

Agriculture

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Introduction

Most people in the developing world depend on agriculture for their livelihoods. Sadly, rural farmers in low-income countries often can't produce enough food to meet the nutritional needs of their families, much less produce an excess to sell. This is mostly due to lack of capital to undertake large scale farming practices, lack of technical knowhow, and lack of access to agricultural inputs and markets, which are invariably made worse by poor infrastructure. Such deficiencies create food insecurity, preventing 800 million individuals globally from having enough food to lead healthy lives.

Each year millions of rural families experience the cruelty of the hunger season, a time where the dry season makes growing food impossible without access to water and irrigation equipment. During this critical time period, families are exceptionally vulnerable to food insecurity. Poor farming practices further degrade the land, making the environment unsuitable for growing food and even less resilient to extreme weather.

WHI's agricultural programs work with vulnerable farmers, the majority of them women, by training them in improved practical agricultural methods, helping them access quality agricultural inputs & technology, and linking them to viable markets. Such efforts help farmers grow more food for themselves or to sell. In doing so, farmers are able to prevent hunger, preserve land for future use, and obtain long lasting food security.

Greenhouses Revolutionizing Output

WHI's Greenhouse Revolutionizing Output (GRO) project has just finished its second year in Sierra Leone and Mozambique, in partnership with Pennsylvania State University's Humanitarian Engineering and Social Entrepreneurship Program (PSU-HESE) and Lehigh University. GRO



Greenhouses let farmers grow vegetables, an agricultural product with high profit margins, while using less water than open-air farming. Due to intensifying climate change and widescale drought, farming in Sub-Saharan Africa poses inherent challenges to properly irrigating plants. By installing durable greenhouses, smallholder farmers can learn how to expand their farms and grow vegetables year-round while conserving precious water. Studies have shown that greenhouses effectively reduce evapotranspiration by 30% when compared to open-field conditions, and the water use per unit yield can be lowered by up to 61% through the usage of a controlled irrigation system inside the greenhouse. Furthermore, the growing season under greenhouse and drip irrigation can be extended from 6 to 12 months, increasing crop yields up to 300%, when compared to crops grown in an open field without drip irrigation. Greenhouses also allow farmers to extend their growing seasons, so they can sell produce to markets when prices for produce are higher.

In 2016, over 1,400 farmers benefited from 77 GRO greenhouses, producing 120,487 kg of vegetables. The most popular vegetables were: sweet peppers, lettuce, tomatoes, okra, hot peppers,



cucumbers and African eggplant. Forty-five new greenhouses were built, some for other non-profits like ACDI/VOCA who work with smallholder farmers. Local academic institutions also took advantage of the opportunity to teach students about water conservation and improved vegetable production through GRO Greenhouses. WHI continues to seek institutional partnerships like these to increase the reach of greenhouse technology.

In addition to the work in Africa, WHI piloted 3 greenhouses in Cambodia with a grant from the U.S. Department of State to trial innovations that help farmers cope with the effects of climate change. The greenhouses have gone through several crop rotations, and as a result of lessons learned, the design has shifted toward a net house where the frame is covered in a mesh net rather than solid infrared-resistant plastic. Replacing the solid plastic with the mesh netting improves ventilation inside the greenhouse in a hot climate while continuing to reduce evaporation and provide crop protection. The project is currently working with a bamboo manufacturing facility in Monduliri Province called Bambusa (www.bambusaglobal.org) to create a standardized frame for the greenhouses that is bamboo weather-treated to ensure it has at least a 10-year life span in the hot, humid climate. Treating the bamboo with a weather resistant coating improves the durability of the material. More greenhouses with this new design will be rolled out in 2017.





Mushroom Business Rapidly Expanding in Cambodia

WHI continues to work with farmers in Cambodia to grow mushrooms for sale in local markets. Mushrooms are grown on agricultural waste from one annual planting of rice followed by an annual planting of mung beans. The mung beans are both a cash crop and soil enhancer as a nitrogen fixer. The dried mung bean stalks and empty pods are added to the rice straw to create the mushroom growing medium. After three growing cycles of mushrooms, the medium is decomposed and returned to the rice field as compost. Farmers in the target community average about 2.5 acres of rice paddy, which is enough to provide sufficient waste for one mushroom house year around. Some of the early adopters of mushroom houses have gone on to build a few mushroom houses and are buying agricultural waste from neighboring farms to supply their mushroom operations.

2016 saw the rapid expansion of 23 Mushroom Houses into a second community in partnership with a World Conservation Society (WCS) community development for conservation initiative. Mushroom houses are of interest to non-profits working to conserve protected areas as they provide a monthly revenue stream (higher than rice farming) on a very small footprint of land. This is expected to reduce pressures on the forest, as less forest land is converted for rice farming.

This growth in mushroom cultivation is partly due to market linkages being developed by WHI. Fair and consistent demand and pricing are encouraging smallholder investment in the mushroom houses. Successful mushroom growers from Siem District are providing the training to the new community in Khaoh Nheak, from construction of the mushroom houses through support of three growing cycles. Such support builds confidence for the existing smallholder group as they teach others about their technical knowhow. Twenty-five farmers are now invested in Mushroom Houses, which have an average return on investment of three and a half months.

The project is also attracting new partnerships, such as the Preah Leap National School of Agriculture (www.pnsa.edu.kh), who are interested in identifying student research projects around alternatives to rice straw as a growing medium for mushrooms. Bambusa, the company working on GRO Greenhouses, is also finishing a new design of mushroom house "kits" that will be assembled upon delivery, thus reducing building time from two weeks to a few days. The weatherized treated bamboo frame will have a guaranteed 10-year life span rather than the current 3-year lifespan. Additional conservation groups in Cambodia have expressed interest in this technology for its ability to create good agriculture incomes on a small footprint for communities living within and around protected forests.

Sierra Leone Pineapple Harvest

Since 2014, WHI has been teaching farmers in Sierra Leone how to cultivate pineapples commercially and how to access viable markets. Sierra Leone has the ideal climate for pineapple production, and while pineapples are often grown in garden plots, they are only now being grown on a larger scale for processing in country and for export. Over the course of the project, WHI provided ten village cooperatives with agronomic training, pineapples suckers, tools, inputs, and oversight. WHI taught farmers skills such as: pineapple induction, fertilizer top dressing, weeding, basal fertilizer application to seedlings, and plant spacing. WHI also worked with farmers to help them organize labor amongst themselves and set up governance structures for the cooperatives.

Through WHI support, in 2016, farmers in ten villages cultivated over 50 acres of pineapple and produced over 40,000 pounds of fruit, which were sold mostly in the local markets for an average price of \$359 USD per metric ton. Additionally, there have been positive social developments. There is now a stronger social cohesion among members. In addition to working cooperatively on the pineapple farms, they have begun to work cooperatively on their personal farms as well, rotating between farms when they are not working on the plantations. The leaders are demonstrating positive leadership skills — leading the work, settling disputes among the membership, helping each other on a rotational basis, and representing the cooperatives in community meetings. The farmers are enthusiastic to continue with the pineapple project and look forward to planting again after the dry season in 2017.



Hope Farms Demonstration Plot

Hope Farms, established by WHI in 2016, serves mainly as a demonstration plot for farmers in Sierra Leone. Farmers, especially those near the capital, Freetown, have the opportunity to observe and learn modern methods of pineapple production. The first farming method demonstrated was drip irrigation. The drip irrigation system is fed by WHI-built wells and conserves water by allowing it to slowly drip on the plant's roots in a controlled fashion. In 2016, 3.7 acres of pineapples were planted under drip irrigation and another acre planted using the dry planting method (where the plants are watered by hand). In 2017, Hope Farms will introduce other demonstration crops to the site.

Mozambique Garden-Cattle Cluster Project

WHI Mozambique's cattle program continues to pick up momentum. Within the program model, five poor rural families are selected to receive two heifers each and to share a bull to create a new cattle cluster. These new cattle come from the offspring of existing cattle, or are purchased by donations from WHI's Gift Catalog. After four years, each family passes on two heifers from their cows' offspring to another needy family in the community, forming a new cattle cluster. During the past year, 10 new cattle clusters were launched, including 104 new cows and 19 new bulls. Over half of the cattle recipients were women. Program beneficiaries use their cattle for emergency funds, whether that be purchasing tools for another business, or making improvements to their homes. Ultimately, cattle are a safety net against hunger when crops fail.

WHI trains para-vets called "village vets" for each cattle group, serving the needs of the cluster and the wider community. In 2016, village vets vaccinated 339 young calves within the clusters. Cattle husbandry workshops increased trainees' knowledge of livestock rearing, and cattle groups were connected to agricultural extension agents to access further assistance. The workshops involved both classroom and hands-on learning. One important lesson village vets learned was how to provide more nutritionally rich food for their cattle. Traditionally, cows receive no supplements to their diet of grasses, but now the para-vets are creating a fortified liquid mixture of sugar and salt that is added to hay to provide supplemental nutrition to the cattle. This is critical in the time period of drought, where there is little to eat.





Garden Program

The thriving vegetable gardens in Mozambique are an excellent example of how WHI programs work together to bring holistic benefits to communities. WHI water wells are used to irrigate the vegetables during the dry season, when no food can be grown. Manure from the cattle clusters is used as fertilizer, and GRO Greenhouses nurse delicate seedlings and protect them from wind, sun, and pests while they become established. Once established, seedlings are planted outdoors, and the impact is remarkable! The vegetables not only provide essential calories, but also improve nutrition, which is often lacking in the typical Mozambican diet.

In 2016, five new community gardens were formed, increasing the total to 11 community gardens. Within these gardens, a total of 429 total families participated in the garden project during the year. Any surplus vegetables not grown for the family's nutritional needs are then sold for a cash income, which are then used to meet needs, including the purchase of seeds for the next year.

Village Para-Vet trained by World Hope discovers Yellow Fever in Maputo

Mateus Cumbula lives in Muchocolote, a small town in the province of Maputo, Mozambique. Mateus is one of the 193 village vets trained by World Hope International. At a recent training, he admitted to previously having contributed to the death of two calves he was trying to treat by accidentally administering too much medicine. Thanks to the training, he later identified some problems with the cattle he was raising. He promptly called the government vet in Xai-Xai and explained what he was observing. Carefully following the vet's instructions on how to examine the cows, he found mouth sores which indicated yellow fever. The government vets arrived the next day in his hometown to take some samples from the cattle back to the laboratory. Thanks to Mateus' quick work, movement of cattle was suspended in most of the districts of Maputo and part of neighboring Gaza province to prevent the spread of yellow fever. Undoubtedly, the livelihoods of many people were saved through WHI's para-vet training program. WHI is grateful to Food Resources Bank and all of the donors who made this project possible.



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