Smallholder aquaponics: NE Haiti is primed to benefit from the technology

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University of C
Denver

Yon Sél Lanmou

Outline

- What is aquaponic farming?
- Potential in Haiti
- Business plan

Local, Sustainable Agriculture

aqua-culture + hydro-ponics = aqua-ponics

Aquaculture

- Farming of fish, shellfish, crustaceans, and other animals
- Humans now consume more farmed fish than wild fish
- Most production is flow-through, requiring large inputs of water
- Water leaving aquaculture tanks contributes to eutrophication
- Anoxic benthos
- Antibiotics
- Escaped animal genetically ‘pollute’ natural populations of fishes

Hydroponics

- Growing plants without soil
- Input of chemical fertilizers
- Very productive, suitable for small spaces
- Large initial investment, but more earning potential

Facts of Hydroponic Growing & Field Method

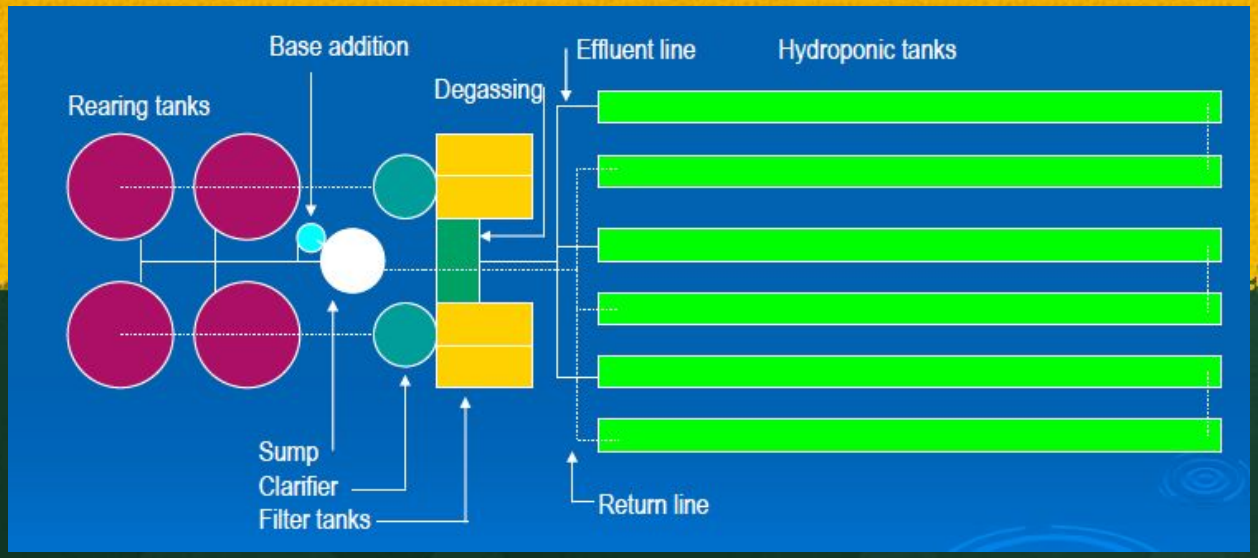
Taken from the Orlando Sentinel Business & Money section
Dated March 9, 1999

	Hydroponics	Field
Yield per acre (in pound):	250,000	62,500
Revenue per pound:	90 cents	32 cents
Revenue per acre:	$213,750	$20,000
Cost per acre:	$175,000	$18,750
Net per acre:	$38,750	$1,250

Aquaponics Anywhere

University of Virgin Islands System

Developed over 30 years by Dr. James Rakocy



UVI System

- Tropical applications
- UVI focuses on aquaculture production
- No greenhouse necessary
- Same climate as Haiti

Tilapia

- 160 kg/m^3/yr
- Nile Tilapia, 77 fish/m^3; Red Tilapia 154/m^3
- Fed 3X/day ad libitum, 32% protein, floating complete diet
- Feed conversion ratio (FCR) if tilapia is 1.7
  - Trout/salmon 1.2
  - Poultry 2-4 (eggs ~2)
  - Pork 3.5
  - Sheep 7
  - Beef 8 or more
- 46,000 pounds per acre per year

VegetableTanks

Denitrification

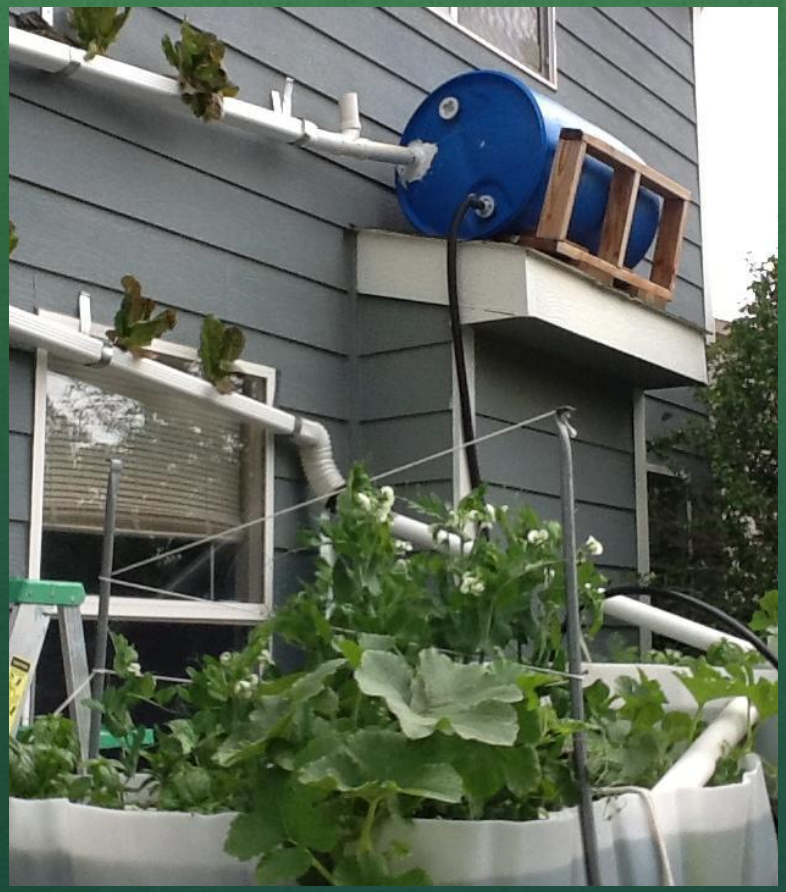
- removes excess nitrate
- improves N:P ratio

Solids removal

- Slow removal improves remineralization
- Prevents clogging of system
- Biosolids can be used to amend degraded Haitian soils

Examples

Aquaponics in Residential Setting



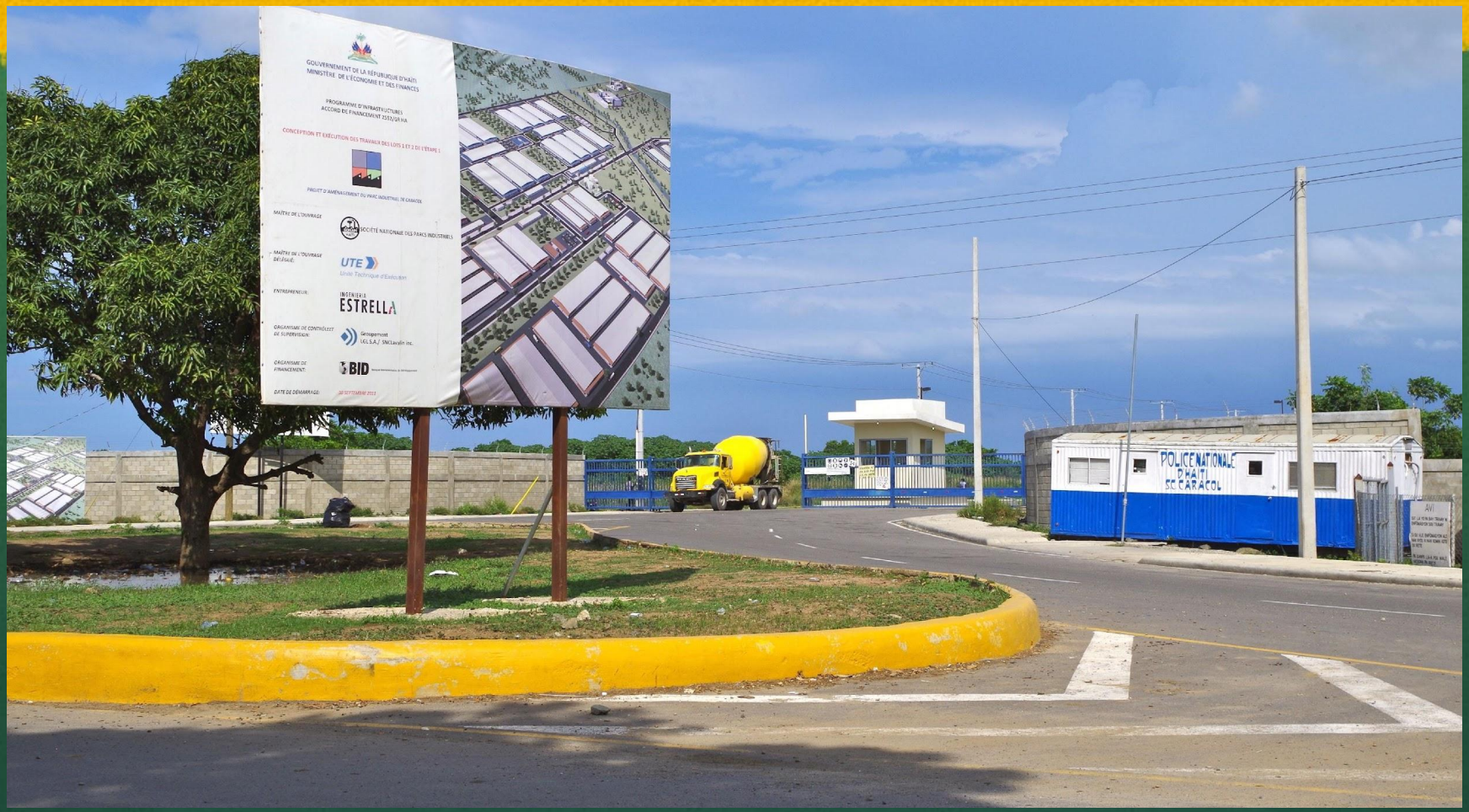
Haiti/Ayiti

- Columbus landed in 1492
- Taino natives exterminated from island ~1600
- Kidnapped Africans imported in large numbers 1700's
- Haitian Revolution, 1791-1803; Independence Declared Jan. 1, 1804
- 10 million, 350/km^2
- $758 per capita GDP, 80% poverty, 53% abject poverty
- 75 kWh/per capita (12,000 in the USA)
- 98% deforested, most degraded ecosystems in Western Hemisphere
- 2010
  - Earthquake
  - Hurricane
  - Cholera
  - Presidential Election
- Economically, the poorest country in the Western Hemisphere
- Historically and culturally, among the richest

Ecological Assessment of Lower Trou du Nord River, NE Haiti

Jean Wiener, Thomas May, and Daniel Dubois

Caracol Industrial Park




We are making
A New Day in Haiti
SAE-A
SAE-A

Sampling Scheme

Field Crew

Bioassessment of the Stream

Rappers Picking Bugs, And Local Fisherman

Identifying Bugs

Table 6 – List of Local Stakeholders Interviewed

Name	Sex	Age	Occupation	DoI(Sept.)	Location
Jean Phomphilé	M	34	Salter	21	Jacquesyl
Alustra Yston	M	23	Farmer	17	Caracol
Wilson Ernetso	M	54	Farmer	21	Jacquesyl
Jean-Robert Nicolas	M	78	Farmer	12	Caracol
Osiri Johnson	M	43	Farmer	14	Caracol
Alix Brutus	M	24	Salter	15	Caracol
Kenol Tamik	M	56	Fisher	21	Caracol
Josue Joseph	M	46	Fisher	15	Caracol
Pierre Cadet	M	45	Fisher	15	Caracol
Toto	M	34	Fisher	18	Caracol
Paul Simon	M	73	Fisher	21	Caracol
Anelson Pierre	M	34	Fisher	21	Caracol
Louradin Dieugrand	M	34	Fisher	20	Caracol
Cadet Jackson	M	50	Fisher	15	Caracol
Gherline Nosime	F	56	Salter	21	Jacquesyl
Maudeline	F	64	Fisher	21	Jacquesyl
Johnny	M	63	Farmer	16	Caracol
Thoma Jude	M	26	Farmer	16	Caracol
Samson Georges	M	43	Farmer	21	Jacquesyl
Jojo Pierre	M	44	Farmer	20	Caracol
Pierre Léosthene	M	46	Farmer	21	Caracol
Josue Jean-Baptiste	M	34	Farmer	20	Bord de Mer Limonade
Pe Georges	M	55	Fisher	19	Caracol
Philomène	F	22	Merchant	21	Caracol
Patrick Sison	M	56	Fisher	21	Jacquesyl
Johnny	M	45	Merchant	19	Caracol
Kola Landry	M	53	Former Mayor	21	Caracol
Fito Josue	M	44	Farmer	21	Caracol
Sonson	M	45	Merchant	21	Caracol

Sand/Gravel Mining

Mangrove to Charcoal

Vehicle Washing

River Debris

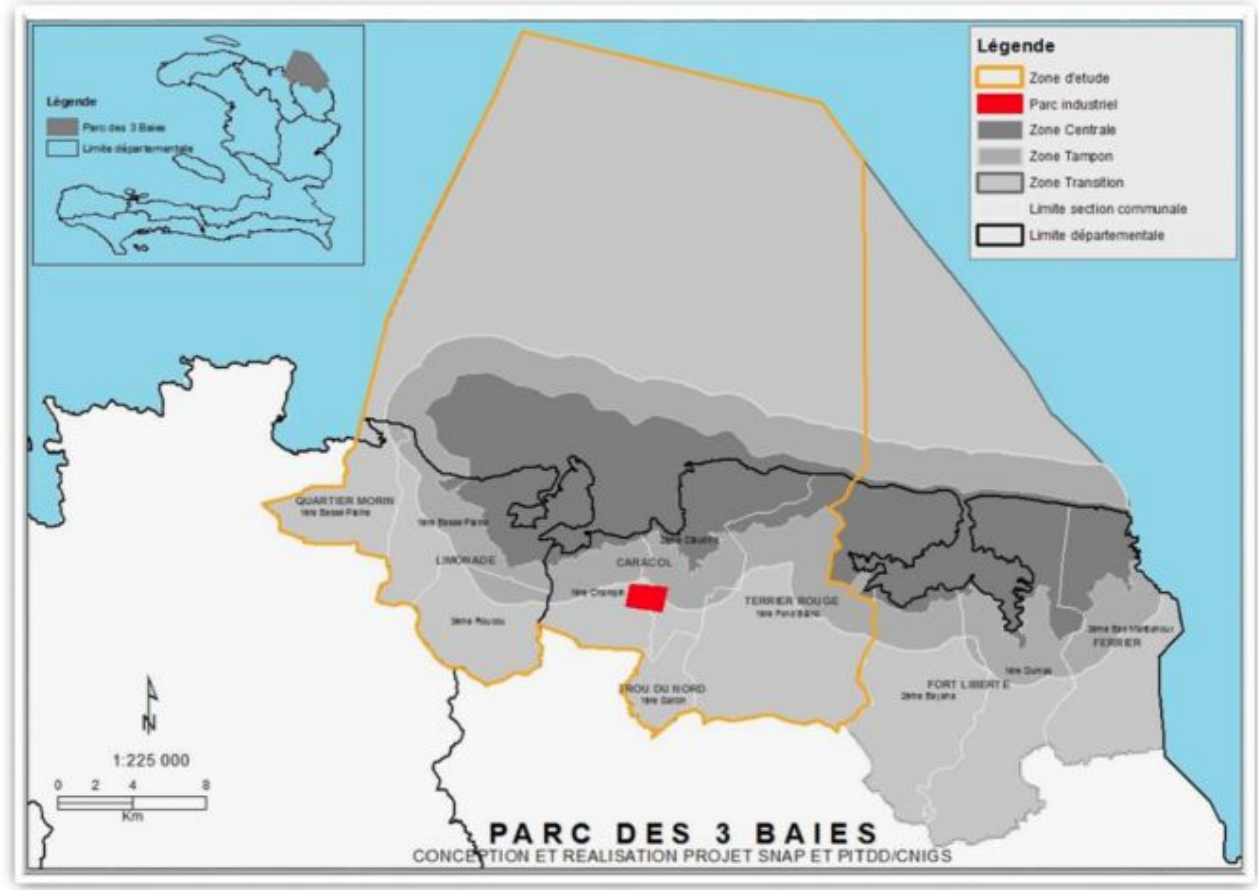
Bathing and Laundry

Spear Fishing/Conch Harvest

Acropora palmata

Outcome: 3 Bays Marine Park

Figure 2 - Proposed Parc des Trois Baies MPA in Northeastern Haiti



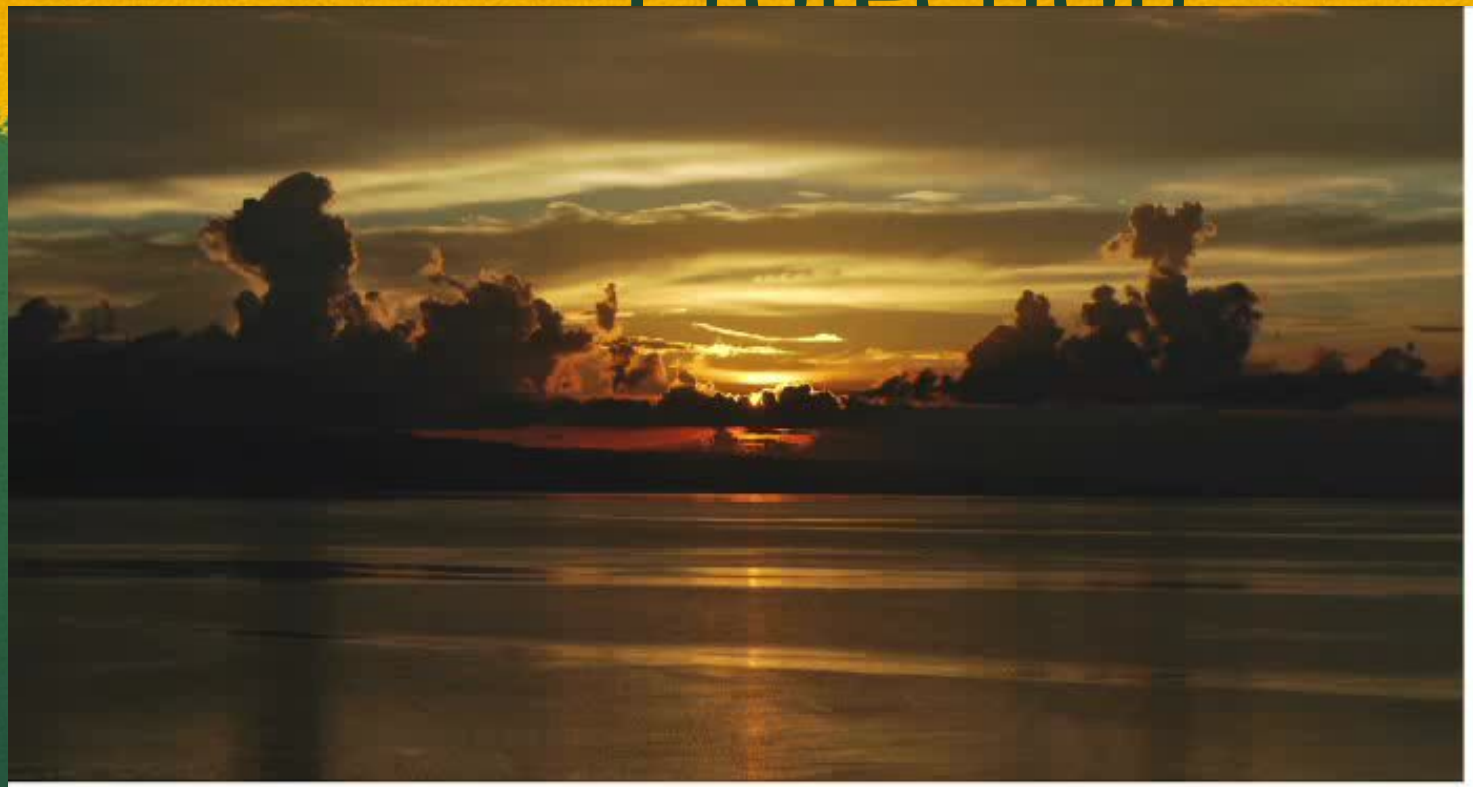
Historical and ecological significance?

Jean Wiener Recognized

http://whitleyaward.org/winners/conserving-haits-coastlines/

Minister of Environment Thomas, President Michel Martelly, and Jean Wiener

Jean Wiener on Coastal Protection



Haiti

Jean Wiener

Conserving Haiti's coastal ecosystems and securing its first marine protected areas

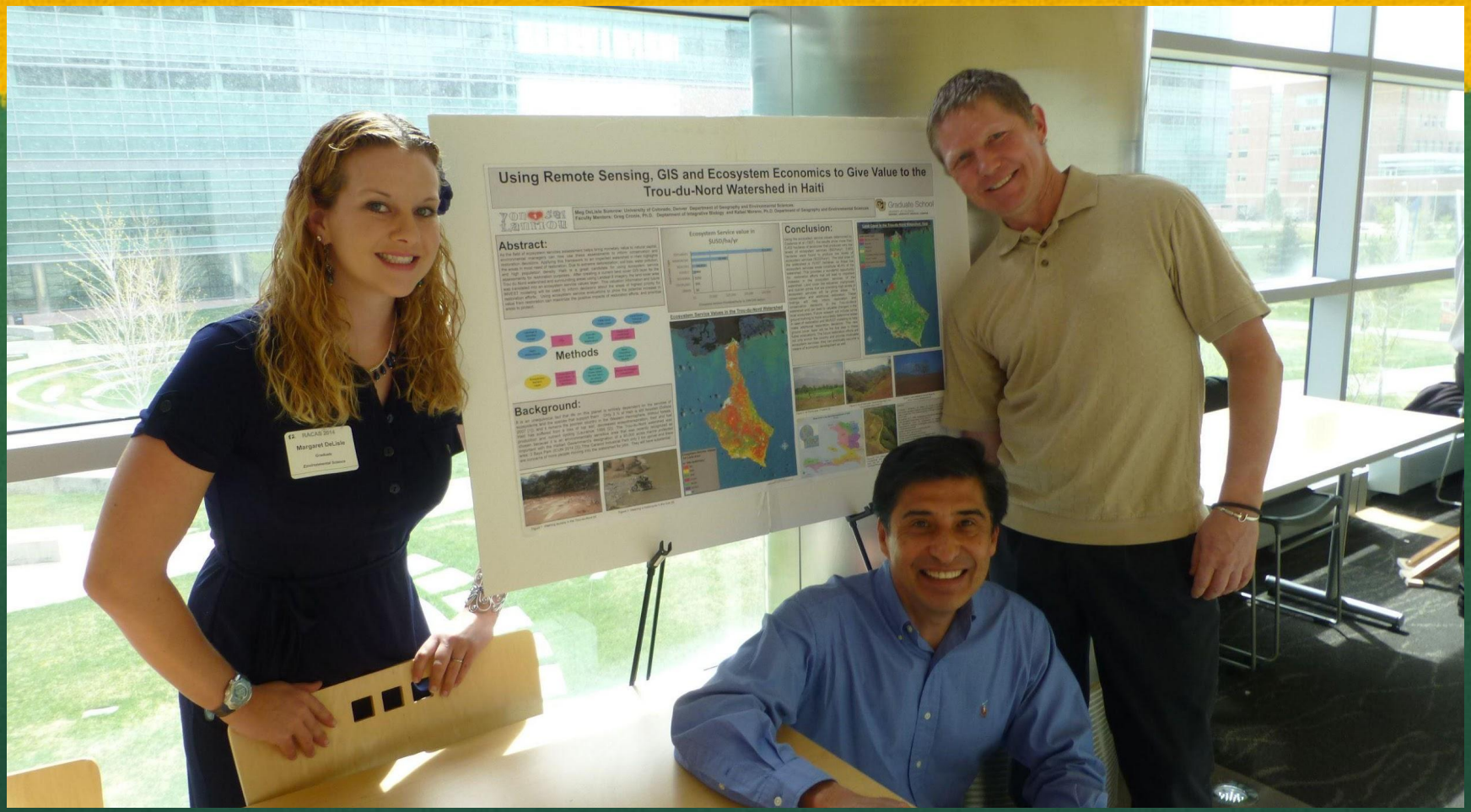
WHITLEY AWARDS 2014

Sailboat on Caracol Bay

Local Fishermen

Aquaponics: Opportunity for Displaced Fishermen

GIS in Haiti


Using Remote Sensing, GIS and Ecosystem Economics to Give Value to the Trou-du-Nord Watershed in Haiti
Abstract:
Methods
Background:
Conclusion:
Ecosystem Service value in $USD/ha/yr
Ecosystem Service Values in the Trou-du-Nord Watershed
Graduate School
IRACAS 2014
Margaret DeLisle
Graduate
Environmental Science

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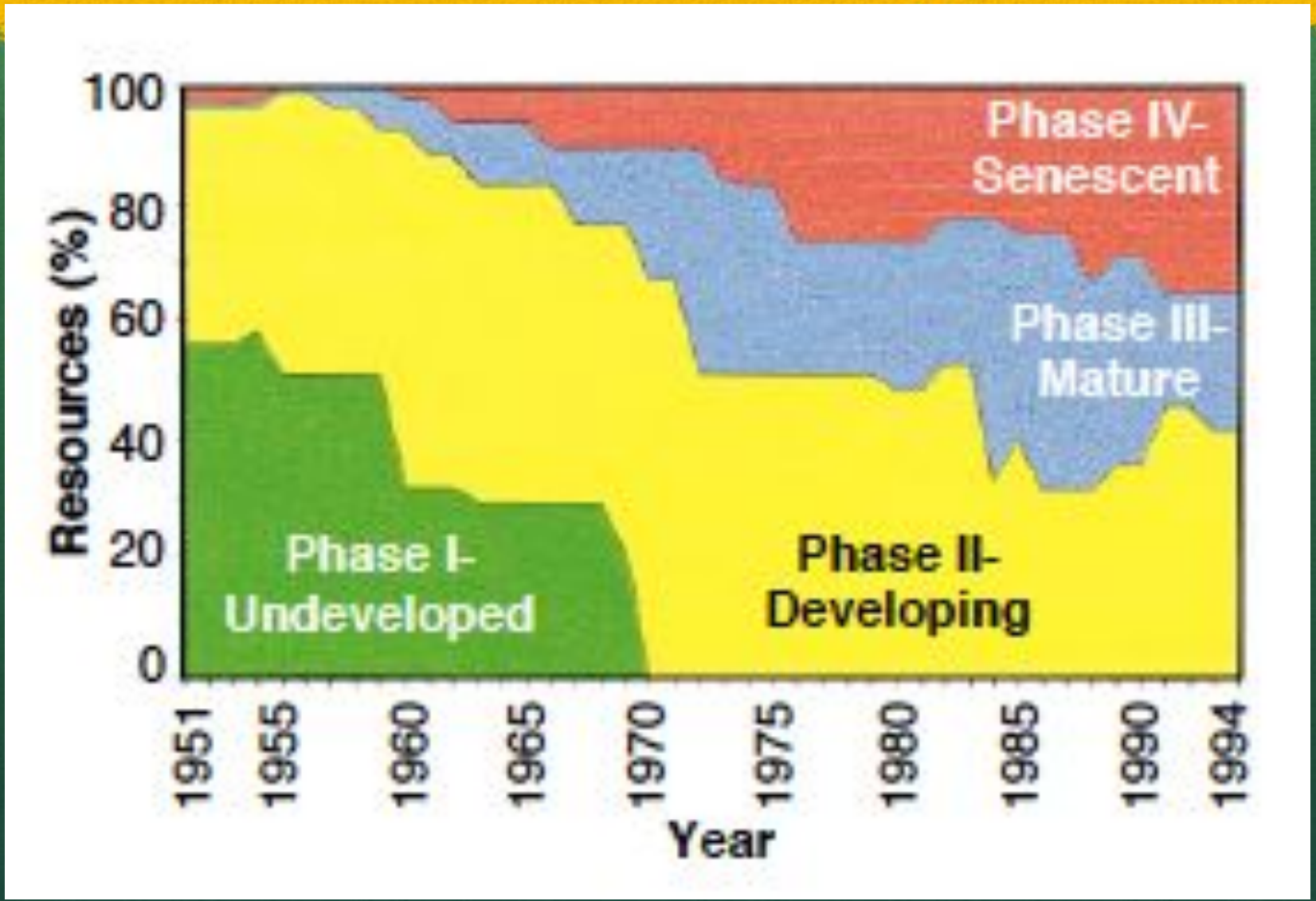
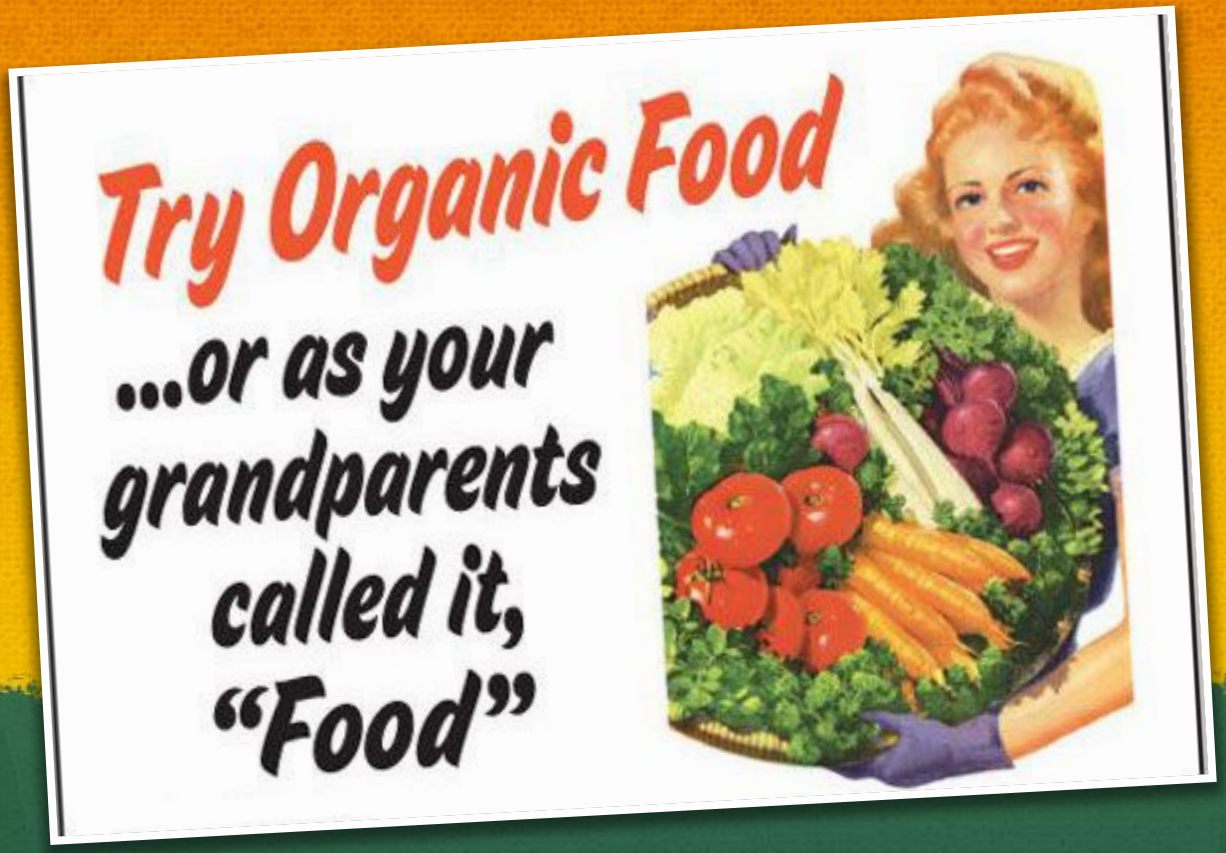
- Aquaponic Technology
- Relevance to Public Health
  - Current food system
  - Access to healthy food
  - Source/sink of disease vectors
- Relevance to Environmental and Social Justice
  - Climate change buffer
  - Denver County Jail
- Transdisciplinarity

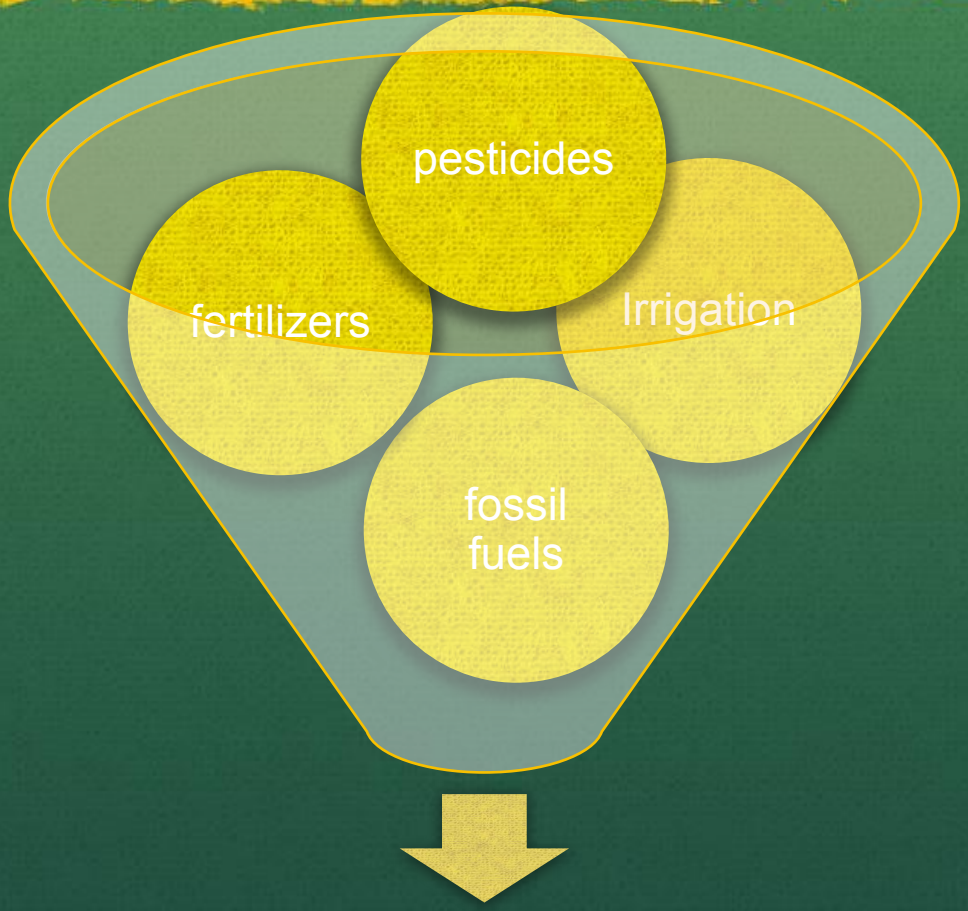
State of Fisheries





Eat Organic

Denver Food Today



99.8% from outside ‘place’

Today's Food System

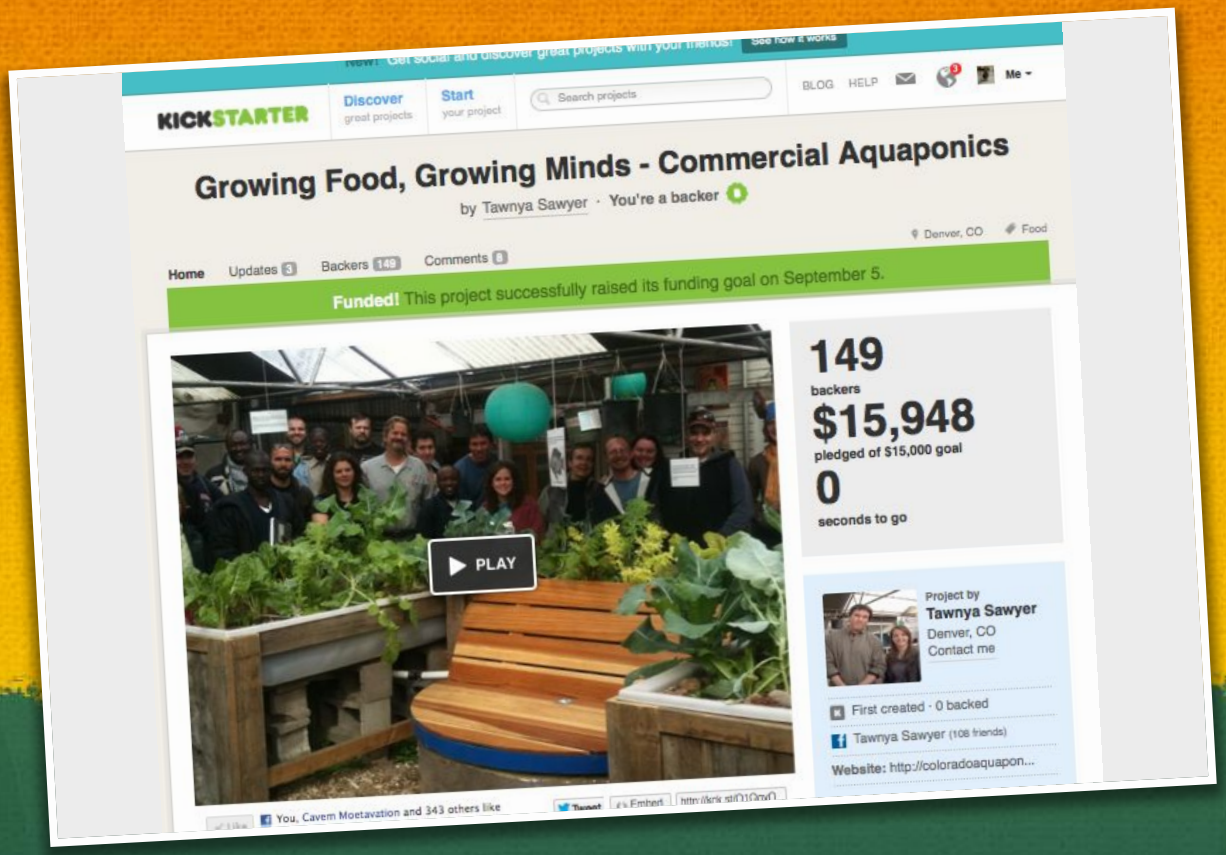
- 40% of land use
- 70% of water use
- 10 billion pounds of pesticides
- 150 million metric tons of fertilizer
- 25% carbon, 65% methane, 80% N_2O
- Dead zones, endocrine disruption, dried streams and lakes
- Food travels 2000 miles before reaching your plate
- 50% is never ingested in the USA
- Food deserts exist
- Unhealthy eating

Health Impacts of Today's Food System

- Obesity
- Type 2 diabetes
- Heart Disease
- Food-borne diseases
- Anti-biotic resistant diseases
- Endocrine Disruption
  - Cancers
  - Developmental problems
  - Immune disorders
  - Reproductive disorders

Live Local, Give Global

Denver's 1st Commercial-Scale Aquaponic System



Community Aquaponic System

Located in a Denver Food Desert

Case Study: Denver, CO, USA

- Urban agriculture has long history of discouragement
- 2009: Councilman Michael Hancock, Ashara Ekundayo, and others create rules to allow aquaponics in city limits
- 2011: Food producing animals allowed without permit
- 2012: Denver Seeds has mission to create local food system in Denver
- 2013: Colorado Aquaponics and Cronin lab build 1st aquaponic system in a jail, Denver County Sheriff's campus

Case Study: Nairobi, Kenya

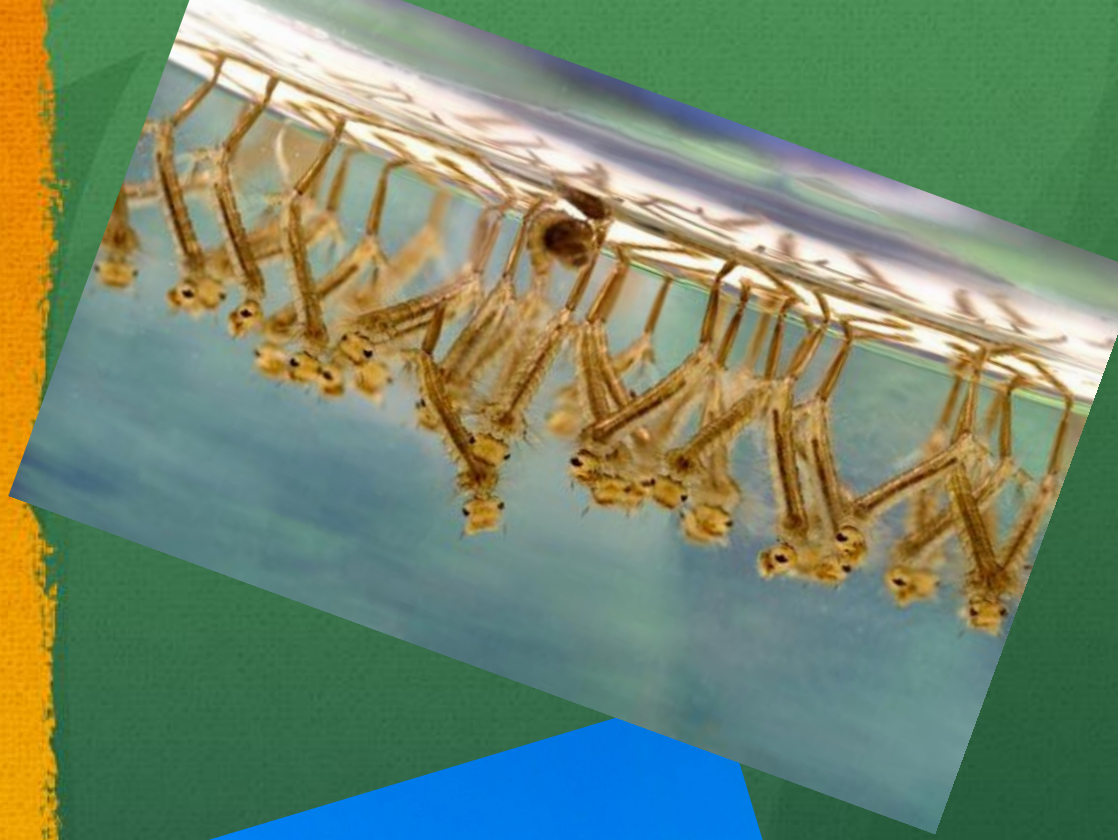
- Antiquated rules from British colonization remain: it is illegal to garden or have animals within city limits
- Urban farmers are susceptible to harassment/theft by corrupt officials
- Ongoing effort to reform laws that affect urban agriculture
- 20% of citizens grow crops
- 7% of citizens keep livestock

Case Study:Kampala, Uganda

- Urban agriculture ordinances established in 2004
- Held as a successful example of UA world-wide
- Fruit trees planted throughout the city
- 60% of vegetables produced within the city
- 90% of poultry products produced within the city
- Komamboga Fish farming Demonstration and Fry Production Project

Vector dynamics

- Are aquaponic systems a significant source or sink of disease vectors?
- If a source, how to make them sinks?
- Public health implications?
- Can baits be used to supplement the feeding of fish?



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Degraded Forests/Soils

- Deforestation

Soil loss contributes to agricultural failure

Famine in East Africa

11 An aerial view of the Dadaab Refugee camp in eastern Kenya, where the influx of Somali's displaced by a ravaging famine remains high, on July 23, 2011. The European Union Aid Commissioner Kristalina Georgieva has vowed to do all that is possible to help 12 million people struggling from extreme drought across the Horn of Africa, boosting aid by 27.8 million euros ($40 million). The funds come on top of almost 70 million euros ($100 million) the bloc has already contributed as assistance in the worst regional drought in decades, affecting parts of Ethiopia, Kenya, Somalia, Djibouti and Uganda. (Tony Karumba/AFP/Getty Images) #

IMPACTS OF CLIMATE CHANGE

Effect of drought on livestock

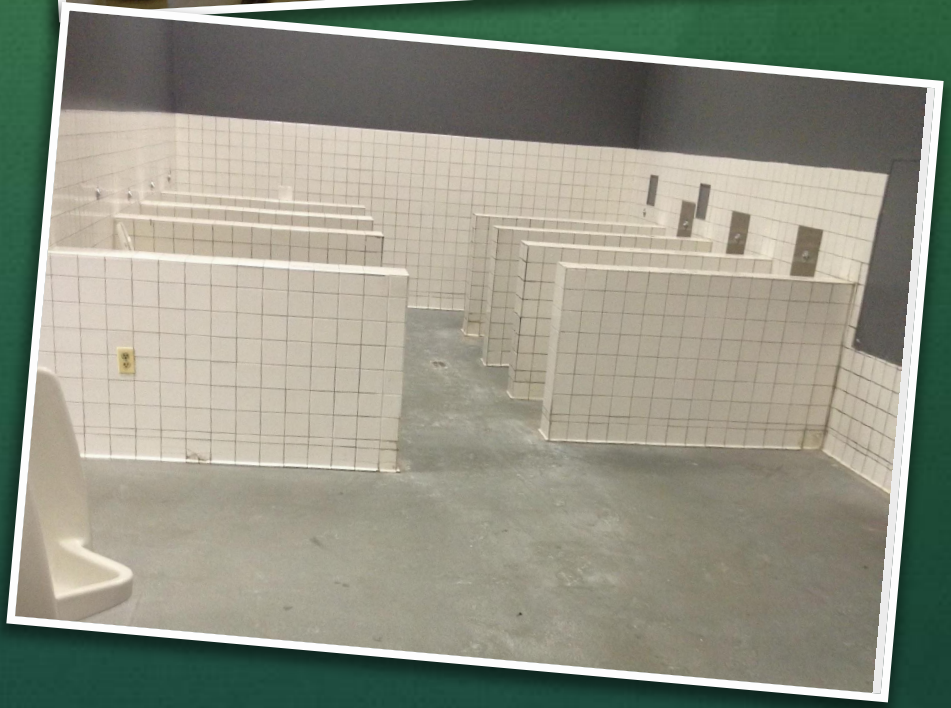
Famine in East Africa

- Worst drought in 60 years
- 15 million affected
- ~100,000 dead
- Crop failure caused by drought/climate change
- African BoldFOOD Fellows state that ***unpredictable, variable*** nature of rains contributes to famine
- Unpredictable floods destroy crops
- Extended drought results in crop failure

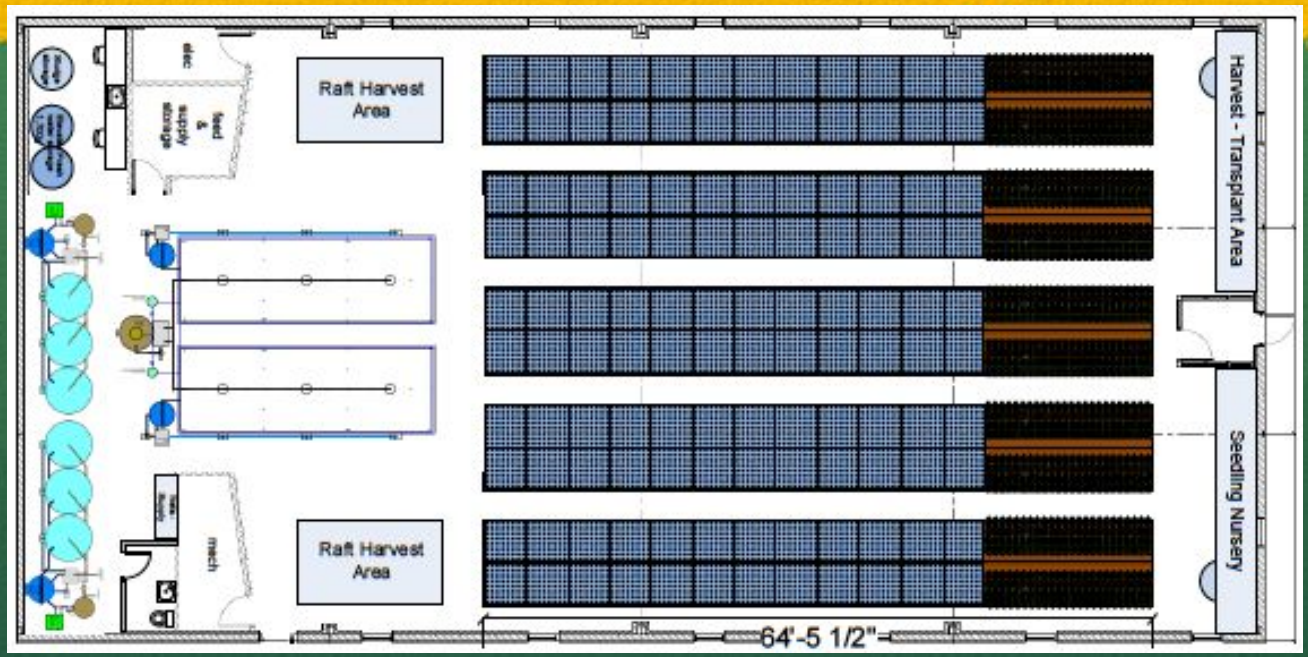
Climate Buffer

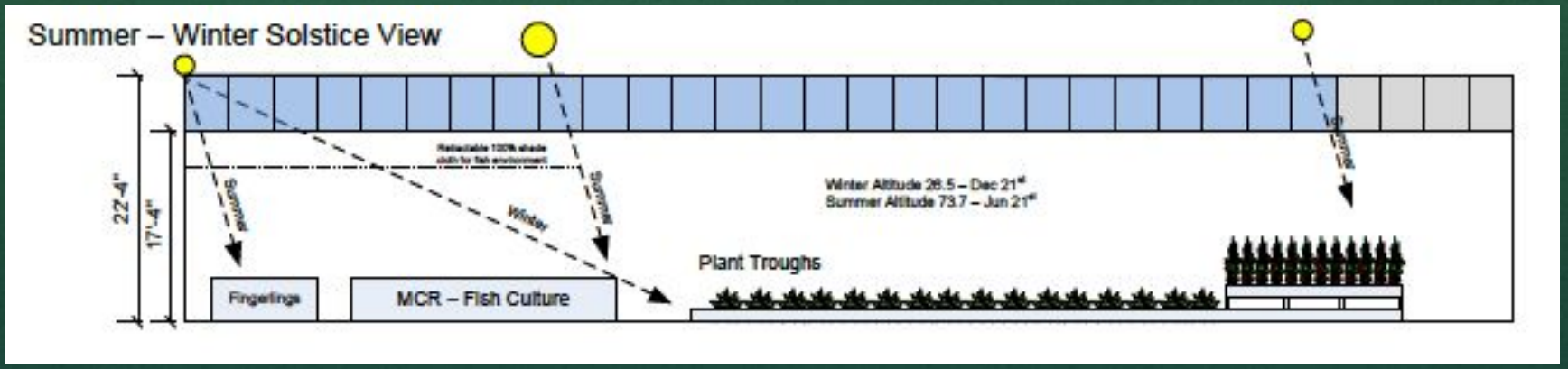
- Aquaponics represents water storage to fill during floods, and efficient use during droughts

Prison Aquaponics



Prison Aquaponics





Prison Aquaponics

- Up to 1600 people fed
- Final phase: 100% of food produced on campus and nearby greenhouses
- Operated and maintained by prisoners
- Job training
- Therapeutic value and pride of growing own food
- Cooperative: Denver Sheriff, Denver Mayor, CU Denver, Colorado Aquaponics, Urban Farm at Stapleton

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CLAS Farm to Fork Forum

UCD Homecoming Event

- A panel discussion about Denver Food System
- Transdisciplinary
  - Agricultural Anthropology: Moderator
  - Two Urban Farmers
  - ‘Denver Seeds’ politician
  - University academic
  - Chef
  - Poet

TransdiscplinaryNature

- Biological sciences
- Stakeholders
- Political sciences
- Climate sciences
- Agricultural sciences
- Communication
- Arts
- Philosophy
- Public Health
- Family planning
- Economics
- Hydrology
- Engineering
- Development
- Business
- Many more

Aquaponics: a promising solution to multiple problems

- Releases no pollution
- Uses water efficiently
- Does not require soil
- Converts compost into food
- Requires little space
- A ‘climate buffer’
- Intensive = jobs

Other Applications?

- Composting/Soil Building
- Nutrient Farming
- Wastewater Treatment
  - nutrients
  - pcp, endocrine disruptors
- Marine applications

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