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#ONEHEALTH2015

# Extended Abstract for the 3<sup>rd</sup> GRF One Health Summit 2015: Healthy Farms for Healthy People and a Healthy Planet

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**ABSTRACT:** Natural systems produce food for all living organisms including humans, yet humanity has dramatically disrupted natural systems. Agriculture is one of the main drivers of these profound alterations, in particular conventional farming practices based on synthetic chemicals, commercial seeds & machinery to produce a very few crops. This article explores how some dominant farming practices contribute to environmental and social instability including poverty, hunger, malnutrition, illness, deforestation, loss of biodiversity and climate change. A literature review of contemporary research leads us to the proposition that feeding a still expanding human population in an environment conducive to a natural systems equilibrium and human prosperity requires a long-term, integrative approach that links ecosystem health, human health and societal health at a global scale. Organizations such as Sustainable Harvest International (SHI) have for decades steadfastly refused to take the quick and simple approach to rural development of increasing opportunities for inconsistent cash income or providing synthetic agro-chemicals that may increase farm production in the short-term but will stress production in the longer-term, while also causing environmental, social, economic and health problems directly or in an externalities form. Instead, SHI along with other organizations and businesses are demonstrating the value of providing farmers with technical assistance to produce more agricultural outputs (food, feed, fibre, fuel, etc.) in equilibrium with natural systems.

*Keywords:* agriculture, nutrition, ecosystems, climate change, development

## 1. INTRODUCTION

In ancient times, humanity fed itself with what nature provided, but this wasn't easy and didn't provide a stable food supply (Ponting, 2011). So humans developed simple forms of agriculture to complement the hunting and gathering. As the human population grew and societies changed, some of the farming practices proved inadequate to sustain farming communities. The last wave of farming innovation was the green revolution, which brought high yields through breeding and an agronomic model based on external inputs (Griffin, 1974). The promise of the green revolution was to make hunger history. Sadly, millions still go hungry whilst unintended, negative consequences of conventional farming practices contribute to a variety of environmental and social problems (Gordon et al. 2014). Why is that? And what innovations will best serve us in the future? Do we want to embrace all new innovations or only those that preserve healthy ecosystems while providing a long-term source of healthy food and other adequate agricultural outputs?

## 2. FAILURES IN TODAY'S DOMINANT FARMING SYSTEMS

### 2.1 *Slash-and-Burn Farming*

Slash and burn farming was likely an effective practice when the human population was small and the expanse of forest cover was immense. Crops were cultivated for one year, which depleted the land requiring a new area to be burned the next year. At one time, burned areas could recuperate, surrounded by forest, for many decades before being burned again. The few crops that were grown such as corn, beans and cassava were complemented with hunting and gathering in the surrounding forest (Palm et al. 2013). Today, farmers throughout the tropics still use the slash-and-burn method, but no longer find it adequate to sustain their families. With limited land available to most farmers, they must return to previously burned land on a much shorter rotation than in the past. Given insufficient time to recuperate, the topsoil is completely lost after a number of rotations and the land can no longer support crops or natural vegetation. Lack of tree-cover causes rain to run off into rivers rather than replenishing aquifers, resulting in widespread deforestation, drought, flooding & hunger, exacerbated by climate change (Brodie et al. 2012).

### 2.2 *Conventional Farming Systems*

Conventional farming systems rely on synthetic chemicals, machinery & commercial seed monocultures to produce a few commodity crops traded in a global food system. This combination boosts short-term production of those crops, but disrupts natural systems as much as slash-and-burn farming. The destruction of these systems eventually decreases the agricultural productivity of the land. Moreover, commodity crops provide limited nutrition creating a costly health crisis. (Tillotson, 2003).

### 2.3 Hunger

About 795 million people in the world do not have enough to eat. This number has fallen by 167 million since 2005, but progress slowed after 2008 when the food and economic crisis began because people were buying food rather than growing it. These statistics are especially troublesome when we consider that 75% of the world's hungry people live in rural areas (FAO, 2015) where they should be able to produce plenty of their own food. Yet they remain hungry because they do not know how to use productive, sustainable farming techniques to grow a diversity of nutritious foods. Since the 1900s, some 75 percent of crop diversity has been lost. The limited amount of maize (*Zea mays*), beans (*Phaseolus spp.*) and cassava (*Mainhot spp.*) grown in traditional slash-and-burn plots does not make for a healthy diet when it cannot be complemented with hunting and gathering after widespread deforestation (Brodie et al. 2012). When a farmer's limited income is spent on production of a single commodity crop with synthetic agro-chemicals, crop failure, decreased prices or lost market share result in insufficient income to buy food for a farming family (Altieri, 2009).

### 2.4 Social instability

In some cases, income from cash crops is insufficient to repay loans for external inputs leading farmers to desperate measures including crime and suicide (Mishra, 2012). When their own land is depleted, most farmers seek new land far from their homes, work on large agriculture plantations or, migrate to their countries' urban areas or to other countries. With limited education, employment is scarce and far from home leaving families separated for long periods or living in urban slums (Roy et al. 1992).

### 2.5 Environmental and agricultural degradation

According to Jones (2014), globally, over \$100 billion of nitrogen fertilizers are applied to crops and pastures every year., but only 10 -- 40% of the applied N is taken up by plants. The other 60 -- 90% is lost when it is leached into water, volatilized into the air or immobilized in the soil. Data from North America's longest running field experiment on the impacts of farm production methods on soil quality have revealed that high nitrogen inputs deplete soil carbon, impair soil water-holding capacity — and ironically, also deplete soil N. The inefficient use of synthetic N fertilizer sources in all the high input regions of the world is considered one of the main drivers of yield stagnation. Seventy-four percent of commercial fertilizers are nitrogen sources, mostly products like urea, which often acidifies soil, reducing availability of phosphorous and speeding decomposition of humus thus starving microorganisms that create healthy soil (Goll et al. 2012). The loss of humus and microorganisms, makes it more difficult for both roots and rainwater to move through the less friable soil leading to unhealthy crops, drought and flooding. As soil is washed away, the fertilizers and pesticides it takes with it result in the indiscriminate killing of aquatic species (Zuazo, et al 2012). Some farmers, rather than face separation from their families, dangerous work or the uncertainties of city life, will start the slash-and-burn process over again in areas of virgin forest that are often protected on paper but not from the reality of hungry families. The resulting deforestation leads to increased loss of biodiversity, drought, flooding, climate change and illness.

### 2.6 Illness

Deforestation and forest fragmentation have been linked to increases in the risk of malaria transmission and other diseases. In the Brazilian Amazon, researchers found that a 4.3% change in forest cover resulted in a 48% increase in the incidence of malaria. Researchers hypothesized that the changes to land cover after deforestation, such as the secondary growth of shrubs, provided habitat that was more favorable for the mosquito vector that causes malaria in the region, *Anopheles darlingi* (Olson et al. 2010). Other studies have found that deforestation may be associated with higher numbers of mosquitoes and increased biting rates (Pongsiri et al. 2009). The use of synthetic chemical pesticides brings additional health problems for the farm workers who are exposed to them and even their children. Every year tens of thousands of farm workers suffer from pesticide poisonings, while thousands more children are born with terrible birth defects caused by their parents' exposure to pesticides. Between 2001 and 2003, 1.7 billion pounds of pesticide products were exported from U.S. ports; almost 28 million pounds of them were banned, severely restricted or unregistered in the United States. The number would be higher but agribusiness is producing more and more of its toxic products overseas where labor is cheaper and standards are lower. (Smith, 2008)

### 2.7 Climate change

The IPCC has consistently stated that two leading causes of climate change are the burning of forests & the removal of carbon from the soil. Moreover, Swaminathan and Sukalac (2004) reported that the fertilizer industry uses about 1.2% of world energy consumption and is responsible for about the same share of global GHG emissions.

## 3. BENEFITS OF AGRO-ECOLOGY

For nearly 20 years, Sustainable Harvest International (SHI) has promoted agro-ecology practices to improve the standard of living of poor farmers and environmental stability. Agro-ecology maximizes the benefits of natural systems to produce abundant and diverse crops. Thousands of farmers who have participated in SHI's extension program have found success through a variety of agro-ecological practices. Association of perennial and annual crops has been proven to increase productivity whilst increasing

production resilience. The soil that is built up with organic material supports trillions of microorganisms, which in turn support healthy crops (Gliessman, 2015). SHI is part of the growing global call for a paradigm shift “from monocultures to diversity, from chemical intensive agriculture to ecologically intensive, biodiversity intensive agriculture, from external inputs to internal inputs, from capital intensive production to low cost, zero cost production, from yield per acre to health and nutrition per acre, from food as a commodity to food as nourishment and nutrition.” (Shiva, 2011)

### **3.1 Growing consensus**

In one of the largest studies to analyze how agro-ecological practices affect productivity in the global south, researchers at the University of Essex in England analyzed 286 projects in 57 countries. Among the 12.6 million farmers followed, who were transitioning toward sustainable agriculture, researchers found an average yield increase of 79 percent across a wide variety of crop types. (Pretty, 2006) A 2008 U.N. Conference on Trade and Development report concluded that “organic agriculture can be more conducive to food security in Africa than most conventional production systems, and ... is more likely to be sustainable in the long term.” In the most comprehensive analysis of world agriculture to date, several U.N. agencies and the World Bank engaged more than 400 scientists and development experts from 80 countries over four years to produce the International Assessment of Agricultural Knowledge, Science, and Technology for Development (IAASTD). The conclusion? Our “reliance on resource-extractive industrial agriculture is risky and unsustainable, particularly in the face of worsening climate, energy, and water crises,” said Marcia Ishii-Eiteman, a lead author on the report.

### **3.2 Nutrition**

While agro-ecology practices can increase crop yields on a par with conventional practices and not only in the short-term, agro-ecology practices further outperform conventional practices in regards to the nutrients produced. Navdanya, an Indian organization founded by Vandana Shiva, released results from a study in India in 2011 comparing organic mixed farming with conventional mono cropping. In the state of Sikkim, they found that organic techniques produced 21.6 times as much vitamin per acre. Additionally, agro-ecology farming produced 276% more protein and 1129% more vitamins per acre in Uttarakhand farmland. (Shiva, 2011) Beyond the techniques used, it is also important to consider the impact of food sovereignty on human health. It is a risky for people living in remote, rural communities rely on inconsistent cash income to feed their families. Knowledge and skills to produce a diversity of crops, however, can consistently provide a healthy diet for generations.

### **3.3 Mental health**

In a recent analysis from the Netherlands, researchers looked at physician records to assess the impacts of proximity to green space on a number of conditions and found that patients living with more green space within 1 km of their homes had lower prevalence rates for depression and anxiety disorders. The relationship was particularly strong among patients from poorer households, and for children (Maas et al. 2009). Researchers have also found a relationship between environmental degradation and mental illness. In western Australia, scientists studying linkages between ecosystem degradation and mental illness in rural populations, found a positive association with depression in these communities. The long-term impacts on the mental health of these communities could be significant, due to ongoing environmental degradation in this region (Speldewinde et al. 2009).

### **3.4 Climate & ecosystem stabilization**

The widespread adoption of current organic practices has the potential to sequester 10Gt of CO<sub>2</sub>, which is approximately 20% of the world’s greenhouse gas emissions. Agro-ecology practices are also an alternative to slash-and-burn farming that improve life for families while also preserving tropical forests since slash-and-burn is a leading cause of tropical deforestation. Halting tropical deforestation would eliminate another 10% of greenhouse gas emissions (Boucher, 2011) and preserve over 50% of the earth’s biodiversity (Butler, 2013)

## **4. ADDED VALUE TO THE ONE HEALTH APPROACH**

Shifting to a biodiverse, organic farming based on enhancing ecological processes connects and improves the health of people, society and the planet in one system.

## **5. CONCLUSIONS**

**The current dominant cropping systems are creating a series of unintended risks and problems that threaten natural systems and human prosperity. Industrial agriculture and slash-and-burn systems both contribute to hunger, poverty, land degradation, water pollution and climate change. If a sustainable food system is desired, a paradigm shift is needed. Small-scale agro-ecology is not part of the problem, but could be the solution. Diversified farms based on ecological processes can be resilient enough to permanently produce enough food, fiber and other agricultural outputs for a healthy and prosperous world.**

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