

## Abstract

Nicaragua, Matagalpa is home to Familias Especiales (FE), one of the country's more progressive special needs foundations. FE provides services to children and adults with disabilities and supports their families. They employ disabled teens and adults to work in their recycling center, yogurt kitchen, and wheelchair workshop, and allow them to use their school and workshop to support those with disabilities in the community. Home visits with a physical therapist were made to determine individuals' needs for new mobility furniture like wheelchairs. An over-heating issue in the yogurt facility was also addressed with the installation of more windows and the use of an evaporative cooler.



Figure 1: ETHOS members after a welcome ceremony

## Introduction

- FE's outreach encompasses a wide variety of services that include education, physical and horse therapy, a support group for mothers, an accessible playground, yogurt kitchen, café, recycling center, craft center, and wheelchair workshop.
- One of FE's priority projects is to improve working conditions in the yogurt kitchen. Temperatures in the packaging area are often as high as 30 degrees C (86 F) and make it difficult to work comfortably.
- Mobility impairments are a challenging problem in developing countries like Nicaragua because the roads, sidewalks, stores, and homes are not designed with disabilities in mind. Due to this design exclusion, not only is it especially important for people to have the devices they need, but the devices must sometimes be customized or modified to fit the conditions of the city

## Project Description

### Ventilation

- The yogurt kitchen is excessively hot and has become an unsafe workplace for their seven regular employees. The building, which houses an office, large stoves, and industrial refrigerators, currently has no ventilation system.
- The temperature and humidity in the packaging area and kitchen were measured every two hours during business hours for approximately two weeks.
- Various solutions were considered including air conditioning, a whole house fan with no air conditioning, the use of evaporative cooling, and an increase in natural ventilation.
- An evaporative cooler was built out of a 5-gallon bucket, a pump, and a fan.



Figure 3: Yogurt facility

- A contractor was consulted to modify windows in the building. All internal glass windows were replaced with screens and an additional window was cut into the front of the building above the large door. A screen was added to the front door so that it could be opened without letting bugs and debris in.

### Adaptive Furniture

- Home visits were made with a physical therapist. Measurements were taken for clients in need of wheelchairs, walkers, commode chairs, and bathing chairs.
- Disabilities observed included muscular dystrophy and cerebral palsy.
- Appropriate pieces of furniture were selected from the Wheelchair Workshop, adapted, and delivered to individual client's homes. The disabilities observed there included muscular dystrophy and cerebral palsy.

## Results & Discussion

### Ventilation

- The windows were installed on the last day of the internship, so no data on the effectiveness of the windows was gathered
- The evaporative cooler was tested for one day in the yogurt facility. The exiting airstream was 2 degrees C cooler than the ambient temperature and 8% more humid than the ambient air. Although the air stream exiting the cooler did decrease in temperature, it was not strong enough or effective enough to mitigate the heat.
- Nicaragua is extremely humid, and this was implemented during the wet season so effective cooling was not observed.

### Adaptive Furniture

- In total, 10 families were visited and several walk-in visits to the Wheelchair Workshop were successfully attended.
- Clients were fitted with several bathing chairs, a large bed, and a commode chair. Additionally, several repairs were made to clients' existing wheelchairs.

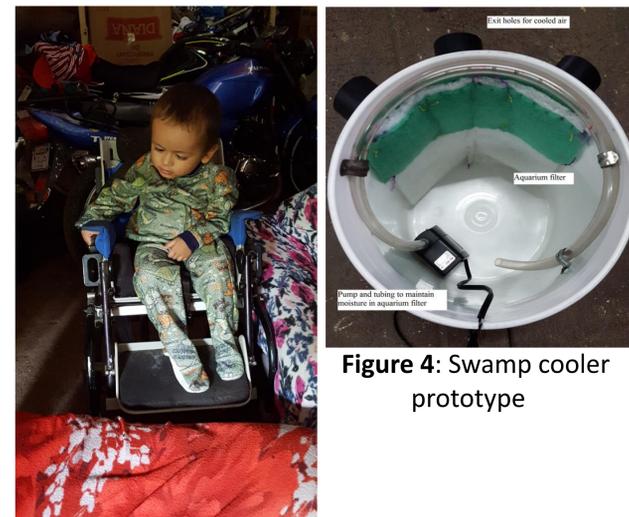


Figure 4: Swamp cooler prototype

Figure 5: A boy in his new wheelchair

## Recommendations

### Ventilation

- The evaporative cooler is ineffective during the rainy season. During the dry months, an evaporative cooler may be effective, but the scale would need to be increased significantly.

### Adaptive Furniture

- There will always be a need at this project site for more adaptive furniture for individual clients and this portion of the project should continue to reach as many families as possible.
- A need for wheelchair ramps at individual homes and throughout the city was observed and is a possible expansion of this project in the future



Figure 7: ETHOS Student with FE Director

## Acknowledgements

A large thank you to all of our family, friends, and loved ones that supported us throughout this trip. Furthermore, a big thank you to the following who made this trip possible and life changing:

- The ETHOS Center
- Familias Especiales
- Adriana, Ariel, Carol, Tania, Isckra, Blanca, Sophia, Luisa, Nelly, Franco, Laura, and all those who accepted us as family.
- The University of Dayton