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IT'S COMPLICATED: THE ROLE OF LAND IN GLOBAL WARMING

An NPG Forum Paper
by Edwin S. Rubenstein

There they go again: Another massive UN climate change report - 107 authors, from 53 countries, examining 7,000 research articles. Another exercise in denial. The Intergovernmental Panel on Climate Change's special report on land, rolled out in Geneva in early August, takes on two questions: how land use contributes to climate change, and how climate change affects land.[1]

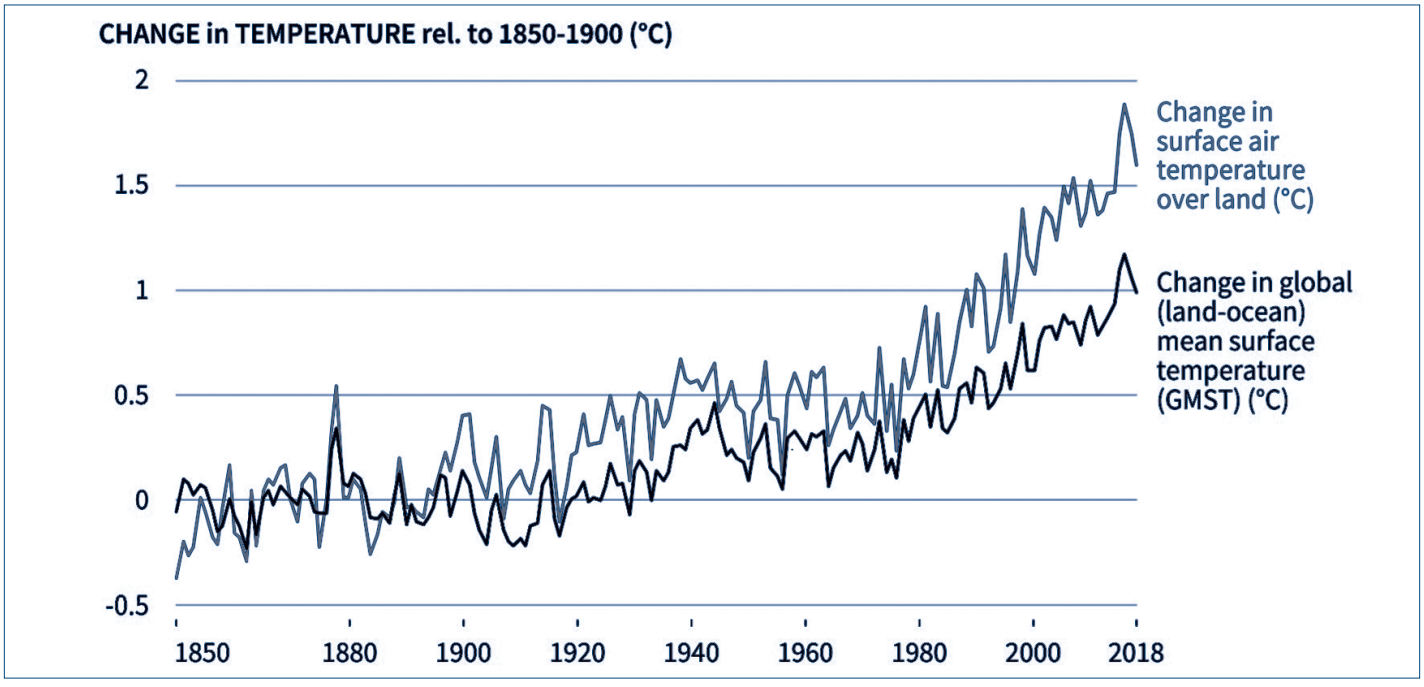
Ask the man in the street about the causes of global warming and he will rattle off things like factories, power plants, gas guzzling vehicles, and other modern activities driven by fossil fuels. But agriculture? There are no clouds of smoke wafting over corn fields or pastures. Agricultural optics are squeaky clean. Farmers get a free pass.

Reality check: CO_2 is colorless and odorless. It is trapped in the Earth during the process of photosynthesis. From the moment man first tilled the soil for crops and pastureland he released CO_2 into the atmosphere.

The study lays out a crucial, even cruel, paradox. Humans have harnessed land to become the highly successful species we are today. But our destructive patterns of land use – particularly agriculture, deforestation, and the development of wetlands - now contribute 23% of all human caused greenhouse gas emissions.

The good news: Earth still removes more emissions than it emits. Land currently removes a net 6 gigatons of greenhouse gas emissions per year, equivalent to the entire annual emissions of the United States.[2]

The bad news: The ability of land to cleanse the atmosphere is being slammed by climate change. UN Scientists find that land temperatures increased 1.5 degrees C. (2.7 degrees F.) between 1850-1900 and 2006-2015, 75% more than the global average which reflects temperature changes over both land and oceans:



Virtually every idea and concept in *Climate Change and Land* has been discussed by NPG and other population control groups. The only thing missing is, well, our main thing: the need to reduce global population to halt the degradation of the Earth's land and water resources.

Not one of the scientists commissioned by the UN explicitly acknowledges the need to cut population. Instead, the UN-ers present a potpourri of weak alternatives that, absent population reduction, could actually make things worse.

For example, the UN report finds that large-scale planting of new forests in treeless areas could offset large amounts of CO_2 but would require repurposing land currently used to grow crops. That could potentially increase food prices by 80% and put up to 300 million people at risk of hunger, according to report author Pamela McElwee, an associate professor of ecology at Rutgers University.[3]

"That's a very serious trade-off," McElwee says, adding **"Let's understand those trade-offs now and think about them, but also think about things that maybe would help us avoid those trade-offs."**

A smaller global population would, of course, do just that, by enabling new forest land to coexist with *lower* food prices. But that will take time, lots of time.

Twenty years ago a group headed by David Pimentel, Professor of Ecology and Environmental Biology at Cornell University, suggested that Earth's carrying capacity was 2 billion people. At that level a European standard of living could be made available to everyone indefinitely, with no diminution in land, water, and energy supply resources.

But getting there, Pimentel acknowledged, would be daunting:

"…**If the whole world agreed on and adopted a policy so that only 2.1 children were born per couple, more than 60 years would pass before the world population finally stabilized at approximately 12 billion … On the other hand, a population policy ensuring that each couple produces an average of only 1.5 children would be necessary to achieve the goal of reducing the world population from the current 6 billion to an optimal population of approximately 2 billion …If this policy were implemented, more than 100 years would be required to make the adjustment to 2 billion people."**[4]

In retrospect, Pimentel was a cockeyed optimist: Global population in 2019 - 7.7 billion - is projected to reach 9.7 billion by mid-century, and 10.9 billion in 2100.[5] No stabilization is in sight: every year brings a larger world population. And world population growth alone – 3.2 billion by 2100 according to the UN – exceeds by a wide margin Pimentel's estimate of the total carrying capacity of Planet Earth (2 billion.)

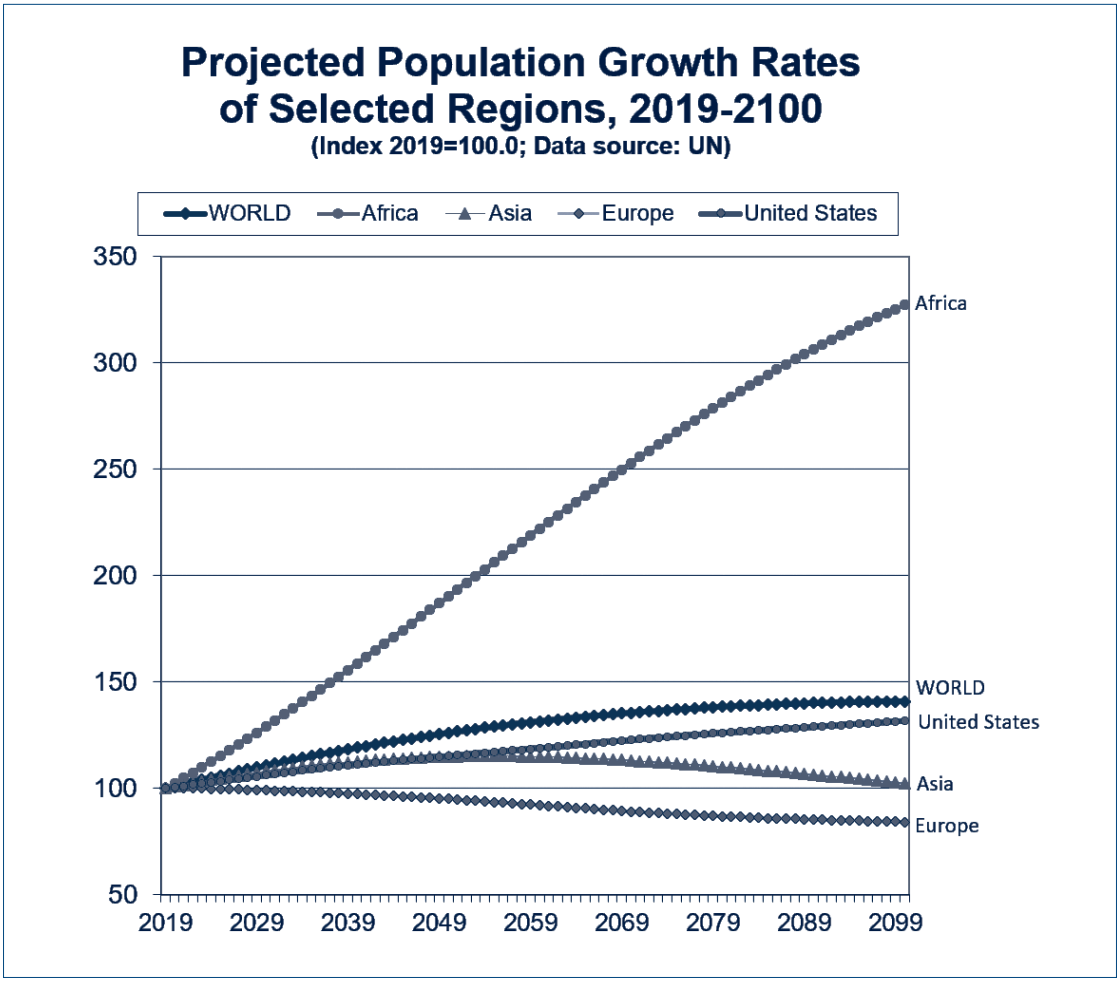
Where in the world is growth coming from? Not Europe or Asia: Europe's population is already shrinking, and Asia's will start to decline after mid-century. Fueled by immigration, U.S. population is projected to reach 434 million in 2100, up a whopping 32% from today's level.

But the really big gains, as the graphic makes painfully clear, will come from Africa.

For every 100 Africans living today there will be 327 in 2100, according to the UN. The continent's population, currently 1.3 billion, will reach 4.3 billion. More than 93% of global population growth will emanate from Africa.

Meanwhile, global warming is eroding land and water resources faster than Pimentel could ever imagine, and his assertion that reforestation technologies are "**currently available**" and **"...only need to be implemented**"[6] has run afoul of political reality in Brazil and other developing countries.

We have reached a breaking point with the land itself and its ability to sustain human population at its current level. Absent population reduction, the following measures are mere coping strategies rather than long-term solutions to the climate crisis.



MITIGATION VIA MIGRATION

"People's lives will be affected by a massive pressure for migration…People don't stay and die where they are. People migrate." - Pete Smith, a professor of plant and soil science at the University of Aberdeen, and one of the UN report's chief authors.[7]

The links between population growth, climate change, famine, and migration may not be immediately obvious, but they are there. The flow of immigration from hot, poor countries to temperate relatively wealthy ones is already redefining politics in the United States, Europe, and other parts of the world.

Between 2010 and 2015 the number of migrants from El Salvador, Guatemala and Honduras showing up at the U.S. border with Mexico increased 5-fold, coinciding with a dry period that left many with not enough food and was so unusual that scientists saw it as a signal of global warming.[8]

One of the largest mass migrations in modern times – the shift of 1.5 million asylum seekers from Syria to Europe, mainly to Germany, in 2014-2015, was likely triggered by a prolonged regional drought in Syria.[9] Three ecological factors: human population increase, resource scarcity, and climate change, created conditions conducive to civil conflict and, eventually, civil war. Angela Merkel's benevolence, applauded at the time, ended badly. The new migrants, most of them young men from across the Muslim world, led to a rise in German right-wing extremism for the first time since the 1930s.

Population pressures emanating from the Middle East are trivial alongside those percolating in Africa. In 1950 the Saharan country of Niger, with 2.6 million people, was smaller than Brooklyn. In 2050, with 68.5 million people, it will be the size of France. By that time, nearby Nigeria, with 411 million people, will be considerably larger than the United States. In 1960, Nigeria's capital, Lagos,

was smaller than Newark; it is now 60 times larger than it was then, with a population of 21 million, and is projected to double again in size in the next generation, making it the largest city in the world, with a population roughly the same as Spain's.[10]

Water, always a scarce commodity in that part of the world, is in free fall. Lake Chad, for instance, a source of water for 30 million people in Niger, Nigeria, Cameroon, and Chad, is a tenth the size it was in the 1960s, and it is about to dry up.[11]

Sub-Saharan migration across the Mediterranean is still relatively small — some 200,000 people a year. But what happens when the continent's population doubles in the next 30 years?

REFORESTATION

"The lungs of the Earth are in flames." – Leonard DiCaprio, to his nearly 34 million Instagram followers.[12]

It is well known that plants absorb sunlight, CO_2, and water to use in photosynthesis, the process by which they grow and then release oxygen as a byproduct. Most of the oxygen in the atmosphere is produced by this process; human life on Earth would be extremely difficult without it.

The Amazon Rainforest, the largest rainforest in the world, produces about 20% of the world's oxygen, which is why it is often called the world's lungs.

The same process takes CO_2 out of the atmosphere and stores it in the ground – which is why they are often called carbon "sinks." The Yale School of Forestry and Environmental Studies reports that all tropical forests combined are sinks for about 25% of all global CO_2 emissions.

"**For reference, if the entire Amazon forest was lost, and that Carbon emitted into the atmosphere, it would be the equivalent to 140-years of all human-induced carbon emissions.**"[13]

We may be headed that way. Data released by Brazil's National Institute for Space Research shows that from January to July 2019 fires destroyed 4.6 million acres of the Brazil rainforest, a 62% increase from last year.[14] Many were deliberately set by commercial interests, serene in the knowledge that the new President, Jair Bolsonaro, is on their side.

This is but the latest chapter in an old story. Half a century ago the Amazon covered an area about the size of the lower 48 United States. Since then nearly 20% of that area has been lost to loggers, miners, and industries that want access to protected lands.[15]

In a country like Brazil, political corruption is the wild card. Prior presidents, while they looked the other way on occasion, supported the enforcement of strict environmental laws and regulations. Bolsonaro, by contrast, is actively creating incentives for industries to break the law with impunity.

One example: Brazil's environmental agencies had been allowed to destroy the equipment and vehicles of people caught working in protected areas. Bolsonaro ended the practice.[16]

Carlos Quesada, with Brazil's National Institute for Amazonian Research, warns that the world's greatest CO_2 sink now may be emitting them. **"You already have a fragile system that may be on the edge,"** Quesada says, **"and then you bring on fragmentation, deforestation, cattle ranching, illegal logging."**[17]

And the fires themselves.

Not to worry, eco-optimists say: We can always reforest.

Reforest. Reforest. Reforest. It has become the refrain of frustrated environmentalists.

If it were only that easy.

Trees in tropical rainforests grow faster, have bigger, brighter leaves than those in non-tropical settings. They are the perfect carbon sink. When they are destroyed by fire, however, they often become swampland, belching methane into the sky. By some estimates, methane has 80 times the

heat-trapping power of carbon dioxide in the first 20 years in the atmosphere.[18]

Genetically modified trees have been developed to grow faster than the ones destroyed by fires. But a forest, writes climate change reporter Umair Irfan, is **"…more than its trees — it's the animals that spread seeds, the bacteria that fix nitrogen in the soil, and the fungi that digest decaying leaf litter. You need the whole community to create a healthy forest ecosystem, so restoring a forest requires carefully cultivating and balancing all these elements**."[19]

That takes time. The Amazon ecosystem has developed over many centuries.

The next step, after reforestation, is afforestation, which involves growing forests in areas where there were none before. Why not grow biofuel forests on croplands – plants and shrubs that can replace fossil fuels and also serve as carbon sinks?

Sounds good. But there is only so much land humans can repurpose before we run into environmental trade-offs. **"While land can make a valuable contribution to climate change mitigation, there are limits to the deployment of land-based mitigation measures such as bioenergy crops or afforestation,"** according to the UN report. "**Widespread use at the scale of several millions of [square kilometers] globally could increase risks for desertification, land degradation, food security and sustainable development**."[20]

This report gave the UN an opportunity to tout population reduction as the missing link in climate change mitigation. The international organization flubbed it.

Eat, Drink, and Be Merry, For Tomorrow We Diet

"Cattle raised on pastures created by clearing woodlands are particularly emission intensive. This practice often comes with large scale deforestation…Cows also produce large amounts of methane…as they digest their food."[21]

"10,000 years ago, humans made up 1 per cent of the weight of vertebrate land animals: the rest were all wild. Today wild animals make up just 1 per cent. The other 99 per cent is humans, our farmed animals and our pets."[22]

The factoids say everything about the role diet plays in global warming.

Paleolithic man lived within what economist Herman Daly calls the "solar-income budget," limiting consumption of food and other materials to the regenerative power of Earth's biosphere. The sun will shine at a constant rate for billions of years. It is the ultimate renewable. It powers photosynthesis, the source of all plant and vegetable growth.

Daly called this economic system a Steady State Economy.

The basic idea behind the Paleo diet is that we homo sapiens evolved under predictable circumstances for most of our time on Earth, but when those circumstances changed in the last century, our bodies did not keep pace. Historically meat was for the privileged few and obesity was a sign that you had made it. With the advent of industrial style farming meat became relatively cheap, and obesity became a public health issue. The deleterious impact of animal fat on health was not appreciated until meat became a mass consumption item.

A paleo diet is possible - if you can afford it. Advocates recommend eating the plants and animals we ate when we were hunter-gatherers. This means cutting out whole grains (agriculture was not "invented" until well after the paleolithic era) and eating unprocessed meat of animals grazed on pastureland. While meat from cows grazed in pastures is less fatty than meat from cows fed grain in conventional industrial feedlots, prices are higher. Despite all the buzz the paleo diet is relatively rare, with only 1% of Americans surveyed following it.[23]

If the diet swept the world we would still be in trouble. How many Earthlings can regularly eat meat without despoiling the environment? Even

paleo activists acknowledge limitations. Lierre Keith, author of the Vegetarian Myth was the "… first to admit that there is not enough land to graze enough animals to feed everyone and adamantly calls for population control, a radical agrarian overhaul, and the dismantling of patriarchy as the only hope for human survival."[24]

Eight billion people on Paleo diets is an ecological disaster. Eight billion on conventionally grown grains and vegetables is another recipe for disaster. There simply isn't enough land on the planet to feed eight billion people on *any* diet without incurring horrific climactic consequences.

Other food-based efforts deserve our attention. One easy option is to cut food waste. More than one-quarter of all food produced in the world is wasted, contributing to almost 10% of anthropogenic emissions.[25] Much food is grown but never harvested, left to rot in the field. Better supply-chain management – cutting the time between food production and consumption – would help.

These options, while necessary, are not sufficient to enable the 50% drop in emissions IPCC says is needed to reach zero net emissions by 2050. Only population control can produce changes of that magnitude.

Someone should tell the scientists hired by the UN.

RENEWABLES TO THE RESCUE?

Hydro, solar, and wind are the great green hopes of renewable energy fans. It's hard to find a more unquestioned assumption than it will be possible to substitute these sources for coal, oil, and other land-based fossil fuels. But objective analysis shows these assumptions are without merit.

Hydropower is the largest source of electricity in the world, accounting for 20% of global output, though only 2% in the U.S. While hydropower plants themselves do not emit greenhouse gases, the dams and reservoirs associated with them do. The greenhouse gas emitted from dams is methane (CH_4), a close carbon cousin of carbon dioxide (CO_2).

Most reservoirs – here and around the world – are in rural, agricultural areas. They emit methane because bacteria that feed on underwater agricultural runoff breathe out methane.

Climate scientists believe that 20% of all man-made methane emissions are generated from reservoirs. It may be far more. When the EPA studied methane emissions from Harsha Lake near Cincinnati, they found more CH-4 emissions than had ever been recorded at any reservoir in the country. Amy Townsend-Small, one of the study's authors, may have understated the peril when she said: "It could be that these agricultural reservoirs are a larger source of atmospheric methane than we had thought in the past."[26]

This raises the prospect of a vicious cycle, where increased reliance on hydropower feeds global warming, which in turn reduces the capacity of hydro plants to produce energy. Hoover Dam is a case in point. In the space of a year the Hoover power plant essentially shrunk in half, from about 2,100 megawatts of generation in early 2014 to 1,200 megawatts in spring 2015, all because of the impact of the drought.[27]

Solar and wind power are equally problematic.

Millions of homeowners have installed rooftop solar panels with great success. They enjoy cheaper and cleaner power while remaining on the grid. No sun? No problem: the system switches seamlessly to the electric grid. Solar is just a backup power source for most residences.

But using solar to run commercial size power plants is another thing entirely. Sunlight is free, but the sun doesn't shine equally over the course of a day. In the heat of the day solar power plants can meet demand with little help from nuclear or fossil fuel backups. When people come home from work and turn on their appliances sunlight has diminished, and the demand for back-up (non-solar) energy spikes dramatically. Problem is,

nuclear and even conventional power plants cannot start or stop on a dime.

One "solution" – proposed by an eminent Stanford University professor of engineering - would have solar plants generate more power than their customers need during sunlight hours, and require customers to store this power for use during periods of darkness.

A modest proposal for the ivory tower, but not for the real world: By some calculations 29.3 billion solar PV storage panels are required just to replace the fossil fuel capacity expected to be retired over the next 25 years. An area the size of New Jersey would be needed to store them.[28]

As for wind power, up to 360 square miles of wind farm is needed to produce the same amount of energy as a 1,000 MV nuclear plant.

Bottom line: mass deployment of solar or wind power will destroy natural habitat on a scale that diminishes the most effective decarbonization process known to mankind: photosynthesis.

CONCLUSION

Land is both a source and a sink for greenhouse gas emissions. Global warming erodes the ability of land to grow the trees and plants needed to remove atmospheric emissions, as well as the crops required to feed a growing population. Farmers respond by increasing the use of chemical fertilizers or putting new land under cultivation. Both activities increase global warming.

A vicious cycle is in place.

One way or another the cycle will end. The question is, how? Will it take a calamity marked by starvation, mass migration, and war, or will it be a soft landing guided by reforestation, dietary change, and population control?

Stay tuned.

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