CRITICAL RESOURCES: THE INTERMEDIATE TERM

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Many factors other than weather can contribute to low global commodity supplies such as government-imposed production quotas or producer prices kept artificially low; bans on planting yield enhancing, genetically improved seed; less than adequate input usage, such as low or no fertilizer application; government curbs on exports to keep domestic commodity prices low; and logistically impaired access to output markets. However, commodity price spikes are usually caused by supply shocks; weather-related production shortfalls or market channel disruptions. Agricultural producers and supply channel participants respond to price incentives to bring supply back in line with demand within one or two crop production cycles. In contrast, the recent high prices for grain and oilseeds came about because of global demand growth. Biofuel production and rising prosperity in many countries, coupled with global population growth, increased demand relative to available stocks to push commodity prices to historically high levels. Many people are concerned about the ability of commodity producers to keep up with demand growth in the intermediate term.

This paper will examine the ability of global production agriculture to expand output in the next two to five years. That is a period of time long enough for producers to change nearly all factors of production, although availability of critical input resources may constrain their ability to do so. If producers are unable or unwilling to expand production over the intermediate term, commodity prices will likely remain at high levels to ration available supplies.

Foodways, peoples' tastes, traditions, and habits, once established, change only slowly over time, but it is well established that as personal disposable income increases, people improve their diets. They reduce consumption of starchy grains and root crops, and purchase more animal protein, vegetables, fruits, and oils; vegetable and tropical. As incomes increase even more, people tend to eat more food away from home; at restaurants and institutions. The shift to higher protein diets, does not lessen demand

pressure on the grains because it takes more grain to feed livestock than to provide calories to humans directly. Livestock and fish production will grow around the world over the intermediate term period and will utilize ever-increasing amounts of feed grains and oilseed meal.

Food demand in developed countries increases at about the rate of population growth. However, in many countries, especially those with young populations, demand for food is growing at near explosive rates, fueled by a decade or more of uninterrupted economic growth. The economies of large-population developing countries such as China, India, Brazil, Russia, Asian-Oceanic island nations, and in aggregate, the Middle East, have been growing at double-digit annual growth rates. Other developing economies, smaller in population, but also experiencing impressive growth rates, have added to global demand. Emerging market growth rates have slowed somewhat, but, at this writing, are still four times that of developed countries. Human food consumption trends have not been dampened by high commodity and food prices, illustrating the price inelasticity of the demand for food. Food consumption will decrease in the intermediate term only if incomes are reduced by a prolonged global economic downturn.

Agricultural commodities have long been used for industrial purposes. Examples include, wheat starch adhesives, soybean oil for paint and printer's ink, and corn starch for biodegradable plastic. In the last few years, biofuel production has taken an increasing share of the U.S. corn crop to make ethanol and triggered a fuel versus food debate. Since only a small percentage of corn is used in the United States to make food products directly consumed by humans, the debate is really a fuel versus feed debate. In 2007, approximately two-thirds of the U.S. corn supply was used for livestock feed domestically and overseas. The fledgling ethanol industry has received government incentives and protection so that enough ethanol would be produced for automotive fuel additive to reduce air pollution. In the 2008/09 crop and marketing year, ethanol production will add about 4 billion bushels to corn demand, or about 33% of total corn usage. This dimension of corn demand has put upward pressure on corn price. However, the build-out of the domestic ethanol industry is slowing. Not much more capacity will

needed to meet the 2015 maximum starch-based ethanol mandate of 15 billion gallons. That will require approximately 5 billion bushels of corn or about one-third of the corn crop in 2015. Domestic livestock feed will still be the leading demander of corn, followed by ethanol, exports, and then industrial and food demand. In the intermediate term, U.S. corn producers will respond to market price signals and produce sufficient corn to satisfy the demand from all uses.

Starting in 2015, the focus of the national ethanol mandate will switch to cellulosic ethanol. The mandate calls for the production of 21 billion gallons of cellulosic ethanol to be added to the nation's fuel supply by 2022. In the intermediate term, two to five years, cellulosic ethanol production will not affect commodity supply and demand. Cellulosic ethanol production is not economically viable at the present time. The intermediate term will be devoted to research and development to improve processing efficiency, evaluate industry economics, and assess various feedstocks.

After many years of surpluses and global low prices, U.S. farmers, and other farmers around the world, are enjoying high selling prices for the commodities they produce. Surpluses no longer exist, back-to-back lower than average world wheat crops, five years of draw-downs in global feed grain carryover stocks, and shortages of oilseed products give credence to concerns that production will not keep up with growing demand in the intermediate term.

The food and agribusiness industries should be seen as an integrated sector of an economy. Input suppliers, including bankers, provide seed, feed, fuel, fertilizer, agricultural chemicals, equipment, credit, etc. to farmers, ranchers, foresters, and aquaculturists to produce commodities, livestock, and fish products. The key to expanded food production is to identify resource constraints and eliminate or innovate around them. Land and water can be viewed as the necessary production substrate for production agriculture. Because they are finite, most people would name land and water as the most limiting resources in the system. In the intermediate term, that will not be the case.

About 4.9 billion acres of land, only 13.3 percent of the world's total, is arable, i.e., suitable for farming; but that is ample to feed the current world population of about 6.7 billion people. It takes about one-third acre to produce enough food for one person per year. Currently, there is .73 acre of farm land in the world per capita. The amount ranges from 6 acres per capita in Australia to .2 acres in the United Kingdom, to give examples. Countries with large land endowments are able to feed their own people and export excess commodities to countries with small per capita land endowments. Globally, about 24.7 million acres of land; .5 percent of the total, are lost each year to urbanization, erosion, desertification, etc.

In many countries, land is underutilized or misused. For example, the United States is utilizing its arable land resource base at about 90 percent of capacity. Approximately 36 million acres of land has been withheld from production for many years, tied up in the Conservation Reserve Program. Over the intermediate term as contracts expire, as many as half of the CRP acres could be brought back into production. Fragile lands and land owned by recreational owners will likely remain in grass. Thousands of hectares of scrub land can be brought into production in Brazil, although lack of infrastructure, high transportation costs, and limited farmer financial resources may limit expansion in the intermediate term. Production can be improved on large tracts of land in Former Soviet Union countries such as Russia, Ukraine, Kazakhstan, and some Eastern European countries. The countries of Africa, which might otherwise become major contributors to the global food supply, continue to suffer from political and social problems that have contributed to the suboptimal use of land. Land reform on the continent of Africa, and in other parts of the world, has gone in the wrong direction. Instead of creating many small subsistence landholder units for political purposes, farms could be allowed to grow large enough to capture economies of size which would result in low per unit costs and the production of marketable quantities of products.

It is true that fresh water is in short supply. Water tables are dropping and dams on rivers reduce water flows to downstream irrigators. In some areas, governments have taken control of water resources and persist in reducing allocations for agricultural producers.

In many crop production areas around the world, seasonal, high rainfall can be a problem. Runoff water not captured not only contributes to crop-damaging flooding, but is lost for productive uses during dry parts of the year. Farmers are shifting to more water efficient crops or high value crops in order to justify high water costs. They are adopting new irrigation technology and production systems that lower water usage. Farmers are moving to minimum tillage and no-tillage farming programs to conserve water. Seed companies are focusing some research and development efforts on the development of crops that use less water or low quality water. Although under normal conditions, it will not use less water, drought tolerant corn seed will be commercialized in the United States in 2010. Over the intermediate term, droughts in various parts of the world will periodically reduce production, but overall, water will not be the major limiting factor in global food production.

Aquaculture is the fastest growing industry in the food and agribusiness sector. Wild catch continues to decline in over-exploited and badly treated ocean fisheries. Domesticated fish production will surpass world-wide wild catch in the intermediate term. Fresh and salt water species are grown in ponds, tanks, and cages. Solutions continue to be found that resolve biological production problems to make the emerging industry economically viable. Significant amounts of grain and soymeal are being used to make fish feed, and development work is underway using soybean proteins to replace high-priced fish meal in fish feed rations. There are water pollution problems associated with concentrated fish production, analogous to problems arising from concentrated mammalian livestock production. Individual countries are slowly promulgating regulations to minimize the environmental impacts of aquaculture.

A major concern for agricultural producers around the world is the high prices of crop production inputs. Seed costs have increased dramatically with the advent of genetically improved crops. However, increased seed costs for corn and soybeans have been offset by reduced tillage and pesticide usage and rising average annual yields. Conventional genetic modification techniques are still used for wheat and rice because of consumer resistance to advanced genetic modification of those crops. As a result, yield productivity

for wheat and rice in recent years has been little more than flat. Resistance to bioengineered crops seems to be subsiding, although it may be near the end of the intermediate term before higher yielding wheat and rice seeds are commercially available. Large-scale agricultural equipment is expensive and is feasible only for large-scale farming operations where the fixed cost of equipment can be spread over many acres or hectares of land, lowering per bushel or per metric ton cost of production. Smaller production units can neither afford nor utilize such technically advanced inputs which puts them at a per unit cost disadvantage relative to large-scale producers. Over the intermediate term this production cost disparity between large-scale farmers and small farmers will widen, leading to a continuation of the 75 year U.S. trend of exit from agriculture and contributing to the on-going agriculture to urban population migration in other parts of the world.

It has been the rapid and large price increases for fuel and fertilizer that have producers worried the most. Fuel costs have doubled in the past year or so and fertilizer prices, depending on type, tripled or quadrupled. On the demand side, while usage of fuel and fertilizer for agriculture among developed nations has been fairly stable, it was the jump in demand for fertilizer in developing nations that caught most by surprise. Energy and fertilizer industry officials offer little hope that prices for these inputs will decrease during the intermediate term. Of the major grain and oilseed producing and exporting countries, only Russia and Canada are energy self-sufficient. The United States, on the other hand, imports about 70 percent of annual petroleum needs, more than 50 percent of the nitrogenous fertilizers used, and nearly all potash.

It requires 33.5 thousand cubic feet of natural gas to make one ton of anhydrous ammonia from which all other nitrogenous fertilizers are made. Because of high domestic natural gas price, there has not been a new nitrogen plant built in the United States for 30 years. During the intermediate term several new nitrogen plants will come online; not in the United States, but overseas in the Middle East, the Caspian Sea Basin, and several other locations where natural gas prices are low. More nitrogen fertilizer will become available,

but the cost to importing farmers, such as U.S. farmers, will likely remain high due to long-distance transportation expenses and high global energy prices.

Russia and Canada produce most of the global supply of potash used for fertilizer. In 2007, one of Russia's largest potash mines was shut down due to a collapse caused by flooding, which resulted in a sudden reduction of global supply. It will take two to three years to bring the mine back into operation. Canada has announced the development of an additional potash mine, but that project will take several years to complete. Potash will remain in short supply until the end of the intermediate term.

The United States is the world's leading producer of phosphate rock used to make phosphatic fertilizers. But a shortage of industrial grade sulfuric acid used convert the rock into fertilizer, the high price of nitrogen used to make nitrogen/phosphate fertilizers, and growing global demand for phosphate fertilizers in developing nations, have kept prices high. The acid shortage will be resolved during the intermediate term, but global demand will keep the price of phosphatic fertilizers relatively high throughout the period.

Large-scale agricultural production is energy intensive. It requires fuel; mostly diesel, but also gasoline, to transport inputs, for tillage operations, to harvest crops, and to haul commodities to buyers. Recent dramatic increases in fuel prices have driven breakeven production costs up for the major crops to about $4.00 per bushel for corn; $7.00 for soybeans, and $5.00 for wheat. While these costs are well below recent market prices for the commodities, they are above long term average prices received by farmers. The inference can be made that commodity prices may drop during the intermediate term but not to previous low levels.

If it is assumed that global food demand continues to grow over the intermediate term, the major limiting factors in producing enough grain and oilseeds to meet the demand will be government policies that limit producers' ability to respond to market signals, adverse weather that reduces yields, and the high cost of energy related production inputs that destroys producer incentives to expand production.