ABSTRACT

TITLE:	Sustainable Biodigester - Cook Stove - Fertilizer System to Promote Community Well-Being for Indigenous People of Ecuador
AUTHOR(S):	Williams, Laurie ; Shuler, Phil ; Ballantyne, Rachel; Hollinbeck, Mesa
PRESENTED AT:	4th Annual Natural & Behavioral Sciences Undergraduate Research Symposium, Fort Lewis College

ABSTRACT: The acquisition and use of biomass fuels for heating and cooking presents a ubiquitous problem for the majority of people on three continents. Inefficient cooking and heating practices (wood burns at 5-8% efficiency and cow dung at 3-5%) not only pollute the home but deplete biomass resources and require increasing amounts of time and energy for fuel acquisition. These factors challenge the sustainability of local and global environments as well as the health and economic prosperity of vast numbers of people in the developing world. In response to these issues, Fort Lewis College students and faculty received a phase I, EPA P3 grant which was used to design and build two biogas digester prototypes. Working with faculty, students also designed a low cost cook stove capable of burning the biogas produced, and evaluated biogas slurry application as an appropriate and effective soil fertility amendment. Phase I prototype digesters demonstrated the feasibility of biogas generation, using simple materials such as trash cans, oil drums, and polyethylene bags. A full scale digester, based on prototype biogas production volumes, would range from 5000 to 9000 liters, depending on the design implemented (fixed drum or polybag). This digester volume is projected to meet the cooking needs of a typical Ecuadorian family of six, 2m3 gas /day. In addition to producing methane gas for cooking and heating, the system produces significant quantities of bio-digested manure. The bio-digested manure was applied as a fertilizer to potatoes and a newly established grass pasture mixture. Potato shoot dry weight at harvest was 132% and 131% of control dry weight for low and high applications of bio-digested manure, respectively. There was a 51% difference and 80% difference in dry weight yield from control between low and high applications of bio-digested manure for pasture grasses. Biogas utilization for cooking, and for the production of anaerobically digested manure is a unique and realizable opportunity for a vast number of people and communities in both the developing and developed world. Positive impacts are possible in terms of quality of life (reduced time for fuel collection, reduced fuel costs, and improved sanitation, increased crop yields), improved health (reduced indoor smoke from clean burning biogas), economic savings and/or earnings (eliminates need for purchasing traditional fertilizers and creates an opportunity to sell excess manure generated by digesters), and environmental responsibility (utilizes renewable resource and enhances soil fertility).