaya Village | Muddiness | 25 | 30 | Iron | 1 | 26,269 |
| | (Low Tide) | Color | 50 | 98 | pH | 6,5 - 9,00 | 6,19 |
| | | | | | $KMnO_4$ | 10 | 17,6 |

## Quality of pond water

Based on the results of water pond in the area of Telang can be seen in the table as follows:

Table 10. Results of pond water in Telang

| Sour. | Test Coliform LB $37^0$C | | | Test Coliform BGLB $37^0$C | | | Test Coliform BGLB $44^0$C | | | MPN / 100 ml Coliform | MPN / 100 ml Colitinja | Meth ods | Remar k |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 ml | 1 ml | 0.1 ml | 10 ml | 1 ml | 0.1 ml | 10 ml | 1 ml | 0.1 ml | | | | |
| Pond water Telang Karya village | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | >2400 | >2400 | MPN | TMS |

## Water quantity

The amount of river water for their daily needs can be grouped into two categories namely the amount of use of river water  >100 liters / day and <100 liters / day, can be seen in the Table 11. In Telang  mostly family members in using more than 100 liters of water per day as many as 150 heads of households with a percentage of 71.4%.

Tables  11. Frequency distribution of water use by respondents

| No | Water Quantity | Amount | % |
|---|---|---|---|
| 1 | ≤  100  Litre/Day | 60 | 28,6 |
| 2 | > 100 Litre / Day | 150 | 71,4 |
| Total | | 210 | 100 |

Figure 1. Environmental condition in sampling sites

Human needs for water resources become very real, in the know that the amount of water on Earth remains in the following form that rotates the hydrological cycle of all time (sea water inland waters vapor). Although world population continues to increase and more advanced life anyway, so use more water and more. Rapidly expanding populations are also rapidly deteriorating water supply per capita per year. The more so that development occurs in small water sources. Water distribution is uneven geographical distribution of population density coupled unevenly causing too obvious imbalance of supply and demand (supply and demand) for water that are difficult to overcome (Soerjani et al., 1997). In terms of quantity that includes the amount of water available and the amount of clean water for daily needs in the Telang Jaya public health center more than 100 liters per day.

### Rainfal

Rain preciitation is very high which can cause flooding and make the area gets wet and humid. Rainfall is high enough to make water-borne diseases spread more widely, flowing water will carry germs and can pass on to people who use contaminated water. Based on the results of measurements of Meteorology and Geophysics (BMKG) on rainfall in the region of Telang standards can be categorized by rainfall in the vicinity or the tropics. But examination of rainfall, the highest rainfall in the year 2008 with rainfall 2685.7 mm in March, April and November are categorized as high compared with other months.

Table 12. Rainfall per year in Telang

| No | Year | High Rainfall (mm) | | | Amount/Year (mm) |
|----|------|-----|-----|-------|-----------|
| 1 | 2007 | Month | Jan | 503 | 2363.9 |
| | | | Apr | 379 | |
| | | | Des | 381.9 | |
| 2 | 2008 | Month | Mar | 371.9 | 2685.7 |
| | | | Apr | 323.4 | |
| | | | Nop | 634.4 | |
| 3 | 2009 | Month | Mar | 564 | 2410 |

Source : BMKG, 2010.

### Air humidity

Based on the results of measurements of Meteorology and Geophysics (BMKG) on the humidity in Telang can be categorized into two: high and low which can be seen in the table as follows:

Table 13. Air Humidity in Telang, Year of 2007-2009

| No | Humidity per Year | Average |
|----|-------------------|---------|
| 1 | 2007 | 83,5 |
| 2 | 2008 | 84,8 |
| 3 | 2009 | 82,3 |

Source : BMKG, 2010

From the table above is known that the highest humidity in Telang which in 2008 reached 84.8 and the lowest humidity in the year 2009 reached 82.3. Based on the results of measurements of Meteorology and Geophysics (BMKG) on the humidity in Telang is quite high, this can be seen from years of moisture and high humidity in 2008, began an average of 84.8 years old survived. The more humid the area and then to higher development of diseases such as respiratory diseases, diarrhea, tuberculosis, skin diseases, and others that can thrive in humid areas. The research was supported by a report  BTKL, which states that the environment in which people with daily living greatly affects the incidence of respiratory disease attack, because the home is very important for example taken into account when, the house should not be moist enough to light sun. Air quality in terms of moisture that the air humidity ranges from 40% to 70% $SO_2$ concentration not exceeding 0.10 (BTKL, 2010).

### Bathing habits

Table 14. Frequency distribution of bathing habits of   respondents

| No | Bathing Habits | Amount | % |
|----|----------------|--------|------|
| 1 | River  Water | 129 | 61.5 |
| 2 | Pond | 55 | 26.2 |
| 3 | Rain Water | 26 | 12.4 |
| Total | | 210 | 100 |

People in the area Telang most have a habit of using river water bath, the water in the wells were dug from the river that flows through the pipes. Dug wells/pond is shaped pool fence, so livestock (ducks, chickens, etc.) into the pond and pollutes the water.

### *Clean Water Sources*

Table 15. Frequency distribution of clean water sources of respondents

| No | Clean Water Sources | Amount | % |
|----|---------------------|--------|------|
| 1 | River Water | 22 | 58.1 |
| 2 | Rain Water | 59 | 28.1 |
| 3 | Pond | 29 | 13.8 |
| TOTAL | | 210 | 100 |

The table above shows the majority of domestic water sources used by residents are the river water (58.1%).

Table 16. Frequency distribution of family latrines of respondents

| No | Family Latrines | Amount | % |
|----|-----------------|--------|------|
| 1 | Cemplung | 150 | 71.4 |
| 2 | Cubluk | 22 | 10.5 |
| 3 | Septick Tank | 38 | 18.1 |
| | Jumlah | 210 | 100 |

The table above shows the majority of the population in using the toilet Cemplung Telang family type, type of latrine is at risk for disease transmission because the area is a wetland that is more Telang.

### Conclutions
1. Most of the population that is in Telang < 4 peoples in one family.
2. Most of the households in Telang working in the agricultural sector.
3. Most of the households in Telang school education did not finish elementary school, elementary, junior high school.
4. Most of the communities that exist in Telang care in protecting the environment, particularly on health and hygiene water.
5. Based on the results of river water that is in Telang can be categorized as unfit for use as daily necessities.
6. Most of the communities that exist in Telang in the use of river water for daily needs of more than 100 liters / day.
7. Rainfall in Telang can be categorized as standard-rainfall tropical regions.
8. Humidity in Telang can be regarded as a fairly humid area compared to other regions with a higher ground.

### Suggestions
For people who exist in the Telang should support the health of the environment, such as maintenance of water quality, contaminated by sewage or manure obtained from the household waste domestic wastewater, cattle sheds, and micro-enterprises that exist in society that may damage the aquatic environment, and advised not to consume or use for their daily water needs, which was contaminated. For health workers is expected to provide guidance and advice to the purity of the environment, particularly in maintaining the purity of water so that it is not contaminated by other materials that may damage or worsen water quality that makes the garbage that makes the pool of sewage the house and livestock pens away from sources of clean water.

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