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Agroecology vs Agribusiness in the Second Solar-Digital Age*

Johanna Butler-Hookes

Abstract

This paper addresses the following question: can the world's nutritional needs be met from a sustainable food system, i.e., one that simultaneously protects the environment from pollution, prevents loss of bio-diversity and reduces carbon emissions, so as to stabilize the climate?

The present agribusiness food production is highly dependent on external inputs of fossil fuel, artificial herbicides, pesticides, fertilizers and genetically modified seeds (GMS) to keep yields maintained. Environmental scientists, social scientists and development agencies consider them as big polluters and major contributors to loss of biodiversity and destabilization of climate.

The paper considers agroecology, working with nature, agroecologists and local knowledge, practiced by millions of smaller farm units, presently providing 70 % of the world food needs. This approach is analyzed and compared with the commercial system through the use of various case studies.

Conclusions are drawn on which system is the most likely to succeed in meeting the urgent need for a Sane (S), Humane (H) and Ecologically (E)(SHE) sustaining food system that will both care for the planet and contain the increase in temperature to within the 2 % above pre-industrial levels with the assistance of solar renewable energy.

Keywords: *agribusiness, agroecological, artificial fertilizers, biodiversity, certification, chemical pest controllers, commodification of food production, contaminate, conventional production, decommissioned, decomposition, ecological catastrophe, farming conglomerate, food security, food sovereignty, genetically modified hybrid organisms, growth in resistance, holistic, Hyper-Expansionist, Sane, Humane, Ecological, land-grabbing, monoculture, monopolization, Monsanto, neoliberal, pesticides, resilient, subsistence farmers, sustainable future, unsustainable.*

Introduction

Is it time to change from the dominant agribusiness model of food production to an agroecological model to ensure the stability of the climate system and ensure a sustainable future for the planet?

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* See D. Hookes 'The Need for the Second Solar Digital Revolution' in this volume.

The success of the Paris Climate summit in December 2015 is in achieving agreement from 195 countries that future temperature rises must remain below 2 °C above pre-industrial levels if we are to avoid runaway climate change (Climate Focus 2015). This is seen as the ultimate wake-up call to the world that it must wean itself away from using fossil fuel energy as the main energy source and make a determined commitment to the transition to a low carbon economy.

This paper will argue that it is imperative that we break the current dominant agribusiness model of food production that is promoted by large transnational corporations roaming the globe for profits at all costs. They, nevertheless, and with the help of the mainstream media (MSM) and with governments' assistance, claim to be saviors of the poor people, on the margins in every continent, from hunger and starvation.

However, for a transition to a low carbon, earth-nurturing economy it is necessary to look to an agroecological approach to food production based on working with the knowledge of local people and with natural resources to ensure a large diversity of crops and environments. This means a stewardship of nature to provide a sustainable future for both humans, animals with healthy, ecological systems delivering a food system that will feed the living inheritors of the Earth and keep the planet below the 2 °C rise as agreed.

In recent years, erratic weather behavior patterns meant that the work done by agencies to improve the lot of the poor in some regions has been undone due to extremes of either drought or flooding. The people in the regions of Africa and South East Asia and South America are hardest hit and are the least able to defend themselves against these occurrences because of the poor social and economic conditions in which they find themselves, such as the problem of landownership.

At the same time, up to a third of the food available to the well-fed and, often, obese and diseased population in the 'North' is wasted (The Guardian 2011). Clearly, in view of such an unsatisfactory situation there is need for a food security plan to be implemented. There is also a need to stabilize these extremes of weather, which, as 97 % of climate scientists claim, is being driven by the emissions from burning fossil fuels and from industrial agriculture. The latter is responsible for 20–30 % of the increase in the emission of greenhouse gases (GHGs) such as carbon dioxide, methane, and nitrous oxide.

A Need for a Food Sovereignty Policy for Every Nation

Policy makers must cultivate a model for food sovereignty − where local people are in control of the food they produce and the land they produce it on, at the same time being culturally and environmentally respectful of their surroundings. This must be done with land rights clearly established and guaranteed. This model will eliminate poverty and build a sustainable low or, prefera-

bly, zero fossil fuel future, with greatly reduced GHG emissions. This approach will thus help to stabilize the climate and meet the nutritional needs of humanity, the animal kingdom and of the whole earth, which is our common home.

About 40 % of the global workforce is employed in agriculture, *i.e.*, 1.3 billion people, the overwhelming majority of whom are small-scale or subsistence farmers. In Africa this figure is about 50 % of the work force (Farming in Africa).[1]

These small farmers are being preyed upon by the agribusiness corporations as illustrated by the 'Alliance for Africa' program which promotes such corporations to 'solve' the food security problems (Todhunter 2014). These companies are not only those involved in agribusiness directly, which grow the food, but also those that supply the seeds and chemical inputs such as fertilizers, herbicides, pesticides and so on. If the small farmers are driven off their land by agribusiness then two catastrophes will result: a social catastrophe since these farmers and their families will end up in urban slums; an ecological catastrophe since small farmers tend to use ecological methods that protect biodiversity. They can more readily use sustainable energy inputs, *i.e.*, clean renewable energy such as solar power, to increase their productivity in order to feed the world.

A central issue is whether the small-scale farmers, by banding together can resist this onslaught from agribusiness. They are already becoming organized in La Via Campesina (2013) with over 200 hundred million members. It is also possible to show (see later) that they can produce enough food to feed the world, *i.e.*, especially if appropriate solar-powered technology can be made available and their biodiversity can be enhanced by modern scientific understanding. It will be proposed that technologies for sustainable development should be created and, in the first instance, given freely to developing countries as part of the conversion of the global economy away from a 'Death Economy' to a 'Life Economy' (Perkins 2016).

Agroecology versus Agribusiness

Using Global Justice Now report 'From the roots up' (Fitzpatrick 2015*)* and other sources, we will explore whether agroecology is capable of delivering the robust system required to transform to a sustainable low carbon food economy and away from the present dominant fossil fuel-led agribusiness that has caused so much uncertainty for food security as well as poisoning and destabilising the biosphere.

[1] URL: http://www.momagri.org/UK/agriculture-s-key-figures/With-close-to-40-%25-of-the-global-workforce-agriculture-is-the-world-s-largest-provider-of-jobs-_1066.html.

What is 'Agribusiness' and can it be the answer to the food security problem?

Agribusiness is the approach to farming that uses industrial methods both for crop and animal husbandry. It was developed initially in US but has spread to most of the developed world. There is now an active program to bring such techniques to Africa again, allegedly as the way to deliver food security. This is part of the program called 'Alliance for a Green Revolution in Africa'[2] and is supported by the Bill and Melinda Gates Foundation and many corporations associated with agribusiness such as Monsanto, Bayer, and Syngenta (Econexus 2013).

Allegedly to satisfy increased demand of the last half century, US farming above all, has evolved from local family farms into an industrial operation business, with vast amount of financial capital investment, sometimes from foreign sources, to create monoculture operations, that is characterized by high external inputs of finance, technology and synthetic non-organic chemicals. This system of operation is where animals are corralled into close density areas and their feeding requires vast acreages to grow crops.

These crops in turn require industrial scale inputs of fertilizers, herbicides and pesticides to produce vast monocultures usually of maize, rice or soya beans. Quite often it requires international export operations from monoculture plantations to meet the food requirements of these agribusiness markets. These agri-operations can only survive through the use of yearly inputs, such as seeds that are often genetically modified hybrid organisms (GMOs), herbicides and pesticides, high fossil fuel-based mechanization and high water consumption compared to the smaller traditional farming units (see Fig. 1).

The few transnational operators that control the global industrial food production system are increasingly competitive, so recent mergers or attempted mergers will attempt to reduce this competition and hence the choice of suppliers. Agribusinesses need systems that are now supplied by only a few giant transnational corporations such as Monsanto, Dow, Bayer, Dupont (see Howard 2013).[3] The alleged purpose of industrial agriculture is said to be able to provide abundant, cheaper food on the shelves to citizens in the US and elsewhere.

As a result of this industrial production of food for profit, by 2050, crop demand for human consumption and animal feed will increase by at least 100 %. At the same time, more resource constraints will emerge: for example, 40 % of water demand by 2030 is unlikely to be met. There will also be a shortage of arable land. Already, more than 20 % of arable land is degraded because of this industrial farming and its reliance on synthetic fertilizers and pesticides. Food and bioenergy production are competing with each other, as corn and sugar are increasingly important for both. According to McKinsey analysis (Goedde,

[2] URL: https://www.gatesfoundation.org/How-We-Work/Resources/Grantee-Profiles/Grantee-Profile-Alliance-for-a-Green-Revolution-in-Africa-AGRA.
[3] URL: https://philhoward.net/2017/05/11/seed-industry-structure/.

Horii, and Sanghvi 2015) since 2004, global investments in the food-and-agribusiness sector have grown threefold, to more than US$ 100 billion in 2013.

Fig. 1. Industrial-scale crop production

Sources: URL: https://www.cpapracticeadvisor.com/article/12332881/how-to-turnagri cultural-clients-into-agribusiness-clients; URL: http://www.ga-agribusiness.org

According to the US Environmental Protection Agency (EPA), Animal Feeding Operations (AFOs) 'congregates animals, feed, manure, dead animals, and production operations on a small land area'. AFOs confine animals indoors for 45 days, in a 12-month period, during normal grass growing season with no grass or other vegetation in the area. Animals in AFOs are fed unnatural diets on-site, instead of allowing them to roam and graze (U.S. Environmental Protection Agency[4]; see Fig. 2). Monocultures of corn maize, wheat and soya, require intensive use of fertilizers to provide nutrients and pesticides to keep insects and disease under control, since, through planting only one species over

[4] URL: https://www.epa.gov/agri culture/agriculture-animal-production.

a large area, pests are naturally attracted. These fields are mechanically planted, weeded, and harvested using fossil fuel (NASA 2002).

Globally, according to the UN Food and Agricultural Organization of UN (FAO), 181.5 million hectares was planted with GM crops in 2014, as stated by the ISAAA (International Service for the Acquisition of Agri-Biotech Applications), make up roughly 3.7 % of the total agricultural area and about 13 % of the world's 1,500 million hectares of arable land (ISAAA 2016). Over 80 % of this land is now covered with monoculture crops, which are highly dependent on fossil fuels and water. The total contribution of industrial food production to GHGs is estimated at 25–30 %. Additionally, the erratic weather patterns mean a near constant crisis to get to save the harvest (Altieri 2011). Half of the global GM crop area is located in developing countries (Qaim 2013).[5]

Fig. 2. Livestock corralled into industrial-scale animal units – the largest in the world – has 500,000 animals in one operation.

Sources: URL: https://www.occupy.com/article/how-factory-farming-burning-our-planet#sthash.VbxZPLVE.UYs4RK13.dpbs; https://www.dailymail.co.uk/news/article-4354586/Shocking-pictures-calves-battery-farm-Dorset.html

[5] The concentration of the global agribusiness industry is shown in diagram at URL: https://philhoward.net/2017/05/11/seed-industry-structure/ in which a very few giant corporations dominate.

Agribusiness also means luxury crops for export have taken over from sustainable local farming. It also means of ploughing 2.6 million tons of pesticides into the soil worldwide yearly. U.S. alone consumed 324 million Kg of 600 different types of pesticides annually impacting negatively the flora and fauna of the region. Now to the social health costs of human poisoning is added the fact that 540 species of arthropods that have developed resistance to 1,000 different types of pesticides (see Fig. 3) (Altieri *et al.* 2011). The figure shows the growth in resistance to the chemical pest controllers with the vertical axis demonstrating the number of species that have become resistant.

Subsidising agribusiness. Contrary to the neoliberal economic philosophy, agribusiness is heavily subsidised. Worldwide subsidies and price support (in which governments keep the prices high to encourage producers to grow crops) amount to US$ 360 billion. This figure is six times the annual development assistance from Northern countries to the global South. In the European Union over the 40 % of the value of agricultural production comes from subsidies (World-Energy-Resources… 2016; World Watch Institute 2014).

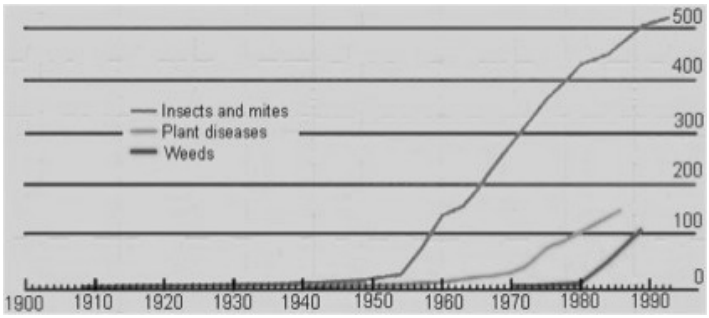

Fig. 3. The growth in resistance to the chemical pest controllers with the vertical axis showing the number of species that have become resistant

Source: URL: https://foodfirst.org/wp-content/uploads/2014/06/JA11-The-Scaling-Up-of-Agroecology-Altieri.pdf

Despite the US being a pioneer of agribusiness methods one in six children and 12 % of the US population go to bed hungry each night. Often people are too poor to buy the food that is available. 'We're seeing more people hungry and at greater numbers than before', said World Hunger Program's executive director Josette Sheeran. 'There is food on the shelves but people are priced out of the market'. This food crisis has produced popular rebellions that quickly spread across the globe and took place not in areas where war or displacement made food unavailable, but where available food was too expensive for the poor.

A statement from the American Journal of Clinical Nutrition is thought-provoking:

> The major threat to future survival and to U.S. natural resources is rapid livestock population growth… The amount of grains fed to U.S. livestock is sufficient to feed about 840 million people who follow a plant-based diet [that being several times the current US population]... The US livestock population consumes more than 7x as much grain as is consumed directly by the entire American population (Pimentel D. and Pimentel M. 2003).

Advocates of the above basic agribusiness model believe it is a recipe for producing cheaper foods and for bringing the world food security. However, below is a case study of the recipe in action in Brazil, with some briefer notes on India, Indonesia, and land grabbing in Russia.

A Brief Case Study of Brazil

Brazil devalued its currency in 1999 – this was trigger for foreign financial investors to be attracted to all sorts of industry but particularly sugarcane, soya, and beef production. Agribusiness major global players arrived to offer intense development of Genetically Modified (GM) soya production alongside intensification of the sugarcane industry where the sugar was converted to ethanol as a fuel competing with crops like castor oil for the bio-diesel market. Alongside this was a huge expansion chiefly of beef production with Brazil sporting the biggest ranch in the world of 500,000 animals in Pará (see Fig. 2). This ranch is situated within an area where some 90 million hectares in the Amazon region have long been deforested, much of it illegally (see Fig. 4) and (Pressures on the Amazon).

Fig. 4. Deforestation in Brazil's Amazon

Source: URL: https://www.youtube.com/watch?v=7rWcgxFVnjY

Large mechanised operations shed labour

All these agri-industries, which were pursued with a view to exporting to the global commodities market, have the common feature of being cash crop generators which worked 'better' on vast areas of land and high external inputs to keep productivity high. Such large crop areas require mechanization leading to shedding of local labour once established or labour used on a seasonal, precarious basis.

Big chemical companies benefit from monocultures

Herbicides, pesticides and fungicides are needed at an ever increasing rate because of Brazil's rapid growth over the last two decades and the need to control various pests and diseases like soy rust and super weeds more prone to flourish in vast monocultures. Brazil trumped the world imports for these pest and weed controllers in 2016 with imports of US$ 34.2 billion supplied in chemical inputs: herbicide, pesticide and fungicide products, worth US$ 10.2 billion, were supplied by companies (Brazil Chemicals 2017).

Major pesticide companies selling to Brazil products banned in US and EU

Brazil is an enticing market for pesticides banned or phased out in richer nations because of health or environmental risks (Brazil Chemicals 2017; see Fig. 6). But they are very capable of generating profits from countries where it is difficult to impose the law, or there is confusion about their toxic character, or even corrupt operators in need of the cheapest way to make a profit.

Fig. 5. Cracked earth outside Sao Paolo, Brazil

Source: URL: https://www.ibtimes.com/sao-paulo-drought-2015-photos-historic-water-crisis-brazil-show-city-brink-collapse-1912767

Fig. 6. The developing countries are awash with banned in US and EU pesticides which pesticide companies sell to Brazil

Source: Reuters 2015.

Below is a brief extract from a Reuters special report on what banned pesticides turned up and got used:

> At least four major pesticide makers – U.S.-based FMC Corp., Denmark's Cheminova A/S, Helm AG of Germany, and Swiss agribusiness giant Syngenta AG – sell products to Brazil that are no longer allowed in the EU domestic markets (Prada 2015).

Paraquat is banned in the EU but among the compounds widely sold in Brazil and was branded as 'highly poisonous' by U.S. regulators. Both Syngenta and Helm are licensed to sell it there (*Ibid.*).

It is alarming for the countries of the world that import fresh fruit and vegetables from Brazil, that screenings by regulators there show much of the food grown and sold violates national regulations. Anvisa, the Brazil National Health Surveillance Agency, completed its latest analysis of pesticide residue in foods across Brazil. Of 1,665 samples collected, ranging from rice to apples and peppers, 29 % showed residues that either exceeded allowed levels or contained unapproved pesticides. There is a growing increase of cases of human intoxication by pesticides from 2,178 in 2007 to 4,537 in 2013 and fatalities have risen from 132 that 2007 year to 206 in 2013… Thus, many lives have been lost already to produce these crops under such stressed conditions (*Ibid.*).

In November, a federal court upheld a ruling that forces Fresh Del Monte Produce Inc., the global fruit giant, to indemnify the widow of a worker whose liver failed after repeated handling of pesticides. In Limoeiro do Norte, in the state of Ceará in the Northeast region of Brazil, a state court is weighing charges against a landowner accused by police of ordering the murder of an anti-pesticide activist (Busscher 2012).

Compulsory notifications: herbicide and pesticide poisoning

There has been a huge increase in the compulsory notifications of herbicide poisoning and there is a grave concern about the spread of contamination in water supplies. There is also a finding of two pesticides that have *never* been registered in Brazil, azaconazole and tebufenpyrad, which suggest product smuggling and lack of control of public policies. According to Information System of Compulsory Notification Conditions (SINAN), in recent years there was an increase of over 67 % of new non-fatal labour accidents due to pesticides. The future is deeply concerning, according to the publication, as the likelihood of tackling the pesticide problem is challenged by the make-up of the Big Players. They are: oligopolies of the chemical, machinery, and seed industries; big land owners, and an important participation of the financial sector that can have a strong influence over any government (Rigotto, Vasconcelos, and Rocha 2014).

This agribusiness farming model has also led to the emergence of superplagues, causing massive economic losses, pressures for allowing the imports of pesticides, formerly forbidden in the country, and the thwarting of the current Brazilian legislation on pesticide use.

Loss of soil and use of water

In addition to the above problems of herbicides and pesticide many of these monoculture crops cause soil losses and consume considerable fractions of the available water as shown (see Table 1).

Table 1. Soil and water losses in annual and semi-perennial crops in Brazil

Annual Crop	Losses	
	Soil (t/ha-year)	Water (% rain)
Castor oil plant	41.5	12.0
Beans	38.1	11.2
Manioc	33.9	11.4
Peanut	26.7	9.2
Rice	25.1	11.2
Cotton	24.8	9.7
Soybean	20.1	6.9
English potato	18.4	6.6
Sugarcane	12.4	4.2
Maize	12.0	5.2
Maize + beans	10.1	4.6
Sweet potato	6.6	4.2

Source: Bertoni *et al.* 1998.

Brazil suffered a drought in 2014/15 when the rains did not come at the due time (see Fig. 5) and this led to huge pressure on water use and crops. The expansion of deforestation activities into the Amazon has been linked to the reduction of rainfall in the south of Brazil. The impact on the economy was to translate into a reduction in GDP by an estimated 5.6 % in 2016 largely owing to severe drought in several key grain-producing regions.

Brazilian public debate on the production of healthy food

The question of safe production of healthy food is raising a serious public debate in Brazil. The Abrasco Report (ABRASCO 2016) makes public the commitment of public health professionals in making available for society the scientific evidence of agrochemical hazards. This report has had significant impact in the academic milieu, in the media and among social movements and has led to this question: is there another way for agriculture and the production of food? It is aligned with the ideas of the International Peasants' Movement, Via Campesina, that designed a food sovereignty proposition that resonates in the discussions on food and nutrition safety held at the Food Safety National Council (CONSEA), leading to a striking document sent to the then President Dilma Rousseff, and the National Forum for Fighting Pesticide Effects, and other recipients (Rigotto, Vasconcelos, and Rocha 2014).

Increasing numbers of people in Brazil now believe that agroecology, that is, working with nature and using local indigenous knowledge and control, can minimize or even eliminate the use of pesticides and herbicides to control plant disease and pests, *i.e.*, it is a successful alternative to industrial agribusiness. The latter has a dependency on poisonous chemical inputs and on uncertainty and changing market whims. This is quite evident from the following and links-in with like-thinking other groups that value rural community: National Articulation of Agroecology (ANA) and in the Brazilian Association of Agroecology (ABA): ‘Over the past few years, there has been an expansion of the agroecological experience, and the consolidation of successful cases’ (Radomsky *et al*. 2000). Later, an example in which the principles of agroecology have been used successfully will be discussed (that model can be applied in all regions of Brazil) when the global viability of agroecology is considered.

The effects of global commodification of food on local rural communities

This case of Brazil shows that there are many concerned Brazilians already working with the small farmers and rural communities. They want to seriously challenge the agribusiness model that is not bringing prosperity to the masses, but rather illness and hunger.

Global commodification of food production by big agribusinesses has a direct negative hit on small holding farmers throughout the world. It leads to their

destruction, *i.e.*, their being forced off their land because of their lack of power to resist the agribusiness corporations and therefore leads to an increase of hungry mouths to feed according to 'Hungry for Profit' (Madoff *et al.* 2000). At the same time an opportunistic land-grabbing is created for the relatively few agri-corporations, controlling global food production growing the monocultures. These monocultures replace the biodiversity offered by the local agroecological methods of local people.

However, people around the world are beginning to realize the enormous damage done to human lives and the environment by agribusiness and the relative few gigantic companies such as Monsanto that promote it.

Monsanto taken to International Court in The Hague

This was just a symbolic people's court, but the witnesses and judges were real. Witnesses from across the globe were called because they have suffered human rights abuses, threats to their communities and destruction of their environment. 'The impact is compounded by a global trade structure that was created to turn farming from a local enterprise into a planet-sized business'.[6] No part of the planet seems safe from this activity.

Farida Akhtar is a Bangladeshi economist and founder of biggest collection of community seed banks in the world, was one of the witnesses at the tribunal on Monsanto. She also (GRAIN 2002) knows the adverse impact that high, chemically dependent food operations have on environment. Agriculture – at least the high-input, chemical-dependent, fossil-fueled system favored by the agribusiness giants – has become a major part of the climate crisis. In addition to producing food and fiber, agriculture produces a harvest of three major greenhouse gasses (GHGs) – carbon dioxide (CO2), nitrous oxide (N2O), and methane (CH4). Carbon dioxide is produced when fossil fuels are burned for energy and transportation and in the production of chemical pesticides and artificial fertilizers. Fertilizer manufacturing emits around 41 million metric tons of CO_2 a year. Up to 60 % of human-caused nitrous oxide (which has 296 times the Global Warming Potential of CO_2) is released by agribusiness in 2015. 50 % of methane (with 25 times the GWP of CO_2) is produced by industrial livestock operations.

Alternative Nobel Prize winners work to expose injustices against poor farming families

The small International charity, GRAIN, working to support small farmer's rights, clearly shows that agribusiness is far from being the vehicle to feed and obtain food security in the world. It was awarded the Alternative Nobel Prize (GRAIN 2011**)** for broadcasting the plight of the young farmers in the presence

[6] See URL: https://www.organicconsumers.org/news/agribusiness-and-climate-change-how-six-food-industry-giants-are-warming-planet

of the land grabbing agribusiness operators in Argentina and the greed of the land grabbing speculators such as Black Earth Farming in Russia.

> On the 16th of November, 2011 Cristian Ferreyra was shot dead by two masked men in front of his house and his family. He was part of an indigenous community and a member of one of, the indigenous peasant organisation MOCASE Via Campesina. His 'crime'? To refuse to leave his homeland in order to make way for a massive soybean plantation, one of so many that have been encroaching on rural communities throughout Argentina in the last decade. So the plantation owners had him assassinated. Cristian was only 25 years old (Busscher 2012).

Effects of Agribusiness on Some Other Countries

Indonesia

14.8 million acres of tropical rainforest were destroyed to establish palm oil plantations over a period of a decade. Increasingly the palm oil is used to produce 'green' biodiesel. The CO_2 is generated by burning the rainforest and loss of carbon due to accelerated decomposition of the peat soils. It will take 400 years of using the biodiesel in place of fossil fuel to compensate for this emission of GHGs. The large scale fires that resulted caused an estimated US$ 16 billion damages including sickness through smoke inhalation of hundreds of thousands of people in Malaysia, and parts of Philippines and Thailand. At least 100,000 people will die prematurely.[7]

India

For instance, it is estimated that over the last two decades 300,000 Indian farmers sadly committed suicide due to indebtedness brought about by buying seeds, pesticides and chemical fertilizers from such companies as Monsanto (Chow 2016).

Russia: Ivolga agribusiness

The MSM would have the people of the world believe that we are all divided in our loyalties by our state boundaries but the true reality of the international capitalist financial system is illustrated by the case of Ivolga agribusiness and the Royal Bank of Scotland (RBS) during the Financial Crisis of 2007/8. Now RBS has been bailed out by the UK Government and thus taxpayers!

According to the UK Telegraph,

> Ivolga, a farming conglomerate which controls 1.5m hectares of land across Russia and Kazakhstan, is presently negotiating with Royal Bank of Scotland, which leads its creditors, to restructure a $300m loan it arranged in 2007.
>
> Analysts estimate that a sale could value the farm at £500m–£1bn (Orange 2011).

[7] URL: https://www.rainforest-rescue.org/topics/palm-oil.

This Ivolga scenario shows the risks of this agribusiness system and the market and its instability as a sustainable system to deliver food security to the planet. Ivolga bought all their fertilizers at the top of the market and then sold all that crop into a very deflated market and made massive losses. Hence it has a need to restructure loans.

Black Earth Farming

GRAIN also publicized the case of Black Earth Farming land-grabbing in Russia. Black Earth Farming's specific goal has been described as the acquisition of 'cheap, neglected, but fertile land in the fertile Black Earth regions of Russia' by CEO Richard Warburton. It is registered in Jersey with contact accounts in Cyprus and Guernsey.

It controls more than 3,000 square kilometers (1,200 sq. miles). They have a contract with PepsiCo, growing potatoes and sugar beets for them.

The company raised its initial funding from the family-backed Swedish investment companies, Vostok Nafta and Kinnevik, who remain major shareholders (GRAIN). The Company holds ownership of an extensive land bank of first class soil in several Russian regions and is a major producer of grains, oilseeds and potatoes. Black Earth Farming's current focus was, until recently, on increasing the productivity and profitability from its existing asset base and to become a best-in-class agri-industrial company in terms of production costs per ton. As of 31 December 2016, Black Earth Farming had 246,000 hectares under control, of which 89 % were owned. In 2016, a total of 134,000 hectares were cropped.

Black Earth Farming Limited is a limited liability company incorporated in Jersey, in the Channel Islands, on 20 April 2005. Black Earth Farming Limited is the holding company for a number of legal entities established under the legislation of Cyprus, Guernsey and the Russian Federation.

In 2017 the assets of the company were liquidated and the company converted its shares into another re-issue, as the recent drought in Russia had badly affected harvest levels for grains and other crops. The potential profits have fallen so maybe a more lucrative project has appeared in another part of the world!

GMOs and Agribusiness

According to 'GMO Myths and Truths' 'GM crops are not about feeding the world but about patented ownership of the food supply so that, looking at evidence, an altogether different picture emerges of the agribusiness approach' (Earthopensource 2016).

> Private enterprise is motivated by profit as a dominating driving force and as these enterprises like Monsanto, Dow, and Bayer are in control of the inputs like the patented seeds and the chemical pesticides and insecticides to the genetically engineered organisms. There is the really unbelievable position where just few agribusinesses could control of the world's food supply (Earthopensource 2016).

Diminishing yields

Rather than solving the food security problem the corporate agribusiness has made it worse. As Altieri (2011) shows convincingly, as the intense fertilizer cocktail is applied year after year the yield from the crop diminishes, as shown in the diagram (see Fig. 7).

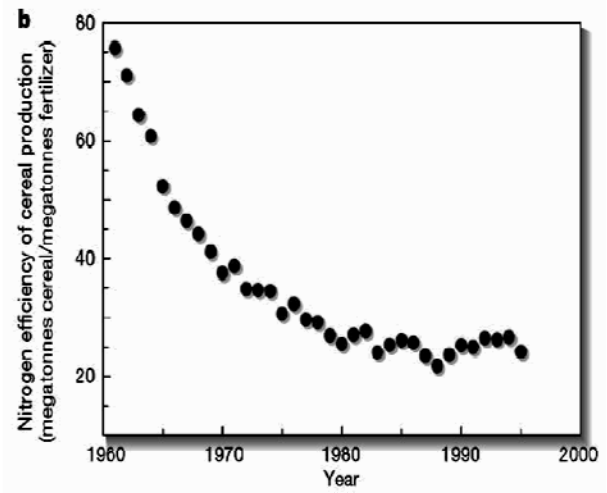

Fig. 7. The yield from the cereal crop diminishes despite the application of an intense fertilizer cocktail year after year

Source: Altieri 2011.

What is Agroecology and is It the Answer to Agribusiness?

Agroecology is the system that encourages a community to work in a holistic way using all the local resources like indigenous knowledge, soil, seeds, water, labour, appropriate technology mechanisms and energy inputs that are sourced from within the community by working with natural processes. It builds on reducing dependency on external inputs or influences. This results in the small farm/holding becoming more resilient to external shock like floods or droughts. It also encourages self-reliance and food sovereignty.

Can the agroecology system meet the requirement of a robust new system required for a future sustainable food system for the planet with its demands?

As we shall see below there is plenty of evidence that answers this question in the affirmative. But key questions for a future agroecology are the issues of sovereignty and resiliency – that the agroecological food production is completely under control of the community of the producers.

Koohanfkan (2014) has summarised the requirements of viable and durable agricultural system for the challenges of the 21st century in this table (see Fig. 8).

It is easy to show that of all the agricultural 'styles' shown in the left-hand column only solar-powered agroecology meets the requirements for a viable new agricultural system (the 3rd column) to replace the failing and unsustainable agribusiness system (the 4th column).

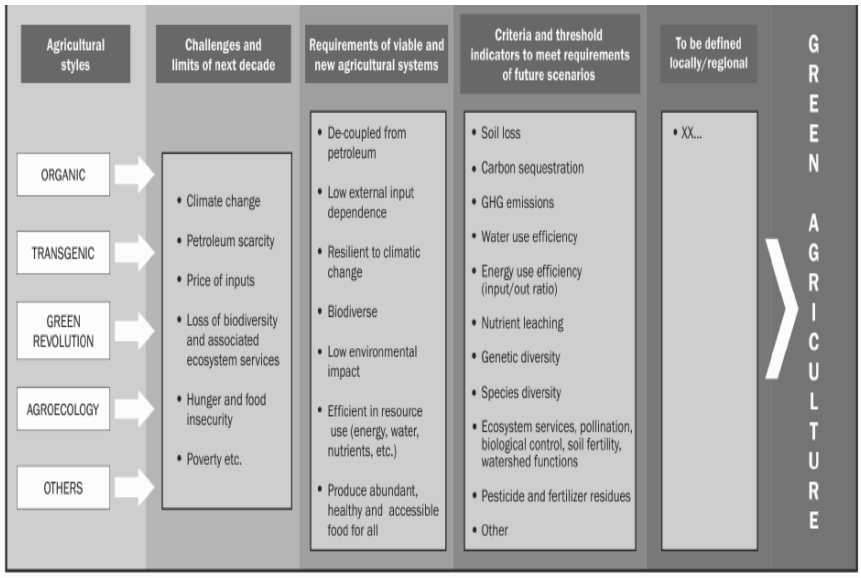

Fig. 8. The requirements of viable and durable agricultural system for the challenges of the 21st century

Source: Koohanfkan 2014.

Agroecology reduces the need for fossil fuel usage

Agroecology greatly reduces the requirement for fossil fuel usage on the small farms. It depends on low external inputs because seeds, fertilizers and pesticides are not required to be purchased as a package on a yearly basis. It has a beneficial impact on the environment as it works with nature and does not destroy species as happens when agribusiness uses pesticides that destroy flora and fauna and contaminate the soil. There is no need for artificial nitrogen or other fertilizers as either an appropriate legume, tree or shrub, or organic compost can be applied as necessary. Small farms are also ideally suited to use solar energy, since it is a distributed renewable energy source which can be stored in enhanced batteries or converted to hydrogen to drive farm machinery.

What are the particular benefits of the agroecology approach?

It is not a 'One Size Fits All' approach as with the industrial agribusiness with their vast monoculture approach. It is very water efficient and composting, mulching, compost pot holing or even edge-tilling is chosen according to the soil/environment requirement, so that it takes into consideration the soil, the environment, the altitude, and the wind cover.

From the present usage in diverse environments the yields are comparable, if not better, than the conventional production (see Fig. 9). Agroecology outstrips the conventional delivery of locally diverse crops, in many cases bred by the user and the agroecologists to meet the micro-environment in which they will be planted. The result is a greater variety of cereals, other staples, vegetables, trees, shrubs and fruit that will improve the diet of the locals and lead to improved health of the community.

	(A) World			(B) Developed countries			(C) Developing countries		
Food category	***N***	**Av.**	**S.E.**	***N***	**Av.**	**S.E.**	***N***	**Av.**	**S.E.**
Grain products	171	1.312	0.06	69	0.928	0.02	102	1.573	0.09
Starchy roots	25	1.686	0.27	14	0.891	0.04	11	2.697	0.46
Sugars and sweeteners	2	1.005	0.02	2	1.005	0.02			
Legumes (pulses)	9	1.522	0.55	7	0.816	0.07	2	3.995	1.68
Oil crops and veg. oils	15	1.078	0.07	13	0.991	0.05	2	1.645	0.00
Vegetables	37	1.064	0.10	31	0.876	0.03	6	2.038	0.44
Fruits, excl. wine	7	2.080	0.43	2	0.955	0.04	5	2.530	0.46
All plant foods	266	1.325	0.05	138	0.914	0.02	128	1.736	0.09
Meat and offal	8	0.988	0.03	8	0.988	0.03			
Milk, excl. butter	18	1.434	0.24	13	0.949	0.04	5	2.694	0.57
Eggs	1	1.060		1	1.060				
All animal foods	27	1.288	0.16	22	0.968	0.02	5	2.694	0.57
All plant and animal foods	293	1.321	0.05	160	0.922	0.01	133	1.802	0.09

Fig. 9. Global comparison of organic versus conventional production using an average yield ratio (organic: non-organic). 1,0: org. = conventional < 1,0: conventional higher than organic; > 1,0: organic higher than non-organic.

What makes agroecology an appropriate twenty-first sustainable global system for delivering suitable nourishing food no matter the location on the Earth?

This agroecological system of farming has inputs which are under the control of local, diverse communities that are best suited to share local knowledge with applied food scientists that ensures delivery of local food firstly to meet local needs. The surpluses can then be marketed or exchanged on a 'fair trade' basis. Agroecology has the huge variety of techniques that are all based on a low-input sustainable approach to farming. Despite the lack of resources and funding for research into agroecology, the evidence available shows that small family units already feeds 70 % of world population. The report from Global Justice Now – 'From the roots up' already mentioned – shows unequivocally that agroecology must be taken seriously (Fitzpatrick 2015). This evidence shows that agroecology leads not only to food sovereignty but also energy and technological sovereignty (Altieri 2011; see Fig. 9) as an all-encompassing system of community control and efficient use of all local resources, as behind it lies the democratic political will of the whole community it is serving.

From Fig. 9 one can conclude that agroecology produces greater yields than conventional production methods (Altieri 2011).

For the world as a whole organic agroecology always, with one exception, produces more yield than conventional methods (left-hand shaded column). In developing countries, the yield ratios always favour organic agroecology over conventional farming methods. Only in developed countries the yields are approximately equal.

Altieri's evidence presented above indicates the extent that the organic (agroecological) production is every bit as, and most often, even more efficient than the agribusiness production – but without the strain on earth resources. The Food Sovereignty movement is already engaging with a food production model of living sustainably, changing lives and giving new life to rural communities.

The agroecological method of farming recognizes that each local area is unique

Around the world agroecological techniques, ranging from community seed banks, water harvesting and applying compost, are helping small-scale farmers across Africa, Latin America and Asia resource sustainably and reduce the need for expensive and unsustainable inputs.

Presently, those forced, through inequality and thus poverty, to use the products of the existing conventional commercial industrial farm system of food production and delivery, have awoken, and are fighting back in such organisations such as La Via Campesina (Via Campesina 2013) with over 200 million members from the marginalized rural workers and peasant organi-

sations, pastoralists, fisher folk, indigenous peoples, women and civil society groups which have formed a growing movement for food sovereignty that allows communities control over the way food is produced, traded, and consumed.

An agroecology example from Brazil – the Ecovida Network

The Ecovida Network is an example of keeping control of local food in the area of Southern Brazil (Radomsky *et al.* 2000). It is also an example of fight back against the damaging effects of agribusiness of Brazil. It is located in the Southern region in the states of Parana, Santa Catrina and Rio Grande and in operation since 1998.

It is a network of small farmers organized by municipality firstly, adhering to agroecological principles sharing knowledge and resources in a deliberate way to promote togetherness. Information and technical knowledge is used in marketing that promotes the unique high quality and socio-cultural reflection of the food.

An organic certification system has been developed to facilitate individual labelling which acts as a pathway for promotion of rural developments and regional markets. Networks have centres for learning and promoting marketing networks in region.

Ecovida community is vibrant and still maintains control of whom the community will sell its produce to – a direct path between the consumer and the producer (Radomsky *et al.* 2000).

Contrasted with the Ecovida municipality approach described above where all locals have a chance to be recognized for the care they take of their locality and the environment, the Hyper-Expansionist agribusiness capitalist system, acts like a death/debt row system – delivering death and debt to people, death to bio-diversity, death to soil, death to water-systems, death of clean air, death of the commons – the common resources, on which nature has placed no price.

An agroecology example from Russia: small-scale, organic gardening can feed the world

When it is suggested that our food system be comprised of millions of small, organic gardens, there is almost always someone who says that it is not realistic. And they will say something along the lines of, ‘There is no way you could feed the world's growing population with just gardens, let alone organically’.

Has anybody told Russia this? (ReclaimGrowSustain). On a total of 8 million hectares (20 million acres) of land, 35 million Russian families grow food in small-scale, organic gardens on their Dachas (a secondary home, often in the extra urban areas) because growing your own food happens to be an age-old tradition in Russia, even among the wealthy.

Based on official 1999 statistics, 92 % of Russia's potatoes, 77 % of its vegetables, 87 % of its fruits, 59,4 % of its meat, and 49,2 % of its milk were produced by these 35 million Dacha families (105 million people, 71 % of the country's population).

If Russian families can manage such production in their region's very short growing season (approx. 110 days), imagine the output in most parts of the world could manage by comparison. Unfortunately, in just the US alone, lawns take up more than twice the amount of land Russia's gardens do – an estimated 40–45 million acres (ReclaimGrowSustain).

Conclusion. In place of this **H**yper-**E**xpansionist (HE) system practiced in industrial food operations we can support a **S**ane, **H**umane, **E**cological (SHE) system for planetary food production, *i.e.*, through agroecology (Robertson 1990).

Summary of the benefits of agroecology

- **Better ways of growing food.** The adoption of sustainable crop-growing systems, ranging from agroforestry, conservation agriculture, home gardens and the 'system of crop intensification', are helping farmers increase their yields and reduce their impact on the environment.
- **Reducing the gender gap.** Agroecology helps to put women in a stronger economic and social position through, for example, Farmer Managed Natural Regeneration.
- **Addressing climate change.** The Intergovernmental Panel on Climate Change (IPPC 2014) has said that agroecological practices can help with the impacts of climate change and reduce the 25–30 % greenhouse gas emissions that agribusiness contributes.
- **Increasing employment and income.** Many case studies show that agroecology provides decent jobs and a way out of poverty. For example, farmers in Kenya using push-pull technology were able to earn three times more income than farmers using chemical pesticides (see Appendix).
- **Increasing agricultural biodiversity.** Organic farming systems can have up to 30 times more species on them than conventional farms and crop diversity can help farmers adapt to changes in heat, drought, pests and low soil fertility.
- **Improving health and nutrition.** For example, the Soils, Food and Healthy Communities Project, a participatory agriculture and nutrition program in northern Malawi, was able to improve child health, crop diversity and food security by using sustainable agriculture techniques combined with education.

Many inspiring examples of agroecology programs can be found in Africa as stated above. These are discussed in the organisation, Global Justice Now's Report 'From then Roots Up' (Fitzpatrick 2015). A summary of some of these case studies can be found in Appendix. South Africa is also playing a leading

role in the African agroecology movement through the work, inter alia, of the African Centre for Biodiversity, for example, in their discussion document: 'Agroecology in South Africa: policy and practice' (African… 2015).

Olivier de Schutter (United Nations Special Rapporteur on the right to food, 2008–2014) had this to say on Agroecology,

> As a way to improve the resilience and sustainability of food systems, agroecology is now supported by an increasingly wide range of experts within the scientific community, and by international agencies and organizations, such as the United Nations Food and Agriculture Organization (FAO), UNEP and Bioversity International (Schutter 2010).

Conclusions

The evidence is there for the world to see, and for the governments of the world to take note and act immediately to break with this failed agribusiness system. This system draws excessively upon so many aspects of the planet's resources, our industries, our transport systems, our financial system, and our human relations with one another. It is a broken system that is undermining the stability of the earth's biosphere. It must therefore be decommissioned as soon as possible.

An alternative more sustainable system of agroecology is already being practiced by many communities around the globe satisfying local need for wholesome food. This system already builds on the acquired knowledge of working with nature over thousands of years, coupled with the best from recent scientific knowledge, and also uses renewable technologies that leave a light footprint earth for generations to come. This agroecology system reduces our carbon footprint by reducing GHG emissions, which, as scientists acknowledge, is necessary to keep the planet stable, with temperature increase kept below a rise of 2 °C from pre-industrial values.

If agribusiness is to be replaced by agroecological production there will, eventually, be a need to increase the productivity of these agroecological producers. That will mean the need to develop solar-powered appropriate scale technology, for instance, small tractors that run on solar-derived hydrogen, solar-powered water pumps for obtaining water from depth for irrigation and drinking. The rapid development of these technologies could be part of an International Worker-Farmer Alliance (Butler-Hookes and Hookes 2016).

Looking to the near future the production of food through agroecology, assisted by solar power, has to be based on intimate understanding of nature and be able to access that knowledge readily. The indigenous knowledge can also be enhanced by modern scientific understanding of plant breeding, soil science, *etc*. The Solar renewable technologies allow the food production system to be sensitive to the ecological balance by transmitting data from digitised sensors about the condition of the air, water and soil and thus enhance indigenous knowledge. The same bDS sensor technologies can also monitor the

effects of other aspects of the total global production system on planetary living systems (Hookes 2017).

Thus, sharing of data and information about best practice, the location of human food needs, environmental effects, using solar-powered digital communications, will greatly enhance the performance of agroecological food systems. Thus, we can state with conviction:

Agroecology is the food production system for the Second Solar-Digital Age.

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Appendix
AGROECOLOGY IN ACTION IN AFRICA

Some case studies used in report by Global Justice Now 'From the roots up'! (Fitzpatrick 2015)

(The references below are from the original report and numbered as such)

Ghana. 'For years, the government provided free chemicals and fertilizers to farmers as part of the Green Revolution strategy. Now, we see that this has led to serious land degradation. The farm lands are in a terrible state and do not produce enough food to feed the families. This has led me and fellow women farmers to begin to sensitise other women about the effects of pesticides... We see the promotion of healthy, traditional crops as a step towards food sovereignty for rural women in northern Ghana'. Patricia Dianon [59].

Ethiopia. A great example of using agroecological methods to increase crop yields and restore soil quality is the work carried out by the Ethiopian Institute for Sustainable Development (ISD) in the Tigray Region of Northern Ethiopia. In 1995, the ISD, in collaboration with a group of farming communities, trained farmers to produce compost and apply it to their crops instead of using chemical fertilisers. The results were immedi-

ately positive. Yields from composted crops were higher than crops which had received chemical fertiliser… [61].

Malawi. Gliricidia trees, which improve soil fertility, have increased maize yields five-fold in good years, and almost four-fold in average years. This has led farmers to describe these trees as a 'fertilizer factory on the farm' [69]**.

Ethiopia. Growing with agroecological methods rather than chemical fertilisers can also be more profitable. In the Ejere locality of the Addaa region, a study carried out during the 1998–99 production season showed that growing low-input varieties of wheat with crop rotation (using legumes) was actually more cost-effective and profitable than growing modern varieties which required chemical fertilizers [72].

Burkina Faso, Mali and Niger: **Integrated pest management** (IPM) is an agroecological technique with a long history which involves using a combination of biological controls (natural predators for pests), modified farming techniques (modifying irrigation practices), and mechanical controls (using physical traps or barriers for pests), to help manage pests and reduce the use of pesticides – which are only used as a last resort. In a number of farming projects across Burkina Faso, Mali and Niger, a parasitic wasp has been successfully used to help control a pest that damages millet [78].

Senegal. Farmers using IPM produced 25 % more rice than conventional farmers with an increase in income of almost US$ 400 per hectare. A survey of 80 vegetable growers who had received IPM training showed that 92 % of them had reduced their use of pesticides by an average of 3.2 litres per hectare helping them to save US$ 60 per hectare in production costs [80].

** [69] Missing from the indices in original report: Evergreen Agriculture: The use of fertilizer trees in maize production in Malawi. URL: http://teca.fao. org/read/7847.