Water Quality and Multiple Uses in the PA of Lege Dini, Dire Dawa

A research within the MUS-project of IWMI, supervision Dr. E. Boelee

- Research Area
- Concept of Multiple Use Systems (MUS)
- Conceptual Framework
- Objective and Research Questions
- Methods and Materials
- Results
- Conclusions and Recommendations
- Questions and Discussion

Description of the Research Area

- Peasant Association Lege Dini, Woreda Dire Dawa
- 9,300 ha, 10 villages
- Population estimated 3000 - 4000
- Religion: Muslim
- Altitude: 1100 – 1600 m
- Topography: Mountainous
- Rainfall 420- 650 mm
- Temperature 26 – 30° C
- Average cropland per HH: 0.8 ha

Overview -- Research Area – Concept of MUS -- Conceptual Framework – Objective and Research Questions -- Methods and Materials – Results – Conclusions and Recommendations

Description of the Research Area

- Main crops cultivated: Sorghum and Maize
- Economic Situation
- Food insecurity

Description of the Research Area

- Water Sources in Lege Dini
  - Shallow Wells
  - Deep Wells
  - Borehole (serves 4 villages)
  - Mountain Stream (serves one village)

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Description of the Research Area

- Additional Water Savings in Lege Dini
  - Roof Catchments
  - Wastewater Reuse for irrigating cash crops like papaya
  - Water Harvesting ponds

Concept of Multiple Use Systems

All individuals are part of a water use system consisting of multiple sources with multiple uses that require different qualities

Conceptual Framework

- Standards for drinking water quality

  WHO guidelines for developing countries

Thermot. Coliform (/100 ml)	EC (µS)	pH	$CaCO_3$ (mg/l)	Chloride (mg/l)	Nitrate (mg/l)	Sulphate (mg/l)
50	*70*	*6.5 – 8.5*	*500*	*250*	*45*	*200*

- Standards for irrigation water quality

  Depending on Crop Type

  Soil Moisture, Rainfall

  Etc.

Conceptual Framework

- Standards for water used for food preparation

  Depending on the water treatment (boiling, filtering, etc.)

- Standards for livestock drinking water quality

- Standards for other uses

  bathing water, cleaning water, etc.

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Conceptual Framework

But…..

- Sometimes water quality at source ≠ water quality received by end user
- Contamination by users
- Failure of Delivery System



Problem Description

- Food insecurity in all villages
  - **Unreliable rainfall**
  - **Degraded Environment**
  - **Low levels of income and diversification opportunities**
- (Drinking)Water shortage for different uses in most villages
  - **Multiple sources for multiple uses not optimised**
  - **In house water treatment and hygiene practices low**
  - **Opportunities for water harvesting and reuse only in some villages applied**

Objective and Research Questions

The objective of this study is to contribute to the improvement of the water security for different domestic and productive water uses in the Peasant Association of Lege Dini and therewith the improvement of health of its population

1. What are the different uses of water in the PA of Lege Dini? What is the required and available discharge of these uses?
2. What are the (possible) contaminating factors in the water system?
3. What is the local knowledge about water quality and contamination?
4. What is the quality of the available water sources?
5. What are the possibilities for change?

Methods and Materials

Combined Research with Martine Jeths

Restrictions of the research:

- Time
- Lack of registration of local data
  - Population
  - Aquifers
  - Health data
  - Etc.

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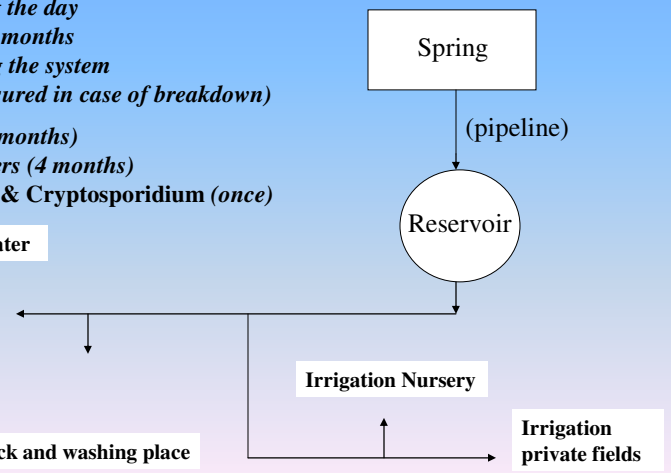
Methods and Materials

1. Water Quality Analysis

- ***In time during the day***
- ***In time over 4 months***
- ***In space along the system***
  (not measured in case of breakdown)

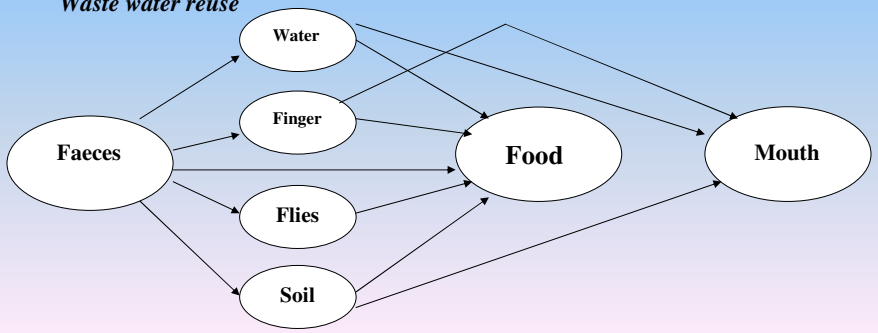
Fecal coliforms (4 months)
Chemical parameters (4 months)
Parasites: **Giardia & Cryptosporidium** ***(once)***



Methods and Materials

2. (Sanitary) Survey: ***Understand the thinking process and perceptions of the inhabitants:***

Which sources used for which purpose
In-house treatment of water and Sanitary Standards
Waste water reuse



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Methods and Materials

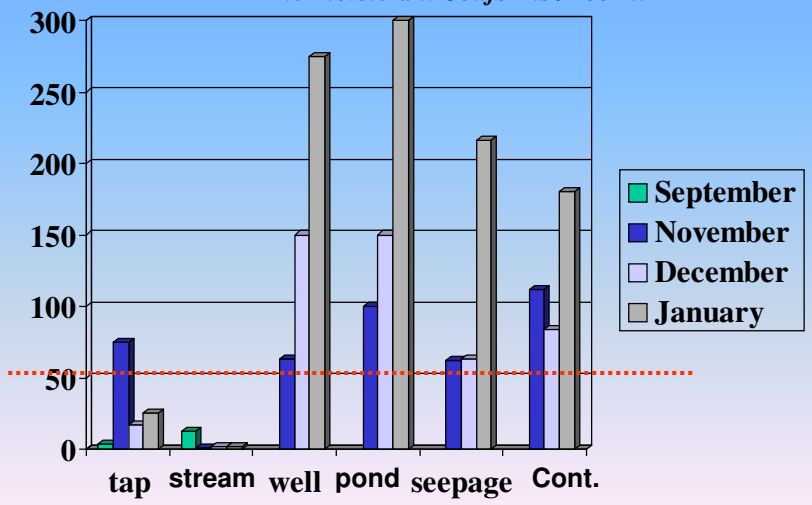
3. Observations

Are there differences between theory and practice?

What are the possible causes of contaminated water and health risks?

Results Water Analysis

Thermotolerant Coliforms / 100 ml



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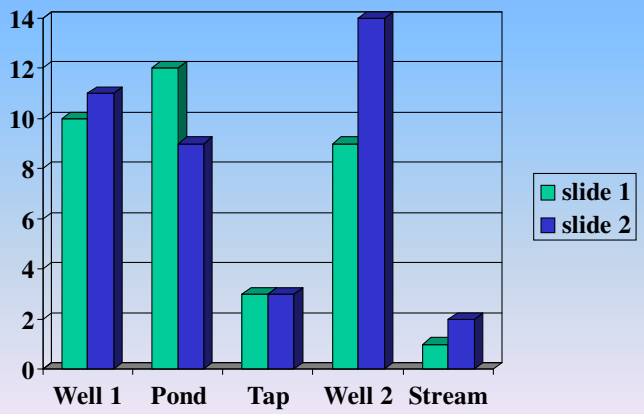
Results Water Analysis

- *EC, hardness, Chloride and Nitrate acceptable according to WHO guidelines for developing countries*
- *The concentration of Sulfate exceeded the standards in December and January with 10 – 15 % in all open wells and seepage wells*
- *Parasite Analysis ….*

Results Water Analysis

Parasite Analysis Giardia



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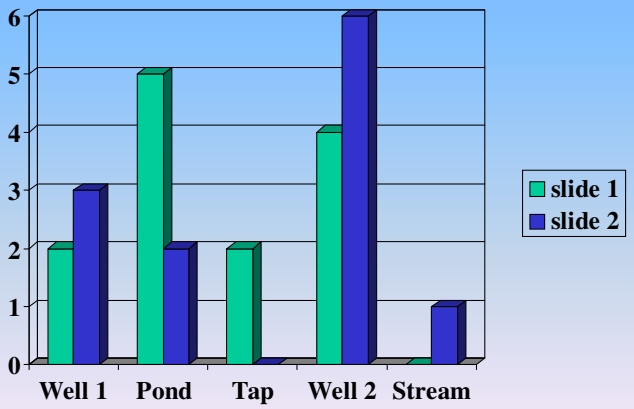
Results Water Analysis

Parasite Analysis Cryptosporidium



Results Water Analysis

Quantitative

1. Best quality water from borehole and stream: enough for drinking water

- **1.6 l/s during 10 h = 57,600 l/day**
  - **Reservoirs 50,000 liter**
  - **Population served estimated on: 2000-3000**
  - **Worst case: 19.2 lpcd > 15 lpcd**
- **0.8 l/s during 24 h = 69,120 l/day**
  - **Reservoir 10,000 liter, overflow during night**
  - **Used 30,000 liters, if required more**
  - **Population served estimated on 1000-2000**
  - **Worst case: at least 15 lpcd**

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Results Water Analysis

Quantitative

BUT…

- In case of breakdown, other (contaminated) sources used as drinking water
- Drinking water not affordable by all inhabitants
- Water not equally shared
- Population growth

Results Water Analysis

Quantitative

2. Water for livestock enough in water harvesting ponds

   Tap and wastewater to young animals

   More ponds can be created to create buffer

3. Not enough water for irrigation

   Waste water reuse can be stimulated

   Rain water harvesting can be stored to create buffer

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Results Sanitary Survey

Observations and positive points raised by population

1. Water from borehole and stream considered as clean, less water borne diseases (diarrhoea) reported
2. Drip irrigation stimulates good watering practices
3. Opportunities at installation latrines
4. Fencing of drinking water places
5. Terracing of terrain

Results Sanitary Survey

Main concerns raised by population

1. No optimal adoption of Water Reuse/ Rain Water Harvesting Practices
2. No clear idea of sharing the sources
3. No emergency plan in case of breakdown
4. Several representatives for different organisations and topics
5. No proper training of representatives, no visual tools
6. Open wells not protected
7. Latrines sometimes poorly covered
8. Drinking water not affordable for the poor, more disease in dry season

Conclusions and Recommendations

Under development, main points:

- Effective way of water treatment for contaminated sources
- Protection of open sources
- Implementation of multiple sources for multiple uses (with study on aquifer, second borehole, extra reservoir Kora)
- Organised and effective (health) education
- In cooperation with research of Martine Jeths:

  How do these recommendations fit in the institutional environment?
- Suggestions??

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Questions and Discussion