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Preventing Diarrhoea and Deforestation in Remote Madagascar: the Zahana Approach

The problem

In the village of Fiadanana in the Bongolava Region of Madagascar's highlands, sustained deforestation from cutting trees and subsequent spreading fires after burning the land reduced daily access to needed wood for household cooking fuel. Diminished forest water retention also resulted in lower access to quality water for household use. Diarrhoea is one of the top five causes of a national 42/1000 under-5 mortality rate and was contributing to one child dying every two days during the months of October through December annually in Fiadanana prior to intervention[1,2]. More powerful stream flow between the mountain and the village during floods in the annual rainy season is also believed to be caused by reduced tree coverage[1]. Increased flooding exacerbated the water quality situation and increases cholera vulnerability[3]. Residents were disconnected from schools and health centres because the regular 2.5km route to town was too dangerous and the alternative 15km route too time-consuming to travel. Other adverse impacts of such deforestation and flooding include reduced agricultural production from rice-field siltation and migration by residents fearing insufficient firewood, water, and household security[4,5,6].

The science

Image source: Dr. Herlyne Ramihantaniarivo

Household point-of-use interventions are the most effective for acquiring safe drinking water to reduce the diarrhoea and cholera vulnerability problem [7,8,9]. Solar pasteurization is simple, sustainable, acceptable, and the most inexpensive point-of-use method in places with sufficient solar radiation. The method involves gathering and washing empty transparent bottles, filling them with water, putting them in sunlight until heated to the 66°C pasteurization point at which most waterborne microbial species are killed, and consuming the pasteurized water within 24 hours to avoid possible regrowth. Although this requires behaviour change to ensure that each step is done habitually, solar pasteurization has reduced childhood dysentery and diarrhoea by as much as 45%[10,11].

For reduction of deforestation-related problems, solar radiation can also replace some of the firewood used for cooking. Although globally success has been limited by cultural barriers, relatively high start-up costs, and insufficient post-introduction support, solar cooking is cost-effective and can also reduce high respiratory illness rates from indoor cooking fires[1,12,13,14,15]. A complementary solution is reforestation by planting two types of trees: trees with deep roots for soil and water retention take longer to grow but will help reduce flood runoff and siltation while faster-growing species can be used almost immediately for firewood when solar power isn't viable[16,17].

The application to policy and practice

Image source: Dr. Herlyne Ramihantaniarivo

A pilot integrated development and flood risk reduction project of local NGO Zahana in Fiadanana began in 2005 with a participatory exercise that prioritised the problems of lack of firewood, diarrhoea from poor water quality, rainy season difficulty accessing goods and services, and decreased rice field productivity from rainy season flood siltation. Eucalyptus and fruit trees were deemed locally appropriate for achieving long-term reforestation and flood reduction effects to reduce all of these problems. Fast-growing acacia and moringa olifeira were determined to be appropriate for short-term firewood needs. To reduce the need for such wood, Zahana introduced solar cooking but recognized that the limited cooking time and functions and the high cost of trying different models could discourage adoption of solar cooking. For times and uses not suitable to solar cooking, they provided training on construction and use of more firewood-efficient stoves and innovatively required construction of such a stove for anyone wishing to enter their annual competitions for planting these trees. They also tested different solar cooking models and provided the model determined to be most cost-effective locally. The water quality problem was solved through introduction of rainwater storage tanks and training and materials for solar water pasteurization. Construction of a village school and health centre reduced difficulty accessing service needs in the rainy season. The science classes in this school were then the testing ground for students to determine locally appropriate ways to implement solar water pasteurization and solar cooking and then transfer this knowledge to their homes.

Did it make a difference?

Solar pasteurization produces safe drinking water in a few hours in Fiadanana even with limited sunshine, so it diffused from successful adoption at schools to households and, along with water tanks, eliminated acute diarrhoea[1]. Like elsewhere in Madagascar, solar cooking and fuel-efficient stoves reduced wood use and home fire risk[18,19]. Further study is required to reveal a resulting reduction in respiratory illnesses. Although planted trees can't yet reduce flood impacts, flood-reducing trees will do so when they grow sufficiently and fast-growing trees are providing branches for firewood. Overall, the biggest success indicator is an increase in population from 700 people at the beginning of the project to over 1,000 now and a corresponding construction of 20 new houses[1]. This indicates that people are returning because they feel secure of access to needed services and livelihoods, less future flood risk, and better focus on livelihood and household needs with less time accessing water and wood.

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