

Is Reexamining the Roots of Agriculture Needed?

Perschbacher P*

Department of Aquaculture and Fisheries, University of Arkansas, Pine Bluff, Arkansas, USA

Introduction

The world's population is increasing, while areas for productive farming and water supplies are diminishing or already utilized. Thus, intensification of existing systems and new systems (ocean or factory based) are needed. However, what existing farming system can intensify without harming the environment or increasing cost of production? Perhaps the oldest systems may need to be revisited. Early land-based farming systems in Asia and Native North America relied on polycultures and integrated systems. Chemical use for pests and fertilizer was not needed, provided by natural pest inhibitions and recycling. Western systems that followed in North America used slash (clear) and burn and plowing virgin land for short term productivity. Once soil fertility was exhausted, farms moved on to new sites, and eventually chemical additions were needed in the form of fertilizers and pesticides. Polluting runoff and unintended targets, including humans, resulted. But family-run farms were small and to a degree integrated. Monocultures, often involving international agribusinesses, became the norm by replacing labor with machinery, and by engineering systems and cultured species for maximum production. The "organic" food movement which did not allow non-natural components resulted from questions about the safety and quality of such production. And budget and profit projections did not factor in the social costs (e.g. rising prices reducing demand and unemployed farm communities), unforeseen climate extremes, new epizootic diseases, and environmental costs. Agroecology is the term given to the movement to utilize ecological principles in farming.

Aquaculture has experienced the same progression. Beginning with the superbly designed Chinese carp systems, that fed seven fish with the

waste from one, aquaculture progressed slowly until the 20th century. Advances in feeds and technology, including labor saving/eliminating mechanical devices, lead to rapidly growing monocultures that were also not resilient to pests or environmental change. Slash and burn in aquaculture was not using up natural fertility, but using up natural waters and wetlands, creating "dead zones." Collapses in shrimp farming from polluted intake water and diseases, along with impacts on natural systems and populations are leading to a need for new more sustainable systems. Water-based agroecology, or aquaecology, is advancing food supplies sustainably by using ecological principles. Polyculture using co-cultured tilapia in commercial brackish water ponds has improved water quality in intensive shrimp production and reduced disease. Salmon pens are being stocked with fishes that consume fish lice. Extractive cultures (e.g. shellfish and seaweed) are being added to marine systems to consume the nutrients that are leading to deadly and recurring algae blooms or tides. Integrated freshwater aquaponics systems on local niche levels are rapidly expanding. In studies conducted by the author, unfed and sequestered tilapia have radically improved culture environment by consuming wastes and excess and noxious algae, while adding production to intensive fed freshwater-pond channel catfish (see the 2017 book *Tilapia in Intensive Co-culture*). The future of farming may be dependent on these approaches to avoid society unrest and to improve the environment and living standards. The farming practices used for wealth creation by Western cultures should not be used ethically or sustainably. Western nations should help to avoid the mistakes of the past. However, following the disastrous collapse of Chinese shrimp culture in overstocked Bohai Bay in 2000, I asked Chinese scientists why they didn't use their touted integrated and ecological based systems. They said we forgot, but they meant we have adopted the Western systems.

***Corresponding author:** Perschbacher PW, Retired Associate Professor, Department of Aquaculture and Fisheries, University of Arkansas, Pine Bluff, Arkansas, USA, Tel: (870) 329-0513; E-mail: pwpersch@gmail.com

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