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The North American Granary: A Policy Research Project Profile

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There is little doubt that North America possesses the world's preeminent grain production and distribution system.[1] Over the past several decades, North America has emerged as the world leader in grain production efficiency and a dominant force in international grain markets.

The continual increase in North American grain supply combined with relatively slow growth in domestic demand has resulted in the availability of substantial grain surpluses. These surpluses have been used to serve expanding export markets driven by growth in world population and income, and a complex of other factors.

Both the U.S. and Canada have benefited from the vitality of grain agriculture in North America. The sustained increase in grain productivity in the post World War II period has served as a counter-inflationary force in domestic food prices. Income from grain farming and related activities has contributed to the economic viability of rural communities. Export sales of grain have generated substantial foreign exchange earnings to offset increases in imports of a variety of products and commodities (most notably petroleum). Leadership in world food (grain) markets has enhanced the diplomatic strength of both the U.S. and Canada.

There is, however, a growing concern in many quarters that continued high intensity grain production in North America will impose serious stress on key agricultural resources. Moreover, as export markets for grain increase in importance relative to domestic markets, new uncertainties and instabilities are introduced into the agricultural economy. Further, pressure on the North American granary from market forces may be intensified by world political pressure for food (grain) aid to those nations without the means to participate adequately in commercial markets.

It is becoming apparent that new public policy initiatives and new institutional arrangements will be required to deal with the increasing complexity of issues related to the North American granary. It is also apparent that effective policymaking requires a sound analytical foundation. To this end, a research policy project entitled "The Future Of The North American Granary" has been recently initiated at the University of Minnesota. This effort is being jointly undertaken by the Hubert H. Humphrey Institute for Public Affairs and the Department of Agricultural and Applied Economics.

The purpose of this paper is to provide a brief description of the North American granary and to discuss a few of the issues which will be addressed in the policy research now underway. The remainder of this paper is organized accordingly. The next (second) section outlines the position of the North American grain agriculture in the larger economic milieu of North America and the world. The following three sections will comment briefly on three issues related to the granary which will likely challenge policymakers in coming years and which are a central focus of the "Future of the North American Granary" project. They are: (1) international trade impacts on North American grain market stability, (2) large scale grain production and soil erosion, and (3) world hunger and the linkage to North American grain exports. Finally, some concluding comments regarding opportunities for policy research will be provided

The North American Granary: Definition and Dimensions

By way of definition, the "North American Granary" encompasses the dense grain production region of the great plains and corn belt of the U.S. and Canada. This region stretches from the Ohio Valley west to the plains of eastern Colorado, from the plains of Alberta, Saskatchewan and Manitoba, south to Texas and the soybean areas of the Mississippi Delta states. While grain is produced elsewhere in North America, this is the dominant surplus production region of the continent (and the world).

In a broader sense, the granary includes all the economic, political and social linkages that go with production and marketing of the grain from this large region. That is, it includes the rural infrastructure, and the resources used in production, as well as the institutions—both public and private—which serve the granary. In a sense, the granary can be viewed as the engine which powers the North American grain and livestock complex and the

[1] In this paper, grain is taken to include oilseeds, specifically soybeans and rapeseed. Also, in this paper North America refers to the U.S. and Canada. While Mexico is also part of North America, it is not a surplus producer of grain and is thus not included in this discussion of the North American Granary.

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rural society associated with it.

In the jargon of the economist, North America holds a strong comparative advantage in grain production. North American grain producers are among the world's most efficient by virtually all conventional measures. Table 1 shows the U.S. share of world production for major grain commodities relative to the share of total world acreage committed to each grain for the year 1980-81. Note that for each grain, the U.S. share of world production exceeds the share of acreage utilized. Using this comparison, the U.S. is particularly efficient in producing coarse grains where the production share is more than double the acreage share. The situation in Canada, while not as marked as in the U.S., indicates that Canada is a relatively efficient producer of wheat and rapeseed when compared with world standards. Though direct international comparisons are difficult due to lack of data, it appears that North American grain productivity is even more pronounced when output per unit of labor is evaluated.

The strength of the North American grain production system has resulted from several interrelated factors. First, the land base itself is abundant and of high quality. In 1977 the U.S. had about 415 million acres of land in crop production with a usable reserve of about 126 million acres. (USDA, RCA Appraisal Part I and II, Washington, D.C., 1981) The largest share of this cropland lies in the Corn Belt and Great Plains. It is relatively flat, has deep well drained soils and is thus perfectly suited for mechanized grain production. Canada has about 209 million acres in farms, with about 70 million acres now in crops. Most of Canada's agricultural land resources (81 percent) are in the grain producing Prairie Provinces (Manitoba, Saskatchewan, and Alberta).

Second, the granary's climate is generally favorable for grain production. The growing season is sufficiently long and rainfall is adequate and timely in most years. In some areas where rainfall is not sufficient, either in annual amounts or in timing, plentiful reserves of groundwater have permitted massive irrigation development. Table 2 shows the change in acres under irrigation in five states over the period 1944 to 1978. Note that total irrigated acres in this region increased more than five-fold over this 34-year time span. While there is growing concern over the capacity of groundwater resources to continue to support such intense irrigation, North America still has an abundance of water by world standards.

Third, technological advances, resulting from major commitments to research and development, have resulted in substantial increases in per acre grain yields and reduced use of farm labor. The development and adoption of new, high yielding grain varieties along with increased use of chemical fertilizers and pesticides have provided dramatic jumps in per acre grain output. Note, for example, that the U.S. average annual corn yield in the period 1940 through 1945 was 32 bushels per acre. By the period 1975 through 1980, the average annual yield had about tripled to 94 bushels per acre. The U.S. annual average wheat yield increased from 17 bushels per acre to 32 for these same compared periods. Thus, in a 40 year period, corn yield nearly tripled and wheat yields almost doubled. Over this same period, use of nitrogen fertilizer increased more than 20-fold (from about .5 million tons to 11.5 million tons).

Simultaneous with this rise in per acre productivity was the decline of labor as a farm input. According to USDA *Agricultural Statistics*, in 1940 grain production utilized about 14 labor hours per acre. In 1980 grain production utilized only 3.2 labor hours per acre. Accompanying this drop in labor use was a precipitous increase in farm mechanization. For example, in 1940 there were 1,545,000 tractors, 190,000 combines, and 110,000 cornpickers in service in the U.S. By 1980, machinery in use had risen to 4.8 million tractors, 609,000 combines, and 690,000 cornpickers and in 1980 machines were much larger than their 1940 counterparts! The combination of high yields and greater mechanization has caused output per man hour of feed grains to increase more than 18-fold from 1940 to 1980 while output per man hour of food grains increased by more than seven times.

Fourth, farm management capabilities have greatly improved. While very difficult to quantify, it is clear that the management input in grain farming has risen in quality if for no other reason than out of necessity. Increased complexity in both production and marketing decisionmaking has increased the demands on management skills.

Finally, the North American granary has been, and continues to be, served by a relatively efficient transportation-distribution-logistics system. This system provides an adequate and timely supply of transportation and storage, and moves grain output to

Table 1. U.S. Share Of World Grain Production and World Acreage Commitment, 1980-81

Grain	Percent Of World Production	Percent Of World Acreage
Wheat	14.7	12.0
Coarse Grains	27.3	12.0
Soybeans	60.1	55.0
Rice	1.7	.9

Source: UNFA *Agricultural Production Statistics*, 1980.

Table 2. Acres Of Irrigated Farm Land In Selected Great Plains States, 1944 and 1978

	Acres Irrigated x 1000	
State	1944	1978
Colorado	2,669	3,458
Kansas	96	2,686
Nebraska	632	2,086
Texas	1,320	7,018
Oklahoma	2	602
Total	4,719	25,850

Source: USDA *Agricultural Statistics*, 1981.

terminal markets, both domestic and foreign with minimal cost and delay by world standards.

As suggested earlier, the granary makes several important contributions to the North American economy. It is a primary agricultural enterprise. In 1980-81, cash grain sales accounted for 60 percent of all U.S. farm income from crops and 35 percent of total farm income. In Canada, grain sales account for about 30 percent of total farm receipts.[2] Of course, the economic activity associated with grain production and the incomes generated in rural communities are central to the state of the rural and national economy.

The role of grain exports in the broader trade picture for both U.S. and Canada has been outlined often. International grain markets have become increasingly important to North American agriculture and the North American economy. In 1966, the U.S. exported roughly 24 percent of its grain output. In 1981/82 about 36 percent of production was exported, down from 43 percent in 1980/81. Canada exports about 53 percent of its grain production.[3] Virtually all analysis suggests that international markets are the growth markets for grain. Thus, it can be expected that the share of North American grain production exported will continue to rise.

Grain exports generate substantial foreign exchange earnings and are a major component in the broader trade situation for the U.S. and Canada. In 1981, the value of the U.S. exports of feed grains and products, wheat and products, rice, soybeans, soybean oil and meal totaled more than $27 billion. This was 63 percent of all agricultural exports and 12 percent of total U.S. exports. Canadian grain and oilseed (and products) exports generate nearly $6 billion annually (1980), accounting for 74 percent of agricultural export value and 8 percent of all export sales.

While export markets have become increasingly important to the North American Granary, exports from the North American granary have become increasingly important in world grain markets. A relatively small portion of total world grain production is traded in world markets. In 1981/82 about 22 percent of the world's wheat, 13.3 percent of the coarse grains, 34 percent of the soybeans and only 4.4 percent of the rice entered international trade.[4] However, due to the inelastic nature of demand for grain, the availability to grain deficit countries of grain imports has a significant price effect. In most countries a relatively small increase in supply, through importation, has a relatively large negative influence on price. Likewise, a relatively small increase in grain export demand for surplus countries tends to have a relatively large positive effect on the price received by farmers. Thus, trade in grain serves both to lower food prices in importing countries and raise producer prices in exporting countries.

North American producers dominate exports of grain. Table 3 shows the export volumes and market share of the U.S. and Canada for the year 1981/82. North American exports accounted for 67 percent of the wheat and coarse grain traded. The U.S. alone contributed 85 percent of the soybean exports. While a minor rice producer, the U.S. is the second leading rice exporter.

In general, coarse (feed) grain exports go to developed countries while food grains go to developing countries. About three-fourths of the coarse grain exports and 81 percent of the soybean exports are purchased by developed countries. While about 55 percent of the wheat and 76 percent of the rice traded is imported by developing countries.

Table 3. Grain Export Volume and Market Shares for the U.S. and Canada, 1981/82

	U.S.		CANADA	
	Exports (mmt)	Market Share (percent)	Exports (mmt)	Market Share (percent)
Wheat	49.1	49.3	17.7	17.1
Coarse Grains	61.4	60.0	7.5	7.2
Rice	2.9	24.0		
Soybeans	25.0	85.3		
Rapeseed	—	—	1.4	60.0

Source: U.S.D.A., F.A.S. *Foreign Agriculture Circulars*, FG82-26, August, 1982 and FOP 10-82, August, 1982.

Grain Exports and Price Instability

Certainly expanded reliance on export markets provides a number of benefits to the North American Granary. It also creates some problems. One of these problems is that increased participation in world markets tends to introduce price instability and uncertainty for producers. Recent experience suggests that North American grain prices have become more variable both between years (interyear) and within any given year (intrayear).

Figure 1 shows average annual corn and wheat prices for the period 1960 through 1981. Prior to 1973 the domestic markets drove the corn price. As a result, price remained at or near government support levels. Prices were relatively low but predictable. In the post-1973 period international markets strongly influenced year to year price movements. It is clear that while expanding world markets raised price levels, prices were also more volatile.

Figure 2 panels (a) and (b) compares intrayear price movements for corn for the crop years 1966-67 and 1976-77. In the mid-60's, monthly price varied only slightly from the weighted average annual seasonal price. However, 10 years later the monthly variability was much more exaggerated.[5]

Grain price variability both interyear and intrayear may result from changes in international demand for grain introduced by changing world economic conditions, weather conditions which affect foreign grain production, shifts in international currency exchange rates, political and diplomatic events, or changing conditions in international financial markets. For example, the recent world economic recession has softened demand for U.S. grain. Combined with this, high interest rates in world financial markets have discouraged grain inventory holding by foreign grain purchasers. Most

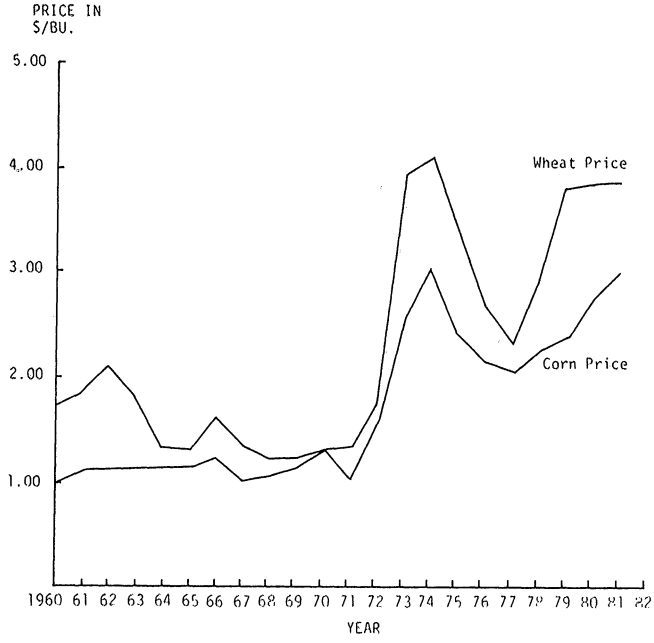
[2]These percentages, for both the U.S. and Canada, understate the true value of grain since on-farm use for feed and seed is not included. In the U.S., for example, 38 percent of corn production is used on-farm. U.S. and Canada statistics are from U.S.D.A. *Agricultural Statistics 1981* and Agriculture Canada, *Selected Agricultural Statistics for Canada 1980*, respectively.

[3]From U.S.D.A., F.A.S. *Foreign Agriculture Circular*, FG82-26 and FOR 10-82 August, 1982.

[4]U.S.D.A., F.A.S. *Foreign Agriculture Circulars*, August 1982.

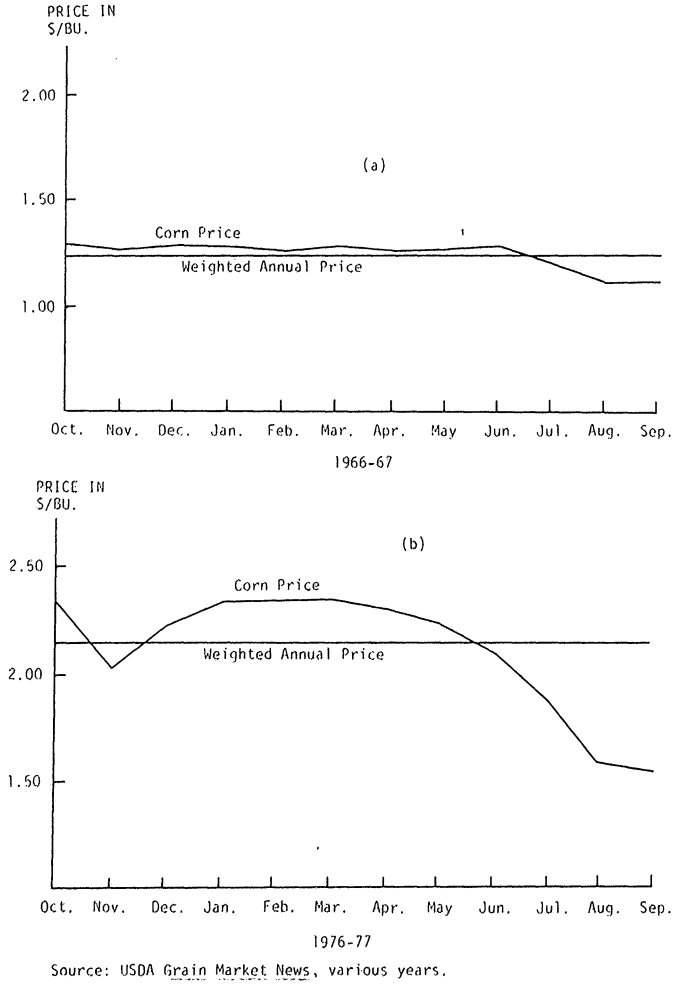
[5]A similar intrayear pattern is revealed for other grain and oilseed prices.

Figure 1. Average Annual Wheat and Corn Prices, 1960-81



Source: USDA Agricultural Statistics, various years.

Figure 2. Monthly U.S. Corn Prices For 1966-67 and 1976-77



Source: USDA Grain Market News, various years.

grain industry representatives believe that the Russian grain embargo served to soften the U.S. position in world markets. The current and recent strength of the U.S. dollar in world currency markets has, in effect, raised U.S. grain prices to foreign consumers. This has resulted in a decline in purchases and a slight shift in market shares. Thus, grain prices have been depressed since reaching a short term peak in 1979. This problem has been compounded by near record U.S. crops in the last couple of years. Prices are currently below federal support (loan) price levels.

Also, prices received by North American producers are now influenced by supplies in other grain surplus countries. For example, U.S. soybean prices are directly affected by the crop in Brazil, and corn prices are closely related to soybean prices.

Because such a wide range of events can influence prices, sudden reversals are possible. If interest rates decline, or if either a major grain importer or a major exporter has a crop failure, prices could again move up sharply, as they did between 1977 and 1979.

This uncertainty and variability creates both opportunities and difficulties for grain producers and merchandisers. When prices move upward holders of grain benefit as their production and inventories appreciate. Those who have the financial capability to ride out grain price declines may benefit from this instability. Producers and merchandisers with substantial cash flow requirements may be stressed financially during these periods.

The variability in farm incomes which accompanies unstable grain prices can have significant impacts on the rural economy of North America. The current slump in farm implement sales and agricultural land values is clearly tied to the current uncertainty associated with grain prices and farm incomes.

Soil Erosion and Grain Exports

Soil erosion was first given prominent national attention during the dust-bowl era of the 1930's. The dramatic increase in exports over the past decade has given rise to renewed concern that high intensity grain production is contributing to rapid depletion of the nation's soil resources. The contention, in

some quarters, is that along with grain we are, in essence, exporting irreplaceable top soil.

There is, however, no consensus as to the severity or cause(s) of the erosion problem. On one hand, T.W. Schultz argues that soil erosion has actually decreased as a result of rising per acre grain productivity and increased attentiveness to erosion control by farmers. On the other hand, Lauren Soth argues "the crux of the food-agriculture problem facing America is soil resource maintenance versus unrestrained grain exports. At the rate exports are increasing, the danger of overexploitation of the land with permanent damage to productivity is becoming eminent."

A first problem confronted in addressing the erosion issue is one of measurement. There is no single measurement technique or soil loss estimate which enjoys broad credibility. Estimates of gross soil loss in the U.S. from water erosion range from one to four billion tons per year. It is generally argued that gross wind erosion occurs at about 25 percent of the rate of water erosion, but is thought to be as severe as water erosion in the U.S. Great Plains.

Estimates of average annual per acre soil loss range from 4.7 to 12 tons. For more precise interpretation these estimates are indexed for the soil loss tolerance of specific land parcels using the universal soil loss equation (USLE) T-value. The T-value is defined as the amount of soil, in tons per acre, which can be lost each year from a given field without affecting long term productivity. Values of T range from two to five tons per acre.

The Soil Conservation Service (SCS) generally uses a T-value of five tons per acre as a guideline in establishing soil conservation programs. It has been estimated that between 27 and 40 percent of U.S. cropland has erosion levels which exceed the five ton T-value. However accurate appraisal of soil loss is confounded by the fact that erosion levels are very site specific.

A second problem inherent in a discussion of soil erosion is analyzing the costs associated with erosion. Two types of costs are generally considered to be significant; the cost of productivity loss and the cost from sediment damage.

Costs from productivity loss are both short run and long run in nature. In the short run, increased levels of fertilizer application are required, due to the loss of soil nutrients associated with water erosion. Additionally, eroded soils tend to have poor water retention capability which contributes to poor yields and uprooting of plants.

In the long run, severe soil loss leads to substantial reductions in yields. David Pimental estimates, for example, that when topsoil depths decline to twelve inches each additional inch of soil loss results in yield reductions of three to four bushels of corn per acre, 2.4 bushels of oats, 2.5 bushels of wheat and 2.6 bushels of soybeans. McCormack and Larson estimate that for each inch of topsoil loss below six inches depth corn yield drops 23 bushels per acre, oats 13 bushels per acre and soybeans 8 bushels per acre. These estimates are, of course, quite rough and subject to some debate. Soil scientists are working to improve their methods of assessing the trade off between soil erosion and productivity.

The second general type of cost from erosion, sediment damage, is also difficult to measure precisely. The costs of sediment damage include: replacing lost soil nutrients, removing soil sediment from navigable waterways, and water reservoir maintenance resulting from sedimentation. McCormick and Larson estimate the annual cost of replacing nutrients at $1 billion, the cost of waterway dredging at $120 million and the sedimentation damage to reservoirs at $1 billion. In addition, erosion degrades freshwater resources by introducing fertilizers, pesticides and silt into water supplies. Soil erosion is considered the single largest source of non-point water pollution. A precise accounting of these costs is also difficult to make.

Even if acceptable measures of erosion and the associated costs are developed the question of cause and solution still must be addressed. There are those who believe that current farm economics discourages soil conservation practices. Earl Swanson points out that unfortunately the "most erosive production system is also the one with the highest net income." Thus, farmers, facing cash flow problems and high debt servicing requirements may be forced to postpone investments in erosion controls or shifts to erosion reduction techniques.

Moreover, impressive increases in per acre yields may mask the longer term productivity impacts of erosion, thus further discouraging change. Though corn is the most erosive grain crop, the rapid growth in yields over the past few decades has served to obscure any effects of erosion on per acre yields.

Still new erosion reducing techniques are being used and some farmers are investing in erosion abatement capital improvements. The public policy response to erosion is currently being debated. The linkage between erosion, conservation and farm programs is unknown. Whether innovations in erosion controls are encouraged, discouraged or unaffected by public policy needs to be determined. If either the reality or perception of the erosion problem becomes more critical, policymakers will require new analytical input in forming appropriate responses.

The North American Granary and the Global Food Situation

Prior to 1972, the world had experienced two decades of expanding agricultural production and rising stocks of grain. During this period, grain prices remained relatively low and domestic farm policy in North America, particularly the U.S., was aimed mainly at supporting farm prices and incomes in the face of excess capacity. However, even during this time of relative abundance, many of the world's poor had insufficient incomes to buy the food necessary to avoid hunger and malnutrition.

High levels of production and surplus accumulation in North America during the 1950s and 1960s led to substantial commitments to food aid. During the period 1954 through 1970, the U.S. exported more than six billion bushels of wheat and wheat flour under food aid programs established by Public Law 480 (Food for Peace). During this period the majority of all U.S. wheat exports where shipped under some form of food aid arrangement.

Weather-induced grain crop shortfalls in the early seventies resulted in a sharp fall in world grain stocks. Coupled with devaluation of the U.S. dollar and the decision by the U.S.S.R. to offset production short-falls by importing grain, this led to sharp grain price increases during 1973 and 1974.

North American farmers benefited from the increased exports and higher prices. For food deficit countries, however, this was a disturbing period. Higher grain prices reduced the already low purchasing power of poorer countries and peoples. Santaj Aziz has

stated that as many as a half a million people died of starvation in parts of Africa and Asia during the food crisis of the early seventies.

The effects of high world grain prices and regional crop failures were exacerbated by a sharp decline in food aid shipments from surplus producers. As a larger share of U.S. grain entered directly in commercial channels, aided shipments of wheat and flour dropped. Figure 3 shows the volume of U.S. wheat and flour aid along with world wheat prices for the period 1954 (the beginning of P.L. 480 assistance) through 1980. Note the rapid decline in the period 1965 through 1973. In the seven year period 1972-78 total aided shipments fell to less than 50 percent of the level of the previous seven years (1965-1971).

In the latter half of the 1970s and in the early 1980s, grain prices, stocks, and aid shipments have shown substantial variability. While generally lower grain price levels and modest income gains have softened the world hunger situation somewhat, it remains a vexing problem. A proportion of the world's population is still experiencing a gap between nutritional need and the effective demand that they can contribute given existing levels of prices and incomes. For a number of reasons, however, the extent of hunger and malnutrition caused by this need-effective demand gap is very difficult to quantify. First, different people require different amounts of food so that it is difficult to devise a single standard of food adequacy. Second, detailed knowledge of the food distribution system (including distribution within households), food prices, income distribution and the relationship between income and food consumption would be required to assess the number of people suffering a shortage of food.

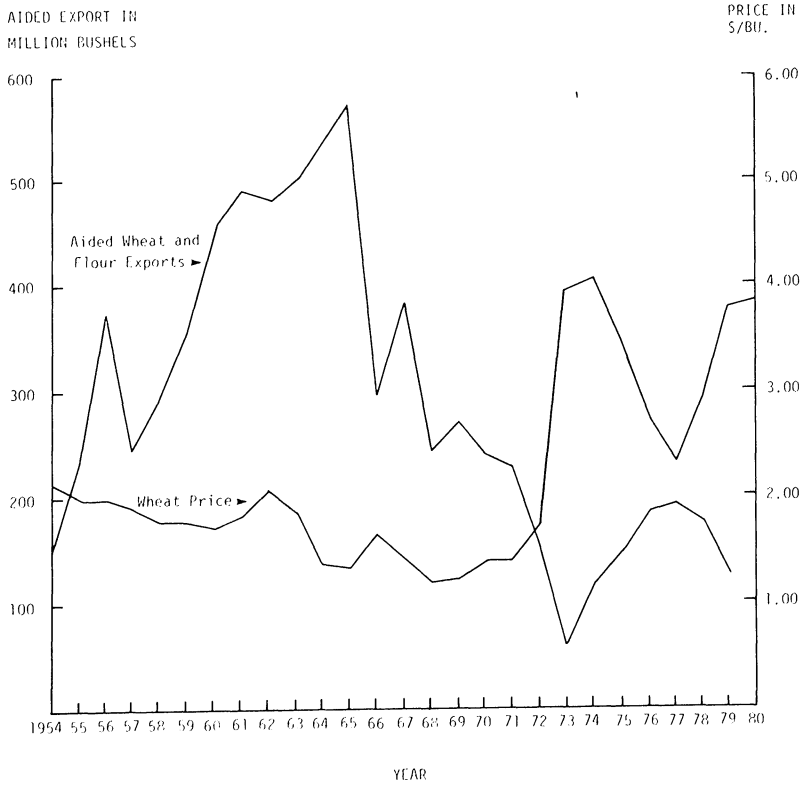
Despite these difficulties several estimates have been made. For example, the World Bank estimated that there were around 800 million people living in absolute poverty—low income, malnutrition, poor health and lack of education—in 1980. Their assessment showed that, in all but the richest developing countries, consumption by large sections of the population is well below nutritional adequacy. Of course, not all people with an inadequate diet live in absolute poverty. The International Food Policy Research Institute (IFPRI) has estimated that as many as 1.3 billion people in the developing world have calorie energy intakes below recommended requirements. Under-nutrition is most prevalent in Africa and South Asia.

According to Shlomo Reutlinger, the proportion, though not the absolute number, of people consuming less than adequate amounts of food is likely to decline in the future as per capita incomes increase. This will occur even if the current distribution of income remains unchanged. IFPRI concurs and has estimated that, given low levels of per capita income growth, the gross dietary energy gap of the developing market economies will decline from 63.9 million metric tons (cereal equivalent) in 1975 to 55.0 million metric tons by 1990. Assuming high levels of per capita income growth, they estimate the gap will fall to 45.1 million metric tons by 1990.

While these predictions account for the influence of rising incomes on effective demand, they pay scant attention to the effects of future changes in grain and other food prices. If there is a phase of rapidly increasing prices (increases in supply fail to accommodate income-induced increases in demand), then higher per capita incomes may be insufficient to reduce the need-effective demand gap. Indeed, Pan Yotopoulos has argued that the income elasticity of the relatively wealthy —those with a higher indirect demand for grain as a result of increasing consumption of animal protein—may "crowd out" the subsistence demand of the poor. This suggests that if per capita incomes and grain prices rise together, without an improvement in income distribution, then the need-effective demand gap may widen rather than close.

It seems clear that the North American granary will play an important role in feeding the world's population in years to come. What is unclear is how the global food situation is likely to progress. There is no clear consensus with respect to the long-term global food outlook. Taking a somewhat simple view, most analysts and commentators can be placed in one of two groups: (1) those who predict a future of global food scarcity, and (2) those who predict

Figure 3. U.S. Aided Wheat and Flour Exports and Wheat Prices, 1954-80



Source: USDA-Agricultural Statistics, various years.

a future where investment and technical improvements in agricultural production systems will continue to expand the food supply, perhaps leading to a period of long-term surplus.

Those who foresee increasing food scarcity base their predictions on one or more of these assumptions: (1) that world food demand will continue to accelerate, driven by population growth and per capita income gains, (2) that increasing amounts of grain, particularly corn, will be diverted from food use for the production of alcohol, (3) that the rate of agricultural productivity growth will slow as real expenditures on research and development shrink, (4) that farm inputs, such as land, water, and energy, will become increasingly costly and scarce, (5) that environmental regulations will curtail use of certain existing technologies and (6) that the recent history of favorable weather will end.

A number of recent analytical works also support the scarcity view. For example, John Mellor has argued that, in the next few decades, a large number of developing countries will be entering a rapid growth phase of development in which the demand for food grows faster than the domestic supply of food. Supporting evidence has been provided by IFPRI, which estimated that, given even low levels of per capita income growth, the net food deficit of the developing market economies will increase from 21.2 million metric tons in 1975 to 83.5 million metric tons by 1990. Assuming high levels of per capita income growth, this deficit was estimated to increase to 107.3 million metric tons by 1990.

On the other hand, there are those who argue that the scarcity view is short-sighted. In 1977, Yeh, Tweeten and Quance argued that there was ample excess capacity for U.S. agriculture to respond to world import requirements until at least 1985. Even with current technology, there may also be substantial potential for output expansions in other surplus production areas (principally Canada, parts of South America and Oceania) and in countries that are presently experiencing food deficits. Moreover, commentators such as Don Paarlberg see little hard evidence to support the contention that the growth of new agricultural technology has permanently slumped. This cry has been disproven too often in the past for this author to have much faith in today's alarmists. Paarlberg has also argued that proponents of the scarcity view have largely ignored the role that price adjustments will play in equilibrating the supply and demand forces —substantial increases in grain and other food production may be induced by higher real prices in the future and less grain would be used in livestock production.

In any case, some level of world hunger will almost surely persist. Continued pressure will be placed on the developed nations, particularly those which are surplus producers of grain, to provide assistance to the world's poor. Thus, it is almost certain that North America will find itself deeply involved in this problem.

Policymakers will be challenged to balance domestic resource conservation, farm prices, and income objectives against humanitarian considerations and world political pressures and commitments. Some suggested solutions for closing the food need-effective demand gap of the world's poor include: greater commitments to food aid from the major developed nations, more investment in international agricultural development, a shift away from meat consumption to move resources from feed grain to food grain production, and the creation of an international food reserve to minimize world price instability and provide a buffer against short run spot food shortages. The potential for success and the residual implications of any or all of these proposals are not well understood. The need for analytical support in this area is obvious and urgent.

Concluding Comments

It is clear that the future of the North American granary will be influenced by a complex and interrelated set of issues. Three of these issues have been briefly discussed here. Each will challenge public policymakers and private decisionmakers. The way in which they are approached will likely impact directly on the state of the rural economy, the world food situation and the long term viability of the agricultural resource base.

Prior to the formation of effective public policy a number of questions need to be answered and a complex set of relations need to be better understood. It is the objective of the policy research project now underway at the University of Minnesota to help in answering these questions and clarifying these relationships.

The policy research project entitled "The Future of the North American Granary" is designed to take advantage of the multi-disciplinary strengths available at the University of Minnesota. Moreover, the University location, virtually in the center of the granary, permits a continual interaction with organizations and individuals intimately involved in directing its course.

(A list of references cited in this paper is available from the authors on request.)

The Hubert H. Humphrey Institute of Public Affairs

The Hubert H. Humphrey Institute of Public Affairs at the University of Minnesota was founded in 1977 as a tribute to Vice-President and Senator Hubert H. Humphrey. As the direct descendant of the University's pioneering Public Administration Center (1936-68) and distinguished School of Public Affairs (1968-77), the Humphrey Institute embodies almost half a century of community service and academic achievement.

The Institute combines the functions of a graduate school and a policy research institute. It offers the Master of Arts (M.A.) in public affairs and the Master of Planning (M.P.) degrees. It has just launched an innovative program called Education for Reflective Leadership, designed for persons in midcareer. Its current research agenda includes work on rethinking "human services," urban neighborhood ventures, criminal justice, "more governance with less government," industry vitalization, power sharing among levels of government, the future of North American granary, information-as-a-resource global environmental policy, modernization and human dignity, and the Pacific Basin Project.

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Dale C. Dahl . . . . . Editor
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