Amber Waves
contents

NOVEMBER 2007 • VOLUME 5 • ISSUE 5
Economic Research Service/USDA

FEATURES

FINDINGS

STATISTICS

Fred Gale, ERS/USDA

Stronger Currency Boosts Chinese Purchasing Power

When converted to U.S. dollars at current exchange rates, Chinese retail food prices are about a fourth of the level of U.S. food prices. Prices of vegetables, which constitute a major portion of most Chinese meals, are as low as a tenth of U.S. prices. The average per capita urban household income in China—when converted to dollars at the official exchange rate—was about $1,600 per year in 2006. With low domestic prices, Chinese consumers can maintain a comfortable lifestyle on seemingly meager incomes—as long as they consume domestic foods.

Imported fruits, for example, are usually eaten only on special occasions or given as gifts in China. U.S. apples are considered a luxury item because they cost several times as much as Chinese apples. Cheaper domestic apples are purchased for everyday consumption.

Since the incomes of Chinese consumers have little purchasing power on world markets, China does not import much food. China's imports have boomed for soybeans, cotton, and vegetable oil, but prices of most imported agricultural commodities are too high to make major inroads in the Chinese market. It has been estimated that less than 5 percent of items in Chinese supermarkets are imported.

Appreciation of the Chinese exchange rate may make imports more affordable for Chinese consumers. After remaining fixed at about 8.3 yuan to the U.S. dollar for a decade, the Chinese yuan has been allowed to appreciate gradually since July 2005. With an ongoing trade surplus, rising foreign exchange reserves, and continuing pressure from trade partners, further appreciation of the yuan is expected.

Normally, a stronger yuan would make imports more attractive to Chinese buyers, but a surge in world prices and record-high ocean shipping rates have kept imports of most grains and meats from being price competitive in China despite the modest currency appreciation. A much larger currency appreciation would be needed to make imports of vegetables, fruits, and processed foods price competitive. These products have especially low prices in China.

Price inflation in China could improve the price competitiveness of imports without an appreciation in the exchange rate, but China has experienced only moderate, intermittent ups and downs in food prices since the late 1990s. A sharp increase in pork prices in China during 2007 led to a Chinese commitment to import U.S. pork during 2007-08. However, the rise in Chinese pork prices was more a reflection of cyclical forces in the hog sector rather than an indicator of broad-based inflation. Chinese hog prices began falling in August 2007, as a major disease outbreak was brought under control and farmers expanded hog inventories in response to record-high prices and government subsidies for breeding sows. Chinese corn and oilseed prices surged in 2006 and 2007, but those increases also appear to reflect world market conditions rather than Chinese inflation.

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This finding is drawn from . . .

China Currency Appreciation Could Boost U.S. Agricultural Exports, Fred Gale and Francis C. Tuan, WRS-0703, USDA, Economic Research Service, August 2007, available at: www.ers.usda.gov/publications/wrs0703/

Global Production Shortfalls Bring Record Wheat Prices

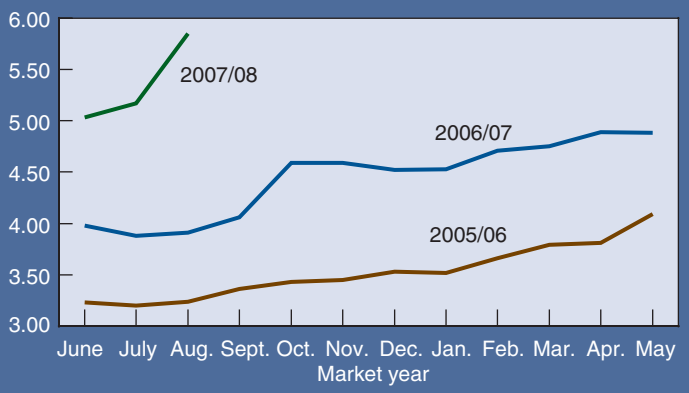
Weather events, low inventories, and subsequent increased export demand have combined to drive U.S. and world wheat prices to record levels. The projected 2007/08 season-average wheat farm price of $5.50-6.10 (as of September 2007) exceeds the previous U.S. record of $4.55 per bushel, even though domestic production of 2.1 billion bushels is only slightly above the average for the previous 5 years. In response, domestic and foreign food processors are announcing price increases for bakery and pasta items, and wheat futures prices on all three U.S. wheat exchanges have hit record highs.

The underlying market pressures leading to these price levels have been developing gradually, with global consumption exceeding production in 7 of the last 8 years. However, markets reacted sharply this year as adverse weather in the Northern and Southern Hemispheres reduced global production, and this year's global carry-over stocks are projected to sink to 30-year lows.

Adverse weather events have brought smaller than expected crops in wheat-producing and -exporting countries in North America and elsewhere. Freeze damage in the U.S. and heavy rains at harvest in the U.S. and Western Europe reduced the output and quality of wheat. Dry weather hurt crops in Canada, Eastern Europe, and some countries of the former Soviet Union. Drought in Southeastern Europe reduced that area's wheat and corn crops, forcing livestock producers in the European Union (EU) to import wheat and feed grains for feed rations. The production shortfalls have curtailed EU wheat exports.

Tight U.S. supplies combined with reduced export competition have driven importers to buy U.S. wheat at a pace not seen since the 1970s. U.S. wheat export sales continue to grow despite higher prices and record-high ocean freight rates, as unfavorable growing conditions in Australia raise concerns about the size of the forthcoming harvests.

All wheat average prices received by farmers



Source: USDA, National Agricultural Statistics Service, *Agricultural Prices*.

While U.S. farmers benefit from higher wheat prices, the extent of those benefits depends on when the crops were marketed and whether output was reduced by local weather conditions. Even as the 2007 wheat crop works its way around the world, current high prices are influencing market expectations about next year's crop. Futures market prices for 2008 crop contracts, though high by historical standards, reflect the expectation that farmers around the world will be planting more wheat in response to high prices, and the additional supplies will result in lower prices.

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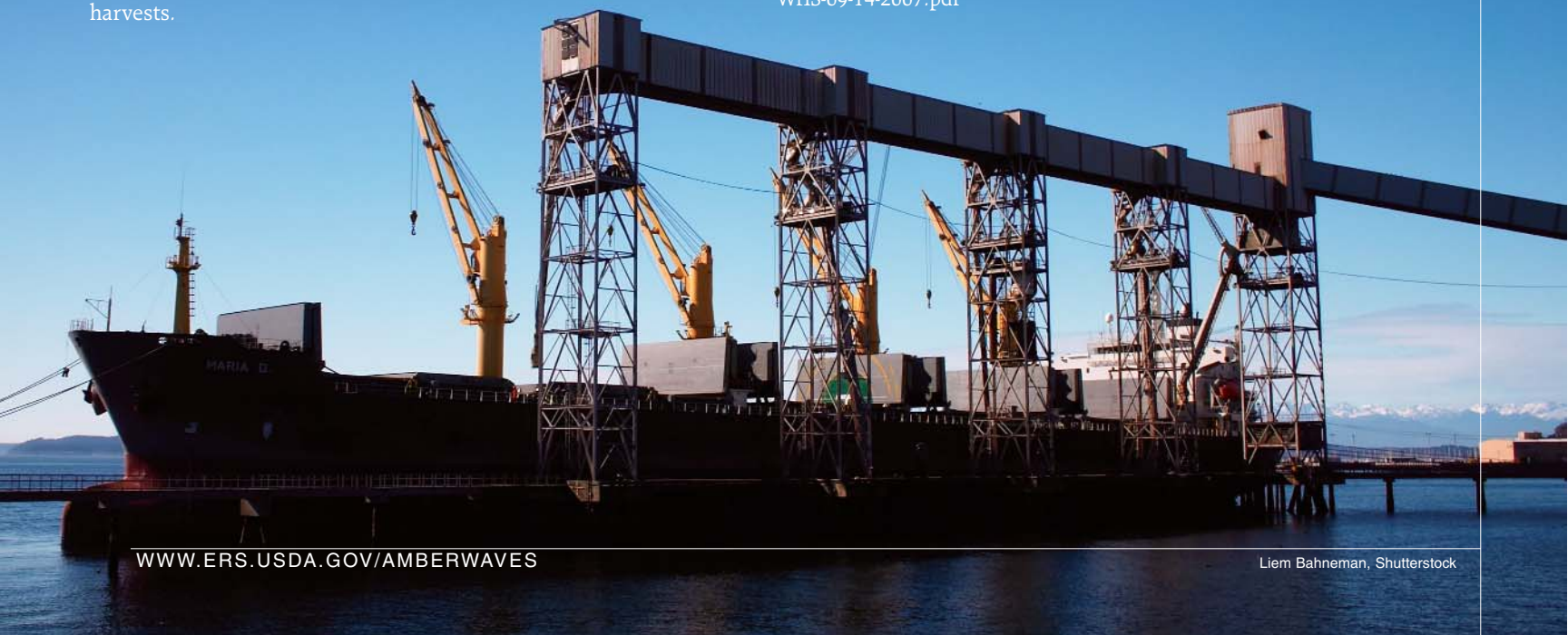
This finding is drawn from . . .

Wheat Outlook, by Gary Vocke and Edward Allen, WHS-07h, USDA, Economic Research Service, September 14, 2007, available at: http://usda.mannlib.cornell.edu/usda/ers/WHS//2000s/2007/WHS-09-14-2007.pdf



Liem Bahneman, Shutterstock

Food Product Introductions Continue To Set Records

A record 20,031 food and beverage products were introduced in 2006, according to Datamonitor, a leading international supplier of information on new packaged products. Food categories with the largest share of new products included candy, gum, and snacks (28 percent), beverages (26 percent), condiments (9 percent), and dairy (7 percent). Ten years ago, beverages accounted for 19 percent of new food and beverage products, and condiments made up 18 percent.

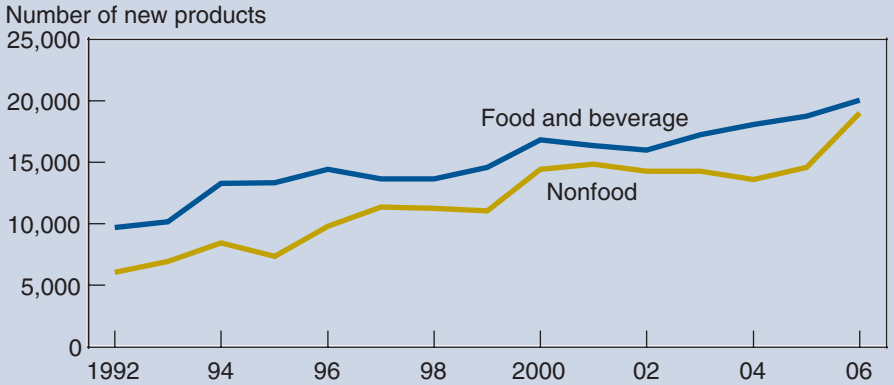
Datamonitor typically classifies over 90 percent of new food and beverage product introductions as "not innovative." Instead, these products may involve variations of existing products, such as new flavors, package sizes, or brand names. This practice suggests that food firms use new-product introductions as a differentiation strategy to present a fresh image to consumers, rather than providing truly novel products. In addition, failure rates for new products are exceptionally high, exceeding 90 percent for some categories.

From 2003 to 2006, "upscale" was the leading new product tag or claim, accounting for 9-13 percent of all new product claims, or 2,665 products in 2006. Datamonitor defines "upscale" as products such as premium ice cream, uniquely processed coffee, gourmet jam and dessert topping, and Certified Angus Beef. As incomes rise and consumers continually seek new experiences and tastes, the market for novel, luxury products grows.

"Natural" and "single serving" were the next two most common claims in 2006. "Organic," "quick," "fresh," "low or no fat," "no preservatives," "kids," and "high-vitamin" made up the remainder of the top 10 claims in 2006.

Cobranding has become an increasingly popular strategy for differentiating food products. Food processors typically pay a fee or royalty to place the logo of a popular food ingredient, container type, or media character—especially those that appeal to children—on a brand-name package. The logos represent a strong image that consumers easily recognize. In 2006, 279 cobranded products were introduced, compared with 16 in 1995. Recent examples include Breyers ice cream containing Splenda® brand sweetener and carrying Splenda's logo, Hillshire Farm deli products packaged in Glad Ware® containers, and SpongeBob SquarePants™ characters on packages of Kraft Macaroni and Cheese.

Food and beverage introductions up 106 percent in 1992-2006



Note: Nonfood items include health and beauty aids, household products, pet products, and miscellaneous items (e.g., tobacco, car care, lighters).
Source: Datamonitor, Productscan Online.

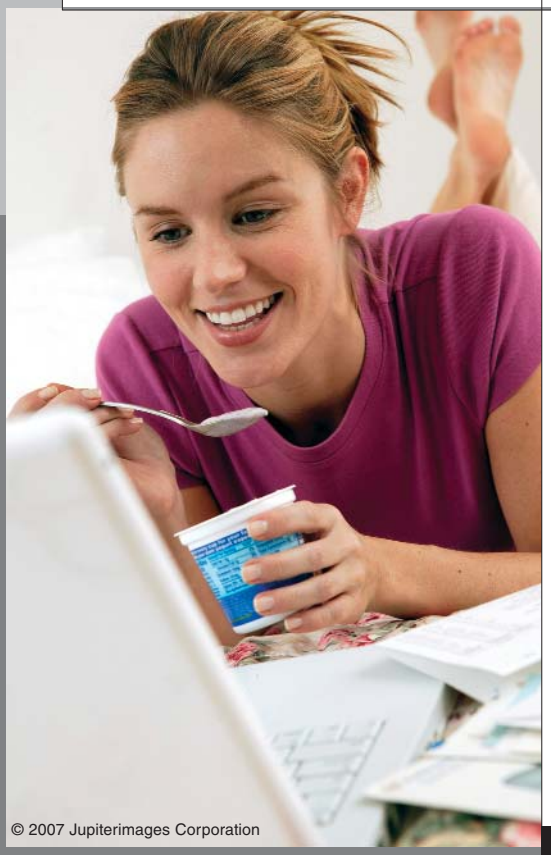
Steve Martinez, martinez@ers.usda.gov

This finding is drawn from . . .

The U.S. Food Marketing System: Recent Developments, 1997-2006, by Steve W. Martinez, ERR-42, USDA, Economic Research Service, May 2007, available at: www.ers.usda.gov/publications/err42/

ERS Briefing Room on the Food Marketing System in the U.S., www.ers.usda.gov/briefing/foodmarketingsystem/

Americans' Dairy Consumption Below Recommendations



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For more information . . .

ERS Food Availability (Per Capita) Data System, available at: www.ers.usda.gov/data/foodconsumption/

Americans are consuming more dairy products than in 1970, but the average American diet still falls short of the daily recommendations for milk and milk products. The good news is that many Americans are taking other dietary messages to heart and have switched to lower fat milks and cheeses.

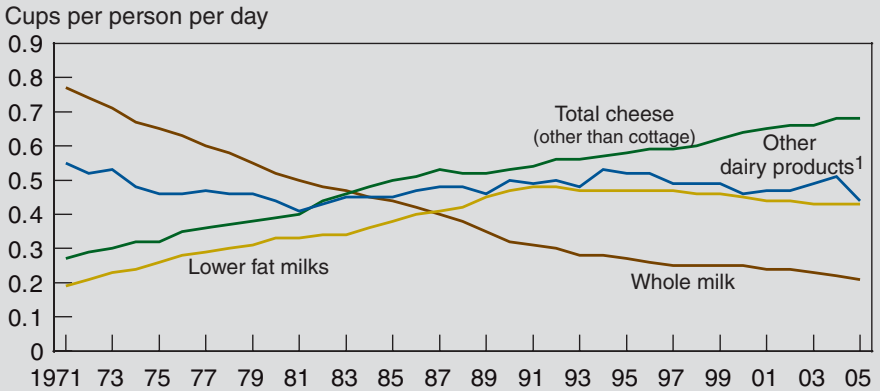
According to ERS's Loss-Adjusted Food Availability data, Americans on average consumed 1.8 cups of dairy products per person per day in 2005. The 2005 *Dietary Guidelines for Americans* and the supporting MyPyramid Food Guidance System recommend that Americans consume 2-3 cups of milk and milk products daily, depending on their age, gender, and level of physical activity.

The total amount of dairy products available for consumption in the U.S., according to ERS's Food Availability data, grew from 564 pounds per person (milkfat basis) in 1970 to about 601 pounds per person in 2005, with some products rising and others declining. ERS's per capita availability estimates are calculated by dividing the total annual supply of a commodity by the U.S. population that year. Although these estimates do not directly measure actual quantities ingested, they provide an indication of whether Americans, on average, are consuming more or less of various foods over time. Cheese contributed significantly to the increase in dairy product availability. Higher sales of resealable bags of shredded cheeses used for snacks or as ingredients in cooking accounted for part of the tripling of per capita cheese availability from 11 pounds to 31 pounds from 1970 to 2005. Cheeses are also used in commercially prepared foods, including pizzas, stuffed pastas, and frozen and refrigerated entrees. Yogurt and cream products were also up from 1970.

In contrast, availability of other dairy products is down from 1970 levels. Milk availability dropped from 31 gallons to 21 gallons per person from 1970 to 2005. Part of this decline can be attributed to competition from other beverages, such as carbonated soft drinks, coffee, and bottled water. Bottled water availability grew from 1.6 gallons per person in 1976 to 25.4 gallons per person in 2005. Availability of cottage cheese, evaporated and condensed milk, dry milk, and frozen dairy products declined between 1970 and 2005.

The *Guidelines* recommend choosing fat-free or low-fat milk and milk products. Are Americans doing this? Whole-milk availability decreased from 26 gallons per person in 1970 to 7 gallons per person in 2005, while lower fat milks grew from 6 to 14 gallons per person suggesting that 68 percent of milk is now lower fat varieties. Americans also are increasingly choosing lower fat cheeses. According to the International Dairy Foods Association, supermarket sales of reduced-fat, low-fat, and nonfat cheese grew by 134 million pounds between 1999 and 2005. During the same period, sales of regular cheese declined by 58 million pounds. Mozzarella, which is lower in fat than other cheeses such as Cheddar and Swiss, has overtaken Cheddar to become America's favorite cheese.

Americans are eating more cheese and switching to lower fat milks



Note: According to MyPyramid, 1 cup of milk or yogurt, 1.5 ounces of hard cheese, 2 ounces of processed cheese, 2 cups of cottage cheese, or 1.5 cups of ice cream count as 1 cup from the milk group.

[1]Includes frozen dairy products, cottage cheese, cream products, yogurt, dry milk, and evaporated and condensed milk.

Source: ERS Loss-Adjusted Food Availability data.

FINDINGS

Mark Vandever

Conservation Reserve Program Boosts Outdoor Recreation in Rural Communities

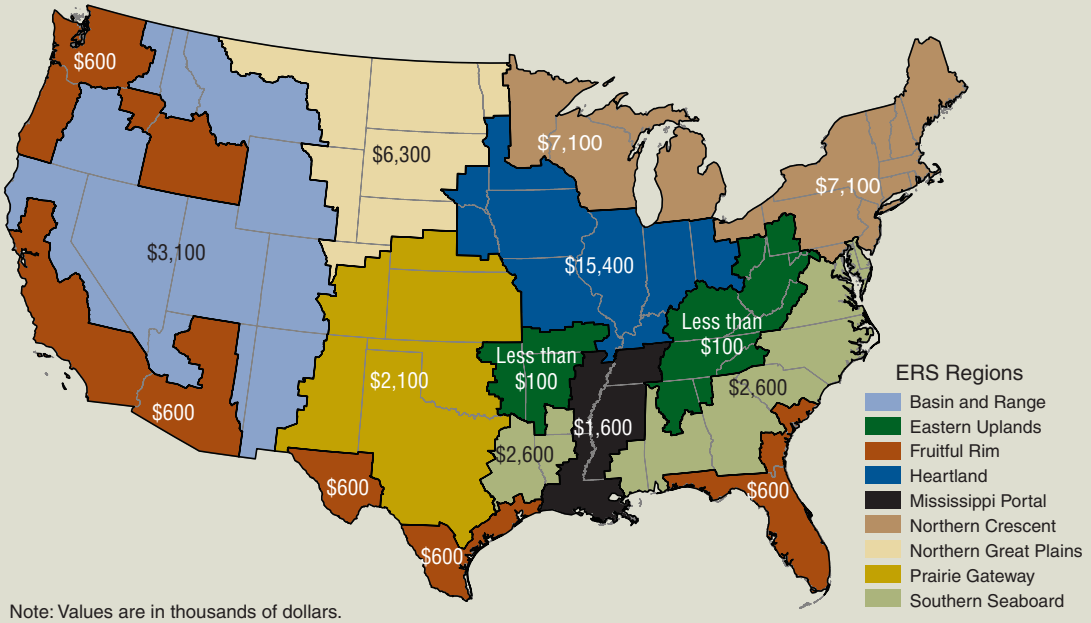
As growth in the biofuels industry increases demand for raw materials, market pressures to devote more land to crop production may lead to the conversion of millions of current Conservation Reserve Program (CRP) acres back to cropland. The 36.7 million acres of U.S. farmland currently enrolled in the CRP provide a range of environmental benefits. Those positive effects could be lost if CRP lands were brought back into production.

The CRP is a voluntary program run by USDA's Farm Service Agency (FSA). Agricultural producers enrolled in CRP plant long-term, resource-conserving vegetative covers to improve the quality of water, control soil erosion, and enhance wildlife habitat. In return, FSA provides participants with rental payments and cost-share assistance. Contracts last from 10 to 15 years.

By improving wildlife habitat and air and water quality, CRP has significantly increased the number and variety of wildlife, attracting bird watchers, hunters, anglers, and other outdoor recreation enthusiasts, who then spend money in rural areas. In 2004, ERS research confirmed that the CRP's environmental benefits can substantially increase recreational expenditures in rural counties. Based on data from national surveys of farmers and hunters, increases in recreational spending attributable to CRP enrollment are estimated to be as much as $290 million per year. This dollar amount includes revenue reported by farmers from recreational uses of their CRP land, as well as the nonfarm local spending of visitors to CRP land for outdoor recreation.

A number of simplifying assumptions were needed to arrive at this estimate, making its precision hard to gauge without more detailed information from landowners and outdoor recreation enthusiasts. However, other analyses also found similarly substantial economic benefits from CRP-induced recreation. For example, one study by Dean A. Bangsund, Nancy M. Hodur, and F. Larry Leistritz of North Dakota State University estimates that CRP lands in North Dakota attract about $13 million per year in recreation-related spending. The same attributes that attract hunters and other outdoor enthusiasts—clean air and water and a healthy ecosystem—create attractive landscapes that make rural communities more pleasant places in which to live and work.

Total recreational expenditures on farms with land enrolled in the Conservation Reserve Program vary by region



Note: Values are in thousands of dollars.
Source: USDA, Economic Research Service, using data from the 2001 Agricultural Resource Management Survey.

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This finding is drawn from . . .

The Conservation Reserve Program: Economic Implications for Rural America, by Patrick Sullivan, Daniel Hellerstein, LeRoy Hansen, Robert Johansson, Steven Koenig, Ruben Lubowski, William McBride, David McGranahan, Michael Roberts, Stephen Vogel, and Shawn Bucholtz, AER-834, USDA, Economic Research Service, November 2004, available at: www.ers.usda.gov/publications/aer834/

Ken Hammond, USDA

Tight Supply and Strong Demand May Raise U.S. Nitrogen Fertilizer Prices

Nitrogen accounted for 56.6 percent of the 21.3 million tons of chemical fertilizer nutrients (nitrogen, phosphate, and potash) used by U.S. agriculture in 2006. The composite fertilizer price increased 113 percent between 2000 and 2007, led by gains in nitrogen prices. During this 7-year period, the price of ammonia, the main source of nitrogen in fertilizer production, increased 130 percent from $227 to $523 per ton. The price of urea, the primary solid nitrogen fertilizer used in the U.S., rose 127 percent from $200 to $453 per ton.

Increased nitrogen prices affect all crop producers, but especially corn and wheat growers, for whom nitrogen costs are the largest single operating expense. Nitrogen applications accounted for 18 percent of the operating costs for corn producers and about 30 percent for wheat producers. Total nitrogen costs for U.S. corn production were $2.98 billion in 2005 and $0.9 billion for wheat in 2004.

Corn accounted for the largest share of nitrogen use among all crops. Planted acres of corn were relatively unchanged from 2000 through 2006, but jumped 19 percent from 78 million acres in 2006 to 93 million acres in 2007. Expanded planting of corn acres is due to high corn prices, driven by growing ethanol demand and strong export sales. Farmers are expected to apply an additional 1 million nutrient tons of nitrogen to the 2007 corn crop. Furthermore, increasing world demand for nitrogen is expected to continue in the near term. Overall, global nitrogen demand grew 14 percent from 2000 to 2006. Greater nitrogen demand from other countries could make U.S. imports of nitrogen fertilizers more costly.

At the same time, the U.S. supply of ammonia for nitrogen fertilizers has been declining. Because natural gas is the primary raw material used to produce ammonia, the volatile and upward trend in U.S. natural gas prices led to a 35-percent decline in U.S. ammonia production capacity and a 44-percent decrease in output between 2000 and 2006. Meanwhile, U.S. ammonia imports increased 115 percent. The share of U.S.-produced ammonia in the U.S. aggregate supply dropped from 80 to 55 percent, while the import share increased from 15 to 42 percent. The annual U.S. aggregate ammonia supply declined 17 percent, while the inventory level dropped 71 percent.

Further expansion of ethanol production and continued strong export sales of corn could boost U.S. demand for nitrogen fertilizers. Further increases in natural gas prices may limit U.S. production capacity to produce ammonia. The additional supply of nitrogen needed to meet the increasing demand may have to come from imports and thus make U.S. crop producers more vulnerable to changes in global nitrogen and natural gas markets.

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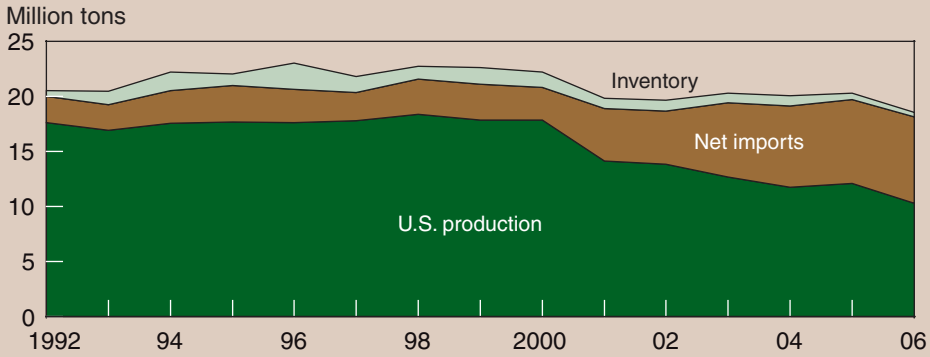
This finding is drawn from . . .

Impact of Rising Natural Gas Prices on U.S. Ammonia Supply, by Wen-yuan Huang, WRS-0702, USDA, Economic Research Service, August 2007, available at: www.ers.usda.gov/publications/wrs0702/

U.S. ammonia supply more dependent on imports since 2000



Note: Fertilizer year starts from July of the preceding year to June of the year indicated in the chart.

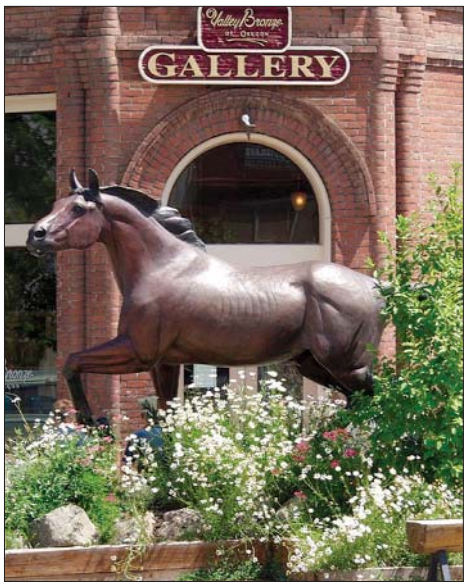
Source: USDA, Economic Research Service, using production and inventory data from the U.S. Department of Commerce and The Fertilizer Institute, and net import data from ERS.

Arts Employment Is Burgeoning in Some Rural Areas

The "art scene" is commonly associated with the largest cities, like New York, Los Angeles, and San Francisco. Indeed, arts employment is high in these and other major U.S. cities. However, ERS research confirms that, increasingly, the arts are concentrating in other, less populated areas throughout the country, including small, completely rural counties. The emergence of these nontraditional arts magnets, especially since 1990, demonstrates the ability of some rural areas to attract creative talent and is related to the growing number of initiatives promoting rural cultural tourism.

As nonmetro arts employment figures continue to rise, development strategies to promote rural arts and related tourism are increasing in number. The concentration of artists in a relatively small number of places suggests that successful strategies will not be widespread. The single characteristic most strongly associated with rural arts magnets in 1990 and 2000 was the ability to retain college-educated workers.

Information on county-level employment in the arts is available every 10 years in the Census of Population. The arts employment share consists of "art and design workers" and "entertainers and performers, sports and related workers." (The two categories include some workers not engaged in artistic pursuits (such as athletes and industrial designers), but they make up a small share of arts employment, and are very rare in nonmetro areas.) The Census data support the widely held view that, on average, artists tend to locate in central cities of the largest U.S. metro areas and are least prevalent in completely rural counties.

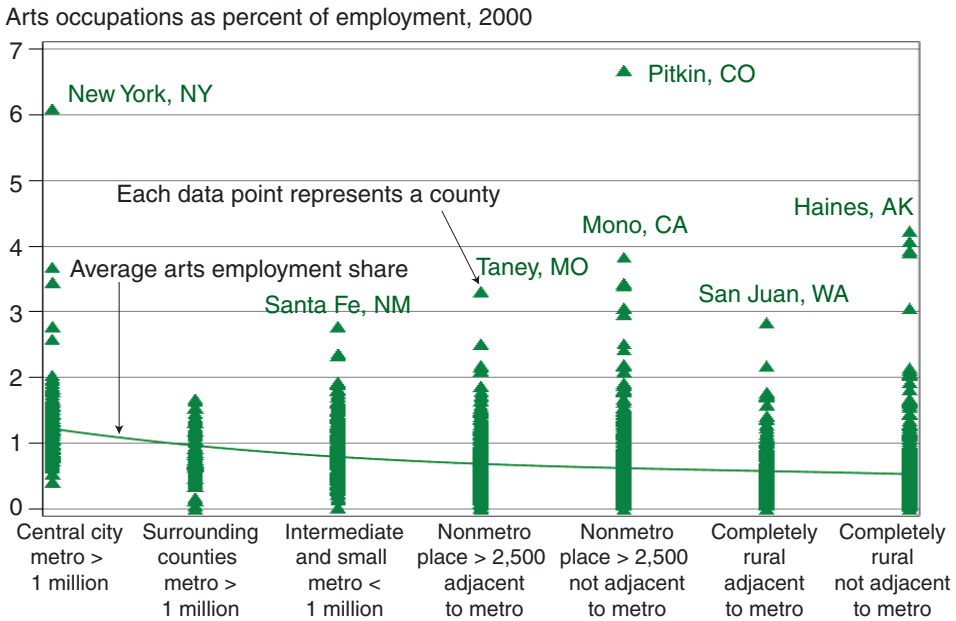


Todd K. Moyer

However, the Census data also show that metro and nonmetro areas as a whole experienced robust growth in arts employment. Growth was fastest in rural areas not adjacent to cities, The nonmetro growth in arts employment did not occur uniformly across the United States, but was concentrated in select counties.

In 1990, concentrations of artists in nonmetro counties were strongly associated with natural amenities in the Mountain West and the Northeast. Nonmetro counties with the highest shares of arts employment in 1990 included Nantucket, MA; Pitkin (containing Aspen), CO; and Teton, WY. In the 2000 data, several counties in the Texas Hill Country (Gillespie and Llano) had high arts employment shares, along with nonmetro counties in the Great Plains (Riley, KS), Midwest (Decatur, IA, and Bayfield, WI) and Southeast (Lincoln, GA, Oktibbeha, MS, and Mitchell, NC). Most of these counties offered considerable tourism and recreation activities or housed a large college-going and college-educated population.

Most counties have less than 1 percent of employment in the arts



Source: USDA, Economic Research Service using data from the Census of Population.

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This finding is drawn from . . .

ERS County-level Creative Class Codes, available at: www.ers.usda.gov/data/creativeclasscodes/

"The Emergence of Rural Artistic Havens: A First Look," Timothy R. Wojan, Dayton M. Lambert, and David A. McGranahan, *Agricultural and Resource Economics Review*, 36:1, April 2007

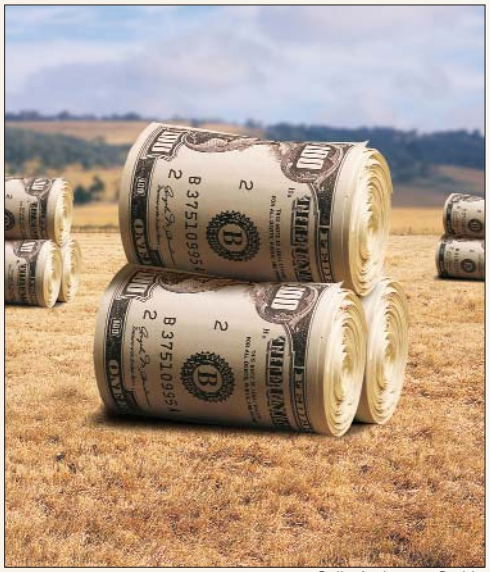
Nearly Half of Sales Come From Million-Dollar Farms

A growing percentage of U.S. farm commodity sales come from "million-dollar farms," with annual sales of $1 million or more. Agricultural census data show that these farms accounted for 48 percent of all U.S. farm product sales in 2002, up from 23 percent in 1982 (with sales measured in constant 2002 dollars). The share of sales attributable to million-dollar farms rose as the share from small farms (sales less than $250,000) declined. (See charts on page 39.)

The number of million-dollar farms more than tripled between 1982 and 2002 to 28,700, or 1.3 percent of all U.S. farms. Twelve percent of million-dollar farms had sales of $5 million or more in 2002, and they accounted for about one-fourth of U.S. farm sales.

By 2005, the number of million-dollar farms had increased to 35,060, according to USDA's Agricultural Resource Management Survey. The increase reflects—in part—good years for the farm sector since the 2002 Census was conducted. Twenty-one percent of million-dollar farms were located in the Pacific States of California, Oregon, and Washington, with 16 percent in California alone.

The number of operators per farm increases with sales since commercial-sized farms often require more management and labor than one individual can provide. Such multiple-operator farms accounted for 69 percent of million-dollar farms in 2005, compared with 43 percent of farms in general. One-third of million-dollar farms with more than one operator were also multiple-generation farms (at least 20 years' difference between the ages of the oldest and youngest operators). Multiple-generation farms made up a larger share of million-dollar farms than any other sales class, probably because million-dollar farms had enough business to keep more than one generation employed.



Colin Anderson, Corbis

Most million-dollar farms (82 percent) were family operations in 2005, where the majority of the business is owned by individuals related by blood, marriage, or adoption. The other 18 percent were nonfamily farms, including 7 percent organized as nonfamily corporations. Direct ownership of million-dollar farms by large, publicly held corporations was negligible since nonfamily corporations with more than 10 stockholders accounted for roughly 1 percent of million-dollar farms.

The situation was similar for the largest million-dollar farms (those with sales of $5 million or more): 69 percent were classified as family operators and 17 percent were owned by nonfamily corporations. Nonfamily corporations with more than 10 stockholders accounted for 1 percent of the $5-million farms.

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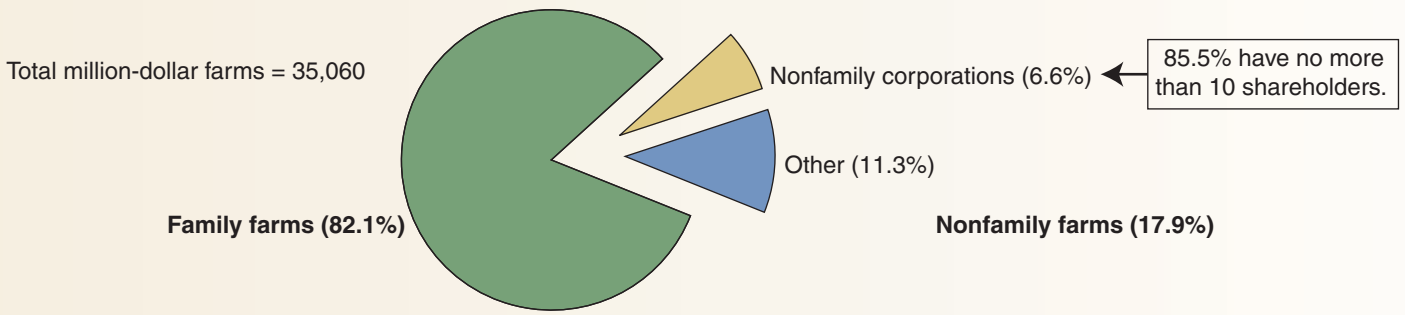
This finding is drawn from . . .

Structure and Finances of U.S. Farms: Family Farm Report, 2007 Edition, by Robert A. Hoppe, Penni Korb, Erik J. O'Donoghue, and David E. Banker, EIB-24, USDA, Economic Research Service, June 2007, available at: www.ers.usda.gov/publications/eib24/

Most million-dollar farms were organized as family farms in 2005



Source: USDA, Economic Research Service, 2005 Agricultural Resource Management Survey (ARMS), Phase III. Number of shareholders is from version 1 of ARMS.

An author interview is featured online at: www.ers.usda.gov/amberwaves/

Do Food Labels Make a Difference? . . . *Sometimes*

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- Competition drives food manufacturers to voluntarily label their products' desirable attributes and to use third-party certifiers to bolster credibility.
- Mandatory food labeling is usually more successful at filling information gaps than at addressing externalities such as environmental or health spillovers associated with food production and consumption.
- Mandatory labeling may initially have a larger impact on manufacturers' production decisions than on consumers' food choices.

There is a lot to know about the food we eat. The ingredients in a jar of spaghetti sauce, a box of cereal, or a cup of coffee could come from around the corner or around the world; they could be processed by children or by high-tech machines; they could be grown on huge corporate farms or on small family-run farms; or they could be mostly artificial or 100-percent natural.

While a description of a food product could include information on a multitude of attributes, not all of them are important to consumers or regulators. Information on some attributes could affect the health and welfare of consumers by influencing their food choices. Information on other attributes might have no effect at all.

Consumers, food companies, third-party entities, and governments play a role in determining which attributes are described on the label. The interaction of these groups influences which information is labeled voluntarily, which is mandated, and which is not labeled at all. It shapes the way information is presented and the accuracy and credibility of that information. The economics behind food labeling provides insight into the dynamics of voluntary food labeling and the types of market failures best addressed through mandatory labeling requirements.

Peter Baxter, Shutterstock

Companies Will Voluntarily Label If Their Benefits Outweigh Their Costs

Voluntary labeling is one of a food company's many advertising options. Assuming that companies attempt to maximize profits, they will add information about an attribute to the label as long as each additional message eventually generates more benefits than costs. The primary benefits of labeling for a company come from either increasing profits or maintaining profits in the face of new competition. Either outcome is more likely if consumers use the information to differentiate the labeled product from similar products and then buy it.

The probability that consumers will value and react to labeled information is improved if the label successfully persuades consumers that it conveys information about a meaningful distinction between labeled and unlabeled products. If consumers decide that the information's significance or accuracy is questionable, they will not use it to modify their purchase decisions. Researchers from the University of California and ERS found, for example, that the geographic branding of Washington State apples is losing its impact because it does not convincingly differentiate the State's apples from those grown in other areas.

To bolster the meaningfulness of their message, firms often rely on advertising and other types of outreach. In 2005, the U.S. food industry spent $32 billion on advertising and $66.5 billion on packaging to differentiate their products from the competition (see "Food Product Introductions Continue To Set Records" on page 4 in this issue).

Firms may also try to convince consumers of the validity of their labeling claims by using third-party labeling services. By offering an "unbiased" assessment of a labeling claim, these services help strengthen the credibility of voluntary labeling (see box, "Third-Party Labeling Services Can Improve Market Efficiency"). A number of entities, including consumer groups, producer associations, private companies, national governments, and international organizations, provide third-party services. The Good Housekeeping Institute, for example, founded for the purpose of consumer education and product evaluation, sets product standards and provides consumer guarantees for a multitude of goods, including foods. Two private companies, Société Générale de Surveillance (SGS) and AIB International (originally the American Institute of Baking), verify and certify food safety for a wide range of food products. USDA's Agricultural Marketing Service (AMS) has developed official grade standards for meats, eggs, poultry, dairy products, fresh fruits, vegetables, tree nuts, peanuts, and other commodities. ISO, a worldwide federation of national standards institutes,

promotes the development of international standards for a variety of products and production processes.

The value of the labeling service generally depends on the credibility and reputation of the providing entity. In some cases, national governments or associations of national governments may be the most widely recognized and reputable third-party providers of labeling services. But this is not always true. For example, although U.S. consumers tend to have confidence in USDA and the Food and Drug Administration (FDA) to regulate food safety, Europeans rank national bodies far below international, environmental, consumer, and farm organizations in terms of trustworthiness.

Private and government labeling services have helped support an explosion of voluntary food labeling. American grocery store shelves have become veritable encyclopedias of labeling claims. A single carton of eggs sold in a national grocery store chain, for instance, is labeled with a "cage free" claim, the grocery store "quality and satisfaction money-back guarantee" logo, the Orthodox Union symbol of kosher certification, and a long list of nutrient claims, including "25% of the daily value of vitamin E; 185 mcg of lutein per egg; and 100 mg of omega-3 polyunsaturated fatty acids per egg."

A byproduct of the explosion of labeled attributes is that consumers learn to "read between the labels" and make deductions about unlabeled products. For example, confronted with one can of tuna labeled "dolphin friendly" and one with no such claim, consumers would likely assume that the unlabeled tuna was caught with dolphin-endangering practices. In a competitive marketplace, the presence of a label is a signal of quality, and the lack of a label on competing brands implies the absence of the quality attribute.

Consumers' ability to make inferences about quality further spurs the proliferation of labels. Companies in a competitive marketplace are motivated to make explicit claims for all positive "sellable" product attributes since they know that consumers may interpret the lack of labeling as a lack of the attribute. It is almost impossible, for example, to find a can of tuna in the United States without a dolphin-friendly label.

Ultimately, the company's bottom line sets limits on product differentiation and labeling. Not all attributes are worth the cost. "Predator-friendly" labeling, a campaign to promote wolf-friendly cattle ranching, has not had the success of the dolphin-friendly label. Likewise, "Made in America" or similar country-of-origin labeling is not always a valuable marketing attribute. Only if consumers believe that food produced in the United States is tastier, safer, or has some other distinctive attribute will the label be worthwhile to manufacturers or retailers. A company's benefit-cost criterion for deciding which information to include on the label helps ensure labeling efficiency. Only information valuable enough to consumers to justify the cost is included on the label.

Voluntary Labeling May Leave Information Gaps

Economic theory predicts that voluntary labeling is not always sufficient for disclosing information on all attributes consumers value or for guaranteeing information accuracy. One limitation to voluntary labeling may arise when an entire product category has an undesirable characteristic. In these cases, manufacturers do not compete on the attribute and therefore do not provide labeled or otherwise advertised information to consumers. For example, there was little information on the sodium content of processed foods before manufacturers were required to disclose it. The competitive process did not work well to reveal high-sodium products; few manufacturers competed to offer reduced-sodium products because less of this "health negative" attribute also tends to reduce taste.

Another limitation to voluntary labeling arises because manufacturers may provide only relative information. For example, a sausage label may boast "30 percent less fat than the leading brand" or a bacon label may brag "half the sodium." Although this type of information is valuable for deciding among competing brands of the same item, it is not complete. Lower fat sausage may still be a high-fat food. In many cases, consumers need information on absolute, not just relative, values to make fully informed consumption decisions.

Market forces may also be unable to eliminate partial disclosure and innuendo. For example, in early 2000, a manufacturer began marketing a wheat-flake cereal with a label proclaiming no "genetically engineered ingredients." A consumer advocacy group asked the FDA to take enforcement action against the manufacturer (and six others) on the grounds that the labels were misleading because they implied that the absence of genetically

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Third-Party Labeling Services Can Improve Market Efficiency

Third-party labeling services—services offered by an entity other than the buyer or seller—can increase a label's value by increasing its reliability and credibility. These services improve market efficiency by reducing uncertainty for producers and search and information costs for consumers. By increasing the value of information, third-party services can also boost the amount of information that producers provide to consumers through product labels. The four primary third-party labeling services are standard setting, verification, certification, and enforcement. A single entity could provide just one service or any combination of all four services.

- Through *standard setting*, third-party authentication helps ensure consumers that a firm's quality standards are meaningful for differentiation and are not simply empty marketing ploys. For example, "green," "sustainable," or "fair trade" could mean almost anything. Successful third-party standards establish a common terminology for goods possessing the same quality characteristics.
- *Verification* services can take the form of either testing (such as testing that pathogen contamination or other safety problems are under control) or process verification (such as inspecting production facilities and bookkeeping records to verify that firms have adhered to safety and quality standards and followed specified production practices) or segregation and traceability monitoring to verify the existence of process attributes, such as organic, fair trade, dolphin-safe, and sustainable. These services help producers strengthen their labeling claims by providing an objective measure of product attributes.
- Third-party *certification* provides evidence that testing and/or process verification has been completed and that the information supplied by firms or third-party verifiers is correct. Third-party certification provides an objective evaluation of the product's quality attributes and helps firms establish credible market claims. Through accreditation, third-party certification can also establish the credentials of other third-party services, including other third-party certifiers. For example, USDA accredits third-party certifiers for the National Organic Program.
- Third-party *enforcement* provides further assurances that quality claims are valid. Private third-party enforcement includes watchdog services and de-certification. Watchdog-type enforcement relies on negative publicity to discourage fraud. Firms with valuable reputations will be most susceptible to this type of enforcement. De-certification provides a clear indication that a product has failed to comply with quality standards. De-certification by government entities could carry the added penalty of prohibiting marketing of the product. Legal requisites concerning advertising and fraud provide the ultimate enforcement, even for voluntary claims.

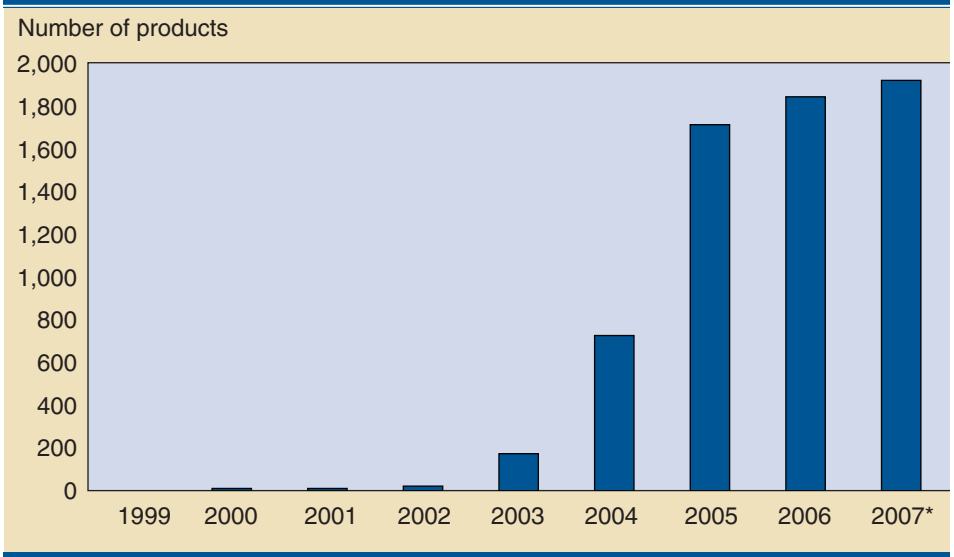
engineered ingredients distinguished the product from competing brands, when actually, no genetically engineered wheat is present in any food. The manufacturer removed the label.

Mandatory Labeling Has Targeted Information Gaps and Social Objectives

U.S. Government intervention in labeling began in 1906 with the Federal Pure Food and Drugs Act and the Federal Meat Inspection Act, which authorized Federal regulation of the safety and quality of food and prohibited sales of misbranded or adulterated foods. Lawmakers' primary objective in passing the acts' labeling regulations was to enhance fair competition by cracking down on deceptive marketing practices.

Enhancing fair competition and market efficiency has remained a primary motivation behind food labeling regulation for the past 100 years. Regulations ranging from the 1966 Fair Packaging and Labeling Act (requiring all consumer products in interstate commerce to contain accurate information to facilitate value comparisons) to the Organic Foods Production Act 1990 have sought to create a level playing field for producers by providing consumers with accurate information for comparing products and making choices. These regulations seek to increase informed consumption, not to alter consumption behavior. USDA's National Organic Program (the result of the Organic Foods Production Act) is designed to improve the comparability of organic labeling claims, not persuade more consumers to choose organic products.

Products claiming to have zero (or low) trans fat took off in 2003



*January 1 through October 1, 2007
Source: Datamonitor, Productscan Online.

Recently, government intervention in labeling has begun to target environmental or other spillovers associated with food production and consumption. Individual food consumption decisions can have social welfare consequences, including effects on the environment, health and productivity, labor conditions, and farm and industry structure. For example, consumers who eat tuna caught with encircling nets may inadvertently endanger dolphins. Economists describe these kinds of situations, in which the action of one economic agent affects the well-being or production possibilities of another in a way that is not reflected in market prices, as *externalities.*

When private consumption decisions result in externalities, social welfare may be maximized by a labeling choice that differs from one generated by private firms. In the tuna example, the potential benefits of providing information on labels include fewer dolphin deaths. For society as a whole, these potential benefits may outweigh the increase in profits that compose a private firm's labeling benefits. As a result, the social benefits of labeling may outweigh the social costs even though the private benefits do not outweigh private costs. The opposite could also be true. For example, the increased consumption of red wine resulting from labeling red wine with the information that moderate consumption may lower the risk of heart disease could result in higher costs from more birth defects, car accidents, and alcohol-related health costs. These social costs may outweigh the benefits of reduced

heart disease. On the other hand, the firm's net benefits may be positive: the costs of redesigning labels could be lower than the benefits of increased sales triggered by the health claim.

In externality cases where private firms do not supply relevant information, the government may decide to intervene in labeling decisions to try to maximize net social benefits. Government-mandated labeling can be a useful tool for achieving social objectives because of the potential power of information to influence consumption decisions. However, economic theory suggests that labels may be a poor means of addressing problems of externalities and advancing social objectives, such as protecting consumer health or the environment. Even if some consumers alter their behavior to account for externality costs, others do not, which means that the objective will probably not be met. For example, while some may purchase only free-range chickens, their goal of ending chicken cooping will not be achieved as long as most consumers continue to buy chickens raised in coops.

Economic theory identifies a number of policy tools that may be more suited to redressing externalities than information remedies. Bans, quotas, production regulations or standards, and Pigouvian taxes (which impose the externality cost of an activity on its producer) may be more successful than mandatory labels in adjusting consumption and production to better match socially optimum levels.

Empirical studies have found mixed results on the efficacy of labels in educating consumers and changing consumption behavior. These studies highlight the observation that consumers often make hasty food choices in grocery stores and usually do not scrutinize food labels. Researchers from Purdue University and the Ecole Nationale Superieure de Genie Industriel in France found that most participants in a marketing experiment did not notice the "GMO" (genetically modified organism) label on a food product until the label had been projected in large letters on a big screen.

Research also shows that a large number of warnings or a list of detailed product information may cause many consumers to disregard the label completely. And, even if consumers do consider each piece of information on a label, they may find it difficult to rank the information according to importance. For example, out of 10 warnings on a label, consumers may have difficulty picking out the most important. As a result, consumers may underreact to important information or overreact to less important information.

Labels May Influence Producers More Than Consumers

The primary impact of mandatory labeling regulations may stem from their effect on product reformulation and innovation, not on consumers' food choices. Changes in labeling regulations can open up areas of competition by allowing producers to compete on a new set of attributes, like health claims. To compete in these new areas, manufacturers may introduce new or reformulated products. Economists at the Federal Trade Commission found that regulation allowing health claims on cereal boxes resulted in significant product innovation and a plethora of cereals claiming to help reduce the risk of cancer. New labeling requirements can also spur product introductions or reformulations. Firms that are forced to disclose the negative characteristics of their products may choose to reformulate rather than risk losing sales from disclosure.

Manufacturers' reactions to labeling policy could be quite swift. In an effort to be the first to label—and capture first-mover profits—manufacturers may reformulate before consumer demand kicks in. FDA researchers found that leading up to mandatory trans fat labeling, most consumers did not know whether trans fats were good or bad. Nevertheless, in anticipation of mandatory labeling, manufacturers quickly jumped on the "no trans fat" bandwagon. From January 2005 through

the first 9 months of 2007, manufacturers introduced 5,459 products with labeling touting low or zero trans fat content.

Manufacturers may label and reformulate even though most consumers are not particularly interested in the new attribute. Sometimes a small niche group of consumers is enough to warrant the expense of reformulation and product innovation, particularly when the new ingredient or attribute does not affect taste or price and therefore does not alienate core groups of consumers. The more attributes manufacturers can stack in their products—eco-friendly, low-sugar, fair-trade, high-fiber—the more niche consumers they may be able to attract.

As a result of product reformulation, labeling regulation can affect consumer food choices more than would have been accomplished simply via consumers' reactions to labels. Even consumers who remain indifferent to or unaware of a new attribute may consume more of it if their usual food choices have been reformulated. For example, some consumers of popular snack foods may not know that their favorite nibbles are now made without trans fats. They are reaping the benefits of a potentially more healthful diet without changing their food choices. However, if the price of their favorite snack rises because of reformulation, consumers who do not want the new attribute are made worse off.

The benefits and costs of labeling regulation could be far reaching when manufacturers respond by reformulating. A shift to "zero trans fat" has triggered changes all along the processed food chain, including investments in new processing technologies and the development of soy and canola crop varieties with different oil characteristics. Other reformulations could have ramifications for the environment, animal welfare, and consumers' health and budgets.

These cases stand in stark contrast to those in which labels go unread and unnoticed. They also underscore the potential of labeling policy that works with industry incentives to affect the content and quality of American diets.

This article is drawn from . . .

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Integrating Conservation and Commodity Program Payments: A Look at the Tradeoffs

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- A payment program that integrates characteristics of conservation and commodity programs could simultaneously support working farms and ranches while improving environmental quality, with some tradeoffs.
- If policymakers structure payments to focus on environmental gain, income support benefits would be more broadly distributed across the U.S. agricultural sector.
- If policymakers seek to preserve the existing distribution of commodity program payments within an integrated program, environmental gain would be lower and per unit costs of environmental benefits higher than under a similar program focused on conservation.

Lynn Betts, NRCS/USDA

Can a single program support farm businesses while encouraging producers to adopt environmentally sound farming practices? That is the question underlying proposals to roll commodity program payments and conservation payments into a single program. This hybrid approach, sometimes referred to as "green payments," would combine the farm income support feature of existing commodity programs with those of conservation incentive payments (see box, "Shades of Green"). Under such an integrated payment program, agricultural producers receiving commodity program payments would also work to improve their environmental performance (and vice versa)—an intuitively appealing quid pro quo.

The challenge of a green payments program is to meld conservation and commodity program payments into a single, workable whole. Commodity payments have a variety of intended goals, such as fostering an abundant supply of food and fiber and supporting and stabilizing farm income. Conservation programs are more narrowly focused on promoting environmentally sound farming practices.

Tim McCabe, NRCS/USDA

Shades of Green

The term "green payment" has had different meanings in different contexts. In this article, a green payment is a payment to agricultural producers that addresses both commodity and conservation objectives. Sometimes, however, the term refers to any agricultural conservation or environmental payment, regardless of its relationship to commodity objectives. Green payments should not be confused with payments made under "green box policies." Green box policies under World Trade Agreement (WTO) rules include programs that have little or no impact on commodity prices or trade. These policies are given the green light to go forward under WTO rules, and do not necessarily require a link to conservation objectives.

Integrating commodity programs and conservation programs would require revisiting basic questions of program design: Who would be eligible for payments? How large would payments be? And what environmental actions would be required of producers who receive them? The answers to these questions will determine how much environmental gain would be realized and how income support benefits would be distributed across producers.

Although it is tempting to view a merger of commodity and conservation programs as a "win-win" proposition, policymakers would face tradeoffs in attempting to balance commodity and conservation objectives. At one level, the tradeoff is clear: for a given level of payment, the contribution to income declines as the cost of conservation increases. The portion of a payment that compensates agricultural producers for mandatory out-of-pocket costs, lost production, higher risk, and other costs associated with adoption of conservation practices does not contribute to the net income of the farm or ranch. A more subtle tradeoff may arise if agricultural operations eligible for commodity program payments differ from those that can produce the largest environmental gain per dollar of conservation cost. Policymakers could have to choose between (1) targeting payments to meet commodity objectives while sacrificing some environmental gain, or (2) targeting environmental gain while recognizing the possibility of shifting the distribution of payments away from producers and regions that have traditionally received commodity program support. Currently, recipients of the commodity program payments are largely producers of major field crops—grains, oilseeds, cotton, and rice.

Where You End Depends on Where You Begin

The level of environmental gain and distribution of commodity program payments depends largely on the starting point for program design—either existing commodity programs or conservation programs. Existing compliance provisions require soil conservation on highly erodible cropland and conservation of existing onfarm wetlands. Producers who fail to comply could lose commodity program payments. Policymakers could require additional conserving practices—such as nutrient management, pest management, and soil conservation on non-highly erodible land—as a condition for future payments. The net income support portion of such a payment would be equal to the total payment, less the costs associated with adopting conservation practices to address compliance requirements.

On the other hand, integrated payments could be viewed as an opportunity to refocus farm policy on environmental performance, or stewardship. Payments could encourage farmers and ranchers to produce environmental "goods and services," such as clean water and wildlife habitat in the same way that market prices encourage production of traditional agricultural commodities like wheat, corn, or beef. Agricultural producers could do this, with respect to clean water for example, by controlling sediment, nutrient, or pesticide runoff from their operations. Payments could be commensurate with the level of environmental gain or environmental performance. Thus, producers who deliver the largest gain or the best performance, relative to the cost of their

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conservation practices, would receive the highest level of net income support.

An ERS study of green payment program options considered four hypothetical program scenarios (see box, "Defining and Modeling Program Scenarios"). The scenarios were developed for illustrative purposes only, and were not intended to mirror specific proposals. Rather, the scenarios were defined to capture key features of alternative program designs. The analysis is intended to show how program design might affect the environmental cost effectiveness of the program and the distribution of payments.

Getting the Most for Conservation Dollars

Conservation payments are environmentally "cost effective" when they produce the largest possible environmental gain for a given level of spending. Although both environmental performance and compliance scenarios leverage environmental gain, performance scenarios produce much larger environmental gains for a similar level of conservation expenditure. The differences in environmental cost effectiveness across the four green payment program scenarios are largely a function of three key determinants: the broadness of program requirements that define the pool of possible participants, the effectiveness of payment incentives in encouraging the participation of producers who can deliver large environmental benefits at low cost, and the flexibility that producers have in responding to payment incentives.

Defining and Modeling Program Scenarios

The four scenarios considered in the ERS analysis represent alternative green payment program designs. Two ERS scenarios focus on strengthening the compliance requirements tied to existing commodity programs—*Extended Compliance* and *Modified Compliance*. Under *Extended Compliance*, payments accrue to crop farms eligible for existing commodity programs (about 25 percent of all farms), but require participants to satisfy extended compliance provisions (e.g., soil erosion control on all croplands, plus nutrient and pest management). *Modified Compliance* is similar to *Extended Compliance*, except that producers may opt out of high-cost conserving practices by accepting a reduction in payments commensurate with the reduction in environmental benefits delivered.

The other two program scenarios—*Improved Performance* and *Good Performance*—are similar to current conservation programs in their emphasis on providing environmental benefits. Under the *Improved Performance* scenario, payments are based on the change in environmental performance relative to a producer's current level of stewardship. Improvements in environmental performance are measured by an environmental index, similar to the Environmental Benefits Index (EBI) used to rank proposed contracts for Conservation Reserve Program general signups. EBI points could be obtained for undertaking a wide range of conservation treatments: soil erosion control, nutrient management, pest management, and enhancement of wildlife habitat, among others. Nearly every U.S. farm and ranch would be eligible for a green payment, not just those producing crops targeted by traditional commodity programs (i.e., grains, oilseeds, cotton, and rice).

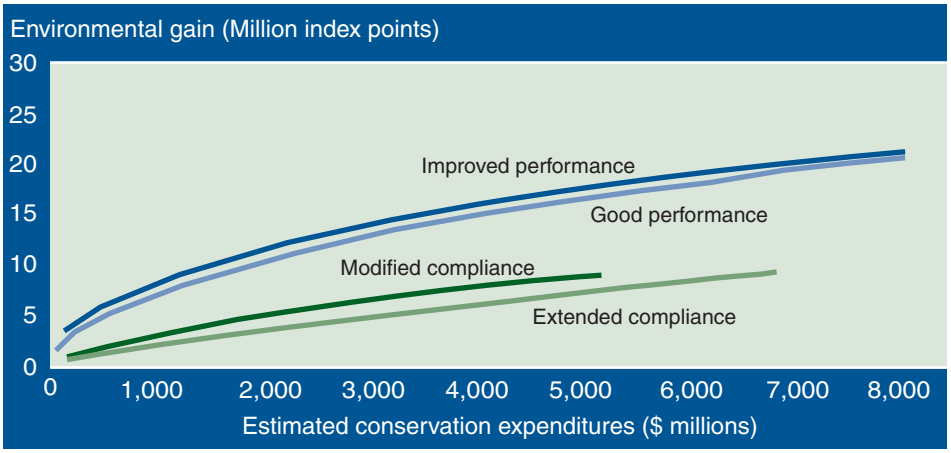
Good Performance is similar to *Improved Performance*, except that payments are based on a level of environmental performance over and above an established minimum environmental threshold, rather than the change in environmental performance. In contrast to the *Improved Performance* scenario, *Good Performance* would allow producers already operating at a high level of environmental stewardship to receive payments without taking additional action to improve their environmental performance. On the other hand, producers with relatively poor levels of environmental stewardship would have to improve performance to reach the threshold before becoming eligible for payments.

These four scenarios were analyzed using data on a nationally representative group of farms derived from USDA's Agricultural Resources Management Survey. Using a simulation modeling framework, ERS assessed how a producer might decide to participate in a green payment program, given the nature and location of the farming operation, program options available, and resource concerns specific to the farm. For each farm, researchers estimated the number of acres where the application of conservation practices would yield environmental benefits, how much environmental gain could be realized, what level of payment the producer could expect for applying those practices, and how much it would cost the producer to apply those practices. It was assumed that agricultural producers would participate in the payment program when the payment offered exceeded the cost of adopting required practices.

In the four scenarios described, the share of program payments representing conservation spending and net income support is not fixed. The allocation of funds between these purposes would arise naturally from producer responses to incentives provided under the voluntary programs. As the model allows for estimating the cost of adopting qualifying practices, payments can be separated into two components: (1) conservation expenditures and (2) net income support—the difference between total payments and conservation expenditures.

In the analysis, each of the four green payment scenarios implicitly allocates a substantial portion of program payments to income support. Depending on the scenario and overall program size, 50 to 90 percent of producer payments represent net income support, as payments generally exceed average costs of conservation practices installed on enrolled acreage. These results also suggest that all four scenarios would result in substantial environmental gain. How much environmental gain is actually realized will depend on how effectively conservation expenditures are used in leveraging environmental gain.

Focus on environmental performance yields large environmental gain, compared with that for compliance scenarios



Source: USDA, Economic Research Service.

The *Improve Performance* scenario is the most environmentally cost-effective alternative, partly because virtually all farms are eligible to participate in the program. Moreover, as payments are proportional to environmental gain, participation incentives are focused on producers who can deliver large gains at low cost; such producers stand to make the largest monetary return on producing environmental benefits. Finally, program applicants are free to select which tracts of land are offered for program enrollment and which resource concerns are addressed on those tracts. Again, given the structure of payment incentives, producers will offer combinations of land and conservation treatments that yield large payments relative to practice adoption costs, thereby maximizing the return on program participation while providing cost-effective environmental gain.

The *Good Performance* scenario is slightly less cost effective in producing environmental gain because payments are structured around an environmental threshold that producers must reach before they qualify for payments. With this approach, producers who have already achieved a relatively high level of environmental performance are rewarded with payments based on environmental *performance* rather than environmental *gain*. No additional conservation is required to receive payments. At the same time, some producers who could make cost-effective environmental gains may decline to participate because they are required to reach the environmental threshold in order to receive payments.

Extended Compliance is the least environmentally cost-effective scenario. Eligibility is restricted to current commodity program participants, payments are not tied to the potential to deliver environmental gain, and producers are presented with a take-it-or-leave-it package of environmental requirements. To retain eligibility for income support payments, producers must satisfy all requirements regardless of cost (or environmental benefit). The *Modified Compliance* scenario is more environmentally cost effective than *Extended Compliance* because it allows producers to opt out of some requirements, with a reduction in payment proportional to the loss of environmental gain due to the opt-out. Environmental cost effectiveness is improved because producers are encouraged to drop expensive, low-benefit activities while complying with relatively high-benefit, low-cost requirements. Moreover, because producers are free to focus on cost-effective environmental gains, some producers who would not participate in *Extended Compliance* would probably sign up for *Modified Compliance*.

Scenario Implications for the Distribution of Green Payments

In attempting to merge programs that support farm operations with those that encourage environmentally sound farming and ranching practices, policymakers face tradeoffs. Although each of the green payment program approaches would result in substantial net income support

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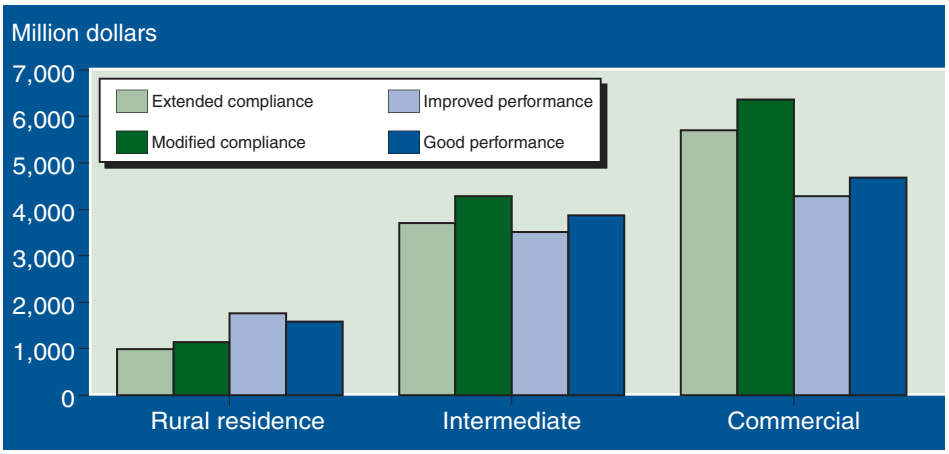
for producers, the four scenarios result in very different *distributions* of income support across agricultural operations. The distribution of payments in the environmental compliance scenarios is similar to that under existing commodity programs. Net income support is different, however, because conservation costs vary across operations. On the other hand, the environmental performance scenarios result in a very different distribution of payments and net income support across farm types, commodity specializations, and regions.

The design features that make the environmental performance scenarios relatively cost effective at producing environmental gains—a broader pool of eligible participants and payments based on environmental performance—also drive the distribution of payments and income support. Under the environmental performance scenarios, smaller payments per farm operation are spread over an increased number of program participants, with a substantial share of payments allocated to producers who are not eligible for current commodity programs. Larger commercial farms (with gross annual sales of more than $250,000) continue to capture the largest share of overall payments. However, payments would generally increase for intermediate-sized operations and smaller rural-residence operations. The share of payments to producers of grain crops and cotton decreases, whereas the share to producers of livestock and other crops increases. Beef producers, in particular, would benefit if grazing lands become eligible for environmental performance-based payments. Regionally, payments would shift from the Corn Belt and Plains States, where grain production is concentrated, to areas where livestock and specialty crop production dominate.

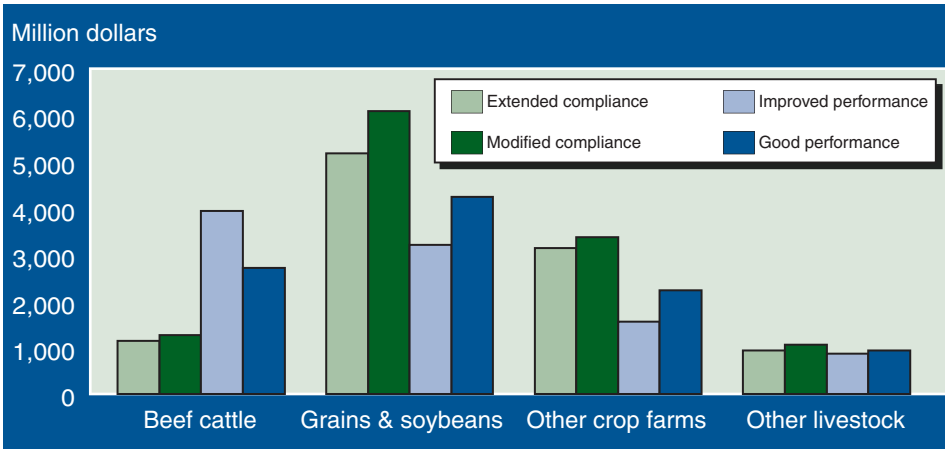
If policymakers intend to refocus farm policy to enhance environmental stewardship, payments based on environmental performance would reallocate net income support across the sector. If policymakers want to maintain income support levels to traditional constituents of commodity programs, a compliance requirement may be a better option, although it will come at the cost of substantially smaller environmental gain.

Large farms still receive the most under environmental performance scenarios, but less than under compliance scenarios



Source: USDA, Economic Research Service.

Green payment scenarios focused on environmental performance would shift payments from crop to livestock producers



Source: USDA, Economic Research Service.

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The Future of Biofuels

A Global Perspective

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With near record oil prices, the future of biofuel—made from plant material—is of keen interest worldwide. Global biofuel production has tripled from 4.8 billion gallons in 2000 to about 16.0 billion in 2007, but still accounts for less than 3 percent of the global transportation fuel supply. About 90 percent of production is concentrated in the United States, Brazil, and the European Union (EU). Production could become more dispersed if development programs in other countries, such as Malaysia and China, are successful. The leading raw materials, or feedstocks, for producing biofuels are corn, sugar, and vegetable oils.

While rapid expansion in biofuel production has raised expectations about potential substitutes for oil-based fuels, there have been growing concerns about the impact of rising commodity prices on the global food system. According to the International Monetary Fund, world food prices rose 10 percent in 2006 because of increases in corn, wheat, and soybean prices, primarily from demand-side factors, including rising biofuel demand. The Chinese Government put a moratorium on expanded use of corn for ethanol because of rising feed prices and is promoting other feedstocks that do not compete directly with food crops, such as cassava, sweet sorghum, and jatropha (an oil-bearing plant originally from South America).

Mexico capped tortilla prices in early 2007 to contain food price inflation from higher priced corn imports. Real sugar prices hit a 10-year high in 2006, stressing budgets of low-income people in Brazil and elsewhere. Prices have since declined. The Indonesian Government increased the export duty on crude palm oil, also used in biodiesel production, in mid-2007 to slow the rising cost of domestic cooking oil.

U.S. livestock producers are facing increased costs for corn and other feed, which may translate into higher retail meat prices. And in Japan, historical concerns have been revived about the country's almost complete dependence on imports of feed grain and oilseeds to support its large livestock sector.

The outlook for global biofuels will depend on a number of interrelated factors, including the future price of oil, availability of low-cost feedstocks, sustained commitment to supportive policies by governments, technological breakthroughs that could reduce the cost of second-generation biofuels, and competition from unconventional fossil fuel alternatives.

A New Era of High Oil Prices Attracts Investment in Biofuels

The rise in oil prices is the most important factor boosting the competitiveness of alternative fuels, including biofuels. The unprecedented 6-year rise in oil prices has prolonged opportunities for efficiency gains, stimulated energy conservation, and generated increased supply from traditional and alternative energy sources. While these adjustments may eventually lower oil prices, most forecasts do not show real prices falling below $50 per barrel.

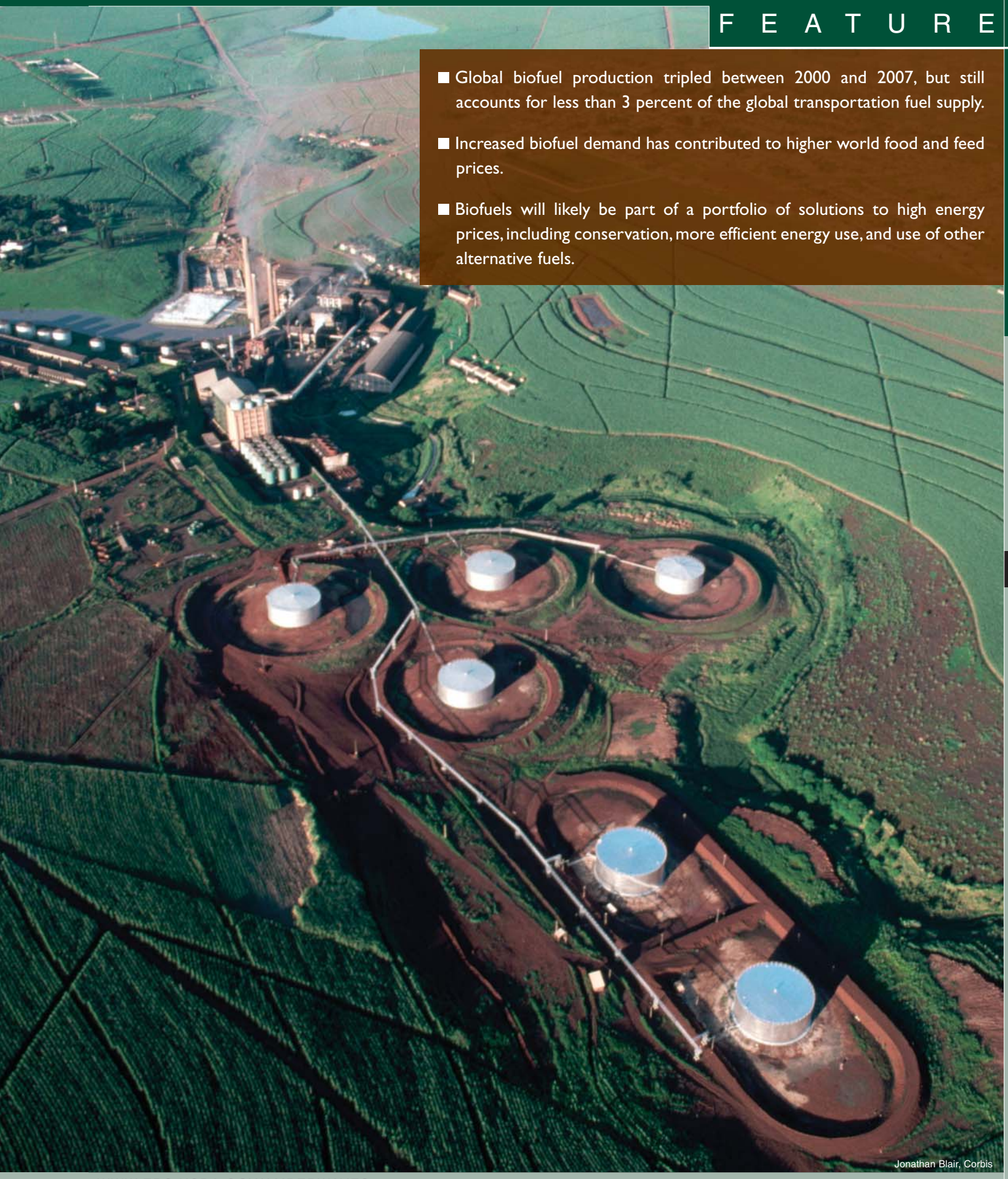
Previous periods of high oil prices were short. Prices tended to rise very sharply, usually induced by military conflict, peaked in a matter of weeks or months, and then declined sharply. Following these price spikes, the rapid decline in petroleum prices made it difficult to sustain alternative fuel programs and reduced incentives for consumers to curb their use of petroleum products.

Unlike previous high-price periods, the current oil market is driven by strong demand-side factors. These factors include robust economic growth and rising oil demand from rapidly growing middle-income economies, where consumers are demanding a higher standard of living and exhibiting big appetites for energy. Almost two-thirds of recent global growth in oil demand has come from China and other middle-income economies.

Profitability of Biofuels Depends on the Availability of Low-Cost Feedstocks

Feedstock costs are the most significant cost of biofuel production, ranging from 37 percent for sugarcane-based ethanol in Brazil in 2003-04 to 40-50 percent for corn-based ethanol in the United States. Sugar beets represented 34 percent of the cost of sugar-

- Global biofuel production tripled between 2000 and 2007, but still accounts for less than 3 percent of the global transportation fuel supply.
- Increased biofuel demand has contributed to higher world food and feed prices.
- Biofuels will likely be part of a portfolio of solutions to high energy prices, including conservation, more efficient energy use, and use of other alternative fuels.



Jonathan Blair, Corbis

based ethanol production in the EU. With rising commodity prices, these cost shares are even higher now. Another major cost component is energy, which may account for as much as 20 percent of biofuel operating costs in some countries.

The ratio of crude oil prices to feedstock prices offers a simple indicator of the competitiveness of biofuel made from various feedstocks. The ratio of crude oil to corn prices, for example, rose sharply after 2004 as oil and ethanol prices increased and corn prices were stable. But the ratio dropped sharply after September 2006, making biofuels less cost competitive. Biodiesel producers in Europe and Southeast Asia also faced declining competitiveness as soy and palm oil prices rose in 2006-07. World sugar prices, on the other hand, declined by 50 percent from 10-year highs in 2006, boosting relative prospects in Brazil's ethanol sector.

The sale or productive use of byproducts also contributes to a biofuel plant's profitability. Dried distillers' grain (DDG), a byproduct of corn ethanol production, can be used as a protein-rich livestock feed additive. Sales of DDG can add as much as 10-15 percent to ethanol producers' incomes. Carbon dioxide, usually released into the atmosphere, is captured by some ethanol plants and sold for use in the food and beverage sector. Bagasse, the fibrous material left over from pressing sugarcane, can be burned to provide heat for distillation and electricity to power machinery or sold to local utilities. Glycerin, a byproduct of biodiesel production, has a wide number of pharmaceutical, food-processing, and feed applications.

Government Support Is Used To Reduce Volatility

Strong long-term government intervention is a feature in the two top biofuel-producing countries—the United States and Brazil (see box, "Lessons From Brazil")—as well as the EU, China, and other countries. Governments justify support in the name of achieving broad societal goals: to diversify energy sources, to enhance energy security, and to meet environmental and rural development objectives. Governments tend to introduce support to help fledgling biofuel ventures overcome cost and scale disadvantages and weather the inherent volatility in profits.

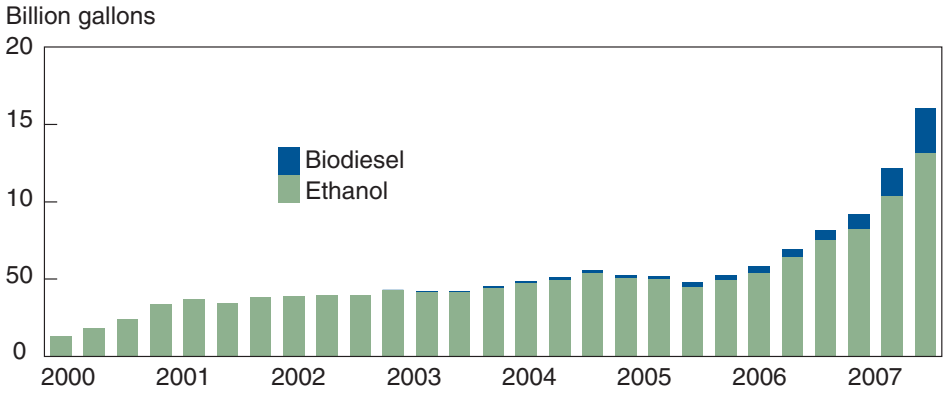
Governments have introduced a variety of policy tools that reduce risk and uncertainty in response to investor and producer concerns about the double-edged uncertainty of volatile feedstock and energy input prices and biofuel output prices. The most common tool is a requirement to blend biofuel with its fossil fuel counterpart to provide a guaranteed market for biofuels. The nature of this requirement varies around the world in the extent to which it is mandatory, the phase-in period, the volume or blend percentage mandated, and whether a nationwide or regional strategy is used.

Countries also rely on subsidies, tax credits, and preferential taxes to overcome the higher cost of biofuel production relative to gasoline and diesel and to encourage consumers to buy biofuel-containing gasoline or diesel. Europe offers an 18.7-euro per acre energy premium for production of biofuel feedstocks. India's Government offers sugar mills interested in setting up ethanol production facilities subsidized loans for 40 percent of project costs. Brazil encourages consumption by imposing a lower sales tax for hydrous ethanol (containing water) and E25 (25 percent ethanol) than for gasoline.

The United States provides a $.51 per gallon tax refund for blenders of ethanol and $1.00 per gallon for biodiesel from vegetable oils and animal fat ($.50 for recycled cooking oil or animal fat). Some States also provide support, and other Federal incentives are provided for smaller biofuel plants.

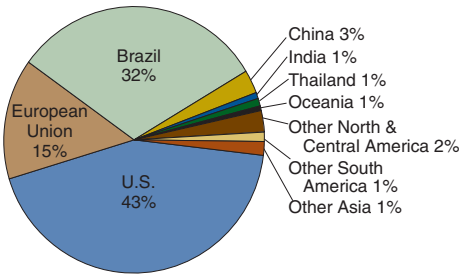
Import restrictions are also used to promote the emerging biofuel industry. Effective tariffs range from 9 percent in Canada (for ethanol imports from Brazil, 0 tariff for renewable fuels from the U.S.) to about 45 percent for undenatured and 24 percent for denatured ethanol in the EU. Import duties and tariffs are waived by the EU for many developing countries (not

Global biofuel production tripled between 2000 and 2007

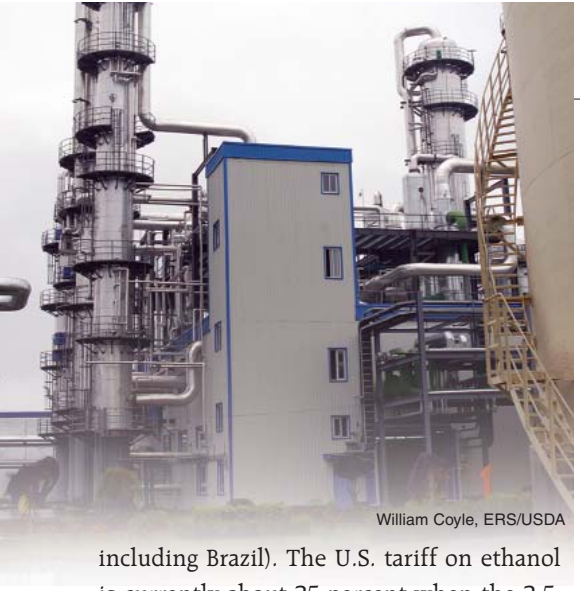


Source: International Energy Agency; FO Licht.

About 90 percent of global biofuel production is concentrated in U.S., Brazil, and Europe, 2007



Source: FO Licht, includes only ethanol for fuel.


William Coyle, ERS/USDA

including Brazil). The U.S. tariff on ethanol is currently about 25 percent when the 2.5-percent tariff is combined with the $.54 per gallon duty.

Brazil is the only country promoting biofuel use beyond minimal blending levels by allowing consumers to choose it as a fuel substitute. The Brazilian Government has promoted the availability of ethanol at almost every gasoline station and the manufacture of flexible fuel cars (capable of using pure gasoline, E25, or pure hydrous alcohol). Proposed U.S. legislation would also provide incentives for expanding E85 distribution and the manufacture of more E85-capable vehicles.

While biofuels share similar attributes with oil-based fuel, they are not perfect substitutes. Biofuels can be used in existing gasoline and diesel engines in blends of up to 10 percent in the case of ethanol and 20 percent for biodiesel with little or no engine modification. This compatibility contrasts with hydrogen fuel cell technology, which would require a radically different distribution system.

However, ethanol has only two-thirds the energy content of gasoline, and biodiesel has 90 percent that of diesel. Thus, a car will get fewer miles per gallon the greater the biofuel blend. Shipping ethanol is more expensive; it cannot be transported by low-cost pipelines because of potential contamination from ethanol's tendency to absorb water and to dissolve impurities on the inside surfaces of multiproduct pipelines. Dedicated pipelines for ethanol are being considered in Brazil and the United States and may become economical with expanded production.

Looking to the Future: The Potential of Second-Generation Biofuels

Many uncertainties remain for the future of biofuels, including competition from unconventional fossil fuel alternatives and concerns about environmental tradeoffs. Perhaps the biggest uncertainty is the extent to which the land intensity of current biofuel production can be reduced. The amount of biofuel that can be produced from an acre of land varies from 100 gallons per acre for EU rapeseed to 400 gallons per acre for U.S. corn and 660 gallons per acre for Brazilian sugarcane.

Cellulosic ethanol could raise per acre ethanol yields to more than 1,000 gallons, significantly reducing land requirements. Cellulosic ethanol is made by breaking down the tough cellular material that gives plants rigidity and structure and converting the resulting sugar into ethanol. Cellulose is the world's most widely available biological material, present in such low-value materials as wood chips and wood waste, fast-growing grasses, crop residues like corn stover, and municipal waste.

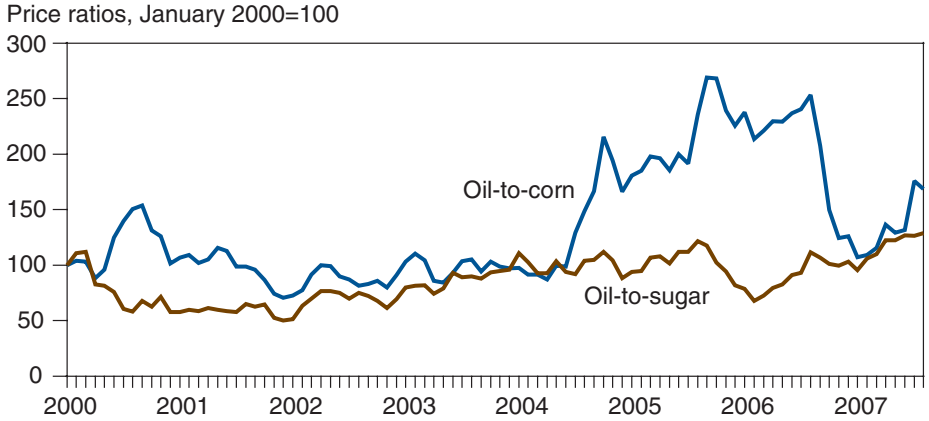
U.S. cellulosic fuel production costs are now estimated at more than $2.50 per gallon, compared with $1.65 per gallon for corn ethanol. Venture capital and government subsidies are supporting companies interested in making cellulosic ethanol commercially viable, primarily in the United States, but also in several other countries, including Canada, Brazil, China, Japan, and Spain.

In the meantime, other costs of cellulosic ethanol production need to be fully assessed, such as the impacts of harvesting grasses, trees, and crop residues on the erodibility and fertility of land resources. There are also questions regarding the upstream logistical and environmental costs of harvesting, transporting, and storing large volumes of bulky feedstock used in processing.

Competitive Fossil Fuel Alternatives

High oil prices have drawn attention not only to biofuels, but to a range of other liquid fuel alternatives. Large investments are being made in developing more difficult-to-access conventional oil resources located in remote areas or deeper waters, unconventional sources, such as oil sands and heavy crude oil, and the conversion of coal to oil. While world oil production is expected to increase 30 percent by 2030, production from unconventional fossil fuels will increase even faster, according to the U.S. Department of Energy. Global biofuel production is projected to more than double. Many of the fossil fuel alternatives have lower costs of production than biofuels. Canada's oil sands, for example, can produce

Corn ethanol profits were more subdued in 2007



Source: USDA, Economic Research Service and Federal Reserve Bank of St. Louis.

oil for $30 per barrel. Current production is more than 1 million barrels per day, with some forecasting production rising to more than 3.5 million barrels per day by 2030.

Another alternative is converting coal to oil, which is of particular interest to economies with abundant coal resources, such as China and the United States. Oil prices of $40 per barrel may be sufficient to make this process profitable despite high investment costs.

What Are the Environmental Tradeoffs?

A key interest in developing or expanding biofuel production and use is the environmental benefits, including the potential to reduce emissions, such as greenhouse gases (GHG). An estimated 25 percent of manmade global carbon dioxide (CO_2) emissions, a leading GHG, comes from road transport. Global road transport has grown rapidly over the past 40 years and is projected to continue to increase, especially in middle-income countries experiencing rapid economic growth, middle-class expansion, and urbanization.

Both biofuels and gasoline give off CO_2 when burned. Biofuels are theoretically carbon neutral, releasing CO_2 recently absorbed from the atmosphere by the crops used to produce them. Gasoline and other fossil fuels add to the CO_2 supply in the atmosphere by giving off CO_2 absorbed and trapped in plant material millions of years ago.

The advantage of biofuels is less clear in a "life-cycle" analysis that examines not just combustion, but the production and processing of the feedstock into fuel. Most studies indicate that the net energy balance of biofuels is positive (energy output is greater than energy input), but estimates vary widely. Net balances are small for corn ethanol and more significant for biodiesel from soybeans and ethanol from sugarcane and from cellulose. The biofuel with the highest net energy balance reduces GHG the most when compared with that for gasoline.

Biofuel blending targets, selected countries

Country	Feedstocks		2007 production forecast (million gals.)		Blending targets
	Ethanol	Biodiesel	Ethanol	Biodiesel	
Brazil	sugarcane, soybeans, palm oil	castor seed	4,966.5	64.1	25 percent blending ratio of ethanol with gasoline (E25) in 2007; 2 percent blend of biodiesel with diesel (B2) in early 2008, 5 percent by 2013.
Canada	corn, wheat, straw	animal fat, vegetable oils	264.2	25.4	5 percent ethanol content in gasoline by 2010; 2 percent biodiesel in diesel by 2012.
China	corn, wheat, cassava, sweet sorghum	used and imported vegetable oils, jatropha	422.7	29.9	Five provinces use 10 percent ethanol blend with gasoline; five more provinces targeted for expanded use.
EU	wheat, other grains, sugar beets, wine, alcohol	rapeseed, sunflower, soybeans	608.4	1,731.9	5.75 percent biofuel share of transportation fuel by 2010, 10 percent by 2020.
India	molasses, sugarcane	jatropha, imported palm oil	105.7	12.0	10 percent blending of ethanol in gasoline by late 2008, 5 percent biodiesel blend by 2012.
Indonesia	sugarcane, cassava	palm oil, jatropha	--	107.7	10 percent biofuel by 2010.
Malaysia	none	palm oil	--	86.8	5 percent biodiesel blend used in public vehicles; government plans to mandate B5 in diesel-consuming vehicles and in industry in the near future.
Thailand	molasses, cassava, sugarcane	palm oil, used vegetable oil	79.3	68.8	Plans call for E10 consumption to double by 2011 through use of price incentives; palm oil production will be increased to replace 10 percent of total diesel demand by 2012.
United States	primarily corn	soybeans, other oilseeds, animal fats, recycled fats and oil	6,498.7	444.5	Use of 7.5 billion gallons of biofuels by 2012; proposals to raise renewable fuel standard to 36 billion gallons (mostly from corn and cellulose) by 2022.

-- negligible
Sources: FO Licht; USDA.

Another important environmental consideration is the potential land requirements if biofuels become a more mainstream fuel. According to the University of Minnesota, devoting all U.S. corn and soybean acreage to ethanol and biodiesel production would offset only 12 percent and 6 percent of gasoline and diesel consumption for transportation fuel, respectively, and even less if adjustments were made for the fossil fuel requirements for producing the biofuel.

Use of so much land to meet a relatively small share of transportation fuel demand is improbable. The resource commitment to meet domestic fuel demand would be less in a lower income economy. Expanding feedstock production, however, that encroaches on fragile rainforest areas and wildlife habitats is still a concern in countries like Indonesia, Malaysia, and Brazil.

Future Role of Biofuels Depends on Profitability and New Technologies

Technological advances and efficiency gains—higher biomass yields per acre and more gallons of biofuel per ton of biomass—could steadily reduce the economic cost and environmental impacts of biofuel production. Biofuel production will likely be most profitable and environmentally benign in tropical areas where growing seasons are longer, per acre biofuel yields are higher, and fuel and other input costs are lower. For example, Brazil uses bagasse, which is a byproduct from sugar production, to power ethanol distilleries, whereas the United States uses natural gas or coal.

The future of global biofuels will depend on their profitability, which depends on a number of interrelated factors. Key to this will be high oil prices: 6 years of steadily rising oil prices have provided economic support for alternative fuels, unlike previous periods when oil prices spiked and then fell rapidly, undercutting the profitability of nascent alternative fuel programs. On the other hand, the sector's profitability has been negatively affected by rising feedstock prices (corn and vegetable oil, not sugar), which account for a very large share of biofuel cost of production. For this commodity-dependent industry, government support to reduce profit uncertainty has been a common theme in the U.S., Brazil, and the EU, where biofuel production has been most significant.

Biofuels will most likely be part of a portfolio of solutions to high oil prices, including conservation and the use of other alternative fuels. The role of biofuels in global fuel supplies is likely to remain modest because of its land intensity. In the U.S., replacing all current gasoline consumption with ethanol would require more land in corn production than is presently in all agricultural production. Technology will be central to boosting the role of biofuels. If the energy of widely available, cellulose materials could be economically harnessed around the world, biofuel yields per acre could more than double, reducing land requirements significantly.

Lessons From Brazil

Brazil has the world's second largest ethanol program and is capitalizing on plentiful soybean supplies to expand into biodiesel. More than half of the nation's sugarcane crop is processed into ethanol, which now accounts for about 20 percent of the country's fuel supply.

Initiated in the 1970s after the OPEC oil embargo, Brazil's policy program was designed to promote the nation's energy independence and to create an alternative and value-added market for sugar producers. The government has spent billions to support sugarcane producers, develop distilleries, build up a distribution infrastructure, and promote production of pure-ethanol-burning and, later, flex-fuel vehicles (able to run on gasoline, ethanol-gasoline blends, or pure hydrous ethanol). Advocates contend that, while the costs were high, the program saved far more in foreign exchange from reduced petroleum imports.

In the mid- to late 1990s, Brazil eliminated direct subsidies and price setting for ethanol. It pursued a less intrusive approach with two main elements—a blending requirement (now about 25 percent) and tax incentives favoring ethanol use and the purchase of ethanol-using or flex-fuel vehicles. Today, more than 80 percent of Brazil's newly produced automobiles have flexible fuel capability, up from 30 percent in 2004. With ethanol widely available at almost all of Brazil's 32,000 gas stations, Brazilian consumers currently choose primarily between 100-percent hydrous ethanol and a 25-percent ethanol-gasoline blend on the basis of relative prices.

Approximately 20 percent of current fuel use (alcohol, gasoline, and diesel) in Brazil is ethanol, but it may be difficult to raise the share as Brazil's fuel demand grows. Brazil is a middle-income economy with per capita energy consumption only 15 percent that of the United States and Canada. Current ethanol production levels in Brazil are not much higher than they were in the late 1990s. Production of domestic off- and on-shore petroleum resources has grown more rapidly than ethanol and accounts for a larger share of expanding fuel use than does ethanol in the last decade.

This article is drawn from . . .

Ethanol Expansion in the United States: How Will the Agricultural Sector Adjust? by Paul C. Westcott, FDS-07D-01, USDA, Economic Research Service, May 2007, available at: www.ers.usda.gov/publications/fds/2007/05may/fds07d01/

Pacific Food System Outlook 2006-07: The Future Role of Biofuels, Pacific Economic Cooperation Council, November 2006, available at: www.pecc.org/food/pfso-singapore2006/PECC_Annual_06_07.pdf

You may also be interested in . . .

The ERS Feature on Bioenergy and Its Implications for Agriculture, www.ers.usda.gov/features/bioenergy/

The ERS Briefing Room on Corn, www.ers.usda.gov/briefing/corn/

The ERS Briefing Room on Long-term Projections, www.ers.usda.gov/briefing/projections/

Cropland Concentrating Faster Where Payments Are Higher

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- Both crop production and government commodity payments have become more concentrated on larger farms, raising questions about the role of payments in changes in concentration growth.
- Concentration of cropland since 1987 grew much more rapidly in areas with relatively high initial payments per acre.
- While causality is not established, the evidence suggests that higher initial payment levels are associated with greater concentration in the control of cropland as time passes.

Bruce Fritz, ARS/USDA

Both crop production and the share of government payments have shifted over time toward the largest farms. The fact that these trends are occurring simultaneously is not surprising since most government agricultural payments are tied to the amount of land farmed or the land's production history. The concentration of production certainly leads to a concentration of payments, but the reverse may also be true.

Increasing concentration of production is observed in many areas of agriculture. Hog finishing operations today typically feed two to three times the number of hogs that they finished in the early 1990s. Broiler operations are typically twice as large as they were 20 years ago. Today, over 1,400 dairy herds comprise more than 1,000 cows. There were fewer than 600 such herds in 1992.

Cropland has become increasingly concentrated on large farms. The Census of Agriculture shows increasing numbers of small farms (less than 50 acres) and large farms (1,000 acres or more) but also sharp and ongoing declines in the number of medium-sized farms. The many small farms account for little acreage and output, but strongly affect measures of average farm size. Thus, while average farm size edged up from 431 acres in 1982 to 441 in 2002, this modest change belies a large increase in the concentration of production—a much greater share of land is now farmed by large operations.

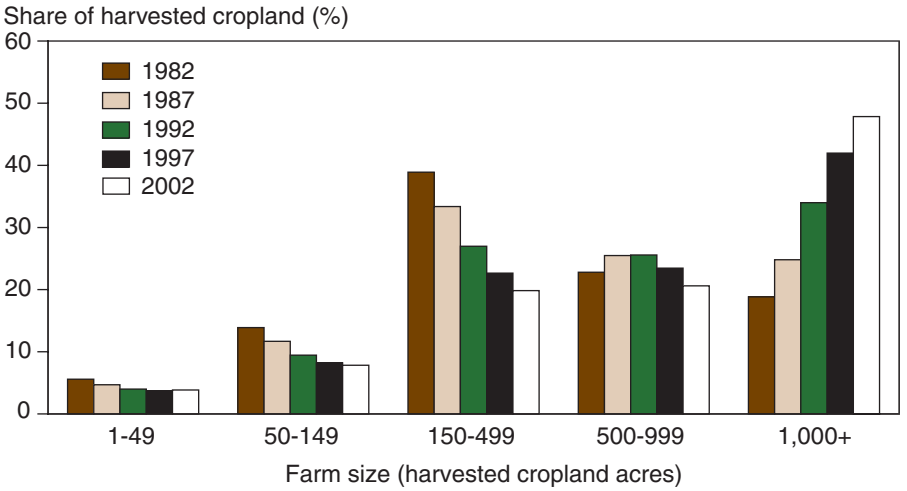
Economists see the trend toward larger farms as a byproduct of the innovations that have spurred vast economic growth and employment opportunities outside of agriculture, from factories a century ago to today's burgeoning service sectors. Farms have turned to bigger, faster, and more automated farm equipment, computerized information systems, and other capital as agricultural labor has shifted to other sectors of the economy. These substitutions have allowed fewer farmers to produce more agricultural output and to operate much larger farms.

Technology may not be the only force driving changes in cropland concentration. Much public discussion of farm size and land concentration centers on the role of government policy and the degree to which program payments to farmers may be facilitating growth in the number of very large farms. In considering this issue, recent ERS research focuses on crop farms because most government agricultural policies are directed toward a handful of key crop commodities. These crops—corn, soybeans, wheat, cotton, and a few other grains—also account for the bulk of cropland in the United States. ERS examined whether areas that had received greater payments per cropland acre subsequently experienced faster or slower concentration of production than areas with lower or zero payments.

Cropland Is Concentrating on Larger Farms

Between 1982 and the most recent Census of Agriculture in 2002, the number of farms and the land in farms declined by less than 5 percent and the average number of acres per farm in 1982 was almost

Cropland is increasingly concentrated on larger farms



Source: USDA, Economic Research Service tabulations based on USDA, National Agricultural Statistics Service's Census of Agriculture data.

equal to the average in 2002. Nonetheless, there was considerable structural change in the distribution of farm sizes.

The share of harvested cropland operated by smaller to midsized farms (50-499 acres of cropland) decreased, while the share operated by large farms (1,000+ acres) increased. By 2002, farms with at least 1,000 acres of cropland operated 48 percent of the total, up from about 19 percent 20 years earlier.

There was little change in the share of land operated by farms with 1-49 acres of cropland. While these small farms operated less than 4 percent of total cropland in 2002, they comprise a growing share of farms. In 2002, about 50 percent of the 1.36 million farms that harvested cropland harvested less than 50 acres. Many of these small operations were "residential/lifestyle" farms, and most of their household income came from off-farm sources. While some small farms operated as commercial enterprises growing high-valued crops on relatively little land, most did very little farming: three-fourths had sales below $5,000, and many had no sales at all. The number of small farms has increased, in part, because USDA's definition of a farm ($1,000 in actual or potential sales) has remained fixed for over 30 years, without adjusting for inflation.

Cropland Concentration Grows Faster Where Payments Are Higher

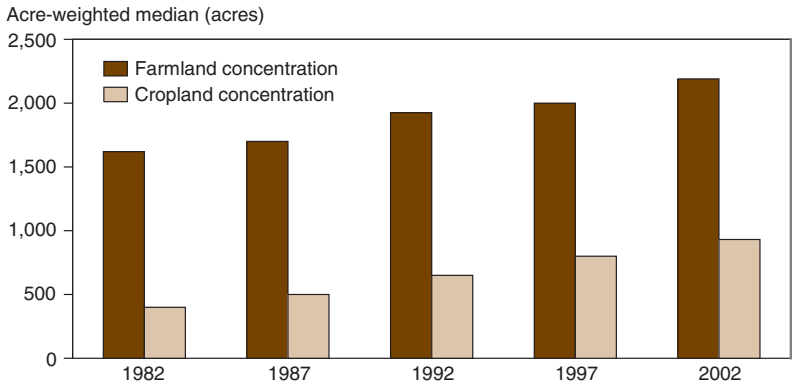
There is a strong statistical relationship between cropland concentration growth during 1987-2002 and payments received in 1987. To determine this, ERS measured changes in concentration for ZIP Codes that contained agricultural production and compared the information with the government payments per acre in the areas in the initial year, 1987 (see box, "Measuring Cropland Concentration and Government Payments"). Between 1987

Measuring Cropland Concentration and Government Payments

Common farm size measures, such as the average and median, obscure the rapid concentration of cropland into larger farms (see "Measures of Trends in Farm Size Tell Differing Stories" on page 36 in this issue). ERS looked at the distribution of cropland acres across farms of different sizes, from those with thousands of acres down to those with just a few, and selected the farm size at the midpoint of the cropland distribution, that is, at the point where half of all cropland is in larger farms and half is in smaller farms. This measure of cropland concentration—an acre-weighted median of cropland acres—is the statistic ERS used in the analysis.

In 1982, the typical U.S. crop farm was 400 acres—half of all cropland was in larger farms and half in smaller farms. Twenty years later, the typical crop farm had grown by 133 percent to 932 acres as cropland became concentrated into larger operations.

An alternative measure of farm size reflects the increase in the concentration of land



Source: USDA, Economic Research Service tabulations based on USDA, National Agricultural Statistics Service's Census of Agriculture data.

Applying the farm-size measure to ZIP Codes provides a highly disaggregated geographic unit of analysis. In rural areas, ZIP Codes usually encompass townships and are substantially smaller than counties. Such areas vary markedly in size, with rural ZIP Codes generally larger than urban, and ZIP Codes in the West generally larger than those in the East. A clear advantage to using ZIP Code areas is that there are a lot of them, which allows researchers to see how cropland concentration is changing across a wide range of payments. ERS measured concentration and payments in each ZIP Code in each of four Censuses of Agriculture (1987, 1992, 1997, and 2002) having at least three farms in all four Census years—about 21,500 ZIP Codes that capture over 90 percent of farms in the Census and 97 percent of cropland.

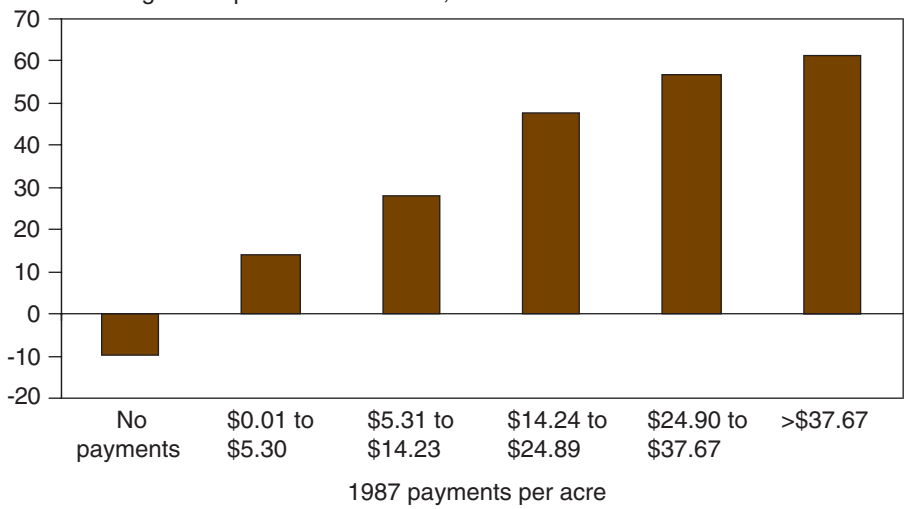
The Censuses of Agriculture also provide data on government payments received by farm operators, including disaster payments, but excluding Conservation Reserve Payments and subsidies paid under the Federal Crop Insurance Program. The data also exclude payments to individuals not involved with the operation of farms, notably landlords. Payments per acre were calculated based on all cropland acres, not just those that were the basis for payments. ERS focused on payments per acre rather than total payments in an area because some ZIP Codes have much more cropland than other ZIP Codes.

and 2002, concentration declined in the 10 percent of ZIP Code areas with no payments in 1987. ZIP Code areas with payments in 1987 show a positive relationship between cropland concentration growth and payment levels. Concentration increased more in areas with high payments than in areas with lower payments. At the high end, concentration grew by more than 60 percent in ZIP Codes with payments exceeding $37.67 per acre; at the low end, concentration increased by about 15 percent in those ZIP Codes with payments less than $5.31 per acre.

The same pattern holds across and within regions of the country. Within each region, cropland concentration increased more rapidly in ZIP Code areas with the highest initial payments per cropland acre, and the relationship between concentration and payments is persistent, steadily increasing as payments increase. Concentration increased noticeably faster in the Heartland, Northern Great Plains, and Mississippi Portal—those regions that tend to specialize in program crops that have higher payments. Moreover, the differences in concentration growth across regions are substantial.

Cropland concentration grew faster in areas with higher payments

Percent change in cropland concentration, 1987-2002



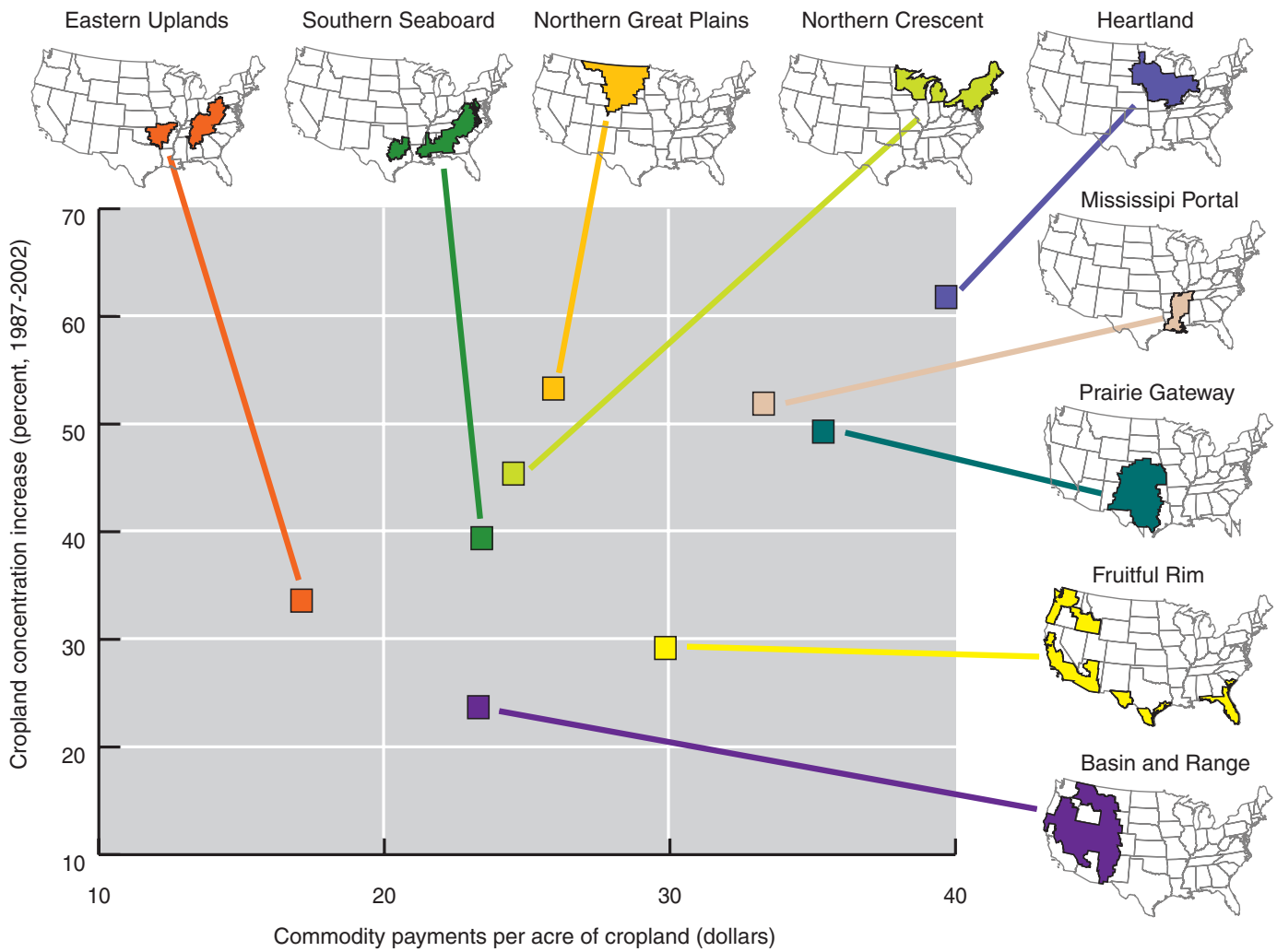
Source: USDA, Economic Research Service tabulations based on USDA, National Agricultural Statistics Service's Census of Agriculture data.

What Might Explain the Association Between Cropland Concentration and Payments?

Association between two variables does not demonstrate causality. While it cannot be concluded that the observed association between cropland concentration and government agricultural payments proves that payments cause concentration or that payments help keep smaller farms in production, the evidence does uncover a specific set of noteworthy patterns. There are several possible explanations for the patterns observed.

Government payments may accelerate the shift in cropland toward larger farms if payments enhance farmers' liquidity and borrowing leverage, allowing payment recipients to expand more easily to larger and more efficient sizes. In this context, government payments—which provide cash, some degree of insurance (due to links with commodity prices), and, perhaps, also a means to leverage greater resources from lending institutions—might allow payment recipients to transition more quickly to a large and efficient scale. While government payments may have accelerated the expected trend for larger and more profitable farms to expand at the expense of smaller farms, this trend is evident in sectors with and without government payments.

The same association between concentration and payments exists across regions



Alternatively, factors other than government payments could have caused the observed link between payments and the subsequent pattern of concentration growth. For example, new technologies might have caused concentration to increase more in regions with better land quality. Per acre payments tend to be higher in areas with greater land quality and yields. Those areas also may feature flatter and more contiguous cropland (that is, fields near each other and not separated by hills and woods). Some new technologies, such as bigger and faster pieces of equipment, may be better suited to areas with better land quality and higher payments, so payments are higher in regions that experience more rapid technological change.

This article is drawn from . . .

ERS Data on Farmland and Cropland Concentration Measures, www.ers.usda.gov/data/croplandconcentration/

You may also be interested in . . .

"Government Payments and Farm Business Survival," by Nigel Key and Michael J. Roberts. In *American Journal of Agricultural Economics*. 88(2) (May 2006): 382-392.

"Do Government Payments Influence Farm Size and Survival," by Nigel Key and Michael J. Roberts, in *Journal of Agricultural and Resource Economics*, Vol. 32, No. 2 (August 2007) pp. 330-348.

Measures of Trends in Farm Size Tell Differing Stories

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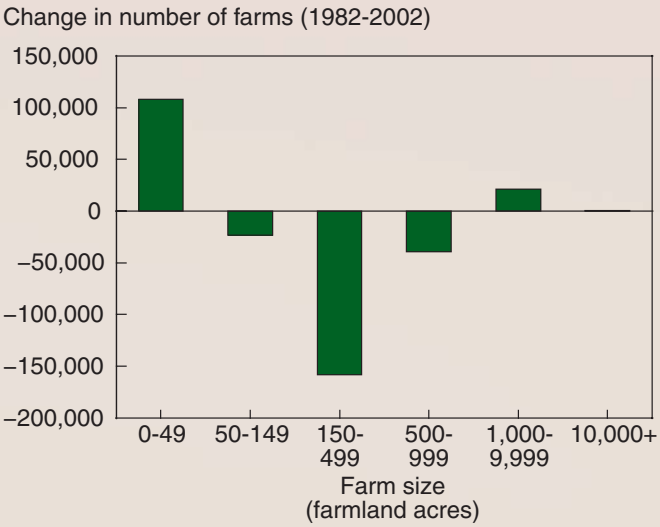
The total amount of land used for farming has been relatively stable for several decades, but this stability masks significant changes in the structure of agriculture. Since 1982, the number of large farms and very small farms has increased, while the number of small to midsized farms has declined. The changing size distribution of farms makes it difficult to capture the trends in a simple measure, such as the average or median farm size. A size measure that reflects both the increasing concentration of production on large farms and the growth in the number of small farms can provide insight into the structural changes occurring in U.S. agriculture.

Farmland Has Become Concentrated on Larger Farms

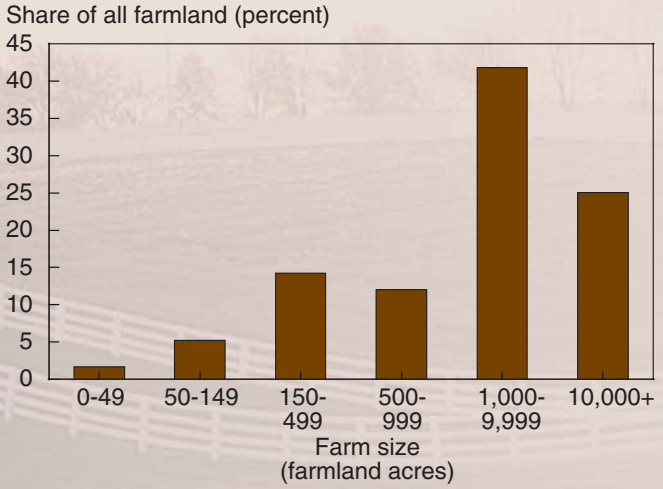
In recent decades, agricultural land has become concentrated on larger operations—the number of farms with more than 1,000 acres increased by 14 percent between 1982 and 2002. Farms with 50-1,000 acres declined by about 17 percent, while the number of farms with fewer than 50 acres increased by roughly the same percentage.

Small farms, however, account for only a very small share of total farmland. Farms with fewer than 50 acres operated less than 2 percent of all farmland in 2002, while farms with more than 1,000 acres operated two-thirds of all farmland.

More large farms, more very small farms, fewer in the middle



Most farmland is in large farming operations, 2002



Source: USDA, Economic Research Service tabulations based on USDA, National Agricultural Statistics Service's Census of Agriculture data.

Traditional Size Measures Mask Concentration Change

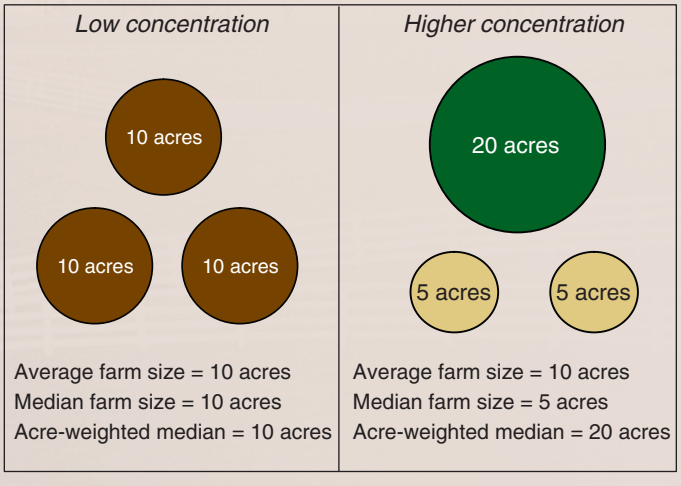
Because most farms are small but most production occurs on large farms, common measures of representative farm size—the average and median—obscure large changes in the concentration of production. Average and median measures of farm size focus on the typical farm, which is small, rather than the typical acre of farmland, which is associated with a larger operation.

Consider the example of three hypothetical farms, each with 10 acres. Suppose two consolidate to make a farm double in size and one farm is split into two smaller operations. Before and after the change, the number of farms, total amount of land, and average farm size remain the same. The median farm size—the farm for which half are smaller and half are larger—declines from 10 acres to 5 acres. Changes in the average and median farm size seem to belie the rather large increase in land concentration—a single farm now accounts for two-thirds of the land.

An alternative measure—the *acre-weighted median*—better reflects the size of operations where most production occurs. The acre-weighted median is calculated by ordering farms from smallest to largest and picking the farm size at the *middle acre* (the standard median focuses on the *middle farm*). Half of all land is on farms smaller than the acre-weighted median, and half of land is on bigger farms. In the three-farm example, two-thirds of the acres are on a 20-acre farm and one-third of the acres are on farms with 5 acres, so the acre-weighted median is 20 acres.

Measures of representative farm size

Three medium-sized farms ⟶ Two merge and one splits

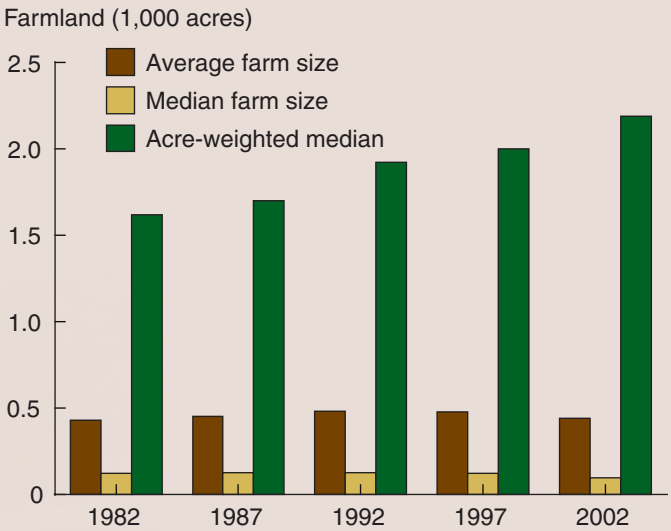


New Measure Tells a Different Story

This simple three-farm example is similar to what has actually occurred in U.S. agriculture, and the three size measures—average, median, and acre-weighted median—suggest different trends over time. Because the total amount of farmland and the number of farms have remained stable since 1982, average farm size has also remained stable. Average farm size was 441 acres in 2002, and ranged between 430 and 480 acres in the previous 20-year period. In contrast, the median farm size in 2002 of 95 acres represents a 20-percent decrease over the period, largely reflecting the growing number of very small farms.

On the other hand, the acre-weighted median increased by about 35 percent since 1982, reflecting continued shifts of land to bigger operations. In 2002, the acre-weighted median was 2,190 acres—half of all farmland was on farms that were larger than that size.

Measures of farm size show different trends



Source: USDA, Economic Research Service tabulations based on USDA, National Agricultural Statistics Service's Census of Agriculture data.

This article is drawn from . . .

ERS Data on Farmland and Cropland Concentration Measures, www.ers.usda.gov/data/croplandconcentration/

STATISTICS

Data may have been updated since publication. For the most current information, see www.ers.usda.gov/publications/agoutlook/aotables/.

Farm, Rural, and Natural Resource Indicators

	2003	2004	2005	2006	2007	Annual percent change 2003-04	2004-05	2005-06	2006-07
Cash receipts ($ bil.)	215.6	237.3	240.7	239.3	276.4 f	10.1	1.4	-0.6	15.5
Crops	109.9	113.7	115.9	120.0	136.2 f	3.5	1.9	3.5	13.5
Livestock	105.6	123.6	124.9	119.3	140.2 f	17.0	1.1	-4.5	17.5
Direct government payments ($ bil.)	16.5	13.0	24.4	15.8	13.6 f	-21.2	87.7	-35.2	-13.9
Gross cash income ($ bil.)	247.8	267.4	281.3	272.5	308.0 f	7.9	5.2	-3.1	13.0
Net cash income ($ bil.)	70.2	82.2	85.8	67.9	85.9 f	17.1	4.4	-20.9	26.5
Net value added ($ bil.)	100.0	127.8	121.4	104.4	135.4 f	27.8	-5.0	-14.0	29.7
Farm equity ($ bil.)	1,203.6	1,401.9	1,576.1	1,771.8	2,008.6 f	16.5	12.4	12.4	13.4
Farm debt-asset ratio	12.7	11.5	10.9	10.5	9.6 f	-9.4	-5.2	-3.7	-8.6
Farm household income ($/farm household)	68,597	81,596	81,420	80,331	86,693 f	18.9	-0.2	-1.3	7.9
Farm household income relative to average U.S. household income (%)	116.1	134.8	128.5	120.7	na	16.1	-4.7	-6.1	na
Nonmetro-metro difference in poverty rate (% points)[1]	2.1	na	2.3	3.4	na	na	na	na	na
Cropland harvested (million acres)	315	312	312p	na	na	-1.0	0.0	na	na
USDA conservation program expenditures ($ bil.)[2]	4.3	5.1	na	na	na	18.6	na	na	na

Food and Fiber Sector Indicators

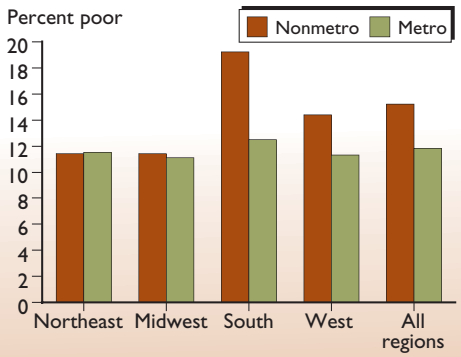
U.S. gross domestic product ($ bil.)	10,961	11,686	12,434	13,195	na	6.6	6.4	6.1	na
Share of GDP in agriculture & related industries (%)[1]	4.8	4.7	4.5	na	na	-2.1	-4.3	na	na
Share of GDP in agriculture (%)[1]	0.8	1.0	0.8	na	na	19.2	-16.3	na	na
Total agricultural imports ($ bil.)[2]	45.7	52.7	57.7	64.0	70.5	15.3	9.5	10.9	10.2
Total agricultural exports ($ bil.)[2]	56.0	62.4	62.5	68.7	79.0	11.4	0.2	9.9	15.0
Export share of the volume of U.S. agricultural production (%)[1]	21.1	20.9	20.1 p	na	na	-0.9	-3.8	na	na
CPI for food (1982-84=100)	180.0	186.2	190.7	195.3	202.7 f	3.4	2.4	2.4	3.8
Share of U.S. disposable income spent on food (%)	9.8	9.7	9.8	9.9	na	-1.0	1.0	1.0	na
Share of total food expenditures for at-home consumption (%)	52.0	51.5	51.3	51.1	na	-1.0	-0.4	-0.4	na
Farm-to-retail price spread (1982-84=100)	225.6	232.1	239.2	246.0	na	2.9	3.1	2.8	na
Total USDA food and nutrition assistance spending ($ bil.)[2]	41.8	46.2	50.9	53.1	na	10.5	10.2	4.3	na

f = Forecast. p = Preliminary. na = Not available. All dollar amounts are in current dollars.

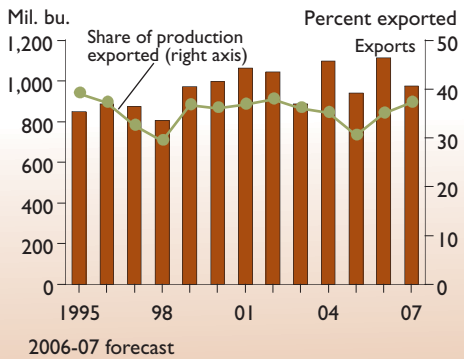
[1] The methodology for computing these measures has changed. These statistics are not comparable to previously published statistics. Sources and computation methodology are available at: www.ers.usda.gov/amberwaves/indicatorsnotes.htm

[2] Based on October-September fiscal years ending with year indicated.

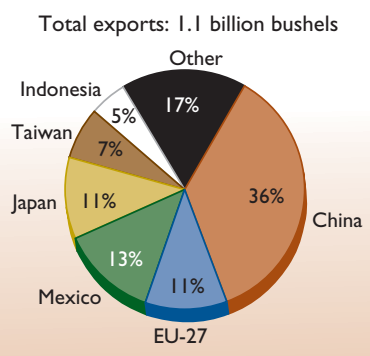
Nonmetro-metro difference in poverty rates is largest in the South, 2006



U.S. soybean exports and share of production exported



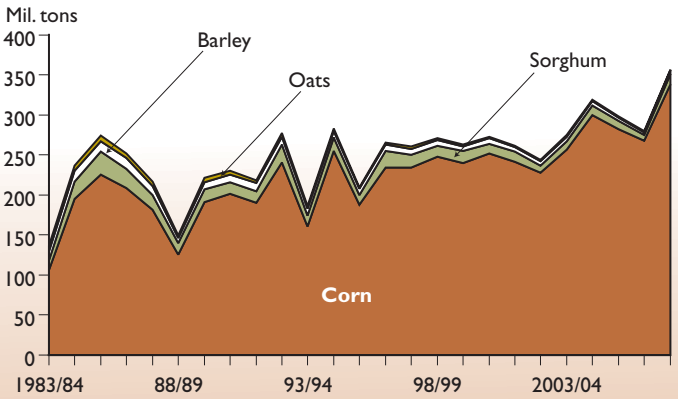
U.S. soybean exports by destination, 2006/07



For more information, see www.ers.usda.gov/amberwaves/

Markets and Trade

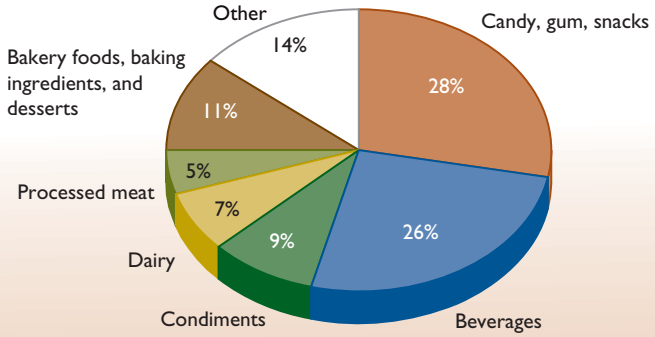
U.S. achieves record feed grain production, 2007/08



Source: USDA, Grain: World Markets and Trade (Grain Circular).

Diet and Health

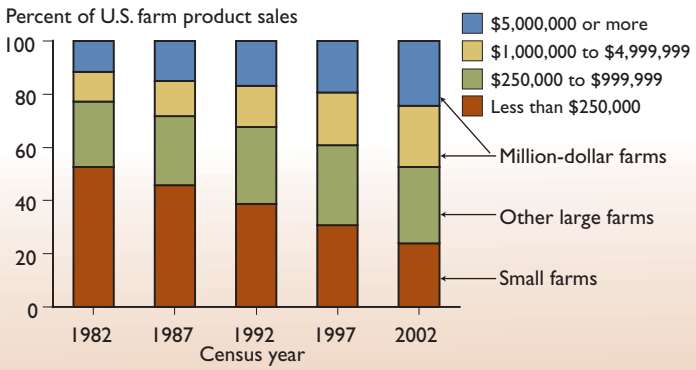
Over half of the food products introduced in 2006 were either candies, gums, snacks, or beverages



Source: Datamonitor, Productscan Online.

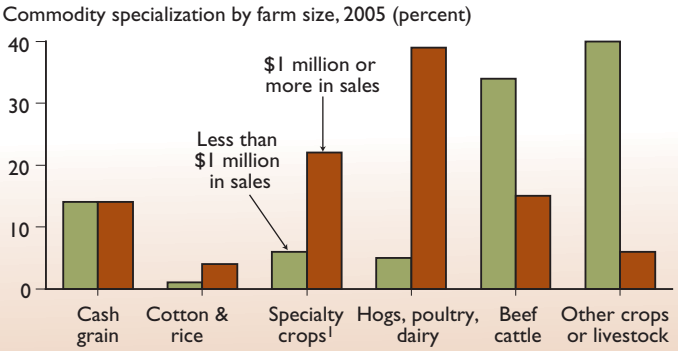
Farms, Firms, and Households

Million-dollar farms' share of sales increased from 23 percent to 48 percent between 1982 and 2002



Note: Sales class is expressed in constant 2002 dollars, using the Producer Price Index for farm products to adjust for price changes.
Source: USDA, Economic Research Service, compiled from Census of Agriculture data.

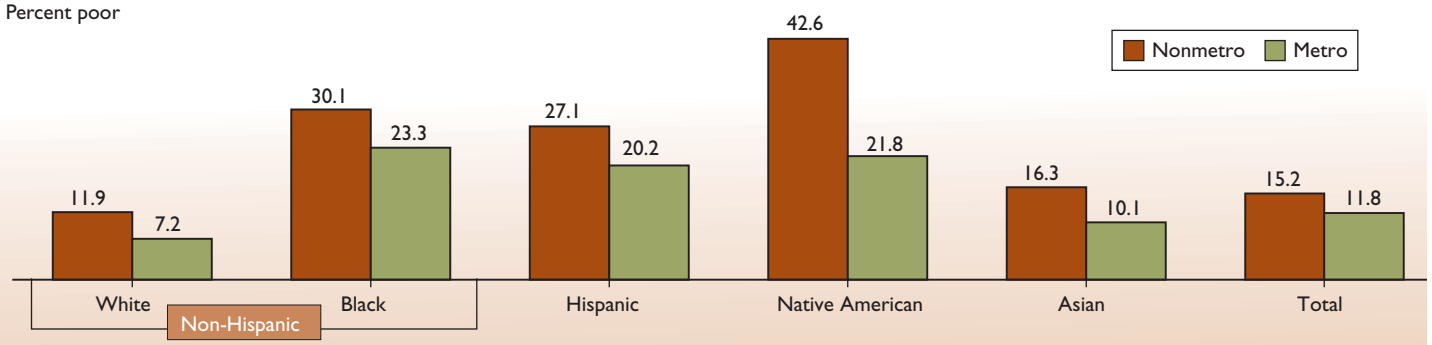
Million dollar farms are more likely to specialize in cotton & rice, specialty crops, and livestock (except beef) than smaller farms



[1]Fruit, tree nuts, vegetables, and nursery & greenhouse products.
Source: USDA, Economic Research Service, 2005 Agricultural Resource Management Survey.

Rural America

Blacks and Native Americans have the highest rates of nonmetro poverty, 2006



Note: Metro and nonmetro are based on the June 2003 metropolitan area classification.
Source: Prepared by USDA, Economic Research Service using data from the U.S. Census Bureau's 2007 Annual Social and Economic (ASEC) Supplement.

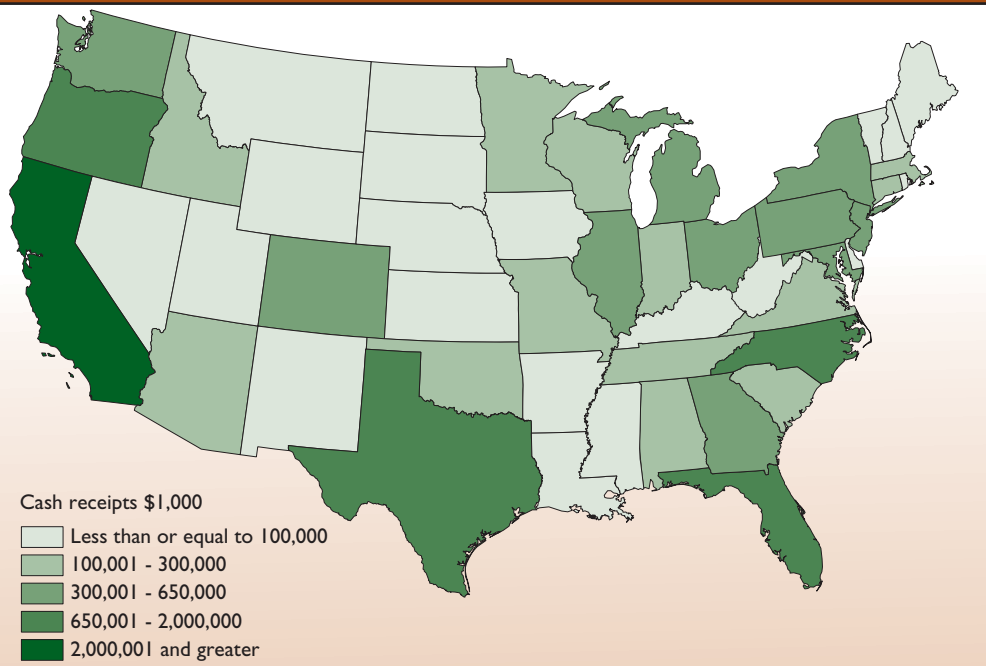
On the Map

Greenhouse and Nursery Production Concentrated in Warmer States

The major greenhouse and nursery products are shrubs, flowers, sod, Christmas trees, and other agricultural products associated with the landscape industry. The principal determinants of where greenhouse and nursery products are grown are climate and local demand. In warmer climates, nursery products can be grown outside of greenhouses, reducing production costs. Strong local demand is important because the bulkiness and perishability of nursery products make them expensive to transport long distances. Hence, production tends to be concentrated across the southern tier of States and those with rapid population and suburban growth.

Roger Strickland, rogers@ers.usda.gov

Greenhouse and nursery cash receipts, 2006



Source: USDA, Economic Research Service.

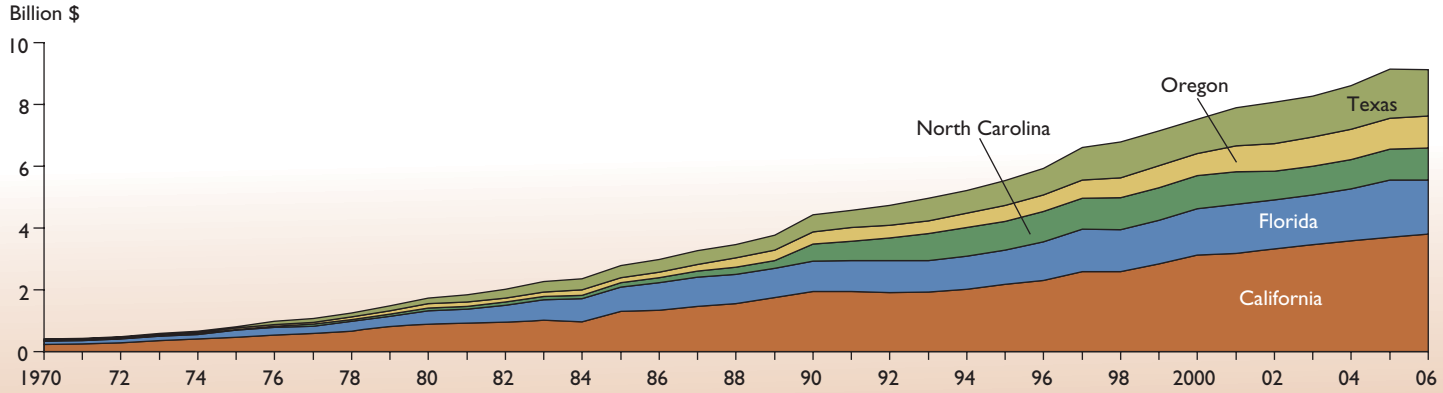
In the Long Run

Greenhouse and Nursery Industry Cash Receipts Growing Rapidly

In terms of cash receipts, the U.S. greenhouse and nursery industry has experienced rapid growth in the last three decades at a rate more than four times that experienced by all agricultural commodities. These trends have been the result of the relocation of both businesses and residences to suburban settings and the concurrent explosive growth in population in the South and West. This combination has generated demand for attractive vegetation and expansive areas of lawn with sod as the preferred ground cover. The top-producing States have always been California and Florida over this time period, and other States in the top five have remained the same since about 1990 when Oregon passed Ohio to enter the group.

Roger Strickland, rogers@ers.usda.gov

Top five States in growth in cash receipts for greenhouse and nursery products



Source: USDA, Economic Research Service.