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The other inconvenient truth: The crisis in global land use

Jonathan Foley

As the international community focuses on climate change as the great challenge of our era, it is ignoring another looming problem — the global crisis in land use. With agricultural practices already causing massive ecological impact, the world must now find new ways to feed its burgeoning population and launch a “Greener” Revolution.

It’s taken a long time, but the issue of global climate change is finally getting the attention it deserves. While enormous technical, policy, and economic issues remain to be solved, there is now widespread acceptance of the need to confront the twin challenges of energy security and climate change. Collectively, we are beginning to acknowledge that our long addiction to fossil fuels — which has been harming our national security, our economy and our environment for decades — must end. The question today is no longer why, but how. The die is cast, and our relationship to energy will never be the same.

Unfortunately, this positive shift in the national zeitgeist has had an unintended downside. In the rush to portray the perils of climate change, many other serious issues have been largely ignored. Climate change has become the poster child of environmental crises, complete with its own celebrities and campaigners. But is it so serious that we can afford to overlook the rise of infectious disease, the collapse of fisheries, the ongoing loss of forests and biodiversity, and the depletion of global water supplies?

Although I’m a climate scientist by training, I worry about this collective fixation on global warming as the mother of all environmental problems. Learning from the research my colleagues and I have done over the past decade, I fear we are neglecting another, equally inconvenient truth: that we now face a global crisis in land use and agriculture that could undermine the health, security, and sustainability of our civilization.

Our use of land, particularly for agriculture, is absolutely essential to the success of the human race. We depend on agriculture to supply us with food, feed, fiber, and, increasingly, biofuels. Without a highly efficient, productive, and resilient agricultural system, our society would collapse almost overnight.

But we are demanding more and more from our global agricultural systems, pushing them to their very limits. Continued population growth (adding more than 70 million people to the world every year), changing dietary preferences (including more meat and dairy consumption), rising energy prices, and increasing needs for bioenergy sources are putting tremendous pressure on the world’s resources. And, if we want any hope of keeping up with these demands,

we’ll need to double, perhaps triple, the agricultural production of the planet in the next 30 to 40 years.

Meeting these huge new agricultural demands will be one of the greatest challenges of the 21st century. At present, it is completely unclear how (and if) we can do it.

If this wasn’t enough, we must also address the massive environmental impacts of our current agricultural practices, which new evidence indicates rival the impacts of climate change. Consider the following:

Ecosystem degradation. Already, we have cleared or converted more than 35 percent of the earth’s ice-free land surface for agriculture, whether for croplands, pastures or rangelands. In fact, the area used for agriculture is nearly 60 times larger than the area of all of the world’s cities and suburbs. Since the last ice age, nothing has been more disruptive to the planet’s ecosystems than agriculture. What will happen to our remaining ecosystems, including tropical rainforests, if we need to double or triple world agricultural production, while simultaneously coping with climate change?

Freshwater decline. Across the globe, we already use a staggering 4,000 cubic kilometers of water per year, withdrawn from our streams, rivers, lakes and aquifers. Of this, 70 percent is used for irrigation, the single biggest use of water, by far, on the globe. As a result, many large rivers have greatly reduced flows and some routinely dry up. Just look at the Aral Sea, now turned to desert, or the mighty Colorado River, which no longer sends any water to the ocean, for living proof. And the extraction of water from deep groundwater reserves is almost universally unsustainable, and has resulted in rapidly declining water tables in many regions of the world. Future water demands from increasing population and agricultural consumption will likely climb between 4,500 and 6,200 cubic kilometers per year, hugely compounding the impacts of climate change, especially in arid regions.

Widespread pollution. Agriculture, particularly the use of industrial fertilizers and other chemicals, has fundamentally upset the chemistry of the entire planet. Already, the use of fertilizers has more than doubled the flows of nitrogen and phosphorus compounds in the environment,

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resulting in widespread water pollution and the massive degradation of lakes and rivers. Excess nutrient pollution is now so widespread, it is even contributing to the disruption of coastal oceans and fishing grounds by creating hypoxic “dead zones,” including one in the Gulf of Mexico. Given our current practices, future increases in food demand will dramatically increase water pollution and ecosystem destruction through agricultural effluent. Ironically, the fertilizer runoff from farmlands compromises another crucial source of food: coastal fishing grounds.

Greenhouse gas emissions. Last, but certainly not least, land use is also one of the biggest contributors to global warming. Of the three most important man-made greenhouse gasses — carbon dioxide, methane and nitrous oxide — land use and agricultural practices, including tropical deforestation, emit 30 percent of the total. That’s more than the emissions from all the world’s passenger cars, trucks, trains and planes, or the emissions from all electricity generation or manufacturing. Compared to any other human activity, land use and agriculture are the greatest emitters of greenhouse gasses. The vast majority comes from deforestation, methane emissions from animals and rice fields, and nitrous oxide emissions from heavily fertilized fields. Yet, for some reason, agriculture has been largely able to avoid the attention of emissions reductions policies.

The list of environmental impacts from agricultural land use goes on and on — and clearly threatens human well-being and the health of the biosphere as much as global warming. In fact, in a recent paper in *Nature*, a number of us documented “**planetary boundaries**” where **large-scale environmental changes could result in catastrophic tipping points**. Of those changes, an equal number were tied to climate change and CO₂ emissions as were connected to land-use and agriculture.

From these newly revealed facts, it’s clear that we must consider multiple inconvenient truths. *The future of our civilization and our planet requires that we simultaneously address the grand challenges of climate change and land use, ultimately finding new ways to meet the needs of our economy, our security and the environment.* Anything less will be a complete catastrophe.

So, what are the solutions to the global land crisis?

Here are just a few to start with:

First, acknowledge the problem. Even in circles of well-informed scientists and agricultural experts, the notion that our land use and agricultural practices rival climate change as a global environmental threat comes as a big surprise. Clearly we need to have a larger international

conversation about this issue, on par with the recent efforts of the climate change community and Al Gore, to give it the attention it deserves.

Invest in revolutionary agricultural solutions. The Obama administration has invested billions of dollars into new energy technology, research and infrastructure, and aggressive plans for new climate mitigation policies are being developed. These strategies are important, but I wonder where the stimulus funding for new “out of the box” agricultural research is? Where are we investing public dollars in revolutionary approaches to feeding the world, while reducing the environmental impacts of agriculture? These might include the development of new hybrid crops, designed to use water and nitrogen more efficiently, or the invention of perennial crops that don’t need to be planted every year. Don’t such ideas count as national priorities, too? Can’t we afford to launch a “Greener” Revolution?

Bridge the artificial divide between production agriculture and environmental conservation. We cannot solve these problems by boosting agricultural production at the expense of the environment, nor can we ignore the growing need for food in the name of preserving natural ecosystems. Instead, we must find ways to simultaneously increase production of our agricultural systems while greatly reducing their environmental impacts. This is not going to be easy. Yet, drawing on the lessons from recent research, including the successes and failures of local organic practice, combined with the efficiency and scalability of commercial agriculture, will be crucial. In recent years, for example, U.S. farmers — working with agricultural experts — have dramatically improved practices in the corn and soybean belt, cutting down on erosion, nutrient loss, and groundwater pollution, even as yields have continued to increase. As a first step, advocates of environmental conservation, organic farming and commercial agriculture all need to put down their guns and work toward solving the problems of food security and the environment — with everyone at the table.

Providing for the basic needs of 9 billion-plus people, without ruining the biosphere in the process, will be one of the greatest challenges our species has ever faced. It will require the imagination, determination and hard work of countless people from all over the world, embarked on one of the noblest causes in history.

But the first step is admitting we have more than one problem.

