



# Improving Slow Sand Filters (SSF) for Communities with Low Incomes and Limited Water Access



## Introduction

- Water is one of the prime elements responsible for life, essentially potable water.
- The state of Chiapas, where about 26% of the population is indigenous, presents a high range in diseases related to the quality of the water.
- Slow sand filtration is a water treatment procedure appropriate for use by community water systems.

Figure 1. Advantages and Disadvantages of Slow Sand Filters. (Biosandfilter.org)

Advantages	Disadvantages
Reduction of 90 to 99% of bacteria and viruses	Need of clean water accessibility to prepare the sand to be used in the filters
Complete reduction of <i>Giardia lamblia</i> cyst and <i>Cryptosporidium oocyst</i>	Need of constant high water flow rates
Removal of an average of 93.3% of fecal coliforms	Communities with limited water access cannot use the slow sand filter technology

## Experimental

### Study Site:

1. Surface water source located in El Verde Field Station in Rio Grande, PR 18° 19'16.83"N, 65° 49'10.13"W
2. Surface water source located in an indigenous community, Yalentay in Chiapas, Mexico



Figure 6. Map of Puerto Rico showing the location of the study site

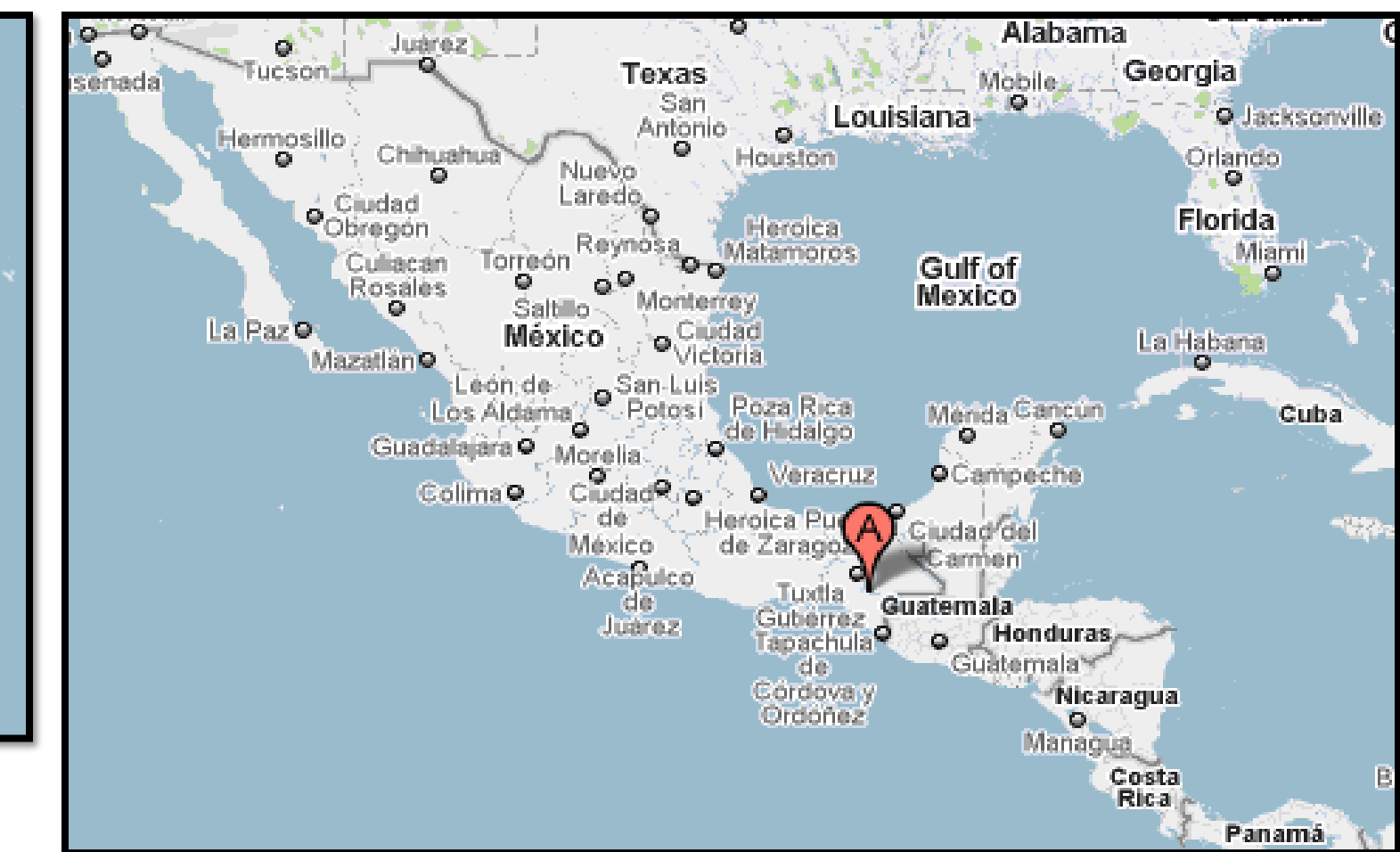


Figure 7. Map of Mexico showing the location of the study site

### Methods

- **Filters:** three plastic containers of 55 gallons with 3 layers: 8" of "chino de río" at the bottom, 12" of gravel in the center and 12" of river sand at the top.
- **Water flow rates to be tested:** 113, 226 and 452 gal-day<sup>-1</sup>
- **Filter's ripening period :** 8 weeks
- **Water quality** - evaluate water parameters including turbidity ( NTU ), pH, dissolved oxygen ( mg mL<sup>-1</sup> ), hardness ( mg mL<sup>-1</sup> ), salinity( % ), conductivity ( mS cm<sup>-1</sup> ), nitrates ( mg mL<sup>-1</sup> ), nitrites ( mg mL<sup>-1</sup> ), phosphate ( mg mL<sup>-1</sup> ), ammonia( mg mL<sup>-1</sup> ), arsenic ( mg mL<sup>-1</sup> ), heavy metals (iron, copper and manganese) and fecal coliforms.

### Research progress and ongoing activities

- The sand's cleaning process has been improved using the sun as a disinfection tool and a fabric bag to contain the sand.
- Collection of the filter's materials – sand, "grava" and "chino de río"
- Construction of a concrete platform to locate the filters to be tested and optimized at EVFS.
- The preparation of the study site and the chemical and physical characterization of the water sources are in progress.

### References

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2. Alicea, A.; Guillont, H.; Ríos, R. A.; Robles, J. C. (2006) Performance Evaluation of Three Slow Sand Filters. IWA Publishing.
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Figure 2. Group from indigenous communities with water quality problems in Chiapas, Mexico.



Figure 3. Slow Sand Filter



Figure 5. Preparation of materials to clean the sand

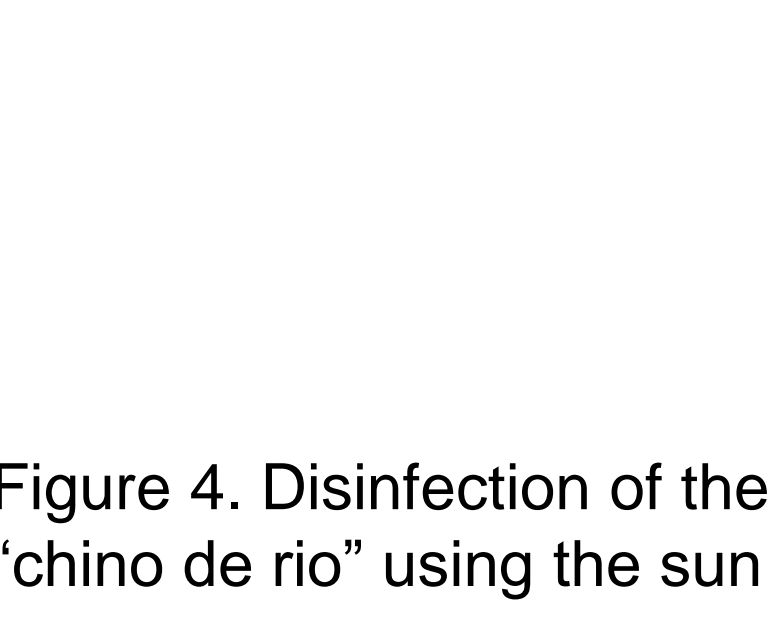


Figure 4. Disinfection of the "chino de río" using the sun



## Goals and Objectives

- Main Goal: To produce an inexpensive operation system that could be used by people with no specialized or academic preparation in a community with limited water access in order to improve the quality of their drinking water.
- In order to accomplish this goal we need to achieve the following objectives:
  - Elaborate a procedure to clean the filter's sand without the need of neither plenty of water nor the excessive time that is consumed usually in this process.
  - Characterize physically (turbidity), chemically (pollutants) and biologically (pathogens) the water source in El Verde Field Station and the water source from an indigenous community in Chiapas, Mexico
  - Produce a slow sand water filtration system that is able to improve drinking water quality by improving turbidity, color, and taste, using a relatively low flow rate (less than 400 gal-day<sup>-1</sup>).
  - Describe in a simple and explicit way the process of the filter's construction, the process of measuring the water quality, and the maintenance process in order that can be reproduced by any member of the community.

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