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Food Apocalypse Now: An Epistemological Understanding of the Coming Food Crisis

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Alexander SK Parker

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Introduction: Food Apocalypse Now

In early 2007, Mexico experienced a 67% rise in corn prices, which drove up the price of tortillas and limited community access to 10,000 year food staple. In some northern rural areas, the price of a kilo of corn ballooned over 400% in two months. The result of this sharp increase has come to be known as the Mexican Tortilla Crisis. By the first week of February 2007, over 70,000 protesters marched through Mexico City, taunting the President and demanding relief from the soaring prices. President Calderon responded by freezing prices of more than 150 consumer staples including Corn, coffee, sardines, and tuna until the end of December 2008.

Mexico was not the only country to experience riots due to spiking food prices in 2007-08. Neither would it be the most severe and deadly. In Bangladesh—which declared itself food self-sufficient in 2002—dozens of protesters and police officers were injured in riots in the capital, Dhaka, after the price of rice, the culinary staple, increased 30%. Reports estimated that 30 million people, or one-fifth of the country’s population, were at risk of going hungry. A government official claimed the food crisis, and resulting riots, posed a “serious threat for the survival of the present caretaker government”

By 2008, the food crisis had spread to Africa. In Burkina Faso, food riots shut down three major cities and threatened the stability of its government. Observers reported over 100 protesters were arrested in the city of Bobo-Dioulasso after rioters burned local government buildings and stoned local officials on February 22, 2008 (IRIN). In the Ivory Coast, the UN Integrated Regional Information Network reported “At least a dozen protestors were wounded during several hours of clashes with police on 31 March [2008]” (IRIN).

In some countries, these protests turned deadly. In Egypt, days of protests led to multiple deaths. NBC news reports “Egypt's prime minister on Tuesday rushed to contain an explosive situation in a northern industrial city rocked by two days of deadly riots over high prices and low wages, some of the worst economic unrest here in 30 years” (NBC). The social unrest NBC News is referring to were the 1977 Bread Riots, which, as the name tells, were also about food. The most deadly riots took place in Haiti, where at least five people died in various protests (trumpet). Overall, the *Guardian* reported riots in fifteen countries while the *New York Times* and the World Bank both reported food riots in thirty (Cribb). The 2007-08 Food Crisis was a global phenomenon with world food prices spiking 80% on average, according to the UNFAO (Cribb).

The 2007-08 food crisis was a shocking wake-up call for global leaders and development organizations who thought that the problem of food scarcity was solved. In 1981, economist Amartya Sen began his essay *Poverty and Famines*, with the argument: “Starvation is the characteristic of some people not *having* enough food to eat. It is not the characteristic of there *being* not enough food to eat” (Sen, 1). Dr. Sen argues that the issue is no longer food supply but food distribution. He says, to avoid starvation, a person must exchange his services or commodities in the market (Sen, 4). I will get to the problems of this analysis in chapter ___; however, the key take-away is that 26 years after his Essay, concern over food supply was back on the menu. Tim Costello, the Australian head of the aid agency World Vision proclaimed, “It is an apocalyptic warning... Until recently we had plenty of food: the question was distribution. The Truth is because of rising oil prices, global warming and the loss of arable land, all countries that can produce food now desperately need to produce more” (Cribb, 4).

While world leaders, development institutions, academics, and reporters debate the causes of the 2007-08 crisis, they overwhelmingly agree on two simple conclusions: It will not be the last food crisis; it will not be the worst food crisis. The implications of these conclusions are immense. Future crises will bring much social unrest, destabilizing governments and threatening regional and global security. In 2008 Former World Bank President Robert Zoellick, warned that 33 nations are at risk of social unrest because of the rising prices of food. “For countries where food comprises from half to three-quarters of consumption, there is no margin for survival,” (New York Times). This social unrest will only get worse.

The future coming food crisis, expected to mature between 2030 and 2050, has been framed as one the greatest challenges facing humanity in the 21st Century. In 2008, UK Government minister Lord Malloch-Brown—who was formerly the UN Deputy Security General and a career development specialist at the World Bank—described the coming food crisis as “The Perfect Storm” (Guardian). Peter Power, Ireland’s Minister for Overseas Development and Aid, called the crisis a ‘silent tsunami’ because of the lack of priority it has received from development agencies: “the hunger crisis ha[s] not been given the same level of attention as the fight against AIDS, the global financial crisis or climate change” (World Food Program). Julian Cribb explains the challenge facing humanity:

To Sum it all up, the challenge facing the world’s 1.8 billion women and men who grow our food is to double their output of food—using far less water, less land, less energy, and less fertilizer. They must accomplish this on low and uncertain returns, with less new technology available, amid more red tape, economic disincentives, and corrupted markets, and in the teeth of spreading drought. Achieving this will require something not far short of a miracle. (Cribb, 13).

Most development institutions, world leaders, and academics view the crisis as both a supply and demand problem. Their argument is simple; the solutions are not. They tell us demand is increasing dramatically due to rising populations and changing appetites as billions of people in China, India, and other rapidly developing nations enter the middle class. In order to meet this demand, they argue, world food supply must double. Unfortunately, global climate change, water shortages, desertification, and slowed technological advancements threaten our ability to supply enough food to meet this demand.

The World Bank Group and United Nations Food and Agriculture Organization (UNFAO) offer similar solutions to the coming food crisis. Their rhetoric follows three main themes: increase production, increase efficiency, and increase domination of nature.

In the UNFAO's 2014 report *Economic analysis of supply and demand for food up to 2030*, the United Nations Food and Agriculture Organization argues: "With the world's population expected to reach 8.2 billion people by 2030, and with 842 million people estimated as having been undernourished in the period 2011-13, food supply will present a growing challenge in the next two decades" (UNFAO, *Economic Analysis*, iv). The solution that the UNFAO presents is to increase food supply to meet growing demands such as aging populations, urbanization, and changing consumer preferences as billions enter the middle class. The FAO argues that food supply "will need to both increase and become more efficient if it is to grow within the constraints presented by the availability of natural resources and existing technology" (UNFAO, *Economic Analysis*, iv).

In the World Bank's *Agriculture Action Plan 2013-2015*, The World Bank argues, "The future needs an agricultural system that produces about 50 percent more food to feed the world's 9 billion people by 2050" (World Bank, *Action Plan 2013-15*, xv). To achieve this goal, the World Bank focuses on five thematic areas: (i) raising agricultural productivity, (ii) linking farmers to markets and strengthening value chains to improve market access, (iii) facilitating rural non-farm income, (iv) reducing risk, vulnerability, and gender inequality, and (v), enhancing environmental services and sustainability (World Bank, *Action Plan 2013-15*, xvii).

The proposed policy solutions offered by these institutions are echoed by a gallery of development specialists. Jacques Diouf, former director of the FAO from 1994-2011, said in 2009 that "Global food production, already under strain from the credit crunch, must double by 2050 to head off mass hunger....The food crisis pushed another 40 million people into hunger in 2008" (World Food Program). Josette Shearan, former director of the World Food Program, said that if we are to achieve this doubling of food production called for by development agencies, it must be made a top priority (World Food Program).

Emphasis on increased production is not new; neither is emphasis on increasing efficiency or man's domination of nature. All three solutions have been firmly entrenched in agricultural development dogma since the Green Revolution. The newest tropes are sustainability, risk reduction, and gender equality; however, sustainability and risk reduction have been around since the 1980s as a response to the ecological damage of development policies. We are seeing nothing new from the World Bank, UNFAO, and development specialists in addressing the coming global food crisis. Instead, what we are witnessing is a near perfect

example of a path-dependent system in overshoot. To break down this claim, I will provide a discourse analysis of the Development framework. The roots of today's agricultural development discourse are derived from the Green Revolution, the 1960s scientific breakthrough that allowed for a drastic increase in agricultural production and efficiency. The Green Revolution set the tone for decades of development discourse focused on production, efficiency, and scientific knowledge and is backbone of agricultural development policies today. The Green Revolution was made possible by enlightenment thinking, which created modernity, modern science, and the current hegemonic epistemology.

This thesis uses Discourse Analysis to understand and break down how the development nexus is conceptualizing the coming global food crisis. It seeks to answer three central questions: how do development institutions conceptualize the coming global food crisis? How is this conceptualization shown within their proposed policies? What impact will the conceptualization have on solving the coming food crisis?

Discourse analysis is useful in the regard because it allows us to understand these policies from a theoretical, practical, and cultural standpoint. Arturo Escobar writes that "discourse analysis creates the possibility of 'standing detached from the development discourse, bracketing, its familiarity, in order to analyze the theoretical and practical context'.... It gives us the possibility of singling out 'development' as an encompassing cultural space" (Escobar, 6). By understanding the theoretical roots of these policies, we can better understand how development institutions are conceptualizing the problem. By understanding the practical historical roots of these policies, we can derive discursive the path which led to this point.

Finally, by bracketing enlightenment and development discourse as a cultural exercise, we can trace its evolution from a theory to the epistemological way in which we view the world.

Ultimately, this thesis serves to trace the line(s) of thought on agricultural development back to the roots of modernity with a focus on the Green Revolution. Understanding how we think—how we conceptualize—this pressing challenge explains how we have gotten where we are and where we are heading if we continue down this same line of thinking. In sum, we need to re-think how we think of agriculture; we need to re-think how we view the world in order to properly meet the challenges facing humanity in the 21st Century.

Part 1: BORLAUG'S MONSTER

You really do have to wonder whether a few years from now we'll look back at the first decade of the 21st century — when food prices spiked, energy prices soared, world population surged, tornados plowed through cities, floods and droughts set records, populations were displaced and governments were threatened by the confluence of it all — and ask ourselves: **What were we thinking?** How did we not panic when the evidence was so obvious that we'd crossed some growth/climate/natural resource/population redlines all at once? —Thomas Friedman

(Friedman, "The Earth is Full").

Preparing for Lord Malloch-Brown's "Perfect Storm" or Peter Power's "Silent Tsunami" has become a top priority of leaders in development agriculture. In his 2008 book *Hot, Flat, and Crowded: Why We Need a Green Revolution*, New York Times columnist and Pulitzer prize winning author Thomas Friedman warns of a coming economic disaster for America—and the

world—if it does not fully embrace a green technology. He argues that in the face of climate change (hot), globalization (flat), and population growth (crowded), we need a new Green Revolution based on sustainable, green technology. Mirroring his call for green technology, the World Bank named the need for green, sustainable agriculture as one of its main themes along with increasing production. While these ideas seem forward thinking, they are just old, re-hashed solutions to problems created by past policies. In a sense, Freidman falls victim of the trap that he creates in his 2011 column “The Earth is Full.” In the face of spiking food prices, soaring energy prices, surging world population, natural disasters, and global insecurity, Freidman asks “What were we thinking?” Framing the question in terms of *what* we were thinking confines Freidman—and other global leaders—to policy considerations, limiting possible solutions. While green technology and sustainable agriculture may be relatively new policies, they fall within the same line of thought. Instead, what is needed is analysis on *how* we were thinking. Framing the question in terms of *how* we were allows us to conduct discourse analysis to understand the thought process behind each policy. Instead of asking what policies are we thinking about, the question becomes how we are thinking about the proposed policies.

Discourse Analysis provides four key roles. First, it allows us to consider how development agriculture is conceptualized within proposed policies. Second, it allows us to analyze not just the effectiveness of each policy, but its epistemic root. Third, it allows us to understand the evolution of how our line of thought is constructed. Arturo Escobar writes, “Discourses do not replace each other completely but build upon each other as layers that can be only partly separated” (Escobar, 195). By understanding how discourses are built upon one-another, we can understand its evolution. Finally, it allows us to separate ourselves from our

object of analysis—in this case development agriculture—in order to analyze it from a theoretical, practical, and cultural context.

Part 1 Section A—The Green Revolution

In this section, I intend to trace the epistemic root of agricultural development discourse in order to understand how development institutions view the coming food crisis. Breaking down their line of thought allows us to consider how their world view manifests itself in the proposed policies. The root of the current policies proposed by the World Bank, United Nations Food and Agriculture Organization, and other world leaders is the Green Revolution of the 1960s. When Friedman says we need another Green Revolution, he is referencing the original Green Revolution; when the World Bank calls for a doubling in food production that is also focused on sustainable technology, it envisions another development “miracle” along the lines of the Green Revolution.

The Green Revolution refers to the scientific and developmental breakthrough in seed (cereal grain) modification that allowed for a doubling in the crop yields per hectare during the 1950s and particularly the 1960s. At the time, the Green Revolution was seen as a miracle; it dramatically increased the incomes of many rural farmers, created a boost in production that saved close to a billion lives from starvation, and allowed for the further world population growth that we have seen since the 1960s. The father of the Green Revolution, Norman Borlaug, won the Nobel Peace Prize in 1970 for his work in saving close to a billion people.

The impact of the Green Revolution lives on today in development thinking, ecology, and in rural societies. It was such a grand agricultural, developmental, and discursive success

that all agricultural development policies today are rooted in its ideology. Unfortunately, the Green Revolution was not without its problems; its implementation caused much ecological and social destruction. Many of today's ecological and social problems were directly caused by the 'miracle' of the Green Revolution. Nevertheless, the development community is completely tied to the Green Revolution as the practical root of all of its agricultural policy. While it has learned some lessons from the green revolution, the theoretical and epistemological background remains intact. In this part, which I have titled Borlaug's Monster, I analyze Green Revolution. In doing so, I will break down the epistemic root of developmental thinking that created the green revolution, the destruction of its implementation, and the rise of path dependency within the agricultural development community.

At the World Food Summit in 1996, the UNFAO defined the green revolution as the "technology package comprising material components of improved high-yielding varieties (HYVs) of two staple cereals (rice and wheat), irrigation or controlled water supply and improved moisture utilization, fertilizers and pesticides and associated management skills (UNFAO, World Food Summit, 1996). It started when Norman Borlaug and his team of researchers received a grant from the Rockefeller Foundation to work in Mexico City in the mid-20th century to develop a new form of wheat. In *Empires of Food: Feast, Famine and the Rise and Fall of Civilizations*, Evan Fraser and Andrew Rimas explain: "Borlaug's group developed dwarf varieties, thick, short-stemmed plants that could stand up to the strain of bulbous grains. These dwarf species, fueled by artificial fertilizer, increased yield from a maximum of about 4,500 kilos per hectare to as much as 9,000 kilos" (Fraser, 215). The impact was immediate. Within years, millions of people were reportedly saved from starvation. Fraser and Rimas write

that to the development community, the problem of food scarcity is solved: “by doubling the productivity of land, Borlaug had seemingly solved the problem of world hunger. The world responded by specializing, exclusively planting Borlaug’s seeds” (215).

This response by the development community has resulted in major ecological and social issues. Evan and Fraser outline three major ecological issues resulting from the green revolution. The first major issue is genetic erosion: “Fifty years after his first experiments, [Borlaug’s] cultivars have driven countless traditional plants out of the field and into the botanical encyclopedia, creating huge swaths of monocultures around the world where biodiversity once buzzed and chirped. The effect is called genetic erosion” (Fraser, 215). In order to increase production to meet demand, development institutions implemented policies that destroyed genetic diversity. Typical of the programs was mono-cropping, which was opposite of the traditional agricultural practices that had been in place for thousands of years, emphasizing crops that could be sold on a global market instead of sustenance farming. Examples of this genetic erosion include China and Greece, “China is now a vast ‘sea of monocultures’ dotted with little islands of native rice. Virtually every indigenous wheat cultivar disappeared from Greece... Today almost every kernel of grain eaten by human or beast is a product of the meticulous field trials of Borlaug and his school” (Fraser, 215).

The Second major ecological issue is the need for artificial fertilizer. Fraser and Rimas write, “Borlaug’s plants can’t survive on a diet of dung. To grow, they need more nutrients than are found on a barnyard floor, so farms with high-yielding crops use lots of artificial fertilizer” (Fraser, 216). The problem with these fertilizers is that they are incredibly energy inefficient.

The continue: “As far back as the 1950s, for instance, the Japanese had loaded their earth with Borlaug rice, boosting energy costs for fertilizer by 400 percent between 1950 and 1974. Energy used by farm machinery went up twelve times” (Fraser, 216). It seems worth it for a 50% increase in production; however, if you look at it based on calories produced versus calories spent, the massive energy cost of this artificial fertilizer is not worth it. “Put another way, if every calorie of energy obtained from a rice field was divided by the energy it took to produce, in 1950 the Japanese had an energy ratio of 1.27 calories produced per calorie spent. By 1974, this had dropped to 0.38 [calories produced per calories spent]. (Fraser, 216).” The inefficiency of the artificial fertilizer made farming extremely costly, industrialized, and unsustainable. By the mid-1970s and early 1980s, large regions including Latin America and Sub-Saharan Africa were struggling to implement development policies based on green revolution style agriculture.

The third major ecological issue Fraser and Rimas identify is the possibility of catastrophic ecological collapse. They identify three major warning signs of imminent, catastrophic ecological collapse: (i) too much biomass, (ii) connectivity, (iii) exclusivity (218). Their analysis is derived from that of Dr. Buzz Holling of the University of Florida. Holling’s system theory predicts: “an ecosystem where biomass and connectivity are both rising but diversity is falling faces an inevitable collapse” (Fraser, 218). Fraser and Rimas predict that we are headed towards a famine. Their argument centers not just on population and low yields, but on the lack of genetic diversity. We have created a recipe for disaster, constructing a global landscape reminiscent of Ireland prior to the great potato famine.

Rimas and Fraser conclude:

Genetic modification is a tool, just like irrigation, artificial fertilizers, and refrigerants, all of which have made it possible to feed our civilization and keep 6 billion bodies and souls together. When misused, however, these tools become bludgeons—they miss the nail and crush the thumb. So while we’ve built our food empire with these tools, we’ve also used them to invent landscapes that fail Buzz Holling’s simple test. Biomass. Connectivity. Lack of Diversity. The result is always the same. (Fraser, 218).

Par 1 Section B—Discourse Forms Reality

“Knowledge is not for knowing: knowledge is for cutting.”

— Michel Foucault

So how did we get here? How did we create an agricultural system that caused so much ecological destruction? How did we ignore and blow past the warning signs? How did our way of thinking become so perverse? I will use discourse analysis to answer these questions.

The power of discourse comes in its ability to frame reality, limiting viewpoints and even making some impossible. Arturo Escobar describes this process as a “colonization of reality” (Escobar, 5). Through discourse analysis, we can take into account how certain representations of reality become hegemonic and shape our view of the world. Escobar draws heavily from Foucault, writing: “Foucault’s work on the dynamics of discourse and power in the representation of social reality, in particular, has been instrumental in unveiling the mechanisms by which a certain order of discourse produces permissible modes of being and thinking while disqualifying and even making others impossible” (Escobar, 5). The strength of development discourse, for instance, meant that its agricultural agenda—increasing production, efficiency, and domination of nature—could not be questioned. Different ways to implement this agenda could be debated, but all policies followed from the same

epistemological framework; the same line of thought. Escobar writes, “The fact of development itself, and the need for it, could not be doubted. Development achieved the status of certainty in the social imaginary.... Reality, in sum, had been colonized by the development discourse” (Escobar 5).

The Development community achieved this power over reality by controlling knowledge. They controlled knowledge in two ways: (i) by amassing a large body of knowledge and (ii) by controlling what could even be considered knowledge. They then used this knowledge as a form of power to control indigenous rural farmers and implement massive agricultural development policies. In chapter 4 of *Encountering Development*, Escobar uses discourse analysis to explain how the development community used their large body of knowledge and power over knowledge to construct a discourse centered on agricultural policy. First, he explains how they gathered this compendium, “From the 1950s to today, an army of scientists—nutritionists, health experts, demographers, agriculturalists, planners, and so on—has been busy studying every single aspect of hunger. This hunger of scientific language has resulted in manifold strategies that have succeeded each other throughout the development era” (Escobar, 103).

Second, Escobar explains how the development community used discourse and labels to control those subject to agricultural development. Through the power of discourse, the indigenous citizen becomes the object of development: Development organizations frequently use labels such as ‘target groups’, ‘Small farmers’ ‘slum dwellers’ ‘landless laborers’ ‘pregnant women’ ‘traditional farming techniques’ to describe the objects of development. A perfect example of this type of label is the starving African: “To be blunt, one could say that the body of

the malnourished—the starving ‘African’ portrayed on so many covers of Western magazines... is the most striking symbol of the power of the First World over the Third World” (Escobar, 103). The power of these labels comes from their ability to frame our reality; frame how we think of the starving African. In controlling how we view this child, we exert power over him. Escobar says “these labels are essential to the functioning of institutions dealing with problems in the Third World (‘Third World’ itself is a label). Labels are by no means neutral; they embody the concrete relationships of power and influence the categories with which we think and act” (109).

These labels are invented and maintained by development organizations and determine access to resources and create a preference for institutional, scientific knowledge over local knowledge. Casting off rural farmers as ‘traditional’ or ‘under-developed’ discredits their knowledge, making the implementation of development easier. “In the case of hunger, local situations are subsumed under the professional discourses of agricultural economists, planners, nutritionists, extension workers, health workers, and so on” (Escobar, 111). This gives rise to the view of the “malnourished” or “illiterate peasant” as a problem that needs to be fixed, not as a person with experiential knowledge.

Part I Section C—The Enlightenment Era: The Epistemic Root of Modern Thought

Before I get too ahead of myself, I would like to take a step back and trace the theories that made the development world view possible. The Green Revolution and the agricultural development policies of the past fifty years could not have been possible without the creation

of the Modern Scientific Worldview. In Chapter Five of *The Postmodern Turn*, Steven Best and Douglas Kellner breakdown the modern scientific worldview that made modernity possible. Our modern world view has its epistemic roots in the enlightenment era. Major enlightenment thinkers, including Galileo, Francis Bacon, Rene Descartes, and Isaac Newton were all architects of the modern world view. Best and Kellner explain: “For the Major architects of the modern view... the cosmos is a vast machine governed by universal and invariable laws that function in a stable and orderly way that can be comprehended and controlled by the rational mind” (Best, 197). In their understanding, it was humanity’s right and destiny to master these laws of the universe for its own domination. Thus, the modern world view is inherently dominative and antagonistic of the natural world. Best and Kellner explain that modern science presided over the death of nature: “Through advancing strictly mathematical and physical explanations of the universe, modern science presided over the ‘death of nature’ and transformed a living, natural world into a dead machine” (Best, 197). Not only was the world transformed into a machine, anything spiritual or traditional had to be either eradicated or dominated: “For modern science to develop, it had to disenchant the world and eradicate from it all influences that saw nature to be infused with living or spiritual forces” (Best, 197).

In the previous section of knowledge and discourse, I explained how knowledge could be used as a form of power. This line of thought begins with Francis Bacon. Bacon writes that the purpose of knowledge is to “extend more widely the limits of power and greatness of man, to command natural forces for the relief of man’s estate.’ Centuries before Foucault, Bacon Stated that ‘knowledge is power’ which allows human beings to control natural and social processes” (Best, 198). In the next section, I will further explain how knowledge is a source of

power in the implementation of the green revolution; however, before I do this, I will also break down how anything that cannot be measured is deconstructed.

“If man believes himself free, he is merely exhibiting a dangerous delusion and intellectual weakness” – Baron D’Holbach

As I explained, The Bacon-Cartesian world view is completely antagonistic to the natural world. In the modern world view, nature is the object of man’s pursuit—something that can be understood, mastered, and put into his service. What follows from this conclusion is that anything that cannot be fully understood, mastered, and put into service is considered to have little value. The only way to describe anything is through mechanics: “The mechanistic paradigm made human beings themselves nothing but matter in motion, pawns of natural forces, and denied them freedom and spontaneity” (Best, 200). Many abstract ideas and cast aside as poor forms of knowledge. Furthermore, intrinsic value is abstracted from the equation: Instrumental knowledge is based on prediction and control, and it attains this goal by linking science to technology, by employing sophisticated mathematical methods of measurement, and by abstracting itself from all other concerns, often disparaged as non-scientific, subjective, or inefficient. Modern science, in its classical self-conception, sharply separates fact from value, thereby pursuing a value free study of natural systems. (Best, 200).

The Enlightenment era created our modern world view. How we conceive of reality and the possibilities of our understanding is defined and constricted by this world view. Development discourse is based upon this world view and uses it to further construct reality. In

this next section, I will demonstrate how the modern world view, with its epistemic roots in Enlightenment thinking, allowed for the implementation of the Green Revolution.

Part I Section D--Implementation of the Green Revolution: Breakdown of Ecology

The Green Revolution was based on the assumption that technology is a superior substitute for nature, and hence a means of producing limitless growth, unconstrained by nature's limits. However the assumption of nature as a source of scarcity, and technology as a source of abundance, leads to the creation of technologies which create new scarcities in nature through ecological destruction. The reduction in availability of fertile land and genetic diversity of crops as a result of the Green Revolution practices indicates that at the ecological level, the Green Revolution produced scarcity, not abundance.

While the Green Revolution is the practical basis for all of today's agricultural development policies, the theoretical roots of the Green Revolution are drawn from the Enlightenment Era. The Green Revolution, unlike the name would suggest, was anything but "green" in terms of natural and sustainable. Instead, it was a complete domination of nature and indigenous farmers, creating ecological and societal destruction. In *The Violence of the Green Revolution*, Vandana Shiva gives a horrifying account of the impact that the Green Revolution had on the Punjab region of India. She begins by explaining the unfortunate paradox of the Green Revolution as it was implemented in Punjab:

The Green Revolution is the name given to the science-based transformation of Third World agriculture, and the Indian Punjab was its most celebrated success.

Paradoxically, after two decades of the Green Revolution, Punjab is neither a land of prosperity, nor peace. It is a region riddled with discontent and violence. Instead of abundance, Punjab has been left with diseased soils, pest-infested crops, waterlogged deserts and indebted and discontented farmers. Instead of peace, Punjab has inherited conflict and violence (Shiva, 19).

In her account, she outlines two major crises created by the Green Revolution. First, an ecological crisis due to scarcity of natural resources, destruction of forests, land, water, and diversity. Second, a social crisis due to erosion of the social structures that makes cultural diversity and plurality possible. In effect The Green Revolution has destroyed Punjab and other cultures' resilience to battle current and future food crises because it destroyed both their ecology and their community resilience.

Shiva explains that the development discourse presented the violence and unrest in Punjab in the 1980s was as an ethnic and communal conflict between two religious groups. In actuality, the roots of the violence can be traced back to the destruction of the Green Revolution. In her analysis, Shiva traces of the conflicts and violence in [1980s] Punjab to the ecological and political demands of the Green Revolution as an experiment in development and agriculture transformation. The Green Revolution was designed as a techno-political development policy to create peace through abundance. Instead, it surpassed nature's limits and destroyed the resilience of indigenous populations to combat food crises.

Ultimately, Shiva argues Green Revolution was a failed experiment; however, it is hailed as a resounding success by those that gained from it, including the World Bank, Rockefeller and Ford Foundations, and other international organizations. She explains, "Ecological and ethnic fragmentation and breakdown are intimately connected and are an intrinsic part of a policy of planned destruction of diversity in nature and culture to create uniformity demanded by

centralized management systems” (12). Just like Escobar’s analysis of the need to bureaucracy, the development institutions need uniformity and homogeneity in order to properly implement their policies. As such, development becomes a precise scientific endeavor which can only be achieved through mathematical precision and analysis. This way of thinking is a direct result of the enlightenment. Agricultural development became the scientific approach to solving insecurity and hunger, resulting in the destruction of nature:

Development then becomes a strategy to combat scarcity and dominate nature to generate material abundance. This view of scarcity and of violence is shared by both the left and the right. Capital accumulation through appropriation of nature is seen by both ends of traditional political spectrum as a source of generating material abundance, and through it, conditions of peace. This orthodox view holds that the unprecedented control of the environment facilitated by a high-level technology, thus the possibility of eliminating toil and poverty is the necessary pre-requisite for overcoming the struggle between met themselves. The Green Revolution was conceived within this orthodox view of scarcity and violence. The Green Revolution was prescribed as a techno-politic strategy that would create abundance in agricultural societies and reduce the threat of communist insurgency and agrarian conflict (Shiva, 14).

In order for Development practices to be successful, it needed control over both people and nature. Having knowledge was not enough, it needed complete domination over nature and over people’s actions. Thus, to achieve its goal, it broke down natural ecology and destroyed the social. Shiva writes: “Control over nature and control over people were essential elements of the centralized and centralizing strategy of the Green Revolution” (14).

The need to control nature was made possible by the enlightenment era. Development institutions used the scientific breakthroughs of the Green Revolution to control nature and make it serve humanity’s needs. Unfortunately, this resulted in numerous consequences. In

controlling nature, it destroyed the natural ecology and created scarcity, not abundance. This scarcity is at the root of the coming global food crisis. Shiva cites how the lack of genetic diversity in the crops has led to low yields while the water intensive agriculture has caused water issues: “The reduction in availability of fertile land and genetic diversity of crops as a result of the Green Revolution practices indicates that at the ecological level, the Green Revolution produced scarcity, not abundance” (Shiva, 15). Her analysis mirrors that Fraser and Rimas. Thus, agricultural development has created an ironic paradox: it has created the issues it sought to solve. The Green Revolution and following development policies over the past fifty years have not made Punjab and other regions, including Africa, more prosperous. Neither has it brought stability and peace to those regions. Ironically, it has created ecological the scarcity and fostered insecurity and instability that it meant to solve.

Unfortunately, while these problems persist in Punjab and Sub-Saharan Africa, the technological and scientific breakthroughs of the Green Revolution remain omnipotent and unquestioned. Scientific knowledge, in the hegemonic epistemology, is separated from social evaluation. From its beginning, the Green Revolution was a political experiment; however, at the first sign of resistance, the science of the Green Revolution was delinked from the political and offered as unquestionable knowledge:

In its very genesis, the science of the Green Revolution was put forward as a political project for creating a social order based on peace and stability. However, when violence was the outcome of social engineering, the domain of science was artificially insulated from the domain of politics and social processes. The science of the Green Revolution was offered as a miracle recipe for prosperity. But when discontent and new scarcities emerged, science was delinked from economic processes” (Shiva, 20).

Unfortunately, this presents an inherent contradiction in the presentation of knowledge. On one side, science is self-consciously embedded in society with science and logic providing the reasoning behind “necessary” social transformation. On the other side, scientific knowledge is placed above society, unable to be questioned and evaluated in the public domain. Once again, this view of scientific knowledge as something separate from the social is derived from Enlightenment thinking.

While science itself is a product of social forces, and has a social agenda determined by those who can mobilize scientific production, in contemporary times scientific activity has been assigned a privileged epistemological position of being socially and politically neutral. Thus science takes on a dual character. It offers technological fixes for social and political problems, but delinks itself from the new social and political problems it creates” (Shiva, 21).

Development institutions used the green revolution as a means to control ecology and the social through a perfect power-knowledge nexus. By separating scientific ‘fact’ from public evaluation, those in control of the scientific knowledge used their power to achieve their agenda. At the same time that scientific breakthroughs of the Green Revolution legitimized the Development agenda, the Development institutions used their power to legitimate scientific knowledge to an unquestionable stature. Thus, it can clearly be seen that the framework that the development community is operating under is one of a Cartesian-Bacon model.

“The knowledge and power nexus is inherent to the reductionist system because the mechanistic order, as a conceptual framework, was associated with a set of values based on power which we compatible with the needs of commercial capitalism. It generates inequalities and domination by the way knowledge is generated and structured, the way it is legitimized, and by the way in which such knowledge transforms nature and society” (Shiva, 22-23).

Understanding how the development community conceptualizes reality is important when evaluating their proposed policies. It is just as important to understand how they are thinking

as it is what they are thinking so that we can understand the process by which global leaders create and consider policies. Many of the issues we see today have their roots in the Green Revolution. Lester Brown's call for fertile soil, genetic diversity, re-forestation, and reduction in carbon emissions are all a product of the Green Revolution's mono-cropping, heavily industrialized, and energy inefficient farming tactics. Policies of today are built upon the roots of the Green Revolution. They still focus primarily on using technology as a means of increasing production and the market as a means of increasing efficiency (which I will explain in greater depth in the coming pages):

“The Green Revolution was based on the assumption that technology is a superior substitute for nature, and hence a means of producing limitless growth, unconstrained by nature's limits. However the assumption of nature as a source of scarcity, and technology as a source of abundance, leads to the creation of technologies which create new scarcities in nature through ecological destruction” (Shiva, 24).

Desertification, water-scarcity, lack of diversity, and increased carbon emissions from farming are all a direct result of the Green Revolution. We need to re-think how we consider agriculture. Solutions based on technology, increased production of mono-crops, and market demand will drive us down the same path we have been on since the 1960s. Unfortunately, path dependency has become the norm. I suggest that we are path dependent for two reasons: (i) the de-linking of scientific fact from political evaluation has created a power-knowledge nexus that legitimates both the science behind Development and the development agencies themselves and (ii) the destruction of the social has desolved any form of resiliency indigenous populations have for dealing with current crises, making them more dependent on development institutions. Furthermore, this destruction of the social makes resilience/resistance to development ideas/policies virtually impossible. In Part I, Section F, I

outline this path dependency in greater detail. Before I do that, it is important that I demonstrate how the implementation of the Green Revolution also required the destruction of the social.

Part I Section E--Implementation of the Green Revolution: Death of the Social

In *The Violence of the Green Revolution*, Vandana Shiva also describes how the implementation of the Green Revolution allowed for development agencies to control indigenous communities, ultimately resulting in loss of tradition and community. The Green Revolution allowed development institutions to control indigenous populations in two ways: (i) by taking away their traditional form of agriculture, (ii) by destroying the social, ethnic traditions that bound the society together. As with the breakdown of ecology, enlightenment thinking, or the Cartesian-Bacon worldview that created modernity, gave development institutions the discursive tools they needed to use knowledge as a form of power. The first way the Green Revolution managed to control indigenous populations was by passing off local knowledge as un-scientific and wrong. The 10,000 history of farming crops in many regions of India and Sub-Saharan Africa was devalued, in its place came unquestionable scientific knowledge.

Local farmers were thus forced to grow mono-crops on the global market; however, they did not own the rights to the seeds or crops they produced—those seeds were protected by intellectual property rights and the crops they grew were chosen by Development institutions. For example, the 2001 documentary *Life and Debt* highlights the plight of the Jamaican population as they struggle to make money on the crops the IMF is mandating that

they grow or else face harsh austerity measures. The end goal was the commodification of both the farmers and their crops. By bringing farmers into the market, they make them commodities that can more easily be valued and assessed. This process of market evaluation is supposed to make trade more efficient. It is also, theoretically, supposed to solve the food distribution problem, as Amartya Sen discusses in *Poverty and Famines*. Sen explains, “In a market economy, a person can exchange what he owns for another collection of commodities. He can do this exchange either through trading, or through production” (Sen, 3). A person’s ability to avoid starvation, according to Sen, comes from his ability to market himself as a valuable asset on the commodity market for producers: “A person’s ability to avoid starvation will depend both on his ownership and on the exchange entitlement mapping that he faces” (Sen, 4). Amartya Sen’s explanation of how a rural farmer or other ‘under-developed’ person may avoid starvation through this market commodification process, which he calls the ‘entitlement approach’ is a perfect example of Neo-Liberal economics. In this understanding, individual commodification increases efficiency in the market and enables the market to better judge each individual’s value. Hidden behind this theory is the Enlightenment world view that is entirely impersonal and ignores human emotion and spirituality for a mechanical, predictive process.

The Green Revolution also destroyed traditional farming practices by taking away their rights to the seeds: “With the Green Revolution, peasants were no longer to be custodians of the common genetic heritage through the storage and preservation of grain. The miracle seeds of the Green Revolution transformed this common genetic heritage into private property, protected by patents and intellectual property rights” (Shiva, 63). The result of the shift from

indigenous seeds to Borlaug's seeds was the shift of a farming system governed by traditional practices to a system controlled by international agribusinesses. The shift also resulted in a transition from seeds being a free resource on the farm to seeds becoming costly inputs. Soon, farmers often had to get loans to buy seeds and fertilizer.

The Second way the Green Revolution allowed the Development community to control indigenous populations was through the breakdown of ethnic and indigenous communities: "As Frankel observed, the Green Revolution was the instrument of a complete erosion of social forms. In those regions where the new technology has been most extensively applied, it has accomplished what a century of disruption under colonial rule failed to achieve, the virtual elimination of the stability residuum of traditional society" (Shiva, 173). The result was a complete breakdown of the social. All of a sudden, there was a spike in regional conflicts that were blamed on religion and communism when in actuality they were caused by the eroding of family and cultural ties (Shiva, 174).

The social and political planning that went into the Green Revolution aimed at engineering not just seeds but social relations as well. The commodification of indigenous farmers sought to break ethnic ties and destroy the social fabric of the communities. By bringing them into the global market, they become objects of development; everything in their lives was given a value and their self-worth was instead derived from the value of these possessions. In order for this to be achieved, traditional, hard to value objects such as community had to be broken down. This not only affected the subjected populations but will have disastrous future implications. As food and water crises worsen, local communities, now

entirely dependent on the market, have lost their resiliency to deal with these crises. This resiliency was destroyed with the devolution of the social.

The death of the social resulted in destruction of traditional communities. These community ties and ethnic identification was replaced by individual self-entrepreneurship and self-commodification on a global market. In effect, the death of the social destroyed the resiliency of a community. This made them more easily governed (governmentality) and increased their dependency on both the market and, in times of trouble, development institutions. Furthermore, the loss of resiliency will have a detrimental impact on their ability to withstand the coming food crisis. In *Death of the Social? Re-figuring the territory of government*, Nikolas Rose describes what the social, economy, and government will look like after the loss of the social:

“The economy is no longer to be governed in the name of the social...The social and the economic are now seen as antagonistic, and the former is to be fragmented in order to transform the moral and psychological obligations of economic citizenship in the direction of active self-advancement. Simultaneously, government... is to be restructured according to a particular image of the economy—the market” (Rose, 340).

Neo-liberal economics, which have been the hegemonic theory of economics since the 1980s, stresses the individual over the social. Self-commodification and self-advancement is necessary for the implementation of neo-liberal development policies typical in later implementations of the Green Revolution. Rose writes, “This emphasis upon the individual as an active agent in their own economic governance... is paralleled in a whole new set of vocabularies and devices for managing individuals (Rose, 339). In indigenous cultures, the individual took the place of

communities; individual advancement became more important than strong community resilience. This made indigenous populations more susceptible to the development community.

As indigenous people were brought into the market as individuals, they became more governable. This aligns with Michel Foucault's theory of governmentability, which addresses how a state exercises control over its populace. Foucault defines governmentability as the deliberations, strategies, tactics and devices employed by authorities for making up and acting upon a population and its constituents to ensure good and avert ill. In this sense, the globalized market is being used as the mechanism to control the behaviors of entire populations, giving them incentives to behave in such a way, a way that maximizes their self-benefit. This behavior can only be achieved with the destruction of the social. In short, with their introduction to the market, their choices and desires could be predicted and manipulated according to Rational Choice Theory economics.

Within Rational Choice Economics is the theory of homo-economicus, or the economic man. The Theory states that man's desires and choices are based on economic value and opportunity cost. He will make the decision that grants him the highest economic benefit. Thus, his actions can be predicted and manipulated according to what seems to be the most beneficial to his individual self-advancement (Rational Choice Theory). Community ties become distracting and must be destroyed if homo-economicus is to fully make every decision based on rational choice model of individual self-advancement and autonomy.

Overall, I make the argument that the destruction of the social has destroyed community ties, which in turn has eradicated resilience. This loss of resilience re-enforces the

power of development institutions and makes indigenous populations (i) more dependent, (ii) more governable, (iii) more tied to the globalized market, and most importantly (iv) unable to deal with the coming global food crisis.

Part I Section F—The Green Revolution and Path Dependency

The result of the implementation of the Green Revolution has been path dependency. When Thomas Friedman asks: “How did we not panic when the evidence was so obvious that we’d crossed some growth/climate/natural resource/population redlines all at once?” (Friedman, 2011), the answer is path dependency. The warning signs have been prevalent for decades. In 1989, two decades after the ‘success’ of the Green Revolution, the World Bank was sending out warning signals for over-population, desertification, deforestation, and food insecurity. The World Bank report *Sub-Saharan Africa: From Crisis to Sustainable Growth* focuses on African governance, explosive population growth, and decreased crop yields due to desertification. First the world bank warns of desertification and population growth: “The pressure of population is causing desertification to accelerate... the productive capacity of land is failing because of shorter rotations, soil erosion and overgrazing” (World Bank 1989: 22). Next the World Bank warns of deforestation and population growth: “Population pressure is pushing farmers onto marginal lands and causing deforestation, severe soil erosion, and declining productivity” (World Bank 1989: 44). Third, the World bank warns of unsustainability; however, this time it comes with a brief policy recommendation: “In several countries overpopulation is putting unsustainable pressure on agricultural land...Without agricultural

modernization, the result is rapid desertification, deforestation, and loss of vegetation cover” (World Bank 1989: 40-41).

While the World Bank worries about population growth, desertification, and deforestation in its 1989 report, it does not stop to reconsider its own policies. Instead, it advises that Sub-Saharan African nations implement scientific and technologically advanced agriculture: “The necessary productivity gains can come only from technological change. This will involve a more intensive use of chemical and organic inputs...the introduction of new higher-value crops better irrigation methods, hand tools, and crop storage techniques” (World Bank 1989: 90). In the face of mounting warning signs, the solution is more of the same; more technology; more intensive chemicals; more higher value crops; more irrigation.

In *Modernizing Malthus*, Gavin Williams addresses this path dependency and says that the World Bank is able to ignore its path dependency through victim blaming. Williams says that victim blaming is a constant refrain throughout the World Bank’s *Sub-Saharan Africa* report: “the fecklessness and ignorance of the poor are the source of their own suffering. To save themselves, they must adopt the contraceptive and agricultural technologies on offer from the international aid agencies” (Williams, 159). Much of this victim blaming comes from the devaluation of local knowledge. Development agencies pass off local knowledge as traditional and experiential, not scientific. They are operating under the Enlightenment era paradigm. Williams continues, “There is no need to draw on the local knowledge and experience of farmers; enlightenment comes from above” (Williams, 164).

The process of devaluing local knowledge while abstracting scientific knowledge from social evaluation contributed immensely to path dependency. In *Encountering Development*,

Arturo Escobar notes “For Forty years, discourses and strategies to combat hunger have succeeded one another. This striking versatility, especially when seen in relation to the persistence and aggravation of the problems they are supposed to eradicate, must be accounted for” (112). He outlines what is essentially a hunger paradox: as we come up with more complex, technically advanced, and institutional ways to deal with hunger and food supply, the problem becomes increasingly aggravated. This paradox is witnessed in Susan George’s 1986 book, “More Food, More Hunger.”

Instead of ending hunger, the goal of agricultural development has become community reform; the objects of development have become the objects of reform. The development discourse, as witnessed in the 1989 World Bank report on Sub-Saharan African casts the rural poor as objects needing to be developed, not as humans with experience and their own body of local knowledge. They have created their own truth about these farmers. Escobar writes, “The development discourse has crystallized in practices that contribute to regulating the everyday goings and comings of people in the Third World” (Escobar, 104).

The line of thought based on higher scientific knowledge and domination of nature and man has its roots in capitalism and in the science of the Green Revolution. It is the thought behind labeling economics as a social *science* and not just a social study. It is derived from Enlightenment thinking and has been reproduced and re-instituted for centuries: “As long as institutions and professionals are successfully reproducing themselves materially, culturally and ideologically, certain relations of domination will prevail; and to the extent that this is the case, development will continue to be greatly conceptualized by those in power” (Escobar, 106).

Finally, path dependency is reinforced through development's destruction of ecology and the social. Lester Brown has been warning about the danger of path dependency for decades. In his essay *Eroding Futures*, Lester Brown warns that if we do not change paths soon, our civilization is in danger of collapse: "The signs that our civilization is in trouble are multiplying...If we continue with business as usual, civilization collapse is no longer a matter of whether but when" (Brown, *Eroding Futures*). Unfortunately, things are not looking good for path diversion. The Power/Knowledge of the Green Revolution, when incorporated with the destruction of ecology and the social, creates a double edged sword that could prove catastrophic for the 21st Century. On one edge, the power/knowledge framework reproduces the hegemonic line of thought on agricultural development while discounting other forms of knowledge. On the other edge, the destruction to ecology and the social as explained in the previous section destroys any resilience local communities might have in resisting development policies and dealing with future food crises.

We need to completely rethink how we consider agriculture if we are going to meet the challenges of the 21st Century. The question can no longer just be what we were thinking; doing so will not break us of our path dependency. We must analyze how we are thinking. In doing so, we are able to take a step back and critique how we view the world.

In this first part, I focused on understanding the epistemic roots of how we think and how these roots have made us path dependent. In the second part, I will attempt to take what I broke down in this section and apply it to where we are today and where we are headed. Judging by our path dependency, it is pretty clear to see where we are headed without any

major change in how we think. My hope is through analysis of where we are, how we got here, and where we are going, we can step back and start to truly analyze what must be done.

Part II: Ghost in the Machine

Re-humanize yourself

I work all day at the factory
I'm building a machine that's not for me
There must be a reason that I can't see
You've got to humanize yourself

Part II Section A—'Isn't This...Where We Came In': The Coming Global Food Crisis

"Economists do not see their science as a cultural discourse. In their long and illustrious realist tradition, their knowledge is taken to be a neutral representation of the world and a truth about it" --Arturo Escobar, *Ecountering Development*, 58

While development has failed to accomplish its goals of raising GNP, it has succeeded in commodifying humans, creating markets, and changing the way people value themselves. Development discourse encompasses a cultural space so powerful "one could criticize a given approach and propose modifications or improvements accordingly, but the fact of development itself, and the need for it, could not be doubted" (Escobar 5). This is due to the fact that development discourse produces a social reality of truisms that creates permissible modes of being and thinking while disqualifying and even making others impossible (Escobar 5).

In order to meet the challenges facing humanity in the 21st Century, we must break free from our current line of thought. This is no easy task. Exacerbated by development discourse that has created its own reality and truisms, creating a power knowledge framework that abstracts its knowledge from social evaluation while discounting other forms of knowledge;

plagued by the ecological and social destruction through the implementation of the Green Revolution, our path dependency is as strong as ever.

To truly understand that task at hand, I will analyze where we are right now. In the previous part, I dealt mainly with how we got to where we are today, breaking down the epistemic roots that help us understand how we conceptualize agriculture. This section deals primarily with where we are today.

In the UNFAO's 2014 report *Economic analysis of supply and demand for food up to 2030*, the United Nations Food and Agriculture Organization argues: "With the world's population expected to reach 8.2 billion people by 2030, and with 842 million people estimated as having been undernourished in the period 2011-13, food supply will present a growing challenge in the next two decades" (UNFAO, *Economic Analysis*, iv). The solution that the UNFAO presents is to increase food supply to meet growing demands such as aging populations, urbanization, and changing consumer preferences as billions enter the middle class. The FAO argues that food supply "will need to both increase and become more efficient if it is to grow within the constraints presented by the availability of natural resources and existing technology" (UNFAO, *Economic Analysis*, iv).

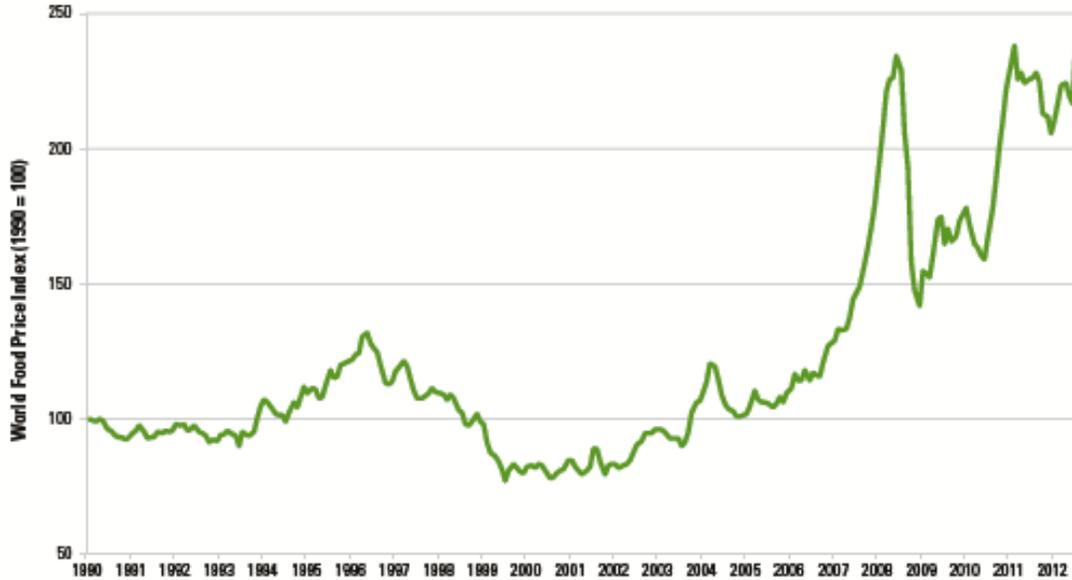
The World Bank is more explicit in the exact increase in necessary food supply. Just like the FAO, the World Bank views the global food crisis as a production problem, in which the answer is an increase in food supply to meet increasing demands. In the World Bank's Agriculture Action Plan 2013-2015, The World Bank argues, "The future needs an agricultural system that produces about 50 percent more food to feed the world's 9 billion people by 2050"

(World Bank, *Action Plan 2013-15*, xv). To achieve this goal, the World Bank focuses on five thematic areas: (i) raising agricultural productivity, (ii) linking farmers to markets and strengthening value chains to improve market access, (iii) facilitating rural non-farm income, (iv) reducing risk, vulnerability, and gender inequality, and (v), enhancing environmental services and sustainability (World Bank, *Action Plan 2013-15*, xvii).

The proposed policy solutions offered by these institutions are echoed by a gallery of development specialists. Jacques Diouf, former director of the FAO from 1994-2011, said in 2009 that “Global food production, already under strain from the credit crunch, must double by 2050 to head off mass hunger....The food crisis pushed another 40 million people into hunger in 2008” (World Food Program). Josette Shearan, former director of the World Food Program, said that if we are to achieve this doubling of food production called for by development agencies, it must be made a top priority (World Food Program).

The World Bank and UNFAO focus on trends to analyze the severity of the coming food crisis. One trend that they analyze is the recent rise and volatility of global food prices. Figure 1 shows that world food prices are both trending upward at an increasing rate and subject to severe volatility. The most prominent spike on the graph is the 2007-08 Food Crisis; however, you clearly shown, the food prices have climbed back up—and even slightly above—2008 levels. The World Bank and UNFAO predict food prices to continue to climb and remain volatile.

FIGURE 1: Recent World Food Price Spikes



Source: World Bank.

The World Bank and UNFAO are also extremely concerned with rising populations. Table 1 shows that world population is projected to increase drastically through the year 2050 with the most significant increases coming from areas most vulnerable to famine and climate change. While this table projects the 2050 World Population at 9 Billion, Demographers are now telling us that we will reach 10 billion by 2050, instead of 9 billion. The increase is caused by continued high growth rates in Africa, where the anticipated improvements in the human indicators did not improve. Another demographic concern is age, which is a two-sided coin. On one side you see aging populations in industrialized nations, putting a strain on the work for to take care of the millions of people living longer than before. On the other side, many of the nations most at risk of food insecurity are still seeing a large increase in populations.

Table 1. Projections of total population size for continents as well as selected countries and regions (millions)

Area	2000	2010	2020	2030	2040	2050
	(millions)					
World	6 124	6 885	7 617	8 233	8 699	9 021
Africa	821	1032	1271	1518	1765	1998
Asia	3 705	4 145	4 546	4 846	5 024	5 095
Europe	729	730	722	707	687	664
Latin America and Caribbean	523	594	660	713	750	769
North America	316	349	379	405	427	445
Oceania	31	35	39	43	46	49
Brazil	174	199	220	236	248	254
China	1 270	1330	1371	1374	1324	1238
India	1 046	1220	1379	1506	1597	1658
United Kingdom	59	62	64	66	68	69
European Union (Member Organization)	482	495	498	496	489	479
Former Soviet Union	289	284	279	271	261	249
NW Europe	246	253	258	262	262	261
Nile catchment	225	285	354	424	492	555
Sub-Saharan Africa	680	867	1081	1308	1540	1761

Source: UN Scenario of IIASA education projections as reported by Lutz and Samir (2010).

Area	Population change 2010-2030
World	Population growth, although slowing, 19.6 percent increase to 2030 to 8.2 billion
Africa	Almost 50 percent increase in population The largest increase in sub-Saharan Africa – 92 percent Highest population growth rate of any region
Europe	Minor decline in population Ageing population
Asia	Almost 17 percent increase to 2030
Latin America and the Caribbean	Almost 20 percent increase to 2030
North America	Almost 16 percent increase to 2030
China	Slight increase to 2030
India	India will surpass China in terms of population by 2030 44 percent increase

Table 2 shows an area by area analysis of projected population changes in the next fifteen years. The highest growth rates will take place in the poorest regions most susceptible to climate change, water shortages, and other crises that will exacerbate the food crisis. The most

worrisome increase is Sub-Saharan Africa, where the World Bank and UNFAO have continually struggled to implement Green Revolution style mass policies successfully.

Demographic change	Impact on food demand
Ageing population	<ul style="list-style-type: none"> • Shift in food consumption towards healthier products by the population over 65 • Stable demand for meat protein in developed countries. Increased demand in some developing countries • Overall increased demand for fish protein • Decreased consumption of starch-based staple foods
Increased life expectancy	<ul style="list-style-type: none"> • Increased average employment period of the population will affect GDP and ability to purchase food
Improved level of education	<ul style="list-style-type: none"> • Improved productivity in all sectors of the economy including the food industry • More conscious choice of food consumed (healthy trend) • Possible reduction in number of children per household in developing countries
Increased urbanization	<ul style="list-style-type: none"> • In 2030, 60 percent of the world's population will live in urban areas • Loss of land for agriculture • Lengthened food supply chain • Increased food waste generation in the countries with poor supply chain infrastructure • Shift in consumption towards processed and ready-made foods. • Increased consumption of foods high in fats and sugar due to advertising..

Table 3 demonstrates the impact of what are considered 'demand side' factors on the World Food Situation in the next 35 years. All of these demographic changes contribute to how the World Bank and FAO understand the crisis. They also make the crisis exceedingly complex. No single solution can truly address all of these factors. As the population ages, they have more opportunity to amass wealth and will prefer diets more abundant in meat and fish. Additionally, they will demand less starch-based staple food, which are easier to produce. The increase in urbanization is a multi-sided sword. It creates a logistics problem of food delivery while consumer land that could be used for agriculture. This also leads to marginalized people being pushed further into marginalized lands, which hastens desertification.

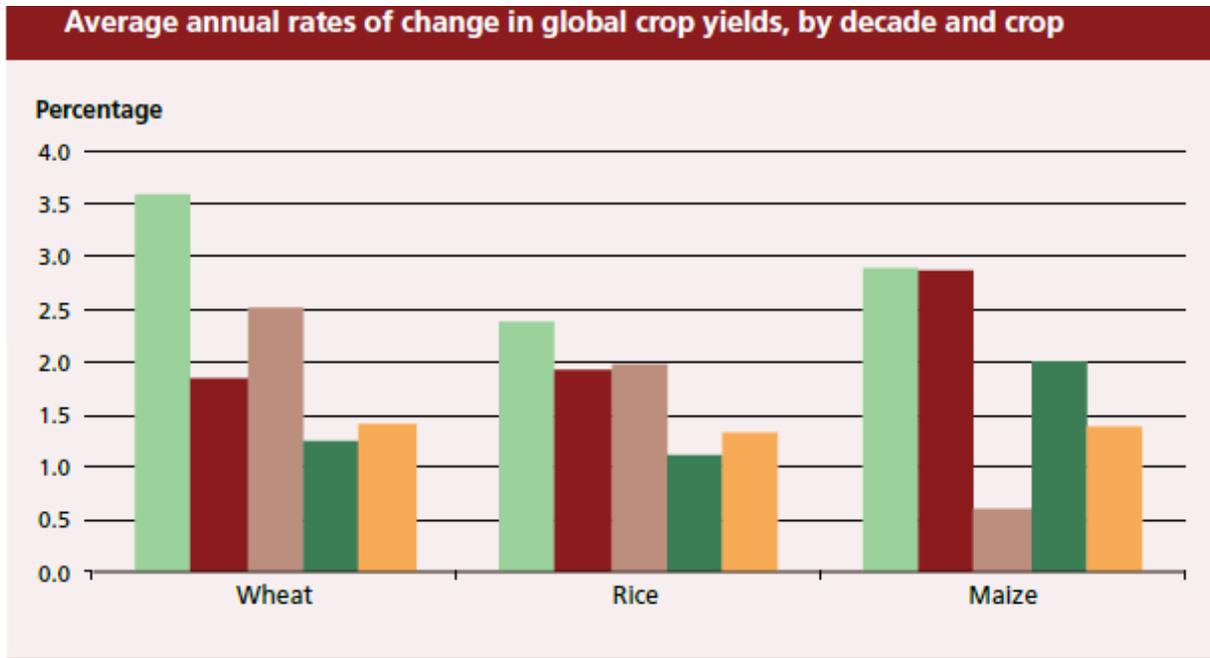
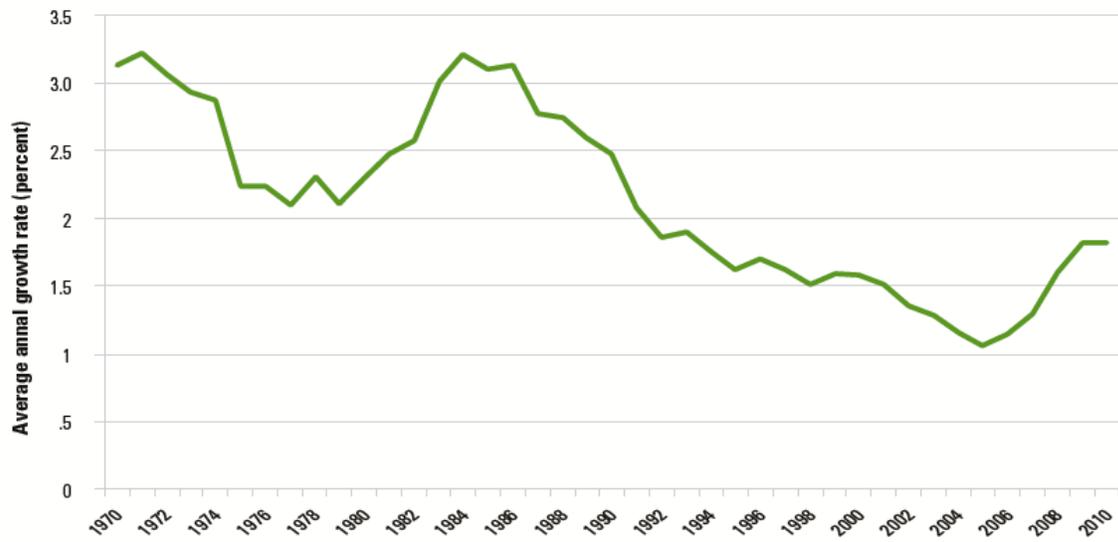


Figure 2 shows that while the average annual rate of change in crop yields is increasing, the rate of increase has been cut in half over the past five decades. Each bar represents a decade: light green 1960s and orange the 2000s. In every regard, there has been a drop since the height of the Green Revolution in the 1960s and 1970s. This is the comparison the World Bank, UNFAO, and other development leaders try to make when arguing for an increase in crop yields; they envisage another spike in yields as witnessed in the 60s and 70s. What they do not consider is the (a) drop after and (b) ecological and social damage the Green Revolution caused.

FIGURE 2: Growth Rates of Yields for Major Cereals Have Begun to Rise but Remain Low

10-year rolling growth rates of yields for major cereals in developing countries



Source: Derived from USDA data.

Figure 3 provides another example of the development community advocating for increased production. Analysis of this graph done by the World Bank stresses the need to increase production of food: “Raising food crop yields and increasing their resilience to climate change are the most important actions needed for sustainable global food security” (World Bank, 2015:24). Along with food, the World Bank also advocates for better water productivity, climate smart technologies, and improved fertilizer and water calibration: “Water constraints are more binding, requiring improvements in water productivity....adoption of new climate-smart technologies and management practices, and improved water management and fertilizer calibration” (World Bank, 2015:24).

Little has changed in the 45 years since Norman Borlaug received his Nobel Peace Prize. Productivity and efficiency are still king and Queen. All policies that advocate for an increase in

productivity (which is all of them) do so in a manner that views humanity as the conqueror of nature. Advocating for better water productivity requires constantly new and improved technologies such as fertilizers that use water more efficiently and irrigation techniques that tap more water from beneath the earth. The last proposition is a dangerous idea. Just last week reports came out about the potential ecological damage California was causing by pumping water from the ground that had been buried beneath the Earth's surface for 20,000 years. This has the potential for some extremely dangerous consequences. Nevertheless, our need to sustain takes precedent over potential unknown ecological damage. I titled this section with a 'Easter egg' lyric from Pink Floyd's album, *The Wall*. It is a semi-hidden lyric sequence that is split between the first and last songs on the same double album. The last words of the album ask "Isn't this..." and the first words of the album complete the question: "...we came in?" Many Pink Floyd fans believe this is Roger Waters giving us one last lesson on *The Wall*: if we do not learn from history, we are bound to repeat it; the whole cycle repeats itself over and over, from generation to generation the way the album cycles through.

Part II Section B—The Matrix: System Overshoot and System Preservation

[Neo sees a black cat walk by them, and then a similar black cat walk by them just like the first one]

[Neo](#): Whoa. Déjà vu.

[Everyone freezes right in their tracks]

[Trinity](#): What did you just say?

[Neo](#): Nothing. Just had a little déjà vu.

[Trinity](#): What did you see?

[Cypher](#): What happened?

[Neo](#): A black cat went past us, and then another that looked just like it.

[Trinity](#): How much like it? Was it the same cat?

[Neo](#): It might have been. I'm not sure.

[Morpheus](#): Switch! Apoc!

[Neo](#): What is it?

[Trinity](#): A déjà vu is usually a glitch in the Matrix. It happens when they change something.

Lester Brown, founder of the Worldwatch Institute and president and founder of the Earth Policy institute believes that we are headed towards complete system collapse. He argues that we are in a system overshoot: we are living beyond our means but, due to path dependency, have few options to deviate course. In *Eroding Futures*, he explains how the ecological destruction of modern agriculture is threatening our very civilization: “The signs that our civilization is in trouble are multiplying. During most of the 6,000 years since civilization began, we lived on the sustainable yield of the Earth’s natural systems. In recent decades, however, humanity has overshoot the level that those systems can sustain” (Brown, *Eroding Futures*). He argues that modern agriculture is ecologically unsustainable, destroying our soil, causing deforestation, and exploiting out fisheries. Unfortunately, he makes a strong argument. If we consider how the implementation of the Green Revolution destroyed both ecological and social resilience, coupled with the power/knowledge paradigm maintaining path dependence, it is easy to imagine an eventual system collapse. He warns: “In system after system, demand is overshooting supply...If we continue with business as usual, civilization collapse is no longer a matter of whether but when” (Brown, *Eroding Futures*).

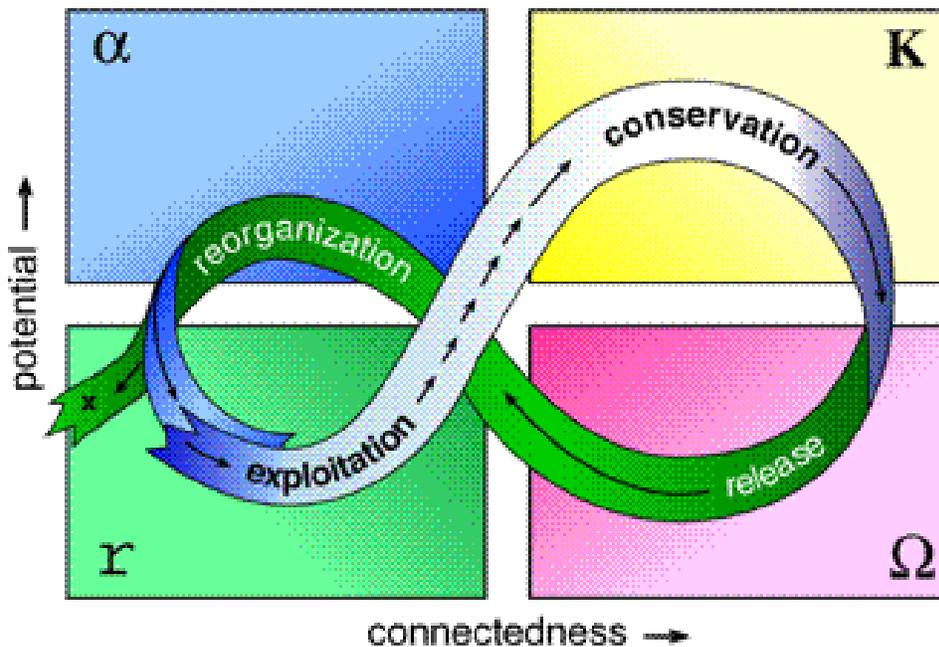
How do systems collapse? What are the characteristics of system collapse? Would we be able to recognize a system before its collapse and a change course? I will attempt to answer these questions using systems theory.

Systems theory is derived from ecology but can be used to describe social and economic systems. It studies the interplay between multiple complex processes and how the rules of the

system are created. System theorists believe that every system has a natural cycle in which its framework, its panarchy, is grown/exploited, conserved, released, and finally reorganized. The most influential systems theorists in regards to panarchy theory are C.S. Holling and Lance Gunderson. Resilience Alliance defines a panarchy as such:

“Panarchy is a framework of nature's rules, hinted at by the name of the Greek god of nature- Pan - whose persona also evokes an image of unpredictable change. Since the essential focus of Panarchy is to rationalize the interplay between change and persistence, between the predictable and unpredictable, Holling et al. (2002) draw on the notion of hierarchies of influences between embedded scales, that is pan-archies, to represent structures that sustain experiments, test its results and allow adaptive evolution.”

The Cycle



Systems theory studies the life of a systems cycle and panarchy: “Traditionally ecology has focused on the concept of succession that describes the transition from a time when

exploitation (i.e., the rapid colonization of recently disturbed areas) is emphasized to a time when conservation (i.e., the slow accumulation and storage of energy and material) is emphasized.” They study how different organisms interact at different speeds, some working to conserve the panarchy while others are working to grow it. The real life concept of sustainable development makes perfect sense under a systems theory because some actors are working to grow the power of development (exploitation) while others are working to sustain and conserve its existence (not let it release): “The fast levels invent, experiment and test; the slower levels stabilize and conserve accumulated memory of past successful, surviving experiments. The whole panarchy is both creative and conserving. The interaction between cycles in a panarchy combines learning with continuity”

Every system, however, has its own life cycle. Hollings and Gunderson write, “In each case, a target variable is identified and successfully controlled. Uncertainty in nature is presumed to be replaced by certainty of human control. Social systems initially flourish from this ecological stabilization and resulting economic opportunity. But that success creates its own failure.” (Hollings, 2002: 1-2). As I mentioned, there are four distinctive phases: growth (r), conservation (k), collapse (omega), and reorganization (alpha). Resilience Alliance writes,

The adaptive cycle exhibits two major phases (or transitions). The first, often referred to as the foreloop, from r to K, is the slow, incremental phase of growth and accumulation. For an economic or social system, the accumulating potential could as well be from the skills, networks of human relationships, and mutual trust that are incrementally developed and tested during the progression from r to K. The second, referred to as the backloop, from Omega to Alpha, is the rapid phase of reorganization leading to renewal. (Resilience Alliance)

A nested hierarchy of adaptive cycles represents a panarchy. Also important in the adaptive cycle in the concept of resilience, or the capacity of an ecosystem of withstand change and pressure without collapsing.

So does this systems analysis apply to us? Are we actually at risk of collapse, just as Lester Brown suggests? It appears so, assuming that we lost our resilience with the implementation of the Green Revolution. With the destruction of ecological resilience, our agricultural system stands on the brink of collapse. Resilience Alliance echoes Fraser and Rimas in their diagnosis that ecological systems that lack diversity are much more likely susceptible to collapse. In *Could Food Shortages Bring Down Civilization?* Lester Brown predicts that food shortages could cause complete system collapse due to governmental collapse: “Our continuing failure to deal with the environmental declines that are undermining the world food economy—most important, falling water tables, eroding soils and rising temperatures—forces me to conclude that such a collapse is possible (Brown, *Could Food Shortages Bring Down Civilization?*). These food crises will pose a large security threat as governments lose their ability to feed their people. We have already seen what happens when the price skyrockets; what will happen when the well runs dry and the soils blows away? If system collapse is where we are headed, how can we avoid catastrophe?

Part II Section C—Jurassic Park: The Dangers of How we Think

[John Hammond](#): [as they gather around a baby dinosaur hatching from its egg] I've been present for the birth of every little creature on this island.

[Dr. Ian Malcolm](#): Surely not the ones that are bred in the wild?

[Henry Wu](#): Actually they can't breed in the wild. Population control is one of our security precautions. There's no unauthorized breeding in Jurassic Park.

[Dr. Ian Malcolm](#): How do you know they can't breed?

[Henry Wu](#): Well, because all the animals in Jurassic Park are female. We've engineered them that way.

[they take the baby dinosaur out of its egg. A robot arm picks up the shell out of Grant's hand and puts it back down]

[Dr. Ian Malcolm](#): But again, how do you know they're all female? Does somebody go out into the park and pull up the dinosaurs' skirts?

[Henry Wu](#): We control their chromosomes. It's really not that difficult. All vertebrate embryos are inherently female anyway, they just require an extra hormone given at the right developmental stage to make them male. We simply deny them that.

[Dr. Ellie Sattler](#): Deny them that?

[Dr. Ian Malcolm](#): John, the kind of control you're attempting simply is... it's not possible. If there is one thing the history of evolution has taught us it's that life will not be contained. Life breaks free, it expands to new territories and crashes through barriers, painfully, maybe even dangerously, but, uh... well, there it is.

[John Hammond](#): [sardonically] There it is.

[Henry Wu](#): You're implying that a group composed entirely of female animals will... breed?

[Dr. Ian Malcolm](#): **No. I'm, I'm simply saying that life, uh... finds a way.**

“We desperately need a new way of thinking, a new mindset. The Thinking that got us into this bind will not get us out”—Lester Brown, *Could Food Shortages Bring Down Civilization?*

In order to avoid the system collapse that Lester Brown warns is eminent, we need to change our mindset, we need to change how we view the world. Our current line of thinking, derived from the Enlightenment era, is driving us off a cliff—and we have no parachute. How do we change our mindset? The question is too loaded to fully answer in this essay, so I will provide a critique of our current mindset followed by an opposing way of thinking.

The Cartesian Mindset led us to view the universe as something we could learn and control to our complete benefit. Through our capacities of reason and understanding, we could control nature; thus, the Enlightenment world view, as I explained earlier, is a dominative world view. In the Cartesian model, war is declared against nature, which allows for the epistemology of science and modernity. While modernity brought much progress in modern medicine and technology, we must remember that it is socially constructed; it is not a universal truth. Modernity presents a linear path of progress while the world is cyclical.

Postmodernism—resiliency thinking—embraces a revolutionary proposition. Instead of seeing the world as static and deterministic, it conceptualizes the world as a complex, interconnected, self-organizing order emerging from chaos (Best, 203). It posits that “No event or natural state in the present moment is exactly similar to any other event or state in the past or future; change, becoming, and transformation are inherent aspects of life” (Best, 204-205).

In the beginning of this section, I provide a quote from Jurassic Park. It is a conversation between Henry Wu and Dr. Ian Malcolm, both of whom have just witnessed the birth of a raptor. Henry Wu explains to Dr. Malcolm that they genetically modify all of the dinosaurs so that they are female in order to precisely control their breeding. Malcolm seems perplexed by this and insists that this control over nature is unnatural and that “life finds a way.”

In this narrative, Henry Wu takes the form of modernity, controlling nature for his benefit. We have to find a way. When asked by energy guru Amory Lovins about thinking outside the box, Elizabeth Kolbert, writer for the New Yorker responded “There is no box.” (Brown, *Food Shortages*).

“There is no box. That is the mind-set we need if civilization is to survive” –Lester Brown

Part II Section D—Apocalypse Now: Where we are Headed

It's impossible for words to describe what is necessary to those who do not know what horror means. And then I realized they were stronger than we, because they could stand that these were not monsters, these were men... trained cadres. These men who fought with their hearts, who had families, who had children, who were filled with love... but they had the

strength... the strength... to do that. If I had ten divisions of those men, our troubles here would be over very quickly. You have to have men who are moral... and at the same time who are able to utilize their primordial instincts to kill without feeling... without passion... without judgment... without judgment! Because it's judgment that defeats us. —Marlon Brando

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