Already Extinct

A parrhesiastic statement

Minoru Kyo

Already Extinct *is a critical analysis of the state of the environment, and a provocation for anyone who wants to create a sustainable society. Many argue that knowing the grim truths of our current relationship with the natural environment will lead to social paralysis. Minoru Kyo believes otherwise, and contends: We don't understand the problem; we couldn't do anything about it if we did; and we wouldn't do anything about it if we could.*

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The Jevons Paradox (The Rebound Effect)

One of the more interesting relationships as it pertains to our vain hopes to dematerialize our society, or reduce resource consumption through gains in efficiency has been called The Jevons Paradox (or the Rebound Effect). Jevons was a British economist who, at the end of the nineteenth century, "argued that increased efficiency in using a natural resource, such as coal, only resulted in increased demand for that resource, not a reduction in demand. This was because such improvement in efficiency led to a rising scale of production."[103] Moreover, Jevons wrote: "*It is wholly a confusion of ideas, … to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth*. As a rule, new modes of economy will lead to an increase of consumption according to a principle recognized in many parallel instances."[104]

The Jevons Paradox is reflected in many of our behaviours. For example, "the fuel efficiency of cars in the UK has improved over the last decade, saving the equivalent of 0.5 mtoe (million tonnes of oil equivalent) per year. But at the same time the ownership and use of cars and the distance they travel has increased the equivalent energy use by 0.9 mtoe per year."[105] You would not be hard pressed to find similar economic responses to any energy saving or efficiency-gaining technology. Take LED lights as an example. LED lights offer the consumer a 99% reduction of energy use with a fifty times longer lifespan. The cost difference between the two has dramatically decreased to about 10 times more for the LED than the traditional incandescent light. This should mean that our electricity consumption will drop noticeably with the greater performance. But (in line with Jevons' observations) this will not be the case, because this long-life, low-energy light can now be used to illuminate areas that would never have been considered before. Now we are lighting the whole sides of buildings with advertisements – even the underside of park benches for aesthetic purposes. Many people have installed them in the refrigerators, because the one that comes with the appliance keeps going out when the door is closed (just kidding … I think).

This paradox has profound implications for efforts to conserve natural resources like fossil fuels. "For example, the development of renewable energy resources, such as wind and solar power, are commonly identified as a way to reduce dependence on fossil fuel, based on the assumption that the development of alternative sources of energy will displace, at least to some extent fossil fuel consumption."[106] If you consider alternative energy technologies as simply making fossil fuels more efficient (as argued above), this efficiency will only exacerbate fossil energy use as the prices for fossil energy drop with falling demand. As prices for fossil fuels decrease, more demand is created. It should be noted that this is only true before the realities of peak fossil energy manifest themselves.[107] Once we are well into the downside slope after the peak, efficiency gains will not be enough to substantially lower the cost of fossil energy – but, at this point, we will no longer have 'extra' fossil energy to invest in energy efficiency technologies like wind and solar.

The Jevons Paradox is not completely unrelated to the illusion of dematerializing the economy. In the face of the many economic contradictions in the functioning of capitalism and the environmental realities of exploiting a finite earth, some people believe that capitalist economies can be 'dematerialized' to sustain growth without expanding the need of energy and resources. Some of this can be (and has been) the result of running out of crap to buy in developed nations –

people go to the theatre instead of buying a fourth sea-doo. But it doesn't take a lot of imagination to visualize that this sort of dematerialization is limited in an economy focused on planned and perceived obsolescence. Some of the gains in dematerializing the economy, it is hoped, will occur with greater efficiency gains from new technologies – though this is refuted by The Jevons Paradox. And some gains in dematerialization can simply be assigned to off-shoring energy and pollution-intensive industries to developing nations. This is precisely argued by Minqi Li: "Claims of the advanced capitalist economies to dematerialization in the wider, more meaningful sense of declining overall environmental impact are in fact refuted by the Jevons Paradox, which says that the increased efficiency in the throughput of energy and materials normally leads to an increase in the scale of operations, thereby enlarging the overall ecological footprint. … Moreover, part of what is referred to as dematerialization arises from the relocation of industrial capital from the advanced capitalist countries to the periphery in pursuit of cheap labor and low environmental standards."[108]

The implications of The Jevons Paradox (or Rebound Effect) are clear in the case of mitigating climate change. The second labor of Hercules was to slay the Lernean Hydra – a multi-headed serpent that terrorized the countryside. When they confronted each other Hercules grasped the serpent and the serpent grasped Hercules in a dual to the death. When Hercules bashed one of the Hydra's nine heads, two would grow back. (That's the point of the story, by the way – slay one problem and two grow back …). To finish the story, Hercules got some help from a buddy who burned off the heads of the Hydra as they tried to grow back from the decapitated stump. Let's just say that we don't have any stump-cauterizing buddies right now. A recent study by Jenkins, Nordhaus and

Shellenberger has evaluated the implications of this rebound effect for climate mitigation policy. They summarize "how multiple rebound effects operate at various scales, and describe rebound as an 'emergent property' with the greatest magnitude at the macroeconomic, global scale relevant to climate change mitigation efforts. Rebound effects are real and significant, and combine to drive a total, economy-wide rebound in energy demand with the potential to erode much (and in some cases all) of the reductions in energy consumption expected to arise from below-cost efficiency improvements."[109]

The Jevons Paradox raises significant concerns about the efficacy of efficiency-giving technologies in reducing total energy use and reducing carbon emissions. It challenges the expectation that greater efficiencies offered by alternative technologies will actually result in the decarbonization of the economy, or that it will actually allow us to match declines in the availability of fossil energy after peaking. This is particularly true since the highest rebound effect is expected in transportation, and space heating & cooling – exactly the areas where there is the highest use of fossil energy. This is why Jenkins, Nordhaus, and Shellenberger call it 'backfire'.

Food or Famine

How many times can a man turn his head
and pretend that he just doesn't see.

Bob Dylan

Roughly one in every six people on the planet is undernourished – that's a billion people. They wake up hungry, they spend their day trying to feed themselves, and they go to sleep hungry. We could probably do something about this, but these hungry represent the surplus population necessary to motivate those earning just enough money to feed themselves by working – accumulation of wealth at one pole means accumulating misery at the other. Though it is said that there is enough food being produced to feed the current population of the world (that undernourishment is a distribution or income problem), there are a number of factors that could be considered game-changers: energy to produce fertilizer and pesticides; energy for transportation; water to irrigate land for food production; the risks of relying on mono-cropping in industrial agriculture; the failure of GMOs to yield greater increases in production; and soil degradation and erosion.

The world has about 14 million square kilometers of arable land and permanent crop land – the land used to grow our food. Half of this land is used to grow 2.5 billion tonnes of cereals. There is another 35 million square kilometers of land that the FAO (2010 statistics) considers to be potentially cultivable, much of it being used for pastures or commons. Of the arable land currently in use for crop production, 20 percent is irrigated to grow roughly 40% of the world's food using 70%

of all water withdrawn from lakes, rivers and groundwater aquifers.[150] These irrigated crops rely on water which may become scarcer with shifting precipitation and diminishing groundwater sources.

The amount of land being brought under irrigation has slowed drastically in the past couple of decades.[151] This may be due to the better areas having already been developed, the prohibitive cost of infrastructure like dams and canals compared to current food prices, and it may partially be due to the difficulty of displacing people from marginal lands – what is marginal for a government is, by contrast, a livelihood for people. Another factor is the challenge of water scarcity. Since 2008 groundwater has been the primary source of irrigation water and most of the newly irrigated land has depended on exploiting this groundwater. Unfortunately, many of these groundwater aquifers are being depleted at rates much greater than the rate of replenishment – many are considered fossil aquifers which are effectively non-renewable. Water is also being removed from surface water sources like rivers at rates that leave little water to maintain the necessary in-stream flows to sustain the ecosystem, leading to species stress and extinction. As the impacts of climate change advance, the area of land considered water-stressed and water-scarce will increase, which will put even more pressure on maintaining even the existing land under irrigated cultivation (and, thus, maintaining the food required to feed a growing population).

Of the cereals grown in the world, roughly a third is maize, a third is wheat, and 20 percent is rice. Of the ten thousand traditional grains, many of them being more nourishing than the grains cultivated today, only 150 crops are being widely cultivated. The reliance on fewer crops reduces agricultural biodiversity and jeopardizes global food security as the impacts of climate change challenge the ability of crop species to adapt to water scarcity and average temperature increases, as well as to changing precipitation patterns that shift the distribution of water in both time and space. Furthermore, monoculture is more susceptible to pests and diseases and tends to unbalance the ecosystem upon which the agricultural system relies (for pollination and the benevolent interrelationships of species in the soil).

Grain production has increased steadily since the 'green revolution' that was prompted by the introduction of fertilizers, pumped irrigation, expanding lands under cultivation, machinery and industrial farming techniques (mono-cropping), and more recently the introduction of genetically modified plants. Yields have increased almost 150% since the 1960s. This steady increase in production for the past half-century has roughly maintained the production rate of grains at over 300 kg per capita each year, as the global population has grown. Half of this is used directly for human consumption, a third is fed to livestock, and about 5% is currently used for the production of biofuels. Pressure to increase biofuel production and meat production (which has almost quintupled worldwide over the past half-century) means that there will be less grain available for direct consumption, and will result in higher prices which, in turn, will prevent the two billion people living on less that $2 per day (purchasing power) to afford the food they need.

Despite diminishing access to new arable land for agriculture, the deterioration of the soil, and the threat of water scarcity for irrigated lands, many believe that genetically modified plants will make up the deficit in food production. Lester Brown, however, has said that the genetic modification of crop plants "have yet to produce a single variety of wheat, rice, or corn that can dramatically raise yields"[152] Gurion-Sherman in his 2009 study, *Failure to Yield*, substantiates this claim: "Bottom line: They are largely failing to do so. GE soybeans have not increased yields, and GE corn has increased yield only marginally on a crop-wide basis. Overall, corn and soybean yields have risen substantially over the last 15 years, but largely not as result of the GE traits. Most of the gains are due to traditional breeding or improvement of other agricultural practices."[153]

There has been some suggestion that GMO species have less genetic diversity and are more vulnerable to changes in the climate compared to natural species. There are also concerns of 'genetic pollution' where unintended modification of natural plant species affects ecosystem balance: a recent study states the "*potential for genetically modified (GM) crops to threaten biodiversity conservation and sustainable agriculture is substantial.*"[154] Furthermore, GMO seeds are generally reliant on greater amounts of water and require an increasing use of herbicides, pesticides and fertilizers, which then result in the poisoning of water systems including the eutrophication of many rivers and productive deltas where rivers meet the sea. Natural species of food plants tend to be more robust with changing temperatures, having developed more resilience over the millennia through which they have evolved.

Due to the growing pressure to respond to demand for food, GMO seeds have become a commercial input controlled by a small number of corporations (The Lauderdale Paradox): "The top 10 seed firms control 30 percent of the global seed market; five companies control 75 percent of the global vegetable seed market."[155] This commodification of seeds through intellectual property agreements and corporate pressure, in collusion with government force, has become a barrier for many nations to become involved in GMOs, and it has become a form of slavery for those who have adopted GMO seeds – borrowing money to buy seeds and the chemicals required to grow the seeds, and then relying on highly manipulated food prices to earn enough to pay back the loans. Thousands of Indian farmers have, as a result, committed suicide out of desperation to maintain this non-virtuous cycle.

Oligopolistic markets are roughly defined as a few companies controlling over 40 percent of the market, and able to exert influences on prices due to the non-competitive nature of the market. "In the meat sectors 87 percent (81 percent by the largest three) of the beef cattle are slaughtered by the four largest firms, and 73 percent of the sheep are processed by the four largest firms. The control of hog slaughtering by the four largest firms increased from 37 percent in 1987 to 60 percent today. … In the crop sectors, the four largest firms process from 57 percent to 76 percent of the corn, wheat, and soybeans in the United States."[156]

In the corporate food system, food is commodified and open to speculation by agri-business and the financial markets. The recent food crises have revealed the vulnerabilities of the population to food speculation, even with ample food harvests: "Food stocks are highly centralized – five corporations control 90 percent of the international grain trade, three countries produce 70 percent of the exported corn, and the thirty largest food retailers control one-third of the world grocery sales."[157] Clearly, making food or water a commodity (as opposed to a human right) makes a large percentage of the human population extremely vulnerable to the effects of scarcity - real or manufactured by corporate manipulation.

Fertile soil hosts some of the most diverse ecosystems on the planet. Plants have evolved in these ecosystems where bacteria, insects and other species help plants absorb nutrients and fight disease. Over-exploiting this soil and disrupting the ecosystem through the use of agricultural chemicals threatens the long-term productivity of the soil. Removing the crop from the fields further degrades the soil through the progressive loss of organic materials: "Long-term research studies reveal average losses of 328 pounds of organic matter per acre per year with plowing, … Erosion from a conventionally tilled watershed has been found to be 700 times greater than from a no-till watershed."[158] In essence, the organic materials are removed from the soil and shipped to the city, where they become 'waste' rather than being returned to the land. Fertilizers are then used to return nitrogen, phosphorous and potassium to the soil, but the many minerals required for nutrition are mined and seldom replaced. As such, the nutritional value of our food has been in steady decline.[159]

Fertilizer use has steadily increased with the growing rates of grain production and is used in the production of over 50% of the world's food supply. The nitrates and phosphorous in the fertilizers, when over applied, run off to the surface water during rainfall. The algae in the water respond well to fertilizers, resulting in algal blooms. When the algae die, they sink to the bottom of the river or lake and decay, and in this process the bacteria absorb oxygen from the water (also called biochemical oxygen demand, BOD). Life in the water is greatly diminished when there is not enough oxygen – this is called eutrophication. In other words, over-fertilization kills our rivers, lakes and the richly diverse regions where rivers meet the ocean. Furthermore, as herbicides and pesticides are applied in ever greater quantities in response to the degradation of the soil, they have become less effective: "Weeds, fungi, insects and other potential pests are amazingly adaptable. Five hundred species of insects have already developed genetic resistance to pesticides, as have 150 plant diseases, 133 kinds of weeds and 70 species of fungus."[160] As they become less effective, new chemicals have to be developed, adding to the complexity and cost of agricultural practices. At a point, we will be running to stand still.

Another factor threatening our ability to feed the global population in the future is the loss of soil to erosion and the reduction of the quality of remaining soil as it is unsustainably mined of minerals. According to the FAO, 25% of the total global land area is currently highly degraded[161]: "with more than 20 percent of all cultivated areas, 30 percent of forests and 10 percent of grasslands undergoing degradation."[162] Humans currently use 40% of the biomass grown each year[163] (that is, the sustainable products of photosynthesis), leaving more soil exposed to erosion, less organic matter being returned to the soil, and less habitat for other species to use. Haberl, Erb & Krausmann suggest that the human impact on the functioning of the biosphere is considerable, and exceeds natural variability in many cases: "Up to 83% of the global terrestrial biosphere have been classified as being under direct human influence, based on geographic proxies such as human population density, settlements, roads, agriculture and the like; [and] another study estimates that about 36% of the Earth's bioproductive surface is 'entirely dominated by man'."[164]

Population pressures cause marginal lands to be brought into cultivation and deforestation. The rain forests in Brazil are being deforested at a rate of about 12,000 square kilometer each year for agricultural use[165], and the land is fertile for only a few years. Climate change exacerbates both drought and flooding which also tends to intensify soil erosion.

> Since 1945, the total land degraded by soil depletion, desertification, and the destruction of tropical rainforests comes to more than 5 billion hectares, or greater than 43 percent of the Earth's vegetated surface. … It takes 500 years for nature to replace 1 inch of

> topsoil. Approximately 3,000 years are needed for natural reformation of topsoil to the depth needed for satisfactory crop production.[166]

The three main factors contributing to soil erosion are urbanization, deforestation, and industrial agriculture. It is estimated by the FAO that 5 to 7 million hectares of land is lost to erosion each year. Worldwide, some 70 percent of the 5.2 billion hectares drylands used for agriculture are already degraded and threatened by desertification.[167] "Soils of farmlands used for growing crops are being carried away by water and wind erosion at rates between 10 and 40 times the rates of soil formation, and between 500 and 10,000 times soil erosion rates on forested land."[168] In the US, "a million acres disappear annually to urbanization and 2 million acres of farmland are lost to erosion, soil salinization, and flooding or soil saturation as a result of intensive agriculture, which consumes groundwater 160 percent faster than its replenishment rate."[169]

> As we chop down rain forests and pipe water deep into deserts, we are fast approaching the time when all land that can be used to grow food has been found, transfigured, and put into production. As we run out of places to grow food, we are pouring roads and building foundations over former farmland, strip-mining the nutrients from our soil, polluting our groundwater and soil, and filling huge tracts of land with salts so that nothing will grow there anymore."[170]

In addition to land degradation and erosion, demands to increase global biofuel production take arable land out of food production. In Africa "at least 50 companies are involved in projects that have already put 3.2 million hectares of land into bio-fuel production cutting food supplies, and increasing dispossession and landlessness."[171] Adding to soil degradation, desertification and erosion, consider a 1-meter rise in ocean levels which, according to the IPCC, will wipe out a third of the land currently used to grow crops.

In the next few decades the amount of food produced must increase by 70% given an expected population of over 9 billion[172]. This will have to occur with less land, less fertility in the soil, less water (in quantity and quality), less *predictable* water, declines in crop yield due to climate change, and declining harvest from the ocean. Our inability to respond to these challenges is manifested in the increasing cost of food: "The onset of the global slump briefly arrested the escalation of food prices that had produced a wave of riots in 2008. But now, as the crisis changes form, they are on the rise once again and reaching unprecedented heights. Indeed, by late 2010 the UN Food and Agriculture Organizations' food price index hit an all-time high, after rising a staggering 32 per cent in the last half of that year."[173] As the U.N. World Food Programme has said, "A hungry world is a dangerous world. Without food, people have only three options: They riot, they emigrate, or they die. None of these are acceptable options."

This is not to argue that the earth cannot sustain 9 billion people. The point is that 9 billion people need food, which needs fertile soil, which needs water to grow the food, which needs energy inputs to plant the seeds, to pump the water, to harvest the food, and to transport the food around the world to the global population. And the amount of arable land, water and energy available to do this will depend a lot on Lifestyle, Organization and Technology. We have argued that Organization is unlikely to respond in a timely way – why should it when there is good money to be made? We have argued that most people will not change their Lifestyle, like reducing meat consumption and urban sprawl. And we have argued that Technologies like industrial farming and GMOs have been exploited to their potential and may in fact become detrimental to productivity due to changes in the future compared to low-impact organic farming and the cultivation of species of grains that have evolved to the geography and climate over millennia. In other words, we are unlikely to respond to food scarcity, and we are unlikely to be able to do so, even if we wanted to, given the twin carbon challenges of peak oil and climate change.

With respect to climate change: "The data point strongly toward a worldwide decrease in crop productivity if global temperatures rise more than 5°F (2.7°C) – well within the range of current predictions – although crop yields from rain-fed agriculture could be reduced by half as soon as 2020. … In addition, the rise in temperature may already be adversely affecting some crops – with higher night temperatures increasing nighttime respiration by rice (and perhaps other crops), resulting in the loss of metabolic energy produced by photosynthesis during the previous day."[174] And the prospect of responding to food scarcity with the advent of peak oil is unlikely, as we are essentially eating oil.

"In October 2009, Luc Gnacadja, executive secretary of the United Nations Convention to Combat Desertification, reported that based on current trends close to 70 percent of the land surface of the earth could be drought-affected by 2025, compared to nearly 40 percent today."[175]

John Bellamy Foster