Economics of Livestock and Crop Production on Post-CRP Lands

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Abstract.—Crop and livestock economics, CRP owners, and policy incentives will influence use of CRP grasslands when contracts expire. Key economic factors are trade negotiations, economic reform, food health and safety concerns, and the impact of technology. Adjusting yields and excluding government payments, 1987 Great Plains cattle cash returns would have been larger than grain returns.

Background

The 1985 Food Security Act's Conservation Reserve Program (CRP) added the largest amount to our stock of grasslands of any federal program since the 1930's. By the end of the ninth signup in August 1989, farmers enrolled 34.9 million acres of highly erodible cropland at an average rental rate of $49 per acre, most planted to grass cover. Owners must plant land retired under CRP to permanent cover or trees to reduce erosion. They cannot use the land for grazing, haying, or other economic uses during the 10-year contract except in declared emergencies. The farm's crop base acreage must be reduced in the same ratio as CRP land to total cropland, but is protected until the contract expires.

The CRP contracts will begin to expire in 1996. Contracts will expire in the same order as land was enrolled in CRP, reaching a peak of almost 10 million acres in February 1997. What will happen to lands currently enrolled in the CRP after contracts expire? The fate of CRP land is of increasing concern to farmers and ranchers, government officials with responsibilities for grazing lands, and policy makers who must consider the implications for 1995 farm legislation. This paper examines factors that will influence CRP grassland use after contracts expire. We focus on the Great Plains because a large share of all CRP land and almost all CRP grassland important for range forage issues are found there.

The future of CRP grasslands is a function of three sets of interacting factors: long-term relative economics of crop and livestock production, the characteristics and attitudes of CRP owners and operators, and direct and indirect incentives in existing and proposed agricultural policy.

Long-Term Crop and Livestock Economics

Projected Demand for Crop and Grazing Lands

Under congressional mandate, the federal government assesses resource needs and availability and projects the demand for crop and grazing lands. The USDA Resources Conservation Appraisal (RCA), conducted in 1980 under the influence of tight food supplies and rising export demand, projected U.S. cropland requirements for 2030 at 457 million acres. This was an 11% increase over the 413 million cropland acres inventoried in 1977 (USDA SCS 1981: table 18, p. 70).

Only 5 years later, hopes for increased productivity through technology adoption and the prospect of declining agricultural exports influenced the second RCA to lower projected cropland requirements. Under these assumptions, projected needs for 2030 were 218 million acres, a 48% decline from the 421 million acres of existing cropland inventoried in 1982 (USDA SCS 1987: table 12-5, p. 12-20).

Similar considerations of relative scarcity and surplus influenced the grazing land projections prepared for the 1979 and 1989 Renewable Resources Planning Act (RPA) assessments. Analysts projected derived demand for grazing land to increase to 1.5 billion animal unit months (AUMs) by 2030 in the 1979 assessment. In the 1989 assessment, the projected increase dropped to only 618 million AUMs (USDA FS 1981, p. 179; Joyce 1989, p. 70). Primarily responsible for these large differences in projected demand is a 34% drop in projected U.S. meat consumption (edible weight basis) per capita (Darr 1988, p. 36).

The point is not that the earlier RCA and RPA projections were done badly, but that any such projections are very sensitive to assumptions about exports, productivity increases, and consumption patterns (Fuglestad and English 1988). The effective demands of larger populations, the responses of other country's agricultural sectors, and changes in trade patterns to meet those demands are important in understanding the fate of CRP land.

Alternative projections of resource demand and supply are beyond the scope of this paper. In view of the uncertainties likely to beset any assessment of future land needs, discussion of factors that will influence the use of CRP land is a more profitable pursuit. Over the next several decades, demographic forces, negotiated changes in the global trading environment, interactions between resources and food producing technologies, and competing demands for energy sources, environmental quality, and resource protection will influence relative demands for crops and livestock products. The reader must judge what the likelihood and relative impact of these factors on resource use may eventually be, but will at least be able to track them as developments occur.

We do not know many of the factors that will ultimately influence landowners' decisions regarding CRP land in 1996. However, there are some emerging forces that will undoubtedly play a role in the decision to crop, graze, or idle CRP land. On domestic markets, changing consumer tastes and concern for healthy diets and food safety are likely to affect underlying demand. Sustainable energy initiatives, some associated with clean air legislation, may be a new source of underlying demand with implications for land use.

On export markets, the Uruguay Round of the General Agreement on Trade and Tariff (GATT) negotiations may change the institutional framework for farm support programs and international trade in agricultural commodities. The unprecedented changes in the centralized economies of eastern Europe and the Soviet Union may be matched by changes of equal potential by 1992 as the western European community moves toward economic integration. The continuing evolution of Japanese, Chinese, and other Pacific rim markets will also be a factor, as will the demands of developing Third World economies. The broader implications of these events can be seen even if none of their impacts can be forecast with certainty. We consider issues for domestic demand first.

Red Meat Consumption

The American Medical Association and American Heart Association advise consumers to reduce their dietary intake of cholesterol and fat, especially from red meats, to reduce the risk of heart disease and colon cancer. Red meats include beef, veal, pork, lamb, and mutton (USDA ERS 1990a). The Food and Drug Administration and National Institutes of Health, in interviews with 4,000 consumers, found that 62% made major changes in their diets to reduce risk of heart disease and cancer. Thirty-six percent reduced intake of red meat (Briggs 1987).

By 1990, red meat consumed per capita in the United States declined 14% from a peak of 157 pounds in 1971 (USDA ERS 1990a). Beef consumption declined faster, dropping 27% from a peak of 94 pounds per capita in 1976 (fig. 1). Data comparability makes demand analysis difficult. Unlike poultry and pork, the beef industry is comprised of fed and nonfed production. Nearly all of the decline in beef consumption has been in nonfed beef. Fed cattle slaughter has ranged from 25 to 26 million head with a slight upward trend for much of the 1980's. This upward trend plus commercial slaughter weights which have risen from about 630 pounds per head in the early 1980's to nearly 680 pounds in 1990 has likely resulted in steady fed beef consumption levels.

Whether this is a change in the demand structure for red meat is controversial. Of 11 studies investigating change in retail meat demand, 7 conclude that some change in the structure of demand for beef and poultry occurred in the late 1970's (Smallwood et al. 1989). Changes in relative prices between red meat and poultry and increasing responsiveness of beef demand to income and price changes account for much of the measured change. No studies make quantitative links to health concerns, convenience demand, increased out-of-home consumption, and other changes that might explain shifts in demand parameters (Buse 1989, Cox et al. 1989, Lee 1989, McCracken 1989, Zafiriou 1989).

Both the 1985 RCA and 1989 RPA assume a constant annual beef, veal, lamb, and mutton consumption of 112 pounds per capita (carcass weight basis) through 2030. However, Blaylock and Smallwood (1986), analyzing demographic and income effects on per capita food consumption expenditures, projected a 39% increase in total food expenditures. Their projections for red meat expenditures did not keep pace, increasing only 15–26% (table 33).

The beef industry has begun to respond to these concerns. Consumer expenditures on beef increased in 1988 following declining expenditures in 1985–87. Additional consumer nutritional information on beef, closer trimmed products, and inelastic demand combined with reduced beef production increased spending on beef. However, the observed decline in red meat consumption over the past two decades, particularly in nonfed beef, offers little support for net increases in forage use

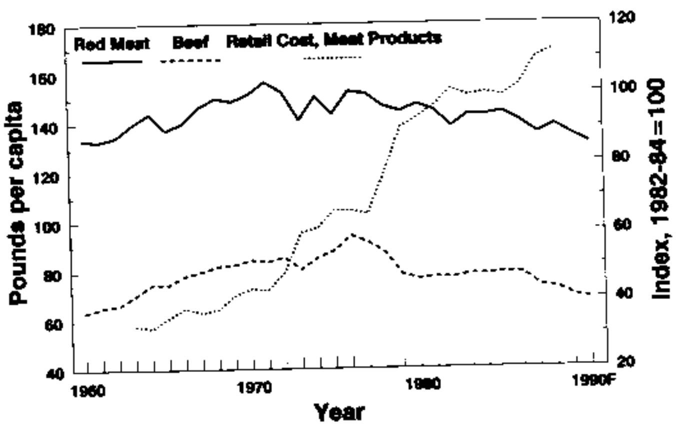

Figure 1.—Trends in Per Capita Consumption Red Meat and Beef, Retail Weight Basis (USDA Economic Research Service).

of CRP land for domestic meat consumption. This is true whether the decline is based on rising beef prices relative to other meats or shifts in the structure of demand due to health concerns.

Food Safety

Concerns over residues from antibiotics given to animals and synthetic biochemicals, such as bovine somatotropin (BST), may also begin to affect consumer demand for meat (Roberts and van Ravenswaay 1989). The European community has already used residues as nontariff barriers to trade, banning imports of meat from animals treated with growth-promoting hormones. This ban led to the loss of a U.S export market worth approximately $92 million, despite expert agreement that methods and products used in U.S. beef are generally safe (Kenney and Fallert 1989). Both the GATT negotiations and EC 1992 market integration plans are considering ways to harmonize food safety regulations to reduce barriers to free trade (Raney and Kelch 1990).

Adoption of BST for beef production would probably have greatest impact on fed cattle, with lesser impacts for cow-calve operations (Kalter and Milligan 1990). Feed efficiency would likely increase, but would require higher protein, higher cost feeds, and fat accretion would likely decrease. Leaner beef may be more marketable, but consumer opposition to hormones may offset any gains. Impacts on grazing land from BST adoption would probably be small, but changes in animal feed requirements would include less feed grain consumption, except soybeans, and less demand for hay and other roughage. Kalter and Milligan (1990) point to immobile resource endowments and excess resource capacity as institutional and economic factors likely to retard adoption of this technology.

Consumers are also concerned about potential health effects from pesticide residues on crops (Roberts and van Ravenswaay 1989). However, recent concern over pesticide residues focuses primarily on fruits and vegetables consumed as raw commodities. The Food and Drug Administration tightly regulates pesticide residues on food and feed grains and oilseeds processed or fed to livestock under the Delaney Clause of the Federal Food, Drug, and Cosmetic Act (FFDCA). It is unlikely that changes in pesticide residue regulations for processed foods would significantly reduce derived demand for land to produce crops likely to be grown on CRP land.

Limits on pesticide and fertilizer use may come about less directly, through concerns about their impacts on surface and ground water quality (McCormick and Algozin 1989). Such limitations, coupled with emphasis on sustainable agricultural systems, could encourage substitution between farm chemicals and cropland through longer crop rotations. This would increase demand for cropland, including land now in CRP.

Under this scenario, conservation compliance requirements for CRP land could be easier to meet than with current production practices since more years of soil-building legume hay in the rotation would reduce soil erosion from more erosive row and close-grown crops. It does not appear that legislators are yet ready to mandate limitations on farm chemicals. Without some legal requirement, there is little economic incentive for most producers to reduce chemical use.

Renewable Energy Sources

Analysts have focused sporadic attention on alternatives to fossil energy sources over the period of recurring energy crises from the early 1970's to the recent Iraq/Kuwait situation. Demand for ethanol from corn or herbaceous biomass feedstocks may increase as a result of stricter air pollution standards in over 30 major U.S. cities under the new Clean Air Act. These cities may have to require 2.7% ethanol or alternative gasoline additives such as ETBE (ethyl-tertiary-butyl ether) to reduce carbon monoxide and ozone emissions. The demand for ethanol-based additives is enhanced by congressional extension of the current $0.60 per gallon tax subsidy for ethanol production beyond its scheduled 1993 expiration. The extension was passed despite critics claims that ethanol's tax breaks are unfair to competing fuel additives (methanol, MTBE), reduce Highway Trust Fund revenues, and are inconsistent with farm program payments some ethanol producers also receive.

McGartland and Shelby (1990) estimated agricultural impacts of increased ethanol production. Air pollution reductions could increase annual ethanol demand 34% to 138% from its current 825-million-gallon level by 1995. If so, an additional 181,000 to 1.2 million acres of corn production would be required. Shifts between crops and regions would likely yield a net increase of 92,000 to 506,000 acres in crop production. If more areas adopted ethanol, demand could increase to 4 billion gallons, a five-fold increase that would require as much as 1.8 million acres of additional cropland. This increase is less than 3% of recent corn plantings, providing little increased demand for cropland.

Production of cellulose-derived ethanol from forage crops could use 12 to 52 million acres of biomass feedstock by 2030 instead of corn, if required technological advances occur (USDOE 1990). If assumptions regarding technical advances, development of energy crops, and cultural techniques prove correct, biomass energy sources for electrical generation, space heating, and liquid fuels could account for 69 to 103 million acres of land. Some of this land may be in woody plant production in the Southeast, but even this demand would indirectly increase demand for forage in the Great Plains to offset resulting losses of forage. Forage-based and corn-based renewable energy scenarios assume that CRP land will be available for crop production if crop prices are to remain stable.

Exports

The 11.7% increase in U.S. exports during the 1970's was a function of rapid growth in real per capita incomes in importing countries, growth in foreign exchange earnings, plentiful credit, import-enhancing agricultural policies of other countries, and a declining dollar. All of these conditions were reversed from 1981–85. Acreage of crops exported bottomed in 1985 at 81 million acres, after a peak of 129 million acres in 1981 (USDA ERS 1990c). Acreage for export rebounded somewhat since 1985, increasing to 102 million acres in 1989.

The global economic environment for agricultural trade seems poised on the brink of major changes as the 1990's begin. Bilateral trade agreements with Japan promise to increase export markets for livestock and other agricultural products. Multilateral trade negotiations under the GATT could also change the rules for trade and government farm support programs on a broader basis. Dramatic changes in eastern Europe and the Soviet Union could open new markets similar to the earlier economic opening to China. Further economic integration of the European community planned for 1992 will also alter trading patterns.

Changes in export demand implied by these events will have different implications for the use of CRP land depending on the mix of export commodities demanded. Change in the kinds of commodities demanded is a function of growth in per capita income and changes in tastes as incomes rise (Marks and Yetley 1988). For example, if high exports are primarily to less developed countries with low per capita incomes, it is likely that they will focus on wheat, rice, and other commodities for direct human consumption. On the other hand, exports fueled by increases in incomes in more developed countries are more likely to be concentrated in commodities like meat and poultry. This is particularly true for countries with few land resources like Japan, Korea, and Malaysia that are less able to develop sizeable livestock industries of their own through imports of feed grains. While there remain large differences between "eastern" and "western" diets, animal protein consumption appears to be growing as per capita incomes increase (USDA ERS 1990b, p. 14).

U.S. exports of meat (excluding poultry) are small relative to crops, accounting for 6% of the value of total exports in 1989 versus 42% for grains and feeds (USDA ERS 1990f, p. 56). However, meat export quantities have increased steadily since 1977, rising 50%, while exports of grains and feed fell 28% from their peak in 1981 (fig. 2). The 1.14 billion pound increase in beef exports projected under an optimistic scenario in a 1986 study has already been realized because of increased exports to Japan (Brandt et al. 1989).

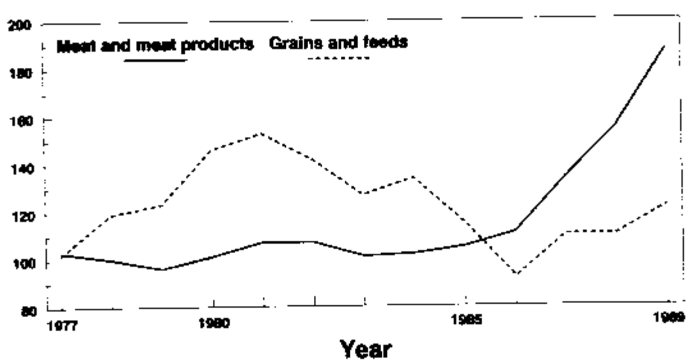

Figure 2.—U.S. Agricultural Exports over 1977–1989 (Quantity index, 1977 = 100) (USDA Economic Research Service).

Pacific Rim

Three-fourths of 1989 U.S. beef exports were to Japan. The 1988 agreement expanded beef import quotas and eliminates quotas in 1991. Tariffs on beef will increase from 25% to 70% in 1991 and decrease to 50% by 1993, bringing a likely further increase in U.S. beef exports. Potential increases in beef imports after bilateral trade liberalization with Japan range from 270,000 to 842,000 metric tons, 100% to 480% (Coyle 1986).

Japanese beef markets have not yet seen the health-related emphasis on lean beef in American markets, making possible differentiation between longer-fed beef for export and shorter-fed beef for the domestic market (Lin et al. 1989). In other Asian markets, lean beef is preferred and is currently supplied by grass-fed Australian beef. Imports of value-added agricultural products to Japan increased from 20% in 1970 to 45% in 1988 (Coyle 1990). Japanese markets for higher-value and processed livestock products will probably increase as disposable incomes rise and import restrictions are eliminated. Similar developments could occur in more developed Pacific rim countries, such as South Korea, Taiwan, and Malaysia.

Another major Pacific rim destination for U.S. exports is China. Lower incomes and restrictive foreign currency reserves limit Chinese imports of U.S. agricultural products to grains and cotton. Wheat, the major U.S. export to China, was sharply reduced after 1984 and has increased to former levels only since 1987. Population growth and slowing output expansion mean that China will reduce exports and increase imports over time, but these will probably be limited to wheat, feed grains, and cotton, rather than meat (Tuan 1990). The U.S. share of China's wheat imports depends on continuing export subsidies to increase price competitiveness.

GATT Negotiations

More than tariff reductions are at stake in the latest round of multilateral trade negotiations under the General Agreement on Tariffs and Trade. While previous rounds of negotiation were successful at liberalizing trade in manufactured goods, the current effort focuses on nontariff barriers to agricultural trade. The United States and other exporting nations are seeking to eliminate all trade-distorting policies, including domestic price supports and export subsidies (Magiera and Johnson 1990). The objective is to open markets and establish a "level playing field" for competition.

Analyses suggest that liberalizing agricultural trade will increase world commodity prices, increase economic growth, and enhance economic welfare (Dixit et al. 1989). Under more liberal trade terms, short-run U.S. meat production and trade volume should rise. Wheat and coarse grain production and trade will also likely rise as the acreage production program is phased out. However, wheat producers' incomes and asset values would likely still be below base levels and some land currently in set-aside programs would likely remain idle. Incomes of producers of highly protected or subsidized commodities would likely fall unless governments substitute decoupled income supports for current price supports.

Longer run effects on crops and livestock will vary in direction and magnitude. Partial equilibrium models of more liberal world trade predict declines in U.S. wheat production of 3% to 6%, with declines in the incentive wheat price (market price plus direct government payments) of 11% to 44% (Roningen and Dixit 1989, Tyers and Anderson 1986). However, U.S. wheat production could increase because production costs for many U.S. producers are lower than those in competing countries (Harwood and Bailey 1990). Wheat producers with below average production costs would benefit from increased exports, higher market prices, and higher asset values. These outcomes would not extend to areas of the U.S. with higher production costs, such as the northern and southern Plains. Less productive land for which the unit cost of production is high, including much CRP land in the Plains, would likely not be used for wheat production.

More liberal trade would likely increase U.S. beef production and trade (Hahn et al. 1990). Moreover, higher grain and lower oilseed prices would change feed rations and could result in higher forage use as well (USDA ERS 1990d). Beef output would likely increase in Australia, Brazil, and Argentina. Raw imports to the United States from Brazil and Argentina would continue to be excluded because of trade barriers to control the spread of foot and mouth disease. Japan and the European community would reduce beef production and increase imports. However, bilateral agreements between the United States and Japan mean that U.S. beef exports to Japan will undergo substantial liberalization apart from changes negotiated under GATT.

European Developments

Europe is a focus of much uncertainty about exports because of European community market integration, planned for 1992, and because of recent political and economic reforms in eastern Europe. While successful GATT negotiations could open the EC to increased U.S. beef imports, market integration could increase intra-European trade, reducing U.S. export opportunities. Reform or elimination of the EC agrimonetary system of special exchange rates, national quotas, and plant and animal health and food safety standards could reduce many of the internal barriers to trade between EC countries without lowering barriers to non-EC competition (Gardiner et al. 1990).

Economic reforms in eastern Europe add to the complexity of GATT and EC 1992 export potentials. Agriculture is a larger part of eastern Europe's economy than in the EC and stands to gain more from improvements in yields, mechanization, and farming practices (USDA ERS 1990e). Both East and West are currently net agricultural importers. However, exposure to higher world prices and pressing foreign currency needs could motivate eastern European farmers to greater export production while reducing domestic food consumption. Eastern Europeans could redirect their current meat exports to the USSR toward hard currency earnings in the West. Exports of meat to the West could increase 10% by 2000 and net exports of grain could increase by more than 200% (Cochrane and Koopman 1990).

These projections depend on eastern European countries developing market-based institutions and pursuing convertible currencies that will facilitate increased trade (Urban 1990). The unprecedented reconstruction of economic institutions required will probably go neither quickly nor smoothly, making the timing of agricultural market changes in eastern Europe especially uncertain.

Export Summary

Export demand will probably be the biggest single factor affecting the ultimate fate of CRP land. Most of the conditions that supported export growth in the 1970's changed in the 1980's. However, multilateral and bilateral trade agreements and changes in Pacific Rim, European, and Soviet economies point to new changes that will affect exports in the 1990's.

While it is difficult to foresee all the impacts of these changes, some outcomes are more likely than others. Changes on the Pacific Rim will probably increase U.S. agricultural exports of livestock products to more developed countries like Japan and of food and feed grains to China. Changes in Europe and the Soviet Union will probably reduce U.S. exports in the long run as internal European and East-West barriers to trade come down. Changes stemming from successful GATT negotiations will probably favor U.S. exports of crops and beef in the long run, but may not be favorable to crop producers in higher-cost regions. In areas with large CRP enrollment and a real choice between crop and grazing use, such as the Great Plains, trade liberalization would probably increase beef exports more than crop exports.

Export markets have already improved considerably since the mid-1980's, aided by improved demand, more aggressive U.S. marketing, reduced stocks, and improved productivity. While exports as a percent of total U.S. production have not yet returned to the levels seen in the early 1980's, they could be nearly as large by the time CRP contracts expire. Livestock products are likely to account for a greater share of exports in the 1990's than they did in the 1980's.

Supply of Crop and Grazing Lands

Grazing Lands

On the supply side, there is no lack of forage resources available for U.S. livestock production. Consequently, there is little pressure to keep CRP lands in grass. Total grazing land amounted to 811 million acres in 1987, down 20% since 1950 (Daugherty 1988, 1990). However, most of the decrease occurred in cropland used only for pasture and grazed forest land. Pasture and range decreased only 6% between 1950 and 1987. Further, much of the decreased pasture and range was in urban regions: the Northeast, Lake States, and Pacific Region. In the regions with the largest amounts of CRP land, pasture and range increased or was unchanged. The southern Plains had a 46% increase in other pasture and range, while the northern Plains recorded an increase since 1969, leaving the regional totals between 1950 and 1987 unchanged.

Grazing supplied on public lands has remained nearly constant at about 20 million AUMs (Joyce 1989, p. 40). Grazing on BLM lands declined from 13 million AUMs in 1969 to 11 million AUMs in 1986. Public land management agencies have responded somewhat to critics who charge that environmental and recreational uses of public grasslands have been slighted in favor of grazing uses. Decreased public grazing could eventually result from recent management changes, including a small increase in public grazing fees. Grazing use of CRP land could eventually substitute for some public forage. How much depends on the location of CRP land in relation to existing public land permittees, ownership or rental arrangements for CRP forage supplies, provision of fencing and water supplies, and the price of CRP forage relative to public grazing fees. Much public grazing land is located in the Mountain States, while most CRP land is in the Great Plains, but there may be limited opportunities for direct substitution in areas where public and private land are in proximity. Where direct substitution is not possible, competition between livestock producers may favor those with access to grazing on post-CRP lands.

The 1989 RPA assessment assumes that all CRP acreage originally in grass and for which the climax type is range will remain as grassland and projects a 47% increase in range productivity by 2030 (Darr 1988 p. 36; Joyce 1989, p. 67, 70). This includes almost all CRP acreage except land in the Northeast and Southeast that could go to trees or wetlands. The 1985 RCA appraisal makes no specific projections of grazing land supply, but the nearly 50% reduction in cropland needed will make some additional land available for grazing use (Joyce 1989, p. 70). At most, CRP could add only 5% to existing forage acreage.

Cropland

Overall, the U.S. cropland base has remained remarkably constant at 400 million acres for much of the postwar period (USDA ERS 1990c). However, only 328 million acres of cropland were used for crops in 1988, down 15% from the peak in 1981. This was due primarily to a record 78 million acres in annual and long-term government idling, including CRP land. Stocks of major program crops were at their lowest levels since the early 1980's through a combination of increased exports, production controls, and the 1988–89 drought. Cropland use rebounded in 1989 to 342 million acres and the 1990 crop may restore depleted stocks. New cropland development in competing countries and productivity increases on existing cropland will influence demands for U.S. cropland currently idled as CRP contracts expire (Phillips and Lu 1987, Purcell 1987).

Technology

Technological advance may reduce the need for U.S. agricultural land resources in two ways: both increasing productivity per acre of U.S. producers and more rapidly increasing productivity of our competitors and former export customers (Phillips and Lu 1987, p. 450; Ruttan 1990; Schuh 1990). The promise of biotechnology is more apparent and immediate for livestock production than for crop production (Barker 1990). Optimistic prospects for bovine and porcine somatotrophin in dairy and hog production are foreseen that could possibly be extended to feedlot beef (Kalter and Milligan 1990, Wagner 1990).

However, few immediate impacts are expected for range livestock because biotech advances in reproduction, progeny selection, and nutrition and feeding require detailed record keeping at the enterprise level that is difficult for range-run animals under current management practices (Sims and Aberle 1990). Gains in production per cow from genetic changes, use of more forage growth before feedlot, and reduced calf slaughter will continue.

Even without biotech advances, changes in livestock technology, including shifts in time on grass and in the feedlot, apparently abetted idling large acreages of pasture and range in the Great Plains. Between 1945 and the peak of the cattle cycle in 1974, pasture and range used per animal declined consistently from 12.7 to 6.5 acres (Daugherty 1988). Pasture and rangeland per cow has rebounded since 1974 as cattle numbers fell, but is still at an historically low 8.3 acres. Any further advances in range technology, including biotech changes, will simply increase our ability to support higher cattle numbers without increased demand on CRP land.

Derived demands for both cropland and grazing land are likely to be less than capacity in the near-term future. Uses for the economically marginal land will likely be outside traditional agriculture, such as the demand for environmental goods like water quality improvement (Purcell 1987). Normal extremes of temperature and precipitation, combined with periodic drought and wind conditions, place much dryland crop production in the Great Plains on the economic margin (Stewart 1990). While proposals for a "Buffalo Commons" are greeted with derision by Great Plains residents, they raise the real possibility that neither crop production nor livestock grazing will be economically valid future uses for CRP lands.

CRP's Future in the Great Plains

The Great Plains Region has been particularly vulnerable to climatic and economic cycles which have affected the relative dominance of crop and livestock production

Government programs appear to have buffered land use changes that might otherwise have come about as a result of drought and economic conditions. CRP's fate in the Great Plains will become more important as 1990 farm legislation continues the trend toward reduced farm program support for agriculture set in the 1985 Food Security Act. The GATT negotiations, if successful, could also reduce farm support levels for crops important in the Great Plains.

Land Use Trends in the Great Plains

One window to the future is the past. Almost half of CRP land has been enrolled in the Plains States of Texas, Montana, Kansas, North Dakota, Colorado, Nebraska, and Oklahoma. Some of these lands have been retired before under government programs in the 1930's and the 1950's (Helms 1989). Owners returned much of the land retired under earlier programs to crop production as cyclical droughts gave way to more favorable weather and increased groundwater irrigation. However, the government acquired 3.8 million acres in the 1940's and 1950's and these remain in public ownership as national grasslands.

Parallels with the Soil Bank program in the Agricultural Act of 1956 are obvious. Almost 29 million acres were under Soil Bank contract in 1960, but over 80% left the program in the 1970's (Aines 1963; Alig 1980; Bowers et al. 1984, p. 22). More than 80% of Soil Bank land planted to trees remained in that use, but farmers plowed out much of the land planted to grass by the time the export boom of the 1970's occurred. The fate of the Soil Bank shows government conservation programs' vulnerability to high commodity prices. This weakness suggests that owners may put most of the land in the CRP back into crop production after contracts expire if economic conditions warrant, despite conservation compliance requirements.

Government idling of cropland may have retarded land use change that might otherwise have occurred (fig. 3). After 1972, changes in cropland used for crop production corresponded to changes in prices received for crops and were much more variable than changes in

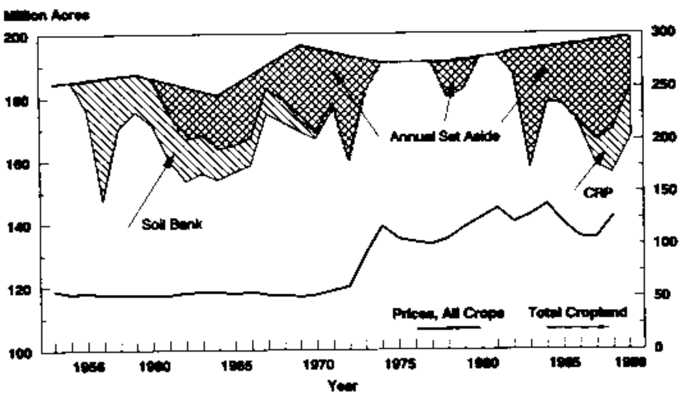

Figure 3.—Cropland and Idled Cropland in the Great Plains States over 1954–1989.

total cropland. Except for brief periods from 1974 to 1977 and 1980 to 1981, government programs idled as much as 20% of Great Plains cropland (25 to 30 million acres). Between 1956 and 1970, much former cropland was in the Soil Bank program. Annual farm program set-aside requirements idled cropland between the mid-1960's and 1985. A combination of annual set-aside and long-term CRP idled large acreages since 1985.

Historically, there is little evidence that either annual or long-term government land idling in the Great Plains ever resulted in permanent changes in agricultural land use. A slow accretion of cropland converted from pasture and range has been accompanied by periodic idling of as much as 30 million acres, most of which is returned to crop production when economic conditions are favorable.

Great Plains Crop and Livestock Economics

The Economic Research Service has prepared enterprise budgets for wheat and cow-calf operations since the early 1970's (McElroy et al. 1989, Shapouri et al. 1990). Budgeted net returns from wheat production in the Great Plains have been similar to returns for cow-calf enterprises adjusted to a per-acre basis, excluding direct government payments and accounting for fallowed land (fig. 4). Wheat net cash income per acre was higher than cow-calf net cash income per acre from 1975 to 1985, but was lower for 1986 and 1987. However, wheat net returns to owned inputs (including general overhead, taxes, insurance, and capital replacement, but excluding interest) were higher than for cow-calf operations only in 1975, 1979, and 1983. While average net cash returns per acre were higher for wheat than beef ($17.51 versus $4.11), average returns to owned inputs were higher per acre for beef ($3.02 versus –$1.26). Wheat returns per acre were more variable than cow-calf returns (C.V. –1,126.3 versus 179.5).

While useful for comparisons over time, ERS regional budgets do not provide detail on geographic variation. State-level aggregate receipts, production expenditures and net cash returns are available for 1987 from the Census of Agriculture for cash grain (SIC 011), cotton (SIC 0131), and beef cattle, except feedlot (SIC 0212) farms (table 1). Averaged across all states, both cash grain and cotton farms in the Great Plains earned higher cash returns per acre than beef cattle. However, when government payments are excluded, cattle returns are higher than cash grain returns in North Dakota and Kansas and are almost equal to those for grain farms in Oklahoma.

A Sensitivity Analysis

Based on these average returns, one could conclude that few acres of CRP land would remain as grazing land after contracts expire, given current levels of government price and income support. However, CRP acres enrolled are not of "average" productivity, either for crop or for grazing use. Also, the thrust of recent farm policy, driven

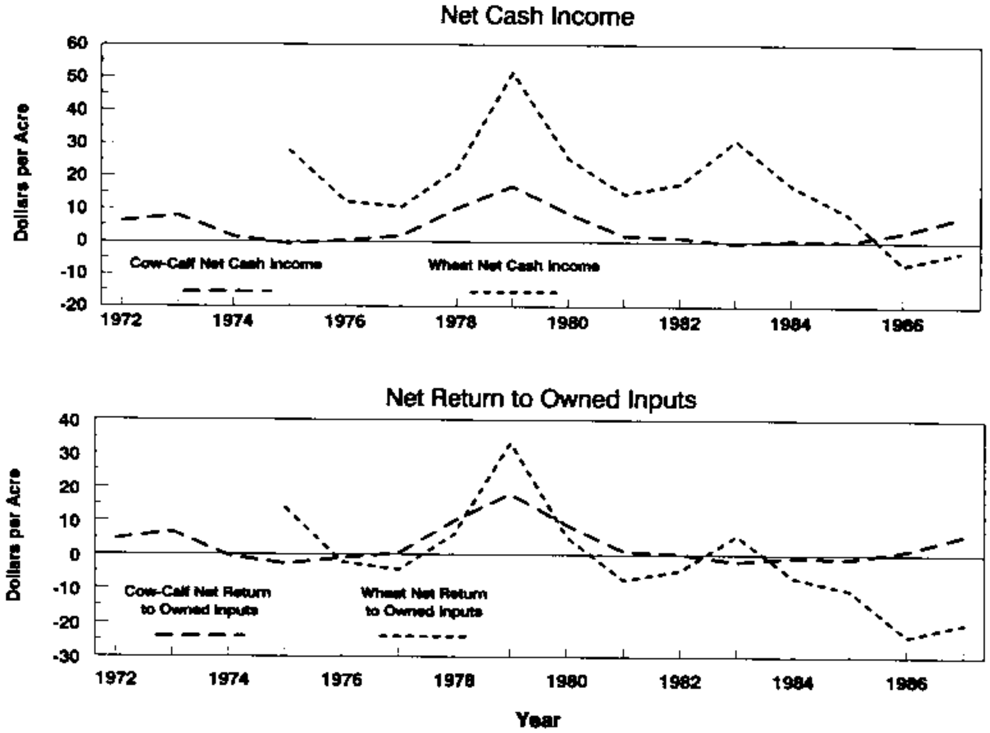

Figure 4.—Comparative Cow-Calf/Wheat Economics in the Great Plains over 1972–1987 (USDA Economic Research Service).

by the federal budget deficit, and of trade liberalization negotiations under GATT is reduce levels of government price and income support. If adjustments are made for the productivity of CRP land and possible reductions in government payments, how much change in relative crop and livestock prices or government support would be required to make grazing competitive with crop production?

In general, highly erodible land is no less productive for crop use than other cropland (Heimlich 1989). Because CRP rental bid caps were set near the average rental rates for all land, farmers enrolled the highly erodible land least productive for crops. State average wheat yields for base acres enrolled in CRP are 53% to 93% of average wheat yields for all cropland in each state. CRP cotton yields are 60% to 69% of average cotton yields. However, since CRP land was used for crop production instead of other, presumably less productive, range and pasture, it is likely to have above average forage productivity unless crop use has dramatically decreased soil organic matter.

Reducing cash grain and cotton farm receipts and government payments per acre based on the ratio of CRP base acre to overall average crop yields reduces returns for crop production relative to livestock production (table 1). Forage yields were not increased to account for CRP lands' assumed higher productivity because no data on CRP forage yield is available and CRP land would probably be a small part of total range supporting a cattle operation.

Excluding government payments, yield-adjusted returns per acre for cash grain farms are less than beef returns in all states and are negative in North Dakota, South Dakota, Wyoming, Colorado, New Mexico, and Texas. Yield-adjusted cotton returns per acre, excluding government payments, are higher than beef returns in New Mexico, but are less than beef returns in Oklahoma and Texas.

Conditions for livestock production vary within Great Plains States more than these state-wide averages show. Reduced precipitation west of the 100th meridian in Great Plains States may limit transition to grazing use on CRP land because stocking factors, and therefore livestock revenue per acre, would be lower than those of more humid areas in eastern parts of the state. Lack of forage in dryer parts of the year restricts herds, even though ample forage may be available during some seasons. While wheat yields are also likely to be limited by lower precipitation, fallowing and moisture-conserving tillage practices may make production possible.

On average for the Great Plains, revenues from grain sales and government payments would have to fall 14.8% from 1987 levels for beef returns to equal returns for cash grain production on CRP land. Various analysts project declines of 11% to 44% in incentive prices (including government payments) for the United States under GATT multilateral policy reform (Harwood and Bailey 1990). Cotton prices would have to fall an average of 12% for returns to cotton production on CRP land to equal beef returns.

Table 1.—Returns to crop and livestock enterprises per acre, Great Plains states, 1987.

Farm type	ND	SD	MT	WY	NE	KS	CO	OK	NM	TX	Great Plains
	Dollars per acre										
Beef cattle, except feedlots (SIC 0212)											
Total sales	63.17	51.18	23.19	18.49	53.55	135.53	33.32	78.76	11.48	34.80	37.99
Production expenditures	50.98	40.85	18.62	14.29	42.77	116.87	27.59	69.47	9.49	31.44	32.40
Net cash return	12.63	10.68	4.56	4.02	11.52	20.17	4.88	6.72	2.01	3.12	5.41
Government payments	7.17	3.88	1.29	0.26	3.45	10.49	1.75	5.32	0.53	1.45	2.22
Net cash return + payments	19.80	14.57	5.85	4.29	14.96	30.65	6.63	12.04	2.54	4.57	7.63
Cash grain (SIC 011)											
Total sales	61.09	76.84	76.84	76.84	137.36	71.63	66.96	59.07	64.81	96.80	82.00
Production expenditures	54.88	61.53	61.53	61.53	106.54	55.90	55.87	54.72	57.11	82.50	67.23
Net cash return	6.21	15.31	15.31	15.31	30.82	15.73	11.09	4.35	7.70	14.30	14.77
Government payments	19.10	19.48	19.48	19.48	36.88	19.88	20.13	19.95	26.20	27.07	23.26
Net cash return + payments	25.31	34.79	34.79	34.79	67.70	35.61	31.22	24.30	33.90	41.36	38.03
With CRP yield reduction											
CRP yield (percent)[1]	81.40	72.80	77.60	72.80	75.00	81.10	63.00	92.60	53.10	78.60	78.00
Reduced total sales	50.99	60.16	63.10	60.16	108.62	60.37	46.00	55.65	41.55	79.82	66.88
Reduced net cash return	−3.89	−1.37	1.57	−1.37	2.09	4.47	−9.86	0.93	−15.56	−2.68	−0.35
Reduced government payments	15.55	14.18	15.11	14.18	27.66	16.12	12.68	18.48	13.91	21.27	18.14
Reduced return + payments	11.66	12.81	16.69	12.81	29.75	20.59	2.82	19.40	(1.65)	18.60	17.79
Price change[2]	15.00	2.90	−17.70	−13.90	−12.90	16.90	6.70	−15.90	8.50	−17.70	−14.80
Cotton (SIC 0131)											
Total sales								114.80	257.78	143.14	142.55
Production expenditures								82.35	158.83	93.70	93.69
Net cash return								32.45	98.95	49.44	48.85
Government payments								27.94	34.66	32.38	32.10
Net cash return + payments								60.39	133.60	81.82	80.95
With CRP yield reduction											
CRP yield (percent)[1]								68.90	60.50	60.10	60.50
Reduced total sales								88.74	181.26	95.58	96.08
Reduced net cash return								6.39	22.43	1.8	72.38
Reduced government payments								19.25	20.97	19.46	19.42
Reduced return + payments								25.64	43.39	21.33	21.80
Price change[2]								−16.20	−21.10	−14.10	−12.00

[1]*Ratio of average yield on base acreage enrolled in CRP to state average wheat yield.*
[2]*Percent change in crop price needed to equate crop and cattle net cash returns + government payments.*

Source: Census of Agriculture, 1987.

Characteristics of CRP Land Operators

The characteristics of the land and the characteristics of the people who own and manage it will obviously be important factors influencing the fate of CRP land after contracts expire. Within any economic and policy environment prevailing when contracts expire, it is likely that some owners on some CRP land will be disposed to return the land to crop production and that others will be more likely to keep the land in grass.

We previously estimated that landowners would likely retain 15% to 30% of CRP land in grass after contracts expire. We based our estimate on an extrapolation of operator characteristics associated with expectations for use of CRP land from a sample of Daviess County, Missouri, farmers (Heimlich and Kula 1989). Predominant enterprise (livestock or crop), average gross sales of agricultural products, the opportunity cost of idling crop base acreage, and the cost of conservation compliance were key variables explaining differences in expected use of CRP land.

The probability that a landowner intended to retain CRP land in grass decreased from 90% for livestock farms with less than $20,000 in sales and no base acreage to only 3% for crop farms selling more than $200,000 with high base acreage. The probability of keeping land in grass was 7% to 28% higher for livestock than for cash-crop farmers, decreasing as sales increased. At the mean levels of the variables, livestock farmers had a 77% estimated probability of retaining CRP land in grass, while the probability for crop farmers was only 44%.

The 1987 Census of Agriculture reported on almost 75% of CRP land idled by 1987 (table 2). Livestock farms, including dairy, animal specialties, and general livestock farms, accounted for 28% of CRP acreage idled in 1987. Although 64% of acres enrolled by the end of 1987 were crop base acres, farmers who participated in annual acreage reduction programs (ARP) operated only 40% of CRP acres reported in the Census. Almost one-third received Commodity Credit Corporation loans. More than 30% of CRP acres were operated by farmers who sold less than $20,000 in 1987 or who where excluded from the census based on lack of sales. Only 8% of CRP operators had more than $250,000 in annual sales.

These data suggest that farmers with characteristics favoring long-term retention of the land in grass

Table 2.—CRP acres by owner characteristics, 1987.

	Farms	Acres	Percent of acres
By farm type			
Crop farm	37,422	5,521,208	35.1
Livestock farm	28,683	4,349,461	27.7
Unknown[1]	na	5,842,010	37.2
By program participation			
ARP	39,737	6,171,585	39.3
CCC loans	22,837	3,203,364	20.4
Unknown[1]	na	5,842,010	37.2
By Sales			
$1,000,000 or more	393	162,427	1.0
$500,000–999,999	921	292,677	1.9
$250,000–499,999	2,833	690,089	4.4
$100,000–249,999	9,586	1,887,956	12.0
$50,000–99,999	10,001	1,789,075	11.4
$20,000–49,999	12,484	1,828,528	11.6
$10,000–19,999	8,636	1,032,588	6.6
Less than $10,000[2]	36,102	3,968,289	25.3
Unknown[3]	na	4,061,050	25.8
By occupation			
Farming	44,680	7,690,398	48.9
Other[2]	36,006	3,961,23	125.2
Unknown[3]	na	4,061,050	25.8
By tenure			
Full owner operators	32,521	3,808,797	24.2
Full owner nonoperators[2]	14,581	1,780,960	11.3
Part owner operators	28,409	5,197,699	33.1
Tenants	5,175	864,173	5.5
Unknown[3]	na	4,061,050	25.8
By census coverage			
Census farms	66,105	9,870,669	62.8
Noncensus farms	14,581	1,780,960	11.3
Subtotal	80,686	11,651,629	74.2
Not counted	na	4,061,050	25.8
Total idled in 1987	na	15,712,679	100.0

[1]*Includes agricultural places excluded by the census farm definition with acres in the CRP and CRP acres not accounted for in the Census of Agriculture.*
[2]*Includes agricultural places excluded by the census farm definition with acres in the CRP.*
[3]*Includes CRP acres not accounted for in the census of Agriculture.*

Source: Census of Agriculture, 1987.

operate relatively few CRP acres. Adding to the uncertainty is the large proportion of CRP land at least temporarily disassociated from farming. Between 25% and 50% of CRP acres idled in 1987 were owned by people who were not identifiable as farm operators, because they either ceased active farming or were not accounted for in the Census of Agriculture. Individuals with a nonfarm principal occupation owned about half the CRP land, and only 63% was part of a farm.

The partial budget analysis discussed above does not reflect capital costs for fencing and watering areas that will be required to use CRP land for livestock production. Mixed livestock and crop farms will be in a better position to develop livestock enterprises than farms specializing in crop production.

Perhaps more important than these capital costs are the requirements for human capital needed to make a transition from cropping to livestock production. Many CRP landowners do not have experience in raising livestock and may be unwilling or unable to learn these new skills. However, given appropriate economic incentives, properly functioning land markets, and barring institutional barriers, land best suited to grazing will be leased or sold to producers who can pursue livestock enterprises.

Policy Changes in the 1990 Farm Bill

Provisions in 1990 farm legislation passed in the Senate (S. 2830) and House (H.R. 3950) affect the terms which CRP landowners will face when contracts begin to expire. While there are more options available to owners to keep CRP land out of intensive crop production, few of those options lend themselves to grazing use of CRP land.

The first option is not in the farm bill conservation title, but in commodity provisions. It allows operators to protect up to 25% of their crop acreage base while planting it to other crops. Producers could use this provision to move from program crop production to forage crops or grazing, but farmers will more likely use it to enhance flexibility in planting decisions for program crops and soybeans. The bills establish an integrated crop management program to protect crop acreage base planted to legumes and other soil and water conserving crops, including livestock production systems. However, farmers cannot receive government payments if they hay or graze the land, limiting this option for livestock production. Another commodity provision that may affect CRP land requires the Secretary to allow haying and grazing of land set aside in the annual or multiyear programs, if requested.

Target prices in the 1990 legislation can be frozen at 1990 levels and program yields remain frozen at 1985 levels. Assuming technological increases in yields and higher market prices, these provisions reduce the amount of government support for program crop production. Reduced government payments should reduce net returns for program crop production on CRP land, in relation to returns for livestock production.

The Grazing Lands Forum noted that a major disincentive to retaining CRP grassland in the 1985 Food Security Act was loss of crop acreage base if the farmer did not plant when the contract expired (Heimlich et al. 1989). In House and Senate farm bill conservation titles, crop acreage base is protected for an additional 10 years if the farmer maintains conservation cover. Limited haying and grazing is allowed under this provision. The Senate requires USDA to study CRP land subject to expiring contracts and report findings and recommendations by the end of 1993. This extension could defer some landowners' decisions regarding CRP land for another 10 years. Ultimately, however, these owners must still choose between crop acreage base and permanent grassland.

The bills extend CRP contract life to 15 years for some purposes, including tree planting, windbreaks, and shelterbelts, and extends restored wetlands to permanent easements. While some grazing use could be made of these lands, most CRP grassland is still limited to 10 year contracts.

The 1990 bills tighten conservation compliance, requiring new or revised plans to reduce erosion at least 50% in the House and to meet T values on new CRP enrollments in the Senate. CRP owners would have 2 years to implement plans after contracts expire.

Conclusions

Fundamental economic trends do not indicate clearly whether CRP land will be needed for either crop or livestock production. Both crop and livestock production seem poised for expansion in the 1990's. However, existing supplies of cropland and grazing land are adequate to meet that expansion, particularly if productivity increases associated with new technology materialize. Key economic factors are the growth and nature of world demand, subject to trade negotiations, economic reforms, and food health and safety concerns, and the impact of technology on U.S. and world cropland productivity.

In the Great Plains, annual and long-term government land idling programs have kept land in crop use. Excluding government payments, returns to owned inputs per acre for cow-calf enterprises over the last 15 years have been similar to returns for wheat production. Adjusting for lower yields on CRP land and excluding government payments, net cash returns for cattle on CRP land in 1987 would have been larger than returns for grain production.

Reductions in either grain prices or government payments averaging about 15% would equate cattle returns to yield-adjusted grain returns. Marginal, high-cost producers in the Great Plains could find the choice between livestock and crop production difficult to make if GATT negotiations and other pressures to reduce government farm supports are successful.

In general, 1990 farm legislation has deferred policy making for CRP land coming out of contracts to 1995. Extending base protection for an additional 10 years removes the most immediate policy incentive to bring CRP land back into production, but does not resolve CRP landowners' ultimate choice between base acreage and permanent grassland. Moreover, grazing land contract length remains at 10 years and opportunities for grazing use to promote a transition to livestock production prior to expiration remain limited. Domestic agricultural policy has been made at least neutral with regard to the ultimate fate of CRP land. Unless major new resource protection provisions are enacted in 1995 or as a response to GATT outcomes, CRP landowners will make their land use decisions on the basis of relative crop and livestock economics, tempered by the global trade environment, existing farm enterprises, and their own preferences and needs.

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