INTO THE FUTURE WITH WILDCAT ENGINEERS
Food Energy Water Systems

Dr. Kimberly Ogden - presenter
Contributors to presentation – Michael Anderson, Dr. Kevin Fitzsimmons, Marisa Gonzalez, Dr. Vicky Karanikola, Nikki Tulley, Dr. Rebekah Waller
The road to U
Projects


Aquaponic Systems – Kevin Fitzsimmons
The Navajo Nation

- Largest Native American Land
- Population in 2000 180,462 increase to 500,000 by 2040
- Population Density < 10/mile² - remote communities
- Food desert (Example Hard Rock)
  - 51% population obtain food off of the nation
- Over grazing
- Solutions have to involve the communities
12 trainees (9 PhDs, 3 MS)
42% Native American
58% Minorities
50% Male & Female


Training Tribal College Students in FEWSS

Figure 7: Indigi-FEWSS research efforts concentrating on water, energy, and food systems.
Hard rocks, tough people

Michael Anderson, Marisa Gonzalez, Nikki Tulley, and Bekah Waller
Culture and Sovereignty

- Sa’ah Naaghái Bik’eh Hózho
  - Life in harmony with the natural world and universe.
- Shabik’ehgo
  - The path of the sun, and path of harmony.
- Naas’ko Shándíín Bi’t’ół Ch’óó’j ł
  - Solar Energy
- Tó báá naal’e’il
  - Water Filtration
- Dá’ák’eh Bi’ghan
  - Greenhouse
Overview of the Design
Solar Hogan Teaching Greenhouse
1,000 – 1,500 gpd SNF system

- Solar Panels
- Raw water tank
- Membranes
- Pre-filters
- Electrical control system
- Finished water tank
- DC pump
- Batteries

50 – 100 gpd SNF system

The solar panels (2) are not shown. The NF membrane used for solute separation is in the white, vertical cylinder at left.
Rain Harvest-Solar Nanofiltration Unit

Mitchell Miller
Maggie Tan
The purpose of this project is to couple a **rain harvest** system with a **solar nanofiltration** unit to increase the longevity and durability of the system, while alleviating water, food, and energy insecurities that the Navajo Nation faces.
Weekly discussions to maintain transparency and accountability

Suggested: Hózhó approach
- Respect for others and earth
- Spirituality of earth
- Collective relationships

Sovereignty
- Maintained by steady step-by-step transition from stakeholders to Navajo members
- Technical training skills so training and maintenance can continue within the community and not be outsourced
Aquaponics

- Aquaculture
- Hydroponics
- Microbial Community - Recycle nutrients

There are fewer fish in the sea than ever before

Percentage of high seas fished in each year

- 1950: 1%
- 1980: 33%
- 2006: 63%

Percentage of species exploited, overexploited or collapsed

- 1950: 0%
- 1980: 39%
- 2006: 87%

*Calculations based on Pauly, D. 2006. Major trends in small-scale marine fisheries, with emphasis on developing countries, and some implications for the social sciences. Maritime Studies (MAST), 4 (3)
System Schematic
Wisconsin
Salmon and lettuce
Aquaponics in Mexico

Building fish tanks

Building aquaponic beds
Aquaponics in Mexico

Planting peppers

Stocking fish
Aquaponics in Mexico

Harvesting peppers

Harvesting fish
Bangladesh
Fishpond dike vegetables
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Supplemental Information
Cost of water

Cost of water in Arizona: $0.2-0.4/100 gal

Cost of hauling water: $13.3/100 gal (NNDWR, 2011)

Pressure Driven Membrane Process

Cost of water with Solar Nanofiltration: $0.8/100 gal

Includes operation and maintenance