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Recognizing and Managing the Tropical Agricultural Revolution in Latin America and the Caribbean

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Contents

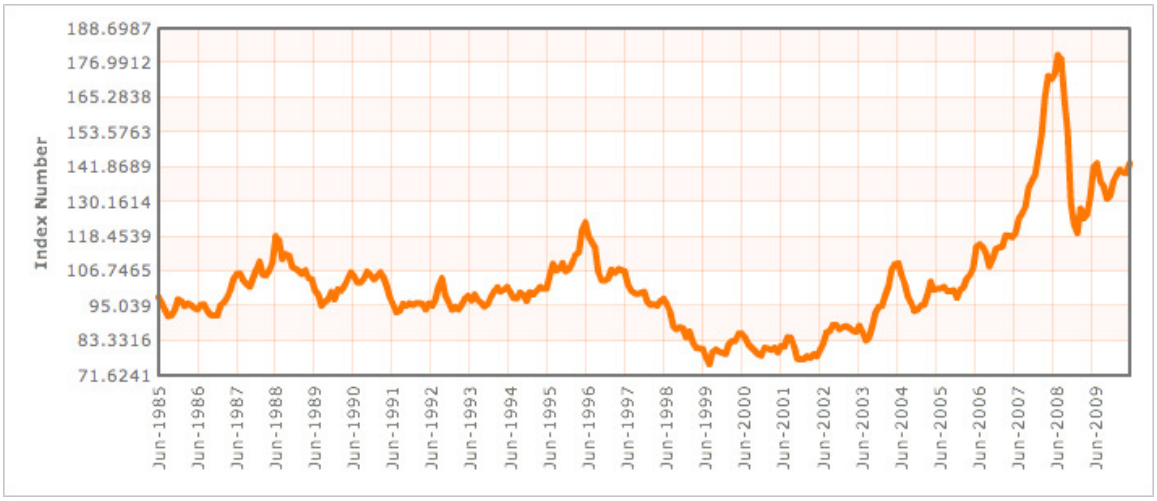
Following on the heels of the well-known Green Revolution, a new agricultural trend has been identified: the tropical agricultural revolution.[i] This can be broadly defined as a global shift in the expansion of agricultural commodity production from the temperate zone to the tropical latitudes, and it is most prevalent in Latin America and the Caribbean. The tropical agricultural revolution carries both risks and opportunities for food security, biodiversity, and climate change mitigation. It differs from the previous emergence of tropical food commodities—coffee, chocolate, bananas, and others—in that tropical nations are increasingly responding to the rising global demand for protein, calories, and biofuels that industrial nations are less capable of meeting. From the perspective of global food security, the rapid expansion of agricultural production in tropical nations has become key to avoiding chronic and disruptive global food shortages.[ii]

A Global Shortage of Agricultural Production?

World food shortages appeared in dozens of countries in 2007 and 2008, providing an early glimpse of a possible global food crisis.[iii] The food price index reached its highest level in 30 years in 2007/2008 (see Figure) and declined only as the global economic recession began to shrink or slow major economies. Still, the index remained above the average pre-2007 price, and in 2010 food commodity prices rose again. The OECD/FAO world food outlook for the next 10 years predicts that food prices will on average be 20–40 percent higher than during the decade prior to 2007.[iv] The long-term shortages of land-based commodity production that underlie the projected increases in food prices are an important stimulus for increasing the flow of investments into tropical agriculture and the conversion of tropical forests into industrial farms.

Latin America and the Caribbean is the most important region for the tropical agricultural revolution over the next decade because of the stability of many governments in the region and its enormous potential for expansion of land-based production. Sub-Saharan Africa, in contrast, has room for expansion but precarious institutions and governments. Although the major non-tropical region of potential agricultural expansion—Eastern Europe—could meet some of the growing demand for food, it too suffers from low institutional capacity and stability.[v]

Global Commodity Food Price Index, 1985–mid-2010



Index number 100 is the average for the entire period. Source: IMF, *Commodity Food Price Index Monthly Price*, 2010.

Participation in the revolution varies greatly in Latin America and the Caribbean, depending on the potential for agricultural expansion onto new land. Brazil is where the revolution is most advanced, with a modern agro-industrial sector that many observers expect to meet half or more of the expanded global demand for food, fuel, fiber, and feed over the next decade. Argentina is another agricultural superpower, but with far less potential for expanding production. Other large nations with substantial forest estates and high potential for agricultural expansion—including Bolivia, Colombia, Venezuela, Peru, and Mexico—could be strongly affected by this revolution. Each nation could respond to higher food prices through expanded agricultural production and exports. Many of the region's smaller nations have lost their self-sufficiency in food through reforms of their farm sectors to promote greater exports that were implemented in the context of structural adjustment policies. They could become even less food self-sufficient because of the tropical agricultural revolution.

The causes of escalating food prices and the shift of expansion in agricultural output to the tropical latitudes are complex. One set of factors is leveling off the rapid growth in land-based production that was ushered in during the Green Revolution. A second set of factors is increasing the demand for land-based production. In other words, growth in supply is becoming flatter, but growth in demand is accelerating.

The supply of land-based production is growing more slowly in part because agricultural yield gains are leveling off in industrial agricultural systems around the world.[vi] Yield

improvements achieved through Green Revolution technologies are providing smaller incremental gains.[vii] The area of prime agricultural land that is not already under cultivation is also diminishing in the temperate zone. Only 10 percent of the world's land suitable for rain-fed agricultural expansion is found in industrial nations; in contrast, Latin America and the Caribbean holds one-fourth of this potential.[viii] The region also has the greatest potential for irrigated agriculture, with abundant, reliable water resources (except for the glacier-fed Andean agricultural regions). In the temperate zone, with the important exception of Eastern Europe, increasingly the land on which agriculture could potentially expand is only marginally suitable for crops or is under formal protection against conversion to cropland.

New factors are also contributing to the leveling off of land-based production. Climate-related disruptions in agricultural output, such as the 11-year drought that devastated the Australian rice industry, are restricting agricultural production at the global scale, pushing prices up. In 2010, the failure of the Russian wheat crop following severe drought and fire could provide an early glimpse of the impacts of anthropogenic climate disruption. It is impossible to know with certainty if these individual weather anomalies are the direct result of human-caused climate change, but they are consistent with the predictions of a warming world.[ix] The growth of agricultural output is also slowing through the loss of farmland to urbanization, soil erosion, and degradation through salinization.

The demand for land-based output is growing rapidly in large part because of economic growth in China, India, South Africa, Brazil, and other emerging economies and the increased consumption of meat and dairy products that accompanies growing affluence. It takes 3–10 times as much agricultural land to produce a gram of animal protein as a gram of vegetable protein, which means that rising meat consumption increases the need for new agricultural land or higher yields. In just 15 years, China has gone from a nation that imports virtually no soy (the best source of vegetable protein for animal feed) to being the world's leading importer of this commodity.

The growing demand for land-based production is reinforced by policy decisions in the European Community and the United States—decisions stimulated by rising oil prices—to increase the contribution of biofuels to national fuel supplies.[x] The impacts of these policy decisions have been striking, particularly in the United States, where corn production increased at the expense of soy production to supply the new market for corn-derived ethanol. These

decisions may also trigger indirect changes in land use in the tropics, as the rising prices of soy and sugar drive the expansion of these crops in Latin America.[xi]

An important factor here is the development of new varieties of crops that can withstand the high humidity and temperatures of moist tropical regions. New soy varieties introduced a decade ago in the northern Cerrado and southern Amazon region of Brazil yield more soy than in the United States, for example.[xii] As Gonzalo Castro notes in his article, EMBRAPA played an important role in developing technologies and crop varieties for this transition.

The speed of the tropical agricultural revolution in Latin America and the Caribbean will depend on several important overarching factors. Currency exchange rates (and hence the competitiveness of the region's products in international markets) will determine how quickly agricultural expansion takes place.[xiii] Cattle ranching—for most nations, the major land use in terms of area of land occupied[xiv]—will also shape agricultural expansion.[xv] If rapid progress is made in increasing the stocking density of the regional cattle herd,[xvi] much of the agricultural expansion that is anticipated could be accommodated on lands that have already been cleared of native forests and savannas. Similarly, the REDD+ program, which will create incentives for nations that slow carbon emissions from the clearing and degradation of native forests, could keep much of the anticipated agricultural expansion within lands that have already been cleared.

Consequences of the New Revolution

The consequences of the tropical agricultural revolution for Latin America and the Caribbean vary greatly across nations and regions. The anticipated growth of the agricultural sectors in many nations could lead to higher rates of economic growth, more jobs, and higher export revenues. Properly managed, it could also increase food security. In addition to these important positive aspects there are some important risks, however. Agro-industrial farming often uses far more fertilizer, chemical pesticides, and water than smallholder production systems aimed at local markets and therefore risks contamination of surface and groundwater, soils, and native ecosystems and the depletion of water supplies.[xvii]

Another process that often accompanies the growth of agro-industrial production is the displacement of smallholder farmers and traditional communities, who sell their farms (or are forcibly displaced) and often seek new lives in cities.[xviii] This can exacerbate the problem of informal urbanization along the edges of cities. It could diminish food security, as became

abundantly clear during the 2007/2008 food crisis. The displacement of smallholders by industrial farms has already started in many nations, with secondary forests growing up on marginal lands left behind by small-scale farmers.[xix] But this landscape recovery could be reversed in a world of elevated food prices.

The countries that will change most dramatically through the tropical agricultural revolution are those with large areas of native vegetation. Brazil has greater potential for rain-fed agricultural expansion than any other nation in the world[xx] and is expected to provide approximately half or more of the global increase in land-based production over the next 10 years. In this and other nations in Latin America with potential for agro-industrial expansion—Bolivia, Colombia, and Peru—the areal expansion of export-oriented agro-industrial cropland threatens native forests, savannas, and woodlands that are rich in species, cultures, and stores of carbon. Sustained high food prices could potentially increase forest and savanna conversion to cropland, maintaining or increasing carbon emissions to the atmosphere at a time when deforestation already accounts for at least 6 percent of global emissions.[xxi] These nations are poised for large-scale losses of native assemblages of plant and animal species, disruption of indigenous and traditional communities who live in these forested landscapes, and contamination of vast river basins with agricultural toxins.

These potential negative consequences of the tropical agricultural revolution are superimposed on growing stresses from climate change in the form of damaging storms and hurricanes and rising sea levels in the Caribbean and Central America as well as record droughts in the Amazon Basin (for example, in 2005 and 2010)[xxii] that provoke widespread forest fires,[xxiii] interrupt cropping cycles, and reduce the flow of streams and rivers. In addition, a sustained increase in the price of food and further shifts toward export-oriented agriculture could reverse progress made in lowering poverty and hunger in the region, especially in the Caribbean and Central American nations that are precariously dependent on food imports.

Managing the Revolution

The development and environmental conservation communities must capitalize on the tropical agricultural revolution through strategies that promote socioeconomic well-being and the conservation of native ecosystems and ecosystem services, harnessing its potential to bring about

positive change while minimizing its negative impacts. Three opportunities in particular for managing the tropical agricultural revolution are worth highlighting.

The first opportunity is found in market transformation as represented in agricultural commodity roundtables.[xxiv] Unlike previous environmental certification systems, the roundtables have developed international criteria for the certification of commodity producers through multiple stakeholder processes that emphasized early participation of a large portion of the supply chain, a focus on performance instead of on techniques to achieve that performance, a small but meaningful number of performance targets, and a way to avoid cumbersome product tracing systems through the "book and claim" approach.

Another core concept of the roundtables is to not depend on price premiums or consumer choice but to become "pre-competitive"—that is, to transform the market to exclude products grown in unsustainable ways. Roundtables for soy, sugarcane, and palm oil are now completed, and certification is under way. Companies and producers representing 20–50 percent of world production of each commodity have joined the roundtables. In less than two years, the organization farthest along has certified farmers who produce 7 percent of the world's palm oil.

Additional roundtables are under development. All the roundtables prohibit the certification of farmers who are clearing forests or savannas to plant their crops, require observance of labor and environmental laws, and restrict the use of dangerous chemicals.[xxv] Producers in Brazil, Argentina, Paraguay, Bolivia, Colombia, and Honduras are participating in at least one of the roundtables.

A second opportunity for improvement is found in the emerging forest carbon market. The mechanism for compensating nations that reduce carbon emissions from deforestation and forest degradation that was agreed to in Cancun has attracted more than US$4 billion in public funding. Several nations—Brazil, Peru, Colombia, Mexico, Ecuador, Guyana, and Panama—are developing REDD programs that could systematically plan agricultural and forestry expansion within zoning schemes, with supporting policies that allow agricultural and forestry production to increase while lowering deforestation rates.

Brazil, for example, has reduced deforestation in the Amazon region 67 percent since 2004[xxvi] and has enacted a National Climate Change Policy that commits it to reduce Amazon and Cerrado deforestation 80 percent and 40 percent, respectively, by 2020.[xxvii] This ambitious

goal will probably be achieved by directing agricultural expansion onto the more than 100 million hectares of planted cattle pasture that are underproductive.[xxviii]

The architecture by which REDD will link forest nations with industrial ones is most advanced among state governments. The Governors' Climate and Forest Task Force links California with states in Brazil, Mexico, Indonesia, and Nigeria. California's cap-and-trade policy allows for 4 percent of emissions reductions to be achieved through international offsets provided by REDD states.[xxix] This task force will probably create the first REDD compliance market, which could grow as new states, and potentially companies, take on emission reduction targets.

Both commodity market transformation and REDD+ are ushering in a new era of large-scale integrated land use planning that could become a third important component of a strategy for managing the agricultural revolution in Latin America and the Caribbean. This promising new trend facilitates the participatory analysis and planning of land use across large jurisdictions to more effectively reconcile economic activities with the maintenance of ecosystem services.[xxx] Ecological and economic land use zoning plans that previously had rarely been implemented with the force of law are now being used as the foundation for state-wide REDD programs. In the state of Acre, Brazil, for instance, the zoning plan maps the allowable land uses for the entire state. It determines the percentage of private landholdings that must be maintained as forest (in keeping with the federal Forest Code) and will be the focus of programs designed in 2011 for each of the rural economic sectors, including extractivist populations such as rubber tappers, indigenous peoples, smallholder settlements, protected areas, state- and federal-run forest concessions, and private landholdings.[xxxi]

Conclusion

The tropical agricultural revolution could mean greater economic prosperity for the nations in Latin America and the Caribbean. But it could also exacerbate food insecurity, increase the contamination of waters, soils, and ecosystems, and speed the conversion of native forests to croplands and pastures, which would increase carbon emissions. If properly managed, on the other hand, this agricultural trend could motivate governments to develop coherent, practical policies to protect the environment and laborers and to support agricultural communities who grow food for local markets, knowing that socially and environmentally responsible low-

emission farming systems will help boost access to increasingly demanding commodity markets while positioning these nations to participate in the world's rapidly emerging low-carbon economy.

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[xiv] Nepstad et al. 2007.
[xv] Cattaneo 2008; Nepstad et al. 2006.
[xvi] See, for example, Gouveau 2010.
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