

Sustainable Community Development

Culturally Sensitive Sustainable Eco-System Integration of Aquaculture and Agriculture

Integrated Eco-System Project Component and Benefits

1. Aquaculture — Fish Farming

Develop an aquaculture fish farm to raise **Talapia** fish for student family consumption and eventually sold commercially for profit to local markets

- Talapia fish are the easiest fish to breed, dozens of middle and high school programs have been able to successfully raise Talapia fish
- Females can produce several hundred to a thousand per spawn
- Highly cost effectively to generate high protein lean fish meat for low-income communities
- Greatly reduced operating costs when combined with agriculture (aquaponics)
- Reduced costs associated with ability to breed fish and solely on algae for fish feed
- Hardy fish resistant to fluctuating levels of pH, oxygen, waste, etc.
- Easy to breed fish and vegetables for middle school age kids
- Consistent with Hispanic and Native American traditions (aquaculture popular Latin American countries - Mexico, Costa Rica, Honduras, etc. and tribal communities — St Croix, Lummi, Menimone, Wampanoag, Suquamish, etc.)

2. Aquaponics - Vegetable roots in water rather than soil

Component provides an integration of hydroponics and aquaculture

- Waste products (fish manure, algae, and decomposing fish feed that can be contaminants or toxic for fish farm) are nutrients for vegetables — waste products for one system serve as food for second.
- Aquaponics tanks act as an organic, natural biological filtration system to clean water to allow it to be recycled for use again in aquaculture Talapia fish tanks
- Recycled water can use less than 1% of water required to produce equivalent yield for fish farm with ponds only (ideal for Arizona's and lands)
- One pound of fish can yield at least 2 lbs of vegetables
- Organic, pesticide-free produce
- Ideal for lettuce, herbs, spinach and basil

3. Aquaculture Fish Feed — Algae Fish Feed

The Talapia fish can feed solely on algae (periphyton).

- Talapia are more cost effective to breed being herbivorous fish (plant eating) versus more expensive carnivorous (meat eating of smaller fish)
- Periphyton algae, which is relatively easy to grow can serve as the food source for Talapia
- Algae (periphyton) provides higher yield of Talapia fish

4. Aquaculture Fertilizer — Chicken Manure Fertilizer to accelerate algae growth

Periphyton algae uses chicken manure fertilizer

- Waste products (chicken manure) serves to stimulate higher yield of algae
- Organic fertilizer - manure produces higher fish yield compared to inorganic algae fertilizer

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5. Community Gardens

Students and families maintain vegetable and herbal garden

- Vegetables and herbs can be an are important component of a low-glycemic, high fiber diet plan
- Kids and families tend to gardens, creating sense of community
- Emphasis on growing healthy vegetables and herbs, including traditional Hispanic and/or Native American foods
- Section of garden oriented to traditional foods helps reinforce healthier diet and create connection to cultural traditions. Many of the traditional food sources have been scientifically identified as helping reduce blood sugar levels and improve insulin production (such as mesquite bean pods, tepary beans, prickly pear fruits, chia seeds, etc.

6. Free Farmed Animal husbandry — Raising Chickens in a Humane Manner

Humanely raise 3 to 6 chickens for eggs

- Eggs good source of protein
- Chicken manure used for periphyton algae
- Secondary use of chickens for lean meat
- Seek "Free Farmed" certification that chickens are treated in a humane manner that is verified by Farm Animal Services.

7. Remediation of Contaminated Soil

Raise aquaculture and gardens at sites that have contaminated soil. First targeted 1 acre site is adjacent to CARE Partnership that has contained a watertower that resulted in paint chips contaminating soil to up to 1400 lead per million parts of soil (ppm) versus EPA threshold of 400 ppm. This site will be converted for more productive used using three methods

- Raised tanks above soil — integrated aquaculture and aquaponics system with self-contained tanks
- Raised garden beds above soil — develop raised garden beds and fill them with new compost and soil. (Note: Added Value case study project built raised beds with imported Bronx Zoo soil and compost)
- Identify section of site with lead level near 400 ppm threshold level and gradually remediate lead levels in soil using Indian Mustards and Sunflower plants which can absorb contaminants through the root system ("phytoremediation") — see similar project in Dudley Street neighborhood in Boston

8. Solar Greenhouse — Energy efficient eco-system

Gradually build many of the eco-system components within solar-powered greenhouses

- Arizona one of the most efficient geographic areas for solar greenhouse
- Solar greenhouse can help cost effectively temper the climate in hot arid desert climates.
- Greenhouse helps reduce energy, increase water conservation, and increase aquaculture, aquaponics and community gardens yields.