THE CONSERVATION RESERVE PROGRAM AND FUTURE USE OF ENROLLED LAND IN MONTANA

by

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THE CONSERVATION RESERVE PROGRAM AND FUTURE USE OF ENROLLED LAND IN MONTANA

Michael David Sheard, 1992

ABSTRACT

The Conservation Reserve Program (CRP), as authorized by the Food Security Act of 1985 is a voluntary cropland retirement program which relies primarily upon positive economic incentives to farm operators in order to entice them to convert cropland considered highly erodible or otherwise environmentally sensitive into a conserving use for a ten-year period.

Through 1989, Montana farm operators enrolled nearly 2.7 million acres of cropland into the CRP. The first CRP contracts were entered into in 1986 and thus will expire in 1995. Under current policy, once the ten year period is over, cropland enrolled in the CRP can be returned to annual cropping, can be used in some alternative commercial use such as haying or grazing, or can remain in a conserving use. There is much concern in Montana and other states over how the future use of these acres could affect commodity prices, farm incomes, government outlays, rural economic activity, and environment quality.

This study examines the factors to be used by individual Montana CRP contract holders upon contract expiration to decide the disposition of their CRP land among the alternative uses. A firm level mean-variance decision model is used to incorporate the risk involved with each alternative. The model also considers any one-time start-up costs that may be incurred to convert CRP acres into an alternative use.

Test results using survey data from Montana contract holders suggest that very few CRP acres in Montana will remain in a conserving use. Most respondents indicated that they plan to either return all of their CRP acreage to annual cropping, or will hay/graze all of the acreage. The results suggest that the greater the percentage of income derived from range livestock, the more likely the CRP land will be hayed or grazed. Similarly, the greater the percentage of income derived from cropping, the more likely the CRP land will be returned to annual cropping. The evidence is that more CRP land will be hayed or grazed on operations that currently have haying/grazing activities, or that have physical attributes to facilitate haying/grazing activities.
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CHAPTER 1

INTRODUCTION

CRP: Present and Future

By the start of 1991, United States farm and ranch operators had enrolled almost thirty-four million acres of cropland into the Conservation Reserve Program (CRP). These highly erodible cropland acres are to be planted for a period of ten years to a conserving use to reduce soil erosion. In exchange for diverting these highly erodible croplands from crop production to a conserving use, operators receive annual per acre rental payments from the Commodity Credit Corporation.

When CRP contracts expire, the lands released from the contracts may be returned to crop production, may be used for haying or grazing, or may be retained in a conserving use. The decisions made by contract-holders when their CRP contracts expire have the potential to impact commodity prices and farm incomes, government expenditures, rural economic activity, and environmental quality.

Montana farm operators have participated heavily in the CRP, enrolling nearly one of every six and a half acres of cropland in the state. As a result of Montana farm operators' high participation in CRP, and their historically high
participation levels in commodity programs, the disposition of Montana CRP acres once the contracts expire is of great concern. Montana CRP contract holders, like CRP contract holders elsewhere, will have the option to use CRP lands for crop production (probably small grain production), for livestock forage production (either haying or grazing), or for continued conserving uses. Montana contract-holder decisions are expected to depend largely on the relative economics of livestock production and grain production. Start-up costs associated with converting CRP lands to grain production or livestock forage production, and the existence or need for capital improvements on CRP lands (such as fences and water improvements for livestock), will influence the relative profitability of future use of CRP lands.

Purpose of Study

This study will provide a brief review of the history of the use of land diversion programs in the United States. A detailed description of the CRP will follow along with the program's implementation and participation in Montana.

The factors used by individual CRP contract holders upon contract expiration to decide the disposition of their CRP land will be examined. A firm level mean-variance decision model is used to incorporate the risk involved with the various land use alternatives faced by CRP contract holders when the contracts expire. The model also incorporates any one-time start-up costs that may be incurred to convert CRP acres into an alternative use. It is hoped this
analysis will reveal some insight into this decision-making process in order to estimate the likely uses of Montana CRP lands when the contracts expire.

Outline of Thesis

The second chapter is a review of the different types of land diversion programs and the history of the use of these programs in the United States, from the Agricultural Adjustment Act of 1933 through the Food Security Act of 1985, including a thorough description of the CRP emphasizing CRP implementation and levels of participation.

The third chapter focuses on the uses of land enrolled in CRP upon contract expiration. Reference is made to data from the 1991 Montana Farm and Ranch Survey and literature on regional and national studies estimating post-CRP contract land uses.

Chapter four provides a presentation of the theoretical model including a review of prior uses of this general theoretical model structure and specification of the model for this application.

Chapter five contains tests of the model results using survey data from Montana CRP contract holders. The final chapter summarizes the information and results, and includes proposals for further research.
CHAPTER 2

AGRICULTURAL LAND DIVERSION PROGRAMS IN THE UNITED STATES

Types of Cropland Diversion Programs

Cropland diversion programs have evolved in the United States as a policy tool to control the amount of acres used to produce surplus commodities, and as a policy tool to limit soil erosion. Cropland diversion programs can be divided into two categories: (1) short-term adjustment programs; and, (2) long-term retirement programs.

Short-term programs have operated under official and unofficial nomenclature including "acreage reduction program", "set-aside", and "paid land diversion". These short-term programs generally consist of voluntary acreage reduction or diversion on an annual basis. Acreage reduction programs require commodity program participants to idle a percentage of their program crop "base" acres to be eligible for commodity program benefits. Paid land diversion programs pay producers to idle a percentage of their "base" acreage. Program commodity base acreage is/has been determined by formulae which have varied through the years, but are usually some "average" of the historical plantings of the commodity. The objective of these short-term acreage reduction and paid land
diversion programs has been to temporarily reduce the quantity produced of a given commodity in an attempt to balance production with demand at a resultant price somewhat in correspondence with the target price (Richardson, Smith, Knutson, and Sechrist, 1991).

Long-term land retirement programs have been and/or are known as "conservation reserve programs", the "wetlands reserve program", and the "soil bank". These are voluntary multiple-year programs that remove cropland from the production of program and other commodities. Usually, producers are required to establish a soil-conserving cover crop, and in return receive a government-paid annual rent. The annual rent is expected to compensate the landowner for the foregone net returns from crop production along with a portion of the cover crop establishment costs. The usual objective of these programs is to remove from production cropland used for growing surplus commodities, and/or cropland that is considered highly erodible.

Cropland Diversion As a Policy Tool in the United States

In this section a brief history is provided concerning the use of various cropland diversion programs in the United States. Emphasis is on the economic conditions in the agricultural sector at the time these programs were implemented. This review provides a partial historical backdrop for the development and implementation of the CRP.
The years just before and during the First World War have been referred to as the "golden age of American agriculture". During the war farm and ranch operators were unable to satisfy the demands of the Allies for food and fiber. Operators were urged: "If you can't fight, farm. Food will win the war." or "Plow to the fence for National defense". There were forty million new, unbroken acres of land plowed (Saloutos, 1982). Following the First World War however, sharp declines in agricultural commodity prices occurred prompting discussions and legislative proposals aimed towards federal intervention in farm commodity markets.

Throughout the 1920s many proposals toward solving the "farm problem" were offered. The farm problem was been described as the composite of low prices for farm products, instability and uncertainty in farm prices and incomes, and associated elements of distress in the farm sector (Halcrow 1984). According to agricultural historian Ted Saloutos (1982), officials in the United States Department of Agriculture (USDA) and many farm economists were convinced that more land was being farmed than could be cultivated at a profit. Among the ideas offered were adjusting production to demand by land-use adjustments, withdrawing submarginal lands from cultivation, and voluntary production curtailment.

The Agricultural Marketing Act of 1929 established the Federal Farm Board. The Federal Farm Board was provided with a revolving fund of five hundred million dollars to be used for government assistance in four courses of
action: (1) to minimize speculation, (2) to prevent inefficient and wasteful methods of distribution, (3) to encourage the organization of producers into effective marketing associations, and (4) to aid in preventing and controlling surpluses in any agricultural commodity. The Farm Board was authorized to set up stabilization corporations to control any "surpluses" that might arise. As the United States moved into the great depression, the Board used nearly all of the five hundred million dollars to establish cooperatives to purchase stocks of wheat and other commodities. The cooperatives were to hold these stocks until prices improved and the commodities could be sold at a profit (Halcrow, 1984). According to Luttrell (1989), the problem was that no shortages developed and the Farm Board had no authority to control production and huge stocks of commodities soon accumulated. In 1932, instead of committing more funds to support commodity markets, the decision was made to liquidate the stocks. The failure to stabilize commodity prices through storage brought about new proposals for production controls (Rasmussen and Baker, 1978).

In 1932, Roosevelt was elected President along with his New Deal proposals, including the Agricultural Adjustment Act (AAA). Under the AAA, the Secretary of Agriculture was authorized to reduce the acreage or production for market of any "basic" agricultural commodity through voluntary agreements with producers. Therefore, although the concept was introduced earlier, the use of cropland diversion as a policy tool has its roots in the Agricultural Adjustment Act.
The main thrust of the Agricultural Adjustment Act was to increase farm incomes through price supports and production adjustments that would raise commodity prices (Luttrell, 1989). The Secretary of Agriculture was authorized to secure voluntary reduction of the acreage harvested in certain basic crops through agreements with producers and to provide direct payments for participation in these programs. The objective of controlling crop production was to withdraw enough cropland from production to balance farm output with market demand to help restore farm purchasing power to the 1909-1914 level (Rasmussen and Baker, 1978). To finance the program, the Secretary of Agriculture was given authority to levy processing taxes on the first sale of designated farm commodities.

In January of 1936, the Hoosac-Mills decision of the Supreme Court invalidated the production control provisions of the AAA. The Court ruled that these provisions, which were carried out through contracts between the federal government and individual producers, and the government's use of processing taxes to finance these adjustment operations were unconstitutional. The programs were halted, and all the contracts and agreements made between individual producers and the government for reducing production were no longer valid (Bowers, Rasmussen, and Baker, 1984).

Following the Supreme Court's decision, the Soil Conservation and Domestic Allotment Act of 1936 was immediately enacted. This Act reestablished the federal government's authority to entice producers to idle cropland, and established the first "soil bank" type program. Instead of making land rental
payments to producers on acres withdrawn from production, producers were paid to shift acreage from soil-depleting crops to soil-building practices such as growing legumes and grasses. During the years 1936 to 1941, nearly two billion dollars was paid to participants for diverting cropland to these conserving uses (Iowa State University Center for Agricultural and Economic Development, 1969).

The Soil Conservation and Domestic Allotment Act of 1936 was reenacted with the Agricultural Adjustment Act of 1938, but with modifications which provided for acreage allotments for corn, cotton, rice, tobacco, and wheat. The national acreage allotment for each commodity was determined as the estimated number of acres necessary to satisfy domestic and export demand. Individual producer acreage allotments generally were allocated according to past cropping history. The allotments restricted production by limiting the number of acres a producer could plant for harvest and still receive price supports. A producer who signed an agreement and complied with the terms of the agreement was paid a certain amount per acre, according to it's productivity, on their base acres (Halcrow, 1984).

By 1941, even with acreage allotments applied to the basic crops, market prices still frequently fell below the nonrecourse loan levels and surplus stocks (resulting from defaulted price support loans) were reaching the capacity of storage facilities. Demand for farm commodities increased sharply with the onset of the Second World War and remained strong in the early post-war years as supplies were shipped to Europe for recovery programs. Concern over the need
to reduce the buildup of government stocks changed during this time to concern
about increasing production to meet war-time and post-war needs (Bowers,
Rasmussen, and Baker, 1984). By 1948, the number of cropland acres planted
reached an all-time high (Halcrow, 1984).

Following the Second World War, Government stocks of commodities were
increasing again. However, with the start of the Korean War in 1950, concern
again shifted from over-production to securing adequate production to meet war­
time demands. The end of the Korean war in 1953 necessitated changes in farm
policy as the threat of increasing government stocks again loomed (Bowers,
Rasmussen, and Baker, 1984). At the end of 1954, 934 million bushels of wheat,
920 million bushels of corn, and eleven million bales of cotton were stockpiled in
the United States (VanGigch, 1972).

The Agricultural Acts of 1954 and 1956 led to increased restrictions on
total farm production. The primary tool was the Soil Bank of 1956. The Soil
Bank was a set aside program very similar to the soil conservation program of the
1930's. The objectives of the Soil Bank were: (1) to reduce the stocks of the
commodities going into government and non-government storage; and, (2) to
promote conservation of land resources. These objectives were to be achieved
through both short-term and long-term retirement of cropland. The program had
two parts, the short-term acreage reserve and the long-term conservation reserve.

The short-term acreage reserve was primarily designed as an effort to
reduce acreage of land planted to allotment crops: wheat, cotton, corn, tobacco,
peanuts, and rice. Under this program, producers were paid to divert land below their established allotments or base acres of these crops (LaFrance, 1990). The program was designed to last for four years, 1956-1959, and the length of contract was for one year. The program ended after 1958.

The conservation reserve was designed as a long-term land retirement program. There were no erosion criteria to be met or other restrictions on the type of cropland that could be enrolled. All farm operators were eligible to participate. This program was in effect for five years, 1956-1960, and participants could sign either three, five, or 10-year contracts. Participants were paid to divert either part or all of their cropland to soil-conserving uses, regardless of the usual crops planted, for the life of the contract. By 1960, the last year contracts were accepted, over 306,000 contracts covering 28.6 million acres were in effect (Reichenberger, 1987).

As of 1960, the government held 2.7 billion bushels of feed grain and 1.4 billion bushels of wheat (Economic Research Service, 1983). The Emergency Feed Grain Program, authorized in 1961, established a voluntary acreage reduction program to divert corn and grain sorghum acreage to soil conserving crops or practices. Producers received payments either in cash or in-kind from government-owned stocks. They were eligible for price supports only after retiring at least 20 percent of their average acreage devoted to the two crops in 1959 and 1960.
Throughout the 1960s, programs such as the Emergency Feed Grain program were continued and expanded to include other commodities such as wheat, barley, and oats. In some years, an optional paid land diversion program was also offered to encourage producers to idle more land.

The Food and Agriculture Act of 1965 established a cropland adjustment program in which the Secretary was authorized to enter into five to ten-year contracts with producers who agreed to convert cropland into uses which would conserve water, soil, wildlife or forest resources; or establish or protect open spaces, natural beauty, wildlife or recreational resources; or prevent air or water pollution (Rasmusson and Baker, 1978).

The Agricultural Act of 1970 allowed producers more flexibility in their planting decisions by relaxing planting restrictions. Acreage diversions on some crops were replaced with a general set aside that called for reduced plantings but did not specify which crops had to be reduced. Except for maintenance of the set-aside and conserving base acreage, producers could grow whatever they wanted on their remaining cropland.

Authorization was also given under the Agricultural Act of 1970 for long-term cropland conversion and "Greenspan" programs at an authorized appropriation level of ten million dollars annually for each program. The Greenspan program was designed to assist state and local governments in acquiring cropland for permanent retirement to non-crop uses such as preservation of open spaces, wildlife or recreational facilities, and pollution
abatement. These programs were never implemented (Rasmussen and Baker, 1978).

During the early to mid-1970s, reduced trade barriers, large Russian grain purchases, export subsidies and the devaluation of the United States dollar, along with other factors led to sharp increases in agricultural exports, and helped to reduce the build-up of commodity stocks in the United States (Luttrell 1989). The Agricultural and Consumer Protection Act of 1973 emphasized that production respond to the growing world-wide demand for United States farm products. Production control programs were not implemented between 1974 and 1977. A Soil Conservation Service survey of cropland expansion in 1974 identified that this cropland expansion had occurred through the conversion of 3.6 million acres of grassland, 400,000 acres of woodland, and 4.9 million acres of idle land to cropland (Helms, 1990).

By 1977, farm income again became a problem in the United States. In spite of expanded exports during the 1970s, increased grain production again depressed grain prices. Wheat prices fell from $4.09 to $2.33 per bushel between 1974 and 1977 (Bowers, Rasmussen, and Baker, 1984). The Food and Agricultural Act of 1977 provided that acreage control programs require idled acreage to be a percentage of current plantings as opposed to historical bases and allotments. National program acreage for wheat, feed grains and upland cotton were to be determined by the Secretary of Agriculture. These estimated acreage
were to be those necessary to meet domestic and export needs plus any desired adjustments in stocks (LaFrance, 1990).

The Agriculture and Food Act of 1981 established an acreage base for each program crop. The base was determined as the acreage considered planted to a program crop in the year preceding the year for which the determination was made. This Act reestablished a commodity-specific focus to supply control programs. Crop-specific acreage reduction programs were introduced which required that a portion of crop-specific acreage base be diverted from production (LaFrance, 1990).

Bumper crops followed in 1982 with wheat at record levels. This increased production, along with reduced exports, brought about a rapid accumulation of program commodity stocks. At the end, the value of government owned commodities totaled $5.5 billion, up from $3.8 billion a year earlier (Luttrell, 1989). These large commodity stocks were the impetus for the payment-in-kind (PIK) program which began in 1983. The PIK program resembled other land diversion programs, but instead of being paid in cash to idle cropland, participants were paid with the commodity they removed from production. A condition of eligibility for the program was that producers also were required to participate in the acreage reduction and paid land diversion programs already in place.

There were two ways a producer could participate in the PIK program. First, producers could remove an additional 10-30 percent of their acreage bases from production. Under the second option, producers could submit sealed bids to
remove their entire bases from production. The acreage removed from production had to be converted to approved conservation uses. This program removed seventy-eight million acres from crop production, the largest single-year removal of commodity base acreage up to that time (Bowers, Rasmusson and Baker, 1984).

The PIK program and the 1983 drought resulted in reduced stocks and higher market prices. However, stocks began to accumulate again in 1984. The Food Security Act of 1985 (FSA-85) authorized the Secretary of Agriculture to use acreage reduction, set-aside, and/or paid land diversion programs to control production. The Conservation Title (Title XII) of the FSA-85 has been labeled as the most significant environmental legislation ever enacted in U.S. history. Attention was directed towards making sure price support programs did not encourage poor soil and water conservation practices, and that government resources used for conservation were targeted to where they were most needed.

The Conservation Title contained three major subtitles: Subtitle B Highly Erodible Land Conservation, Subtitle C Wetland Conservation, and Subtitle D Conservation Reserve. Subtitle B contained provisions popularly known as "sodbuster" and "conservation compliance". The sodbuster provisions were designed to prevent landowners from bringing new highly erodible cropland into agricultural production without an approved conservation plan. Conservation compliance provisions required that operators of existing cropland considered highly erodible develop and implement an approved conservation compliance plan.
in order to remain eligible for most United States Department of Agriculture programs.

The "swampbuster" provision, required that farmers not physically plant crops on natural wetlands to remain eligible for other USDA benefits. Subtitle D authorized the Conservation Reserve Program.

The Conservation Reserve Program

The Conservation Reserve Program (CRP) is a voluntary land retirement program which relies primarily upon positive economic incentives to farm operators in order to entice them to convert cropland considered highly erodible or otherwise environmentally sensitive into a conserving use for a ten-year period. The primary objective of the CRP under FSA-85 provisions is reduce water and wind erosion on cropland. Secondary objectives are to: (1) protect the nation's long-term capability to produce adequate food and fiber, (2) reduce sedimentation, (3) improve water quality, (4) create better fish and wildlife habitat through improved food and cover, (5) reduce surplus stocks of particular agricultural products through acreage reduction and, (6) provide income support for farmers.

Under the FSA-85, the Secretary of Agriculture was authorized to enroll up to 45 million acres of cropland into the CRP. In an attempt to limit the off-farm adverse economic impacts in areas heavily dependent on crop production (a criticism of the Soil Bank program of 1956), enrollment is generally limited to 25
percent of the total cropland in each county. Land eligibility requirements for enrollment in the program have varied with each CRP sign up; however, when the operators have entered highly erodible cropland in CRP the basic requirement has been that at least two-thirds of a field must be classified by the Soil Conservation Service as HEL. Additionally, the HEL cropland must have been annually planted or considered planted to produce an agricultural commodity other than orchards, vineyards, or ornamental plantings in two of the five crop years, 1981 through 1985.

**Implementation**

Operators satisfying the land eligibility and land use criteria who wished to participate in the program were required to submit a sealed bid to their local Agricultural Stabilization and Conservation Service office during a designated bidding period. These sealed bids indicated the minimum annual payments that bidders were willing to accept in return for converting these lands from crop production to a conserving use. Operators were instructed to determine their bids based on foregone returns from their next best use of the cropland and quasi-fixed resources. For accepted bids, contracts were written that specified the terms and conditions of the agreement. The contract holders receive annual rental payments for a period of ten years. These rental payments are made from funds appropriated to the Commodity Credit Corporation.

The maximum payment per person cannot exceed fifty thousand dollars per year, and does not affect the total amount of payments that are available under
other USDA programs. Grazing, harvesting, or other commercial uses on cropland enrolled in the CRP is prohibited, although fee hunting is permitted. The USDA provides technical assistance and pays up to 50 percent of the initial capital costs incurred in establishing the conserving use. Annual maintenance costs are borne by the land owner; however, in many CRP bids, the contract holders incorporated into their bids the uncompensated establishment costs and annual maintenance costs (Johnson and Clark, 1989).

Nationwide Levels of Participation in CRP

According to the USDA CRP enrollment statistics (1990), during the first nine bidding periods, 33.9 million acres of cropland were enrolled in the CRP nationwide. The USDA's rental expenditures on the CRP acres totals 1.7 billion dollars to reimburse operators for conserving use establishment costs. The average per acre rental rate is 48.93 dollars. There were 333,392 contracts signed with an average of 101.7 acres per contract.

Soil erosion reduction on land enrolled during the first nine biding periods is estimated to be nearly 644 million tons annually (Osborn, Llacuna, and Linsenbigler, 1990). The net present value of the probable economic effects on national income from a fully implemented CRP (45 million acres) is estimated to range from 3.4 to 11.0 billion dollars over the life of CRP (Young and Osborn, 1990).
Levels of Participation in Montana

Montana farm operators have participated heavily in the CRP. The state has approximately 17.3 million acres of cropland of which an estimated 8.6 million acres meet the highly erodible lands and cropping history requirements for CRP eligibility. Given the limitation that no more than 25 percent of the cropland in any county may be enrolled in CRP, the maximum acres of CRP enrollment in Montana would be approximately 4.3 million acres (Johnson, Standaert, Smith, 1989).

Through the first nine signups, there were almost 2.7 million acres of Montana cropland accepted into the CRP. This represents about 15 percent of the total cropland in Montana, or about one of every 6.5 acres of cropland. Of the fifty-six counties in the state, all but six counties have cropland enrolled in CRP, and seven counties have the maximum acres of cropland enrolled in CRP. There were a total of 7,503 separate CRP contracts signed with an average of 362.5 acres per contract. Annual soil erosion reductions in Montana attributable to CRP are estimated to be 35.4 million tons annually (Osborn, Llacuna, and Linsenbigler, 1990).

Montana producers were encouraged to calculate their CRP bids based upon the value of the next best alternative for their cropland, which was usually the production of some program commodity (wheat or barley). The bids were adjusted for inflation and time preference for money.
Demographic, Ownership, and Income Characteristics of Montana CRP Participants

The following characteristics are based on data collected in February 1991 through the 1991 Montana Farm and Ranch Survey; a survey sponsored by the Montana State University Agricultural Experiment Station and administered by John Saltiel, Montana State University Department of Sociology. The questionnaire was mailed to a random sample of operators selected by the Montana Agricultural Statistics Service. The results are based on responses from 1,084 farmers and ranchers, which represents a 58 percent response rate. Of the 1,084 respondents, 240 indicated they had CRP contracts.

The ages of respondents with CRP contracts ranged from twenty-four to seventy-seven years. The average age of respondents participating in the CRP in Montana was fifty years. The average respondent has spent twenty-four years as a farm operator, and many were at least a second or third generation farmer on the same land. Over half had attended college, and 20 percent have a college degree.

According to the survey, the size of the average operation with CRP participation in Montana is 5,090 acres. The average operation with CRP has 2,580 acres of cropland, with an average of 620 acres enrolled in the CRP. There were 136 respondents who own 100 percent of their CRP acres, while thirty-seven respondents are tenants on 100 percent of their CRP acres. The remaining respondents have some combination of owned and leased CRP land.
The majority (93 percent) of the respondents with CRP contracts indicated farming/ranching was their primary occupation. About 38 percent receive 100 percent of their income from crops, while only 3 percent receive 100 percent of their income from range livestock. The remainder have both crop and livestock production activities on their operations.
CHAPTER 3

CRP UPON CONTRACT EXPIRATION

The Uses of Enrolled Land Upon CRP Contract Expiration

The ten-year contracts will begin expiring in 1996 in generally the same order as they were enrolled. There is growing concern regarding what will happen to these CRP lands when the contracts expire. Under current policy, once the ten-year period is over, cropland enrolled in the CRP can be returned to annual cropping, can be used in some alternative commercial use such as haying or grazing, or can remain in a conserving use. Concerns are being expressed over how the future use of these acres could affect commodity prices, farm incomes, government outlays, rural economic activity, and environment quality. As one author stated, "Imagine the effect on wheat prices if U.S. farmers could suddenly plant another ten million wheat acres. And imagine what might happen to cattle prices if all of a sudden there were an extra twenty million acres of pasture" (Sands, 1990). However, to dampen the previously cited author's concern, if wheat were to be produced on program crop acre base, there are only 10.3 million acres of wheat base in escrow under the CRP (Osborn, Llacuna, and Linsenbigler, 1990).
Concern over post-contract land use is shared by many including farmers and ranchers, environmentalists, and government officials and policy-makers. The CRP's benefits to natural resources seem apparent, and have been documented (Ribaudo, Piper, Schaible, Langner, and Colacicco, 1989). Conservationists and wildlife enthusiasts are eager for these natural resource benefits to continue. The Society for Range Management also recognizes the many benefits from the CRP. In a letter to the Secretary of Agriculture (1989) they proposed several suggestions for the use of land when the contracts expire. These alternatives include provisions for extending the contract life of the CRP, and allowing the contract-holders to use this land for certain economic uses, such as haying or grazing. This view seems to contradict that of the National Cattlemen's Association which has expressed concern about proposals to allow haying or grazing on CRP lands (Lambert, 1990). This Association's contention is that allowing such uses would impact the relative competitive positions of individual livestock producers, could lead to regional shifts in cow-calf production, and would affect the price of beef relative to alternative meats.

Some have looked back to the disposition of croplands enrolled in the Soil Bank of the 1950's to help predict the disposition of the CRP land. When the Soil Bank contracts expired, most of the land, with the exception of the acreage in trees, was eventually returned to crop production. Cacek (1988) suggests that like the Soil Bank, the CRP acreage planted to trees will likely remain in that use until the trees mature. He contends that the CRP contains some features that
differentiate it from the Soil Bank and will discourage wholesale reversion to annual crops. The majority of CRP land, if returned to annual crop production, will be subject to the conservation compliance provisions of the FSA-85. Producers returning CRP lands to commodity production on lands deemed highly erodible will need to develop and implement conservation plans to control soil erosion as a condition for remaining eligible for program commodity and other USDA benefits.

Cacek also contends that CRP land is concentrated on marginal cropland while land enrolled in the Soil Bank included some highly productive cropland. He expects the financial incentive to return CRP land to crop production to be less than these incentives were for most Soil Bank cropland.

National and Regional Estimates of Post-Contract Land Uses

Heimlich and Kula (1990) suggest that the future of CRP land planted into grass is a function of the long-term relative economics between crop and livestock production, the attitudes and characteristics of CRP contract-holders, and the incentives existing in proposed agricultural policy. They argue that their expectations of future agricultural markets lead them to anticipate no more than 20 percent of the CRP land will remain in grass upon contract expiration.

Johnson, Dicks, Kraft, Clark and Taylor (1990) provided regional estimates of CRP land that might return to crop production when the contracts expire.
Estimates ranged from a low of 10 percent in the southeast U.S. to 80 percent in the southern plains.

According to a national survey completed by the Soil and Water Conservation Society (1991), more than half of the respondents who indicated they already had plans for use of their CRP land when their contracts expire said they expect to leave the land in grass for livestock forage or hay production, in trees, or in wildlife habitat. Over 75 percent indicated that fencing would be required before CRP acres could be grazed, and almost half would need to develop water improvements. Only a third of the respondents said they would return the land to crop production. Respondents indicated that economic considerations such as market prices, government price supports for crops, and costs of crop production along with conservation and lifestyle considerations will influence their CRP land use decisions.

Expectations in Montana

In Montana, much of the land enrolled in the CRP was previously used for wheat and barley production, and the majority of Montana wheat and barley producers generally enroll in commodity programs. According to the Montana Agricultural Statistical Service (1990), during the 1980s government payments to Montana crop producers made up an average of 38 percent of the total cash receipts from crops. In some years, the average was close to 70 percent. Through the first nine CRP signups, Montana wheat growers enrolled 987,710 base acres of
wheat, and Montana barley growers enrolled 720,327 base acres of barley in the
CRP (Osborn, Llacuna, and Linsenbigler, 1990). These base acres will come out
of escrow when the CRP contracts expire, and depending upon government policy
at that time, a strong incentive may exist to return these acres to wheat and barley
production.

According to the raw data (Table 1) from the 1991 Montana Farm and
Ranch Survey, Montana operators participating in the CRP would return just over
half of their CRP acres to annual cropping when their contracts expire. About 43
percent of the CRP acres would be used for haying or grazing. Just over 5
percent would be left in the conserving use, and 1 percent would put be put to
some other use. Operator's intentions vary according to what type of operation
they manage. Producers with greater than or equal to 70 percent of their income
from crops indicated they would return 62 percent of their CRP land to annual
cropping, while producers with greater than or equal to 70 percent of their income
from range livestock indicated they would return only 16 percent to annual
cropping. These numbers will be evaluated in detail in a later chapter.

Support of Policy Change in Montana

The CRP has sparked debate in Montana since the program's outset.
Many of Montana rural areas are dependent upon agriculture and sensitive to
proposed changes in agricultural policy. During the 1980s, many of these areas
were struck by drought and other economic problems. According to Saltiel
Table 1. Montana contract holder’s intentions for CRP land.

<table>
<thead>
<tr>
<th>Intentions for CRP Land</th>
<th>Producer Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crop</td>
</tr>
<tr>
<td>Return to Crop</td>
<td>62%</td>
</tr>
<tr>
<td>Hay or Graze</td>
<td>30%</td>
</tr>
<tr>
<td>Retain in Conserving Use</td>
<td>6%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

(1990), Montana farm operators’ perceptions of the impact of the CRP on business and land resources in their communities, along with whether or not operators were livestock or crop producers influence their attitudes toward the program.

Survey results indicate that Montana operators’ opinions about the CRP shifted between 1989 and 1990. In 1989, about 47 percent of survey respondents indicated they wanted the CRP to continue to the maximum allowable limit in Montana or even expand beyond that limit. In 1990 only 33 percent wanted the CRP to continue to the maximum allowable limit or be expanded (Saltiel, 1990).

The debate over the CRP has also included suggestions to continue to compensate operators to keep CRP land in conserving use after the contracts expire. Two methods have been proposed: 1) continue CRP contracts with payment if CRP remains in a conserving use, or 2) modify the program to allow the CRP land to be hayed or grazed and provide a reduced level of compensation.
to make up the difference between returns from cropping and haying or grazing. Respondents to the 1991 Montana Farm and Ranch Survey with CRP contracts indicated that if the contracts were extended, 79 percent would keep 100 percent of their land in CRP, while only 3 percent would return 100 percent to annual cropping. If contracts were continued but modified to allow haying or grazing with reduced compensation, survey results indicate that 61 percent would hay or graze 100 percent of the land. Another 17 percent indicated they would hay or graze at least a portion of their CRP land. Only 21 percent indicated they would not use the option of haying or grazing the CRP land with reduced compensation.

The debate over the future use of CRP land will likely continue as the contract expiration dates draw nearer, and the policy proposals proliferate.
CHAPTER 4

THE CONCEPTUAL MODEL

Introduction

Economic modeling of decision-maker behavior under conditions of certainty is relatively less complex than under conditions of uncertainty. Under certainty, the decision-maker is assumed to mathematically optimize some ordinal index (i.e., utility function) given behavioral constraints. If the resulting first-order and second-order conditions are well defined, the result is a set of easily interpreted decision rules. Under uncertainty, however, the decision-maker faces many possible resultant outcomes, given the choice of a particular behavioral strategy. The techniques for analyzing optimal decisions under uncertainty introduce stochastic elements to the optimization process. Therefore, more complex techniques, involving statistical and probability theory, must be used to analyze optimal decision-making under uncertainty.

Most agricultural decisions are made under conditions of uncertainty. Agricultural production processes are characterized by time lags and biological/meteorological phenomena that introduce stochastic elements into the decision-maker's optimization problem. Agricultural price discovery is often more
clouded than in other industries which also contain stochastic elements in their production decisions.

The decision to be made by CRP contract holders when their contracts expire is an example of an agricultural decision under uncertainty. They can return all or a portion of their CRP acres to annual cropping, to haying/grazing, or the acres can be retained in a conserving use. Although the contract holders may have some idea of the likely returns from these alternatives, these returns are not known with certainty.

There are many rules available for decisions made under conditions of uncertainty. One decision rule could simply be to avoid the worst that can happen (i.e., the maximin criteria); however, this rule implies extreme risk aversion. Another rule is the maximization of expected returns. A criticism of this rule is that it values each dollar equally and may not adequately weight the possibilities of low-level or high-level returns (Robison and Barry, 1987).

The conceptual model developed to address the future uses of CRP lands is based upon mean-variance analysis which is a variant of expected utility maximization. The next section introduces expected utility theory and its role in decision-making under uncertainty. Then some of the practical difficulties with expected utility models will be examined along with the origins and justification of mean-variance models. The final section will review recent applications of mean-variance analysis.
Expected Utility Models

Expected utility models are used to rank alternatives based on the expected value of some utility function (i.e., the expected utility function) defined over the payoffs from the possible outcomes and subject to behavioral constraints. It has been shown by Von Neumann and Morgenstern (1947) that if a decision-maker's preferences satisfy a set of axioms, then those preferences for uncertain alternatives can be expressed in terms of an expected utility function. The primary axioms are:

(1) an uncertain alternative with outcome \( x \) in state 1 and \( y \) in state 2 is equally preferred to an alternative with outcome \( y \) in state 1 and \( x \) in state 2 if the probability of receiving \( x \) in both alternatives is the same.

(2) If \( x \) is an uncertain alternative consisting of outcomes \( y \) and \( z \) with probabilities \( p \) and \( 1-p \), then an alternative consisting of \( x \) and \( z \) with probabilities \( p' \) and \( 1-p' \), is equally preferred to an alternative consisting of \( y \) and \( z \) with probabilities \( pp' \) and \( 1-pp' \).

(3) If \( x \) is preferred to \( y \), and \( y \) is preferred to \( z \), there is some probability value \( p \) such that \( y \) is equally preferred to an uncertain alternative consisting of outcomes \( x \) with the probability of \( p \), and \( z \) with the probability of \( 1-p \).

(4) If \( x \) is preferred to \( y \), then for any \( z \), an uncertain alternative consisting of outcomes \( x \) with the probability of \( p \), and \( z \) with the probability \( 1-p \) will be preferred to an uncertain alternative consisting of outcomes \( y \) with probability of \( p \), and outcome \( z \) with the probability of \( 1-p \).
If these axioms are satisfied, the decision-maker's preferences for uncertain alternatives can be expressed in terms of a Von Neumann-Morgenstern utility function, where the utility of a risky alternative or investment is equal to the expected utility of the possible outcomes or returns. If an alternative or investment consists of \( n \) possible outcomes, its expected utility can be expressed as:

\[
E(U) = \sum_{i=1}^{n} P(R_i) U(R_i)
\]

where \( R_i \) is the \( i \)th possible return, and \( P(R_i) \) is the probability of \( R_i \).

A summary of the purposes of expected utility models is provided by Schoemaker (1982). He divides the uses of expected utility models into four categories: descriptive, predictive, postdictive, and prescriptive.

Although the expected utility model has been called the premier indexing rule for ordering choices under uncertainty (Robison and Barry, 1987), the model can be difficult in practice. The reasons are (1) expected utility models require accurate measurements of the probability distributions of outcomes, and (2) the models require the derivation of a decision-maker utility function in order to derive practical results.

Mean-Variance Models

Mean-variance models use utility functions which are linear functions of the first two moments of the probability distribution. Mean-variance analysis is often a more convenient and economical method to use than expected utility
models. The results obtained using mean-variance models have been shown to be consistent with results obtained with expected utility models when certain conditions are satisfied.

The principles of mean-variance analysis are based on the research concerning portfolio theory by Markowitz (1952) which explains investors' selections of financial assets under conditions of risk and uncertainty. It was shown that specifying an expected utility function in terms of expected value and variance is consistent with the axioms of expected utility theory if at least one of the following sufficiency conditions are met: (1) the decision-maker's utility function of wealth is quadratic (Tobin, 1958), and (2) the probability distribution of returns is normal (Samuelson, 1970). Meyer (1987) proved that mean-variance analysis will be consistent with expected utility theory if the distribution of returns satisfies a location and scale condition.

Mean-variance analysis can be justified for at least three reasons. First, expected utility itself approximates the true unknown utility function, and actual estimates of the probability distributions of the outcomes of the alternatives are difficult to obtain. Therefore mean-variance analysis is appropriate as an approximation to the more general expected utility models as long as one of the above consistency conditions is met.

Second, mean-variance models can be justified in that they have better analytical qualities than expected utility models for most problems. According to Robison and Barry (1987), mean-variance models are valuable for their
characterization of the relationships between variables and for the determination of the direction of change in relevant variables as changes occur in other factors that exist in the decision environment.

Finally, using mean-variance analysis is rooted in the concept of risk aversion. Risk aversion implies that an individual must be compensated for taking risks. This compensation is in the form of a premium over and above the return on a completely certain investment (i.e., the certainty equivalent). The difference between the expected return on a risky investment and the certain return on a riskless investment where the decision-maker is indifferent between the two choices is the risk premium. The certainty equivalent of the expected return on a risky investment is equal to the expected return on the risky investment minus the risk premium. Risk aversion implies a positive risk premium so that the certainty equivalent is always less than the expected return on a risky investment. If the decision-maker is risk-averse, mean-variance analysis is appropriate since most risk-averse utility functions can be represented as a quadratic utility function using a second-order Taylor series approximation.

Risk aversion can be measured using the direction of bending of the utility function and the rate of change in slope of the function with respect to wealth. This is known as the Arrow-Pratt measure of absolute risk aversion. The Arrow-Pratt measure of absolute risk aversion can be defined as the ratio of the negative of the second derivative of the decision-maker's utility function with respect to wealth to the first derivative of the same utility function with respect to wealth.
This can be expressed as
\[- \frac{U''(W)}{U'(W)}.
\]

Another measure of risk aversion is known as the Arrow-Pratt measure of relative risk aversion. This measures the elasticity of marginal utility. It can be defined as the ratio of the negative of the second derivative of the decision-maker's utility function with respect to wealth multiplied by the decision-makers' level of wealth to the first derivative of the utility function, or
\[- \frac{U''(W)W}{U'(W)}.
\]

Both measures are positive for risk-averse decision-makers. The Arrow-Pratt measure of absolute risk aversion is more commonly used than the relative measure.

Applications of Mean-Variance Analysis in Agriculture

Robison and Barry (1987) provide examples of decision problems where mean-variance analysis is appropriate and yields practical theoretical results. They illustrate how this analytic framework can be applied to a diverse set of choices available to a competitive firm operating under conditions of uncertainty. The mean-variance framework is applied to analyze input and output adjustments, hedging, diversification, insurance, information management, and liquidity, all as responses by competitive firms to risk. They justify this model structure because of its widespread empirical use, its explicit measures of risk, its usefulness as an
approximate method for portfolio selection, and its ease of use in theoretical applications.

Examples of mean-variance analysis applied to agricultural decisions include Fedor (1979), who investigated the impact of uncertainty on decisions made by risk-averse farmers regarding pesticide use. Scott and Baker (1972) used mean-variance analysis to select an optimal farm plan under risk based on the farmers' own self-assessed income-risk preference functions. Another application was by Barry and Willmann (1976) to evaluate forward contracting and other financial choices for farmers who are subject to market risks and external credit rationing. Other applications were by Whitson, Barry, and Lacewell (1976) who used mean-variance analysis to evaluate the risk-return effects of selling calves, or holding them through subsequent stages of the production process, and by Buccola and French (1977) who analyze pricing alternatives for long-term marketing contracts of tomato and tomato paste processors.

**Analytical Model**

It is assumed that the CRP contract holder's objective upon contract expiration is to maximize the discounted sum of expected utility from profits due to the allocation of the expiring CRP contract land into alternative uses. The alternative uses of this land will be 1) returning the acres to annual cropping, 2) haying or grazing the acres, and 3) leaving the acres in a conserving use. The decision-maker will also consider any start-up costs associated with converting
CRP land to an alternative use.

The distribution of returns from these alternative land uses are assumed to be stationary over the decision-maker's planning horizon, so that the decision-maker's expected returns from the alternatives are constant. It is also assumed that once the decisions are made, the land will remain in that use over the entire planning horizon. The start-up costs included in the decision model are one time costs incurred when the CRP contract expires and the land is converted to an alternative use.

The following definitions will facilitate the development of the model:

\[ R_i \] = returns over variable costs from the \( i \)th alternative use, where

\[ i \] = \( c \) for annual cropping, \( g \) for haying/grazing, and \( s \) for conserving uses.

\[ A_i \] = CRP acreage allocated to \( i \)th alternative use,

\[ \bar{A} \] = total CRP acreage,

\[ S_i \] = start-up costs associated with the \( i \)th alternative use.

The returns \((R_i)\) are the excess gross returns over variable costs per acre from annual cropping, haying/grazing, or from conserving uses. Acres \((A_i)\) are the number of acres allocated to annual cropping, haying/grazing, and/or conserving uses. The acreage available for allocation \((\bar{A})\) is the total acreage in the contract holder's expiring CRP contract.

The start-up costs are costs that may be incurred by converting CRP acres
to annual cropping, or haying/grazing. For example, to convert CRP acres to annual cropping will require sod-breaking activities. Converting acreage to grazing may require fencing and installation of livestock water improvements. If a contract holder wishes to harvest hay from the CRP acres, haying equipment may have to be purchased. It is assumed that the start-up costs of leaving the CRP acres in a conserving use are zero.

The decision-maker's optimization problem can be represented as:

$$\max_{A_e, A_g, A_p} J = \sum_{t=0}^{T-a} \gamma^t (E[U(\pi)]) - S_e A_e + S_g A_g$$

subject to

$$A = A_e + A_g + A_p$$

where

- \(a\) = the decision-maker's age,
- \(T\) = the decision-maker's retirement age,
- \(\gamma\) = \((1 + i)^{-1}\), where \(i\) is the interest rate,
- \(E[\cdot]\) = expectations operator,
- \(U(\cdot)\) = the decision-maker's utility for wealth,
- \(\pi\) = the total profits from all allocated CRP acres.

The summation is included in equation (1) because the decision-maker is maximizing expected utility of profits from the CRP acres over an entire planning horizon; future returns are discounted back to present value. For example, if a
decision-maker will be 55 years old upon CRP contract expiration, and plans to retire at 65 years of age, the planning horizon in this case will be 10 years ($t=0$ to $T-a$).

The first part of (1) discounts the expected utility of profits over the planning horizon to the present value. The expression

$$\sum_{i=0}^{T-a} y^i$$

will be referred to as $r$ and can be evaluated to produce

$$r = 1 + \frac{1 - (1 + i)^{(T-a)}}{i-1}.$$  

The change in $r$ due to a change in the decision-maker's age is negative. In other words as the age of a decision-maker increases, the value of $r$ decreases, and vice versa.

The sign of a change in $r$ from a change in the interest rate is inconclusive. A numerical analysis was performed using different values for age (ranging from 20 years old to 60 years old), and different values for the interest rate (ranging from 5 percent to 10 percent). The results over these ranges universally indicated that as the interest rate increases, $r$ decreases, and vice versa.

Expected utility refers to the decision-maker's expected utility of wealth as described earlier. The profit function where profit is equal to the returns from each of the alternative uses multiplied by each of the alternative uses respectively is:

$$\pi = R_c A_c + R_g A_g + R_s (\bar{A} - A_c - A_g).$$  

(3)
The decision-maker's utility of profits is represented by the following Von Neumann-Morgenstern constant absolute risk aversion (CARA) function:

\[ U(\pi) = -\exp(-\lambda \pi) \]  

(4)

where \( \lambda \) is the decision-maker's risk aversion coefficient. If the wealth invested in these activities is sufficiently small, relative to the decision-maker's total wealth, then a second order Taylor series approximation of the expectation of equation (4) is sufficient (Tsiang, 1972). Therefore, equation (4) can be rewritten as:

\[ E[U(\pi)] = E[\pi] - \frac{\lambda}{2} V(\pi), \]

(4')

where \( V() \) is the variance operator. This approach is consistent with mean-variance analysis.

The expectation of the profit function (equation (3)) can be written as:

\[ E[\pi] = E[R_c]A_c + E[R_g]A_g + R_g(\overline{A} - A_c - A_g). \]

(5)

The returns from acres left in a conserving use \((R_s)\) are assumed to be known with certainty so no expectation operator is necessary.

The variance of the profit function is:

\[ V(\pi) = V(R_c)A_c^2 + V(R_g)A_g^2 + 2C(R_c,R_g)A_cA_g, \]

(6)

where \( C() \) is the covariance operator so that \( C(R_c,R_g) \) is defined as the covariance between the returns from cropping, and the returns from haying/grazing.

The optimization problem can be redefined as:

\[ \text{Max } J = r(E[\pi] - \frac{\lambda}{2} V(\pi)) - S_cA_c - S_gA_g \]

(1')
subject to the constraint that the CRP acres allocated to the alternative uses must equal the total number of acres in the expiring CRP contract(s).

To determine the optimal allocation of CRP acreage between the alternatives upon contract expiration, (5) and (6) are substituted into equation (1') which yields the following first-order conditions for expected utility maximization:

$$\frac{\partial J}{\partial A_c} = -r(E_c - R_c) - r\lambda(V_c A_c + C_{R_c R_g} A_g) - S_c = 0$$ (7)

and

$$\frac{\partial J}{\partial A_g} = -r(E_g - R_g) - r\lambda(V_g A_c + C_{R_c R_g} A_g) - S_g = 0.$$ (8)

The second-order conditions can be represented by the following Hessian matrix:

$$-r\lambda \begin{bmatrix} V(R_c) & C_{R_c R_g} \\ C_{R_g R_c} & V(R_g) \end{bmatrix},$$

which is a negative definite matrix. This implies that the solution to the first order conditions will provide a global maximum.

Solving (7) and (8) for $A_c$, the optimal allocation of acres to be returned to annual cropping and $A_g$, the optimal allocation of acres to be hayed/graazed yields

$$A_c = \gamma_c - \beta_c A_g - S_c',$$ (9)

and

$$A_g = \gamma_g - \beta_g A_c - S_g'.$$ (10)
where

\[ \gamma_c = \frac{E[R_c] - R_c}{\lambda V(R_c)}, \quad \beta_c = \frac{C(R_c, R_g)}{V(R_c)}, \quad S_c' = \frac{S_c}{r\lambda V(R_c)}, \]

and

\[ \gamma_g = \frac{E[R_g] - R_g}{\lambda V(R_g)}, \quad \beta_g = \frac{C(R_c, R_g)}{V(R_g)}, \quad S_g' = \frac{S_g}{r\lambda V(R_g)}. \]

The simultaneous solution of (9) and (10) gives the following demand functions which show the optimal acres to be returned to annual cropping, and the optimal acres to be hayed or grazed:

\[ A_c^* = \frac{\gamma_c + \beta_c (S_c' - \gamma_g) - S_c'}{1 - \beta_c \beta_g}, \quad (11) \]

and

\[ A_g^* = \frac{\gamma_g + \beta_g (S_g' - \gamma_c) - S_g'}{1 - \beta_c \beta_g}. \quad (12) \]

Making the appropriate substitutions, the expanded demand functions are:

\[ A_c^* = \frac{rV(R_g)[E[R_c] - R_c] - rC(R_c, R_g)[E[R_c] - R_c]}{r\lambda \Gamma} \]

\[ - V(R_c)S_c + C(R_c, R_g)S_g \]

and

\[ A_g^* = \frac{rV(R_c)[E[R_g] - R_g] - rC(R_c, R_g)[E[R_c] - R_c]}{r\lambda \Gamma} \]

\[ V(R_c)S_g + C(R_c, R_g)S_c. \quad (11') \]

and

\[ (12') \]
The optimal acres to be left in a conserving use are the total acres in CRP minus the sum of the optimal acres to be returned to annual cropping and the optimal acres to be hayed or grazed. The optimal acres to be left in a conserving use are:

\[
A_s^* = \bar{A} - \frac{rC(R_c,R_e)\{E[R_c] + E[R_e] - 2R_e\} - rV(R_e)\{E[R_c] - R_e\}}{r\lambda\Gamma} - \frac{-rV(R_c)\{E[R_e] - R_e\} - C(R_c,R_e)\{S_c + S_e\} + V(R_e)S_c + V(R_e)S_g}{r\lambda\Gamma}.
\]

In equations (11'), (12'), and (13):

\[
\Gamma = V(R_e)V(R_g) - C^2(R_c,R_e) > 0,
\]

which was described by Bullock and Hayes (1992) as the portion of the total underlying variance that cannot be offset through diversification among the three alternatives.

For later use, \(A_c^*\) and \(A_g^*\) can be defined as:

\[
A_c^* = \frac{\theta_c}{r\lambda\Gamma}, \quad (11'')
\]

and

\[
A_g^* = \frac{\theta_g}{r\lambda\Gamma}. \quad (12'')
\]

Note that the denominators in (11''), and (12'') are always greater than zero. Therefore \(\theta_c\) and \(\theta_g\) must also be greater than or equal to zero since the optimal acreage cannot be negative.

It can be seen that the optimal allocation of the CRP acres is a function of the expected returns, variances, covariances, risk aversion level of the decision-
maker, and the discount factor.

**Comparative Statics**

The direction of changes in the optimal allocation of CRP acres due to changes in the expected returns from cropping and haying/grazing, variances of returns to these uses, start-up costs of these uses, the decision-maker’s risk aversion level, and the discount factor will be examined in this section. First, the signs of the partial derivatives of $A_c^*$, $A_g^*$, and $A_s^*$ with respect to $E[R_c]$ are as follows:

$$\frac{\partial A_c^*}{\partial E[R_c]} - \frac{V(R_g)}{\lambda \Gamma} > 0,$$

(14)

and

$$\frac{\partial A_g^*}{\partial E[R_c]} - \frac{C(R_c, R_g)}{\lambda \Gamma} < 0,$$

(15)

and

$$\frac{\partial A_s^*}{\partial E[R_c]} - \frac{C(R_c, R_g) - V(R_g)}{\lambda \Gamma} > 0, \text{ as } C(R_c, R_g) > V(R_g).$$

(16)

These results are somewhat intuitive. As expected returns from cropping increase, more acres are diverted from haying or grazing to cropping. Whether any acres are converted from the conserving use alternative or not depends on the relationship of the covariance between the returns to cropping and returns to haying/grazing, and the variance of returns to haying grazing. If the covariance term is just equal to the variance of returns to haying/grazing, the increase in
acres allocated to cropping will be just equal to the decrease in acres allocated to haying/grazing, and no change will occur in the optimal allocation to the conserving use. If the covariance term and the variance of returns to haying/grazing are not equal, then the optimal allocation of acres to the conserving use will either be increased or decreased. If the covariance term is greater than the variance of returns from haying/grazing, not all of the decrease in acres allocated to haying/grazing will be returned to cropping. Some of them will be used for the conserving alternative.

The partial derivatives of the optimal uses with respect to \( \mathbb{E}[R_g] \) are as follows:

\[
\frac{\partial A^*_c}{\partial \mathbb{E}[R_g]} - \frac{C(R_c,R_g)}{\lambda \Gamma} < 0, \quad (17)
\]

\[
\frac{\partial A^*_g}{\partial \mathbb{E}[R_g]} - \frac{V(R_c)}{\lambda \Gamma} > 0, \quad (18)
\]

and

\[
\frac{\partial R^*_c}{\partial \mathbb{E}[R_g]} - \frac{C(R_c,R_g) - V(R_c)}{\lambda \Gamma} > 0, \quad \text{as} \quad C(R_c,R_g) - V(R_c) \quad < \quad (19)
\]

As the expected returns to haying/grazing increase, more acres will be returned to annual cropping, and less will be hayed or grazed. Acres allocated to the conserving use alternative may or may not change depending on the relationship between the covariance of returns between cropping and haying/grazing and the variance of returns to cropping. If these two terms are
equal, the decrease in acres returned to annual cropping will equal the increase in acres hayed or grazed. If the covariance of returns between cropping and haying/grazing are not equal, the decrease in acres returned to annual cropping will not equal the increase in acres hayed/grazed, and the difference will be made up from the acres allocated to the conserving use.

The partial derivatives of the optimal allocations with respect to start-up costs associated with returning the CRP land to annual cropping are:

\[
\frac{\partial A^*_c}{\partial S_c} = -\frac{V(R_g)}{r \lambda \Gamma} < 0, \tag{20}
\]

\[
\frac{\partial A^*_g}{\partial S_c} = \frac{C(R_c,R_g)}{r \lambda \Gamma} > 0, \tag{21}
\]

and

\[
\frac{\partial A^*_c}{\partial S_c} = -\frac{V(R_g) - C(R_c,R_g)}{r \lambda \Gamma} < 0, \tag{22}
\]

As the cost of converting CRP land to annual cropping increases, less land is allocated to that use and more land is allocated to haying or grazing the land. The change in the conserving use alternative due to a change in the start-up costs of returning the land to cropping depends upon the relative magnitudes of the covariance term and the returns to haying/grazing. If the terms are equal, the decrease in the optimal allocation of acres to cropping will equal the increase in the optimal allocation of acres to hay/graze.

The changes in the optimal allocations with respect to a change in the
start-up costs associated with haying or grazing the CRP land are:

$$\frac{\partial A_c^*}{\partial S_g} - \frac{C(R_cR_g)}{r\lambda\Gamma} > 0, \quad \text{(23)}$$

$$\frac{\partial A_g^*}{\partial S_g} - \frac{V(R_c)}{r\lambda\Gamma} < 0, \quad \text{(24)}$$

and

$$\frac{\partial A_s^*}{\partial S_g} - \frac{V(R_c) - C(R_cR_g)}{r\lambda\Gamma} > 0, \quad \text{as} \quad V(R_c) < C(R_cR_g). \quad \text{(25)}$$

As the cost of converting CRP land to haying or grazing increases, the optimal allocation on CRP land to haying or grazing decreases, and the optimal allocation to be returned to annual cropping increases. Once again, the change in the conserving use alternative depends on the relative magnitudes of the covariance term and the variance of returns to cropping. If the two terms are equal, then the increase in the optimal allocation of acres to cropping will equal the decrease in acres to hay/graze. If the terms are not equal, the change in the allocations of acres to return to cropping and acres to be hayed/grazed will not be equal, and the difference will be made up from the allocation of acres to the conserving use.

The partial derivatives of the optimal allocations with respect to the variance of the returns to cropping are:

$$\frac{\partial A_c^*}{\partial V(R_c)} - \frac{V(R_c)\theta}{r\lambda\Gamma^2} < 0, \quad \text{(26)}$$
As the variance of returns to cropping increases (or as the risk associated with cropping increases), less CRP acres are likely to be returned to annual cropping, and more are allocated to haying/grazing. The change in the conserving use alternative again depends upon the relationship between the covariance of returns from cropping and haying/grazing, and the variance of returns from haying/grazing. If the variance of returns from haying/grazing is greater than the covariance between the returns from cropping and haying/grazing, some of the acres diverted from the cropping alternative will be retained in the conserving use.

The changes in the optimal acreage allocated to each alternative due to a change in the variance of returns to haying/grazing, (or as the risk associated with haying/grazing increases) are:

\[
\frac{\partial A^*_c}{\partial V(R_g)} - \frac{C(R_c,R_g)\theta_c}{r\lambda \Gamma^2} > 0,
\]

and

\[
\frac{\partial A^*_g}{\partial V(R_g)} - \frac{(V(R_g) - C(R_c,R_g))\theta_c}{r\lambda \Gamma^2} < 0, \text{ as } V(R_g) - C(R_c,R_g). \tag{28}
\]

\[
\frac{\partial A^*_c}{\partial V(R_g)} - \frac{C(R_c,R_g)\theta_g}{r\lambda \Gamma^2} > 0, \tag{29}
\]

\[
\frac{\partial A^*_g}{\partial V(R_g)} - \frac{-V(R_c)\theta_g}{r\lambda \Gamma^2} < 0, \tag{30}
\]
As the variance of returns to haying/grazing increases, the optimal allocation of acres to be hayed or grazed decreases, and the optimal allocation of CRP acres to be returned to annual cropping may increase or stay the same. The optimal allocation of acres left in the conserving use may or may not change, depending upon the relative magnitudes of the covariance term, and the variance of returns from cropping.

The changes in the optimal allocations due to a change in the decision-maker's level of risk aversion are:

\[
\frac{\partial A^*_c}{\partial \lambda} = -\frac{\theta_c}{r \lambda^2 \Gamma} < 0, \tag{32}
\]

\[
\frac{\partial A^*_g}{\partial \lambda} = -\frac{\theta_g}{r \lambda^2 \Gamma} < 0, \tag{33}
\]

and

\[
\frac{\partial A^*_s}{\partial \lambda} = \frac{\theta_c + \theta_g}{r \lambda^2 \Gamma} > 0. \tag{34}
\]

As the decision-maker's level of risk aversion increases the optimal allocations to the risky alternatives (cropping and haying/grazing) are likely to decrease, and the allocation to the riskless alternative (the conserving use) is likely to increase.
The partial derivatives of the optimal allocations with respect to the discount factor are:

\[
\frac{\partial A_c^*}{\partial r} = \frac{S_c V(R_c^r) - S_g C(R_c^r R_g^r)}{r^2 \lambda \Gamma},
\]

(35)

\[
\frac{\partial A_g^*}{\partial r} = \frac{S_g V(R_c^r) - S_c C(R_c^r R_g^r)}{r^2 \lambda \Gamma},
\]

(29)

and

\[
\frac{\partial A_s^*}{\partial r} = \frac{C(R_c^r R_g^r) (S_c + S_g) - V(R_c^r) S_g - V(R_g^r) S_g}{R^2 \lambda \Gamma}.
\]

(37)

The signs of these are indeterminant and depend upon the tradeoff between the start-up costs between the two alternatives.

Summary of Comparative Studies

This chapter specified the analytical model used to determine the optimal allocations of CRP acres to return to annual cropping, hay or graze, or retain in a conserving use. Cropping and haying/grazing are risky alternatives while retaining the land in a conserving use is assumed to be riskless. However, the risky alternatives have higher returns.

The optimal allocations of CRP acreage to the three alternatives were determined to be a functions of the decision-maker's expected returns and variances of returns from cropping and haying/grazing, as well as his/her level of risk aversion, and a discount factor. The decisions will also depend upon the
start-up costs associated with returning the land to annual cropping, or haying/grazing the land.

The signs of changes in the optimal acreage allocations due to changes in the parameters of the allocations are summarized in tabular format in Table 2. As indicated in the table, as the expected returns for the risky alternatives (cropping and haying/grazing) increase, the more land will be allocated to that alternative, and less land will be allocated to the competing risky alternative. The direction of changes in the conserving use alternative due to changes in the expected returns from cropping and the expected returns from haying/grazing are indeterminate, and depends upon the relative magnitudes of the covariance and the variances.

An increase in the start-up costs associated with returning the land to annual cropping, and haying or grazing the land, the less acres will be allocated to those alternatives and more will be allocated to the competing alternatives. Again, the direction of changes to the conserving use allocation due to changes in the start-up costs for the other two alternatives is indeterminate.

Changes in the variance of returns of a risky alternative, will likely cause a decrease in the optimal allocation of acres to that alternative. The sign of the change in the conserving use allocation due to changes in the variances of returns to cropping and returns to haying/grazing is indeterminate.

As the risk aversion level of a decision-maker increases, the allocations to the risky alternatives will likely decrease, and more acres will be allocated to the
Table 2. Directions of changes in the optimal acreage allocations due to changes in the parameters.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>$A_c^*$</th>
<th>$A_g^*$</th>
<th>$A_s^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E[R_c]$</td>
<td>+</td>
<td>-</td>
<td>?</td>
</tr>
<tr>
<td>$E[R_g]$</td>
<td>-</td>
<td>+</td>
<td>?</td>
</tr>
<tr>
<td>$S_c$</td>
<td>-</td>
<td>+</td>
<td>?</td>
</tr>
<tr>
<td>$S_g$</td>
<td>+</td>
<td>+</td>
<td>?</td>
</tr>
<tr>
<td>$V(R_c)$</td>
<td>- or 0</td>
<td>+ or 0</td>
<td>?</td>
</tr>
<tr>
<td>$V(R_g)$</td>
<td>+ or 0</td>
<td>- or 0</td>
<td>?</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>- or 0</td>
<td>- or 0</td>
<td>+ or 0</td>
</tr>
<tr>
<td>$r$</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

risk-free alternative. The effects of an increase in the discount factor are indeterminate.
CHAPTER 5
THE EMPIRICAL RESULTS

Introduction

The data and statistical methods used in this study are discussed in this chapter, along with the test results. First, the data are described. Next, the statistical methods used are explained and justification is given for their use. Finally, the statistical results are presented and discussed.

The Data

The source of the data used in this analysis is the 1991 Montana Farm and Ranch Survey (included in the Appendix). There were 240 survey respondents who indicated they were participants in the CRP. Respondents were asked to indicate the number of CRP acres on their operation that they owned and the number on which they were a tenant (Q6E1 and Q6E2). Then they were asked (Q6F1 through Q6F4) how much of their CRP land, both owned and leased they would put into the following uses when their contracts expire: 1) return to annual crop production, 2) retain in permanent cover and hay or graze, 3) leave in a conserving use, such as native or improved grasses, but not hay or graze, and 4) other. Survey responses were not used in this analysis unless the total number of
acres listed for questions Q6F1 through Q6F4 equalled the total acres listed for question Q6E1 and Q6E2. A total of 224 responses met this criterion. These respondents make up the study sample.

**Statistical Methods**

The primary question of interest in this analysis is Q6F, in which CRP contract holders were asked to indicate how many CRP acres they intend to return to annual cropping, and how many acres would be hayed or grazed. The responses were converted to percentages by dividing the number of acres indicated in each use by the sum total number of CRP acres on the operation. The majority of the respondents indicated they intend to either return 100 percent of their CRP acres to annual cropping or hay/graze 100 percent, with few planning to utilize both alternatives. Because of this bimodality, statistical methods are used which do not rely on the assumption of a normal distribution.

Data from two variables which are separated into one or more categories can be arranged into a contingency table. A contingency table contains a row for each category of one variable \( r \) (the number of rows) and a column for each category of the second variable \( c \) (the number of columns). The observed number of cases characterized by one category of each variable is placed in the cell formed by the intersection of the rows and columns. The numbers in the cells can be referred to as the observed cell frequencies. The observed cell frequencies are designated by \( O_{ij} \) where \( i = 1 \) to \( r \), and \( j = 1 \) to \( c \). The observed
cell frequency \( (O_{ij}) \) represents the joint occurrence in the sample of the \( i^{th} \) category of the first variable and the \( j^{th} \) category of the second.

A contingency table can be examined visually to search for associations between the two variables, but a statistic that can be used to test the hypothesis that the two variables are independent is the Pearson Chi-Square statistic. Two variables displayed in a contingency table are by definition independent if the probability that a case falls into a given cell is the product of the marginal probabilities of the two categories defining the cell. The Pearson Chi-Square statistic is:

\[
X^{2} = \sum_{i} \sum_{j} \frac{(O_{ij} - E_{ij})^2}{E_{ij}},
\]

where \( E_{ij} \) is the expected frequency for cell \( ij \), which is equal to the number of cases in row \( i \) multiplied by the number of cases in column \( j \) divided by the number in the sample.

The calculated Pearson Chi-Square statistic is compared to the critical value of the theoretical chi-square distribution for a chosen significance level to produce an estimate of how likely this calculated value is if the two variables are independent. The degrees-of-freedom, \((r-1) \times (c-1)\), are needed to use the chi-square table of critical values. The Pearson Chi-Square statistic can be used to test the following hypothesis:

\( H_0: \) Two variables are independent
\( H_A: \) The variables are not independent.
While the Pearson Chi-Square statistic may reveal an association between two variables, it does not provide a satisfactory measure of the strength of association.

A measure that reveals a somewhat clearer meaning of association between two variables is known as Goodman and Kruskal's lambda. This test is based on the idea of a measure of the proportional reduction in error in prediction. It is basically a ratio of a measure of error in predicting the values of one variable based on knowledge of that variable alone and the same measure of error applied to predictions using information from an additional variable. For example a value of .25 means that a reduction in error of twenty-five percent in predicting a variable is obtained when information about an additional variable is used compared to predicting the original variable only on information about that variable, and without information about the additional variable.

Another measure of association between two variables is the Spearman rank correlation coefficient. This statistic ranks the observances of each variable for a particular case by order of magnitude and then measures the degree of correspondence between the ranks of the sample observations. For example, using survey data, responses to two questions from a particular respondent make up an observation pair for that respondent. The values for each response in the observation pair are each ranked relative to the values of the responses from other respondents for those questions from small to largest in order of magnitude. The values of each response for all observation pairs are similarly ranked. The
Spearman correlation coefficient measures the degree of correlation between the ranks of the responses in the observation pairs. If the rank of one response is the same as the rank of the other variable in each sample observation pair, the test statistic will be equal to one, and the relationship between the two variables is a perfect direct one. Inverse relationships are revealed by negative test statistics, with a perfect inverse relationship having a value equal to one.

The Spearman rank correlation coefficient reveals some information about the nature and direction of association between two variables. The statistic can be used to test the following hypotheses:

\[ H_0: \text{Two variables are independent} \]
\[ H_A: \text{There is a direct relationship between the variables,} \]

and

\[ H_0: \text{Two variables are independent} \]
\[ H_A: \text{There is an inverse relationship between the variables.} \]

**Test Results**

Data from the 1991 Montana Farm and Ranch Survey were used to test several of the implications from the analytical model used in this analysis. The model specified that the optimal uses of CRP acres upon contract expiration were functions of the expected returns from cropping and livestock production, risk associated with those activities (measured by the variance of the returns), one-time start-up costs of these activities, the decision-maker's risk aversion level, and the decision-maker's discount factor. Survey data provided either direct or
indirect measures of some of these variables. Statistical tests were performed to identify the relationships between these variables and respondents' intentions for future use of their CRP land. The contingency tables tabulating the responses to various questions found in the survey with the respondent's planned use of the CRP acreage. The results of the statistical tests are included after each table.

Survey respondents were asked (questions Q2A1 and Q2A2) to predict what the price of wheat and the price of feeder steers would be in three years (the price of wheat at the time of the survey was $2.60 per bushel, while the price of feeders was $90 per hundred weight). It is assumed that the expected price of wheat is proportional to the expected returns from returning CRP land to annual cropping, and the expected price of feeder steers is proportional to the expected returns from haying/grazing CRP land.

In the model, holding everything else constant, the higher the expected price of wheat, the more CRP acres will be returned to annual cropping, and less will be hayed or grazed. Similarly, the higher the expected price of feeder steers, the more CRP land will be hayed/grazed and less will be returned to annual cropping.

Tables 3 through 6 in the Appendix are the contingency tables tabulating the responses to these price projections against the percent of CRP land these operators plan to return to cropping and the percent they plan to hay or graze. The values of the statistical tests are found below each table. No strong statistical relationships were found. The hypothesis that the price projections are
independent of the planned CRP land uses was not rejected.

The contract holders were asked a series of questions (Q6C1 through Q6C4) designed to estimate how easily they could use their CRP acres for livestock forage production, either by haying or by grazing the permanent cover. They were asked if they have any range livestock, or haying equipment on their operation, and if any of their CRP land was fenced enough to use for livestock grazing, or if any of it had livestock water improvements or access to water.

The assumption is that for operations that include one or more of these attributes, start-up costs associated with using CRP land for livestock forage production will be less than for those operations that lack these attributes. The analytical model is specified such that if start-up costs are less for an alternative, contract holders will allocate more CRP land to that alternative with lower start-up costs.

Tables 7 through 10 show the relationship of these variables to the percentage of CRP land the contract holders plan to return to annual cropping. The test statistics indicate a very strong negative statistical relationship between the existence of livestock and haying equipment. A somewhat weaker negative statistical relationship is indicated between the existence of fences and livestock water improvements on the CRP land, and the percentage of CRP land to be returned to cropping. These results imply that if an operation includes at least one of the following: range livestock, haying equipment, fenced CRP land, or CRP land with water improvements for livestock, then the CRP land on that
operation is less likely to be returned to annual cropping. These results are consistent with the model results.

Tables 11 through 14 show the relationships of the existence of range livestock, haying equipment, fenced CRP land, and livestock water improvements on CRP land to the percentage of CRP land the contract holders plan to hay or graze. The statistics imply that the existence of these attributes on an operation with CRP land will lead to more CRP land being hayed or grazed. Again the results are consistent with the model. The null hypothesis that the existence of these physical attributes that may reduce the start-up costs associated with haying or grazing the CRP land is independent of the contract holders planned use of this land was rejected at high significance levels.

Contract holders were asked to indicate what percent of their farm/ranch revenue was derived from various agricultural enterprises (Q13Q). The variable cropincome was created by summing their percentages of income from both dryland and irrigated cropping. The variable liveincome was created by summing their percentages of income from cow/calf, registered cattle, sheep, and yearling/feeder enterprises. It is assumed that the higher cropincome is, less start-up expense will be incurred to return CRP land to annual cropping. Similarly, it is assumed that the higher liveincome is, less start-up expense will be incurred to hay or graze their CRP acres.

Table 15 shows the relationship of cropincome to the percentage of CRP acres to be returned to annual cropping. A strong statistical relationship exists
between the two variables, and a positive rank correlation coefficient. The relationship between \textit{liveincome} and the percentage of CRP acres to be hayed or grazed is tabulated in Table 16. Again a strong statistical relationship exists with a negative correlation coefficient. These results imply that an operation where the primary source of income is from cropping is more likely to return more CRP land to annual cropping and less CRP land will be used for haying or grazing.

Tables 17 and 18 contain the tabulation of \textit{cropincome} and \textit{liveincome} with the percentage of CRP acres to be hayed or grazed. Both variables have a strong statistical association with the percentage of income from range livestock, with \textit{cropincome} having a negative correlation coefficient, and \textit{liveincome} having a positive correlation coefficient. These results are consistent with those of the previous two tables. CRP land on operations where the primary income source is from livestock production is less likely to be returned to annual crop production and more likely to be used for haying or grazing.

Survey questions Q1B and Q1C asked contract holders how concerned they were about the financial condition of their own farm/ranch, and asked them to estimate their financial condition over the next five years. The relationship between their responses and their intentions for their CRP land is tabulated in Tables 19 through 22. No significant statistical relationships were found.

Survey questions Q10A asks contract holders to rate their ability to withstand price fluctuations. No statistical relationships were found between the responses and the contract holder's intentions for their CRP land. The results are
shown in Table 23 and Table 24.

Contract holders were asked to rate their preference to play the market rather than be assured of a given price for their products in question Q10C. The responses can be interpreted as a measure of the contract holder's level of risk aversion. The less risk averse being more willing to play the market. No significant statistical association was found between the responses to this question and the contract holder's intentions for CRP land use.

Summary of Test Results

Statistical tests support the model implications concerning start-up costs associated with the alternative. There seems to be evidence that lower start-up costs associated with an alternative will lead to more CRP land being allocated to that alternative. If a contract holder's operation includes physical attributes that would enable the CRP land to be used for livestock forage production, that contract holder is more likely to use the land for that purpose. If a contract holder's operation does not include those physical attributes, more of the CRP land is likely to be returned to annual cropping.

Related to these results is the statistical association between the contract holder's income source, and his/her planned use of CRP land. If a greater percentage of income is derived from cropping, the tests show that more of the CRP land is likely to be returned to annual cropping. Likewise, the greater the percentage of income derived from range livestock, the more likely the CRP land
is to be hayed or grazed.

The hypothesis that expected returns from the alternatives do not affect the contract holder's intentions for CRP land use was not rejected by the tests used in this analysis. Tests for association between responses to other questions in the survey and the contract holder's planned CRP land use were performed, however, no statistically significant relationships were identified. These questions included Q1B, Q1C, Q10A, and Q10C.
CHAPTER 6

SUMMARY AND CONCLUSIONS

This chapter summarizes the study, with special attention on the analytical model and test results. Finally, several problems with this study are discussed, and suggestions are made for future research.

The objective of this study has been first to provide a thorough description of the Conservation Reserve Program, including a brief historical review of land diversion programs in the United States, and to examine the factors used by individual Montana CRP contract holders to decide the disposition of their CRP land.

Land diversion programs have a long history of use in the United States primarily as a policy tool to adjust production of agricultural commodities, and to reduce soil erosion. The CRP is the most comprehensive land diversion program in the history of the United States. As of the first nine signups, enrollment nationwide reached nearly thirty-four million acres. Crop producers in Montana have enrolled 2.7 million acres in the CRP, and there is much concern in the state over the disposition of these acres once the CRP contracts expire.

In Montana, CRP contract holders have three primary alternatives for post-contract land use: 1) return the land to annual cropping, 2) hay/graze the land,
and 3) leave the land in a conserving use. A mean-variance model was used in this thesis to determine the influence the expected returns, risk, and start-up costs of the alternatives will have on the decisions contract holders will make upon contract termination.

The optimal acreage allocations to the three CRP land use alternatives will depend upon the contract holders expected returns from returning the land to cropping, and haying/grazing the land. The optimal allocations will also be a function of the risk associated with cropping and haying/grazing, and the start-up costs associated with these two alternatives, as well as the decision-makers risk aversion level and discount factor.

According to the theoretical model, as expected returns from cropping increase, CRP acres returned to cropping increase. Likewise, as expected returns to haying or grazing increase, more CRP acres will be hayed or grazed. As the risk associated with these alternatives increases less CRP land will be allocated to that alternative. As the start-up costs associated with an alternative increases, less land will be used for that alternative.

Some of these theoretical results were tested using data from the 1991 Montana Farm and Ranch Survey. Many survey respondents plan to either return 100 percent of their CRP acreage to annual cropping, or hay/graze 100 percent. Test results indicate that the intentions for CRP land use in Montana is primarily a function of the existence on the individual operations of physical attributes which would facilitate conversion of the land to livestock forage production. It
was found that if the operations included range livestock, haying equipment, fenced CRP land, or water improvements for livestock, that the contract holder was more likely to plan to hay or graze his/her CRP land.

Another result revealed by the survey data is that contract holders intentions for post-contract CRP land use have a strong association with the contract holders income source. As the contract holders percentage of income from cropping increased, his/her percentage of CRP acres to be returned to cropping also increased. Likewise, as the percentage of income from livestock increased, the percentage of acres to be hayed or grazed also increased.

These results indicate that the decisions made by individual contract holders depend upon how easily the land can be converted either to haying/grazing, or to annual cropping. Survey responses indicate that few contract holders plan to leave their acres in a conserving use, although there is evidence that if the program was extended, many contract holders would extend their contracts.

One problem that plagued this study was that the survey questions were written before the analytical model formulation. It is possible that alternative questions could be designed to elicit more appropriate information to test the model. For example, it may be useful to have more information concerning contract holders machinery complement to determine the start-up costs for returning the CRP land to annual cropping.

Other areas where further research may be beneficial are to determine the
quality of the forage on the CRP land, and how much fencing and livestock water improvements would be needed before the land could be used for grazing.

The Soil Bank of the 1950s resembles the CRP in many aspects, and it may be beneficial to try to determine the conditions which prevailed when Soil Bank acres were returned to cropping.

Given the amount of controversy that has surrounded the CRP in Montana, and the amount of interest concerning the disposition of CRP land in the state, continuing research is needed to reveal insight into the way contract holders will make their CRP land-use decisions when the CRP contracts expire.
REFERENCES CITED


APPENDICES
APPENDIX A

CONTINGENCY TABLES
Table 3. Return to annual cropping by wheat price expectations.

<table>
<thead>
<tr>
<th>% Return to crops</th>
<th>Projected Price of Wheat (Q2A1)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; $1.50 - $2.24</td>
<td>$2.25 - $2.74</td>
</tr>
<tr>
<td>0-25%</td>
<td>11</td>
<td>28</td>
</tr>
<tr>
<td>26-50%</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>51-75%</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>76-100%</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>55</td>
</tr>
</tbody>
</table>

Chi Square = 5.35221, degrees of freedom = 9, significance = .8026
Lambda = .00000
Spearman Rho = .03047, significance = .65688

Table 4. Return to annual cropping by feeder price expectations.

<table>
<thead>
<tr>
<th>% Return to Crops</th>
<th>Projected Price of Feeders (Q2A2)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; $57 - $77</td>
<td>$78 - $87</td>
</tr>
<tr>
<td>0-25%</td>
<td>37</td>
<td>31</td>
</tr>
<tr>
<td>26-50%</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>51-75%</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>75-100%</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>68</td>
</tr>
</tbody>
</table>

Chi Square = 3.45871, degrees of freedom = 6, significance = .74946
Lambda = .00000,
Spearman Rho = -.00730, significance = .91604
Table 5. Acres to be hayed or grazed by wheat price projections.

<table>
<thead>
<tr>
<th>% Acres Hayed or grazed</th>
<th>Projected Price of Wheat (Q2A1)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; $1.50- $2.24</td>
<td>$2.25 - $2.74</td>
</tr>
<tr>
<td>0-25%</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>26-50%</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>51-75%</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>76-100%</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>55</td>
</tr>
</tbody>
</table>

Chi Square = 2.73416, degrees of freedom = 9, significance = .97391
Lambda = .01600
Spearman Rho = .00480, significance = .94423

Table 6. Acres to be hayed or grazed by feeder price expectations.

<table>
<thead>
<tr>
<th>% Acres Hayed or Grazed</th>
<th>Projected Price of Feeders (Q2A2)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; $57 - $77</td>
<td>$78 - $87</td>
</tr>
<tr>
<td>0-25%</td>
<td>28</td>
<td>25</td>
</tr>
<tr>
<td>26-50%</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>51-75%</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>75-100%</td>
<td>30</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>68</td>
</tr>
</tbody>
</table>

Chi Square = 1.36012, degrees of freedom = 6, significance = .96824
Lambda = .00000,
Spearman Rho = -.00800, significance = .90798
Table 7. Acres returned to cropping by range livestock on operation.

<table>
<thead>
<tr>
<th>% Return to Crops</th>
<th>Range Livestock? (Q6C1)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>0-25%</td>
<td>29</td>
<td>81</td>
</tr>
<tr>
<td>26-50%</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>51-75%</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>76-100%</td>
<td>43</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
<td>135</td>
</tr>
</tbody>
</table>

Chi Square = 24.16175, degrees of freedom = 3, significance = .00002
Lambda = .12500
Spearman Rho = -.31339, significance = .00000

Table 8. Return to annual cropping by haying equipment on operation.

<table>
<thead>
<tr>
<th>% Return to Crops</th>
<th>Hay Equipment? (Q6C2)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>0-25%</td>
<td>31</td>
<td>80</td>
</tr>
<tr>
<td>26-50%</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>51-75%</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>76-100%</td>
<td>37</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
<td>143</td>
</tr>
</tbody>
</table>

Chi Square = 15.76548, degrees of freedom = 3, significance = .00127
Lambda = .05405
Spearman Rho = -.22200, significance = .00087
Table 9. Return to annual cropping by CRP land fenced.

<table>
<thead>
<tr>
<th>% Return to Crops</th>
<th>CRP Fenced? (Q6C3)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td>Total</td>
</tr>
<tr>
<td>0-25%</td>
<td>38</td>
<td>73</td>
<td>111</td>
</tr>
<tr>
<td>26-50%</td>
<td>11</td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td>51-75%</td>
<td>8</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>76-100%</td>
<td>40</td>
<td>29</td>
<td>69</td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
<td>126</td>
<td>223</td>
</tr>
</tbody>
</table>

Chi Square = 9.82486, degrees of freedom = 3, significance = .02011
Lambda = .01786
Spearman Rho = -.20519 significance = .00207

Table 10. Return to annual cropping by livestock water improvements on CRP land.

<table>
<thead>
<tr>
<th>% Return to Crops</th>
<th>Water Improvements? (Q6C4)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td>Total</td>
</tr>
<tr>
<td>0-25%</td>
<td>32</td>
<td>80</td>
<td>112</td>
</tr>
<tr>
<td>26-50%</td>
<td>11</td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td>51-75%</td>
<td>5</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>76-100%</td>
<td>32</td>
<td>37</td>
<td>69</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>144</td>
<td>224</td>
</tr>
</tbody>
</table>

Chi Square = 7.70700, degrees of freedom = 3, significance = .05247
Lambda = .00000
Spearman Rho = -.15488, significance = .02039
Table 11. Acres to be hayed or grazed by range livestock on operation.

<table>
<thead>
<tr>
<th>% Acres Hayed or Grazed</th>
<th>Range Livestock? (Q6C1)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>0-25%</td>
<td>54</td>
<td>34</td>
</tr>
<tr>
<td>26-50%</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>51-75%</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>76-100%</td>
<td>18</td>
<td>73</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
<td>135</td>
</tr>
</tbody>
</table>

Chi Square = 32.94919, degrees of freedom = 3, significance = .00000
Lambda = .27481
Spearman Rho = .37931, significance = .00000

Table 12. Acres to be hayed or grazed by haying equipment on operation.

<table>
<thead>
<tr>
<th>% Acres Hayed or Grazed</th>
<th>Hay Equipment? (Q6C2)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>0-25%</td>
<td>48</td>
<td>39</td>
</tr>
<tr>
<td>26-50%</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>51-75%</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>76-100%</td>
<td>20</td>
<td>72</td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
<td>143</td>
</tr>
</tbody>
</table>

Chi Square = 24.13719, degrees of freedom = 3, significance = .00002
Lambda = .21538
Spearman Rho = .31062, significance = .00000
Table 13. Acres to be hayed or grazed by CRP land fenced.

<table>
<thead>
<tr>
<th>% Acres Hayed or grazed</th>
<th>CRP Fenced? (Q6C3)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>0-25%</td>
<td>51</td>
<td>37</td>
</tr>
<tr>
<td>26-50%</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>51-75%</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>76-100%</td>
<td>26</td>
<td>66</td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
<td>126</td>
</tr>
</tbody>
</table>

Chi Square = 21.46020, degrees of freedom = 3, significance = .00008
Lambda = .19084
Spearman Rho = .25711 significance = .00010

Table 14. Acres to be hayed or grazed by livestock water improvements on CRP land.

<table>
<thead>
<tr>
<th>% Acres Hayed or Grazed</th>
<th>Water Improvements? (Q6C4)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>0-25%</td>
<td>40</td>
<td>48</td>
</tr>
<tr>
<td>26-50%</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>51-75%</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>76-100%</td>
<td>26</td>
<td>67</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>144</td>
</tr>
</tbody>
</table>

Chi Square = 7.65063, degrees of freedom = 3, significance = .05381
Lambda = .10687
Spearman Rho = .15695, significance = .01875
Table 15. Return to annual cropping by percentage of income from cropping.

<table>
<thead>
<tr>
<th>% Return to crops</th>
<th>% of Income From Crops (Q13Q)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-25%</td>
<td>26-50%</td>
</tr>
<tr>
<td>0-25%</td>
<td>24</td>
<td>32</td>
</tr>
<tr>
<td>26-50%</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>51-75%</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>76-100%</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>50</td>
</tr>
</tbody>
</table>

Chi Square = 38.98918, degrees of freedom = 9, significance = .00001
Lambda = .12727
Spearman Rho = .39684, significance = .00000

Table 16. Acres to be hayed or grazed by percentage of income from cropping.

<table>
<thead>
<tr>
<th>% Acres Hayed or Grazed</th>
<th>% of Income From Crops (Q13Q)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-25%</td>
<td>26-50%</td>
</tr>
<tr>
<td>0-25%</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>26-50%</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>51-75%</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>76-100%</td>
<td>24</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>50</td>
</tr>
</tbody>
</table>

Chi Square = 60.92388, degrees of freedom = 9, significance = .00000
Lambda = .33858
Spearman Rho = -.50353, significance = .00000
Table 17. Return to annual cropping by percentage of income from range livestock.

<table>
<thead>
<tr>
<th>% Return to crops</th>
<th>% of Income From Range Livestock (Q13Q)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-25%</td>
<td>26-50%</td>
</tr>
<tr>
<td>0-25%</td>
<td>48</td>
<td>25</td>
</tr>
<tr>
<td>26-50%</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>51-75%</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>76-100%</td>
<td>57</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>45</td>
</tr>
</tbody>
</table>

Chi Square = 41.17044, degrees of freedom = 9, significance = .00000
Lambda = .08182
Spearman Rho = -.36518, significance = .00000

Table 18. Acres to hayed or grazed by percentage of income from range livestock.

<table>
<thead>
<tr>
<th>% Acres Hayed or Grazed</th>
<th>% of Income From Range Livestock (Q13Q)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-25%</td>
<td>26-50%</td>
</tr>
<tr>
<td>0-25%</td>
<td>71</td>
<td>10</td>
</tr>
<tr>
<td>26-50%</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>51-75%</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>76-100%</td>
<td>33</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>45</td>
</tr>
</tbody>
</table>

Chi Square = 53.00122, degrees of freedom = 9, significance = .00000
Lambda = .29921
Spearman Rho = .45706, significance = .00000
Table 19. Return to annual cropping by concern over finances.

<table>
<thead>
<tr>
<th>% Return to crops</th>
<th>Concern Over Own Finances (Q1B)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
<td>Slight</td>
</tr>
<tr>
<td>0-25%</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>26-50%</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>51-75%</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>76-100%</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>29</td>
</tr>
</tbody>
</table>

Chi Square = 8.62228, degrees of freedom = 12, significance = .73481  
Lambda = .00000  
Spearman Rho = -.01383, significance = .83687

Table 20. Acres to be hayed or grazed by concern over finances.

<table>
<thead>
<tr>
<th>% Acres Hayed or Grazed</th>
<th>Concern Over Own Finances (Q1B)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
<td>Slight</td>
</tr>
<tr>
<td>0-25%</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>26-50%</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>51-75%</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>76-100%</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>29</td>
</tr>
</tbody>
</table>

Chi Square = 8.71708, degrees of freedom = 12, significance = .72689  
Lambda = .07634  
Spearman Rho = -.05568, significance = .40692
Table 21. Return to annual cropping by projected finances

<table>
<thead>
<tr>
<th>% Return to Crops</th>
<th>Projected Finances (Q1C)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Much Worse</td>
<td>Slightly Worse</td>
<td>Same</td>
<td>Slightly Better</td>
<td>Much Better</td>
</tr>
<tr>
<td>0-25%</td>
<td>8</td>
<td>35</td>
<td>43</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>26-50%</td>
<td>3</td>
<td>9</td>
<td>5</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>51-75%</td>
<td>2</td>
<td>4</td>
<td>10</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>76-100%</td>
<td>9</td>
<td>17</td>
<td>27</td>
<td>14</td>
<td>2</td>
</tr>
</tbody>
</table>

Chi Square = 8.38999, degrees of freedom = 12, significance = .75396
Lambda = .00893
Spearman Rho = -.00330, significance = .96111

Table 22. Acres to be hayed or grazed by projected finances.

<table>
<thead>
<tr>
<th>% Hayed or Grazed</th>
<th>Projected Finances (Q1C)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Much Worse</td>
<td>Slightly Worse</td>
<td>Same</td>
<td>Slightly Better</td>
<td>Much Better</td>
</tr>
<tr>
<td>0-25%</td>
<td>12</td>
<td>24</td>
<td>32</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>26-50%</td>
<td>3</td>
<td>8</td>
<td>11</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>51-75%</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>76-100%</td>
<td>5</td>
<td>28</td>
<td>39</td>
<td>13</td>
<td>4</td>
</tr>
</tbody>
</table>

Chi Square = 8.63791, degrees of freedom = 12, significance = .73351
Lambda = .06154
Spearman Rho = .05495, significance = .41629
Table 23. Return to annual cropping by ability to withstand price fluctuations.

<table>
<thead>
<tr>
<th>% Return to crops</th>
<th>None</th>
<th>Slight</th>
<th>Moderate</th>
<th>Well</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-25%</td>
<td>39</td>
<td>40</td>
<td>25</td>
<td>7</td>
<td>111</td>
</tr>
<tr>
<td>26-50%</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>-</td>
<td>24</td>
</tr>
<tr>
<td>51-75%</td>
<td>5</td>
<td>10</td>
<td>4</td>
<td>-</td>
<td>19</td>
</tr>
<tr>
<td>76-100%</td>
<td>16</td>
<td>22</td>
<td>22</td>
<td>5</td>
<td>65</td>
</tr>
<tr>
<td>Total</td>
<td>69</td>
<td>81</td>
<td>57</td>
<td>12</td>
<td>219</td>
</tr>
</tbody>
</table>

Chi Square = 8.65573, degrees of freedom = 9, significance = .46964
Lambda = .00000
Spearman Rho = .10896, significance = .10783

Table 24. Acres to be hayed or grazed by ability to withstand price fluctuations.

<table>
<thead>
<tr>
<th>% Acres Hayed or Grazed</th>
<th>None</th>
<th>Slight</th>
<th>Moderate</th>
<th>Well</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-25%</td>
<td>26</td>
<td>25</td>
<td>24</td>
<td>8</td>
<td>83</td>
</tr>
<tr>
<td>26-50%</td>
<td>8</td>
<td>13</td>
<td>6</td>
<td>-</td>
<td>27</td>
</tr>
<tr>
<td>51-75%</td>
<td>5</td>
<td>7</td>
<td>4</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>76-100%</td>
<td>30</td>
<td>36</td>
<td>23</td>
<td>4</td>
<td>93</td>
</tr>
<tr>
<td>Total</td>
<td>69</td>
<td>81</td>
<td>57</td>
<td>12</td>
<td>219</td>
</tr>
</tbody>
</table>

Chi Square = 7.98280, degrees of freedom = 9, significance = .53588
Lambda = .03968
Spearman Rho = -.06521, significance = .33667
Table 25. Return to annual cropping by preference to play the market.

<table>
<thead>
<tr>
<th>% Return to crops</th>
<th>Play Markets? (Q10C)</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
<td>Slight</td>
<td>Moderate</td>
<td>Well</td>
<td></td>
</tr>
<tr>
<td>0-25%</td>
<td>51</td>
<td>31</td>
<td>14</td>
<td>10</td>
<td>106</td>
</tr>
<tr>
<td>26-50%</td>
<td>9</td>
<td>6</td>
<td>7</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>51-75%</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>-</td>
<td>18</td>
</tr>
<tr>
<td>76-100%</td>
<td>21</td>
<td>28</td>
<td>13</td>
<td>2</td>
<td>64</td>
</tr>
<tr>
<td>Total</td>
<td>91</td>
<td>70</td>
<td>37</td>
<td>14</td>
<td>212</td>
</tr>
</tbody>
</table>

Chi Square = 13.37300, degrees of freedom = 9, significance = .14644  
Lambda = .00000  
Spearman Rho = .07379, significance = .28486

Table 26. Acres to be hayed or grazed by preference to play the market.

<table>
<thead>
<tr>
<th>% Acres Hayed or Grazed</th>
<th>Play Markets? (Q10C)</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
<td>Slight</td>
<td>Moderate</td>
<td>Well</td>
<td></td>
</tr>
<tr>
<td>0-25%</td>
<td>31</td>
<td>33</td>
<td>14</td>
<td>2</td>
<td>80</td>
</tr>
<tr>
<td>26-50%</td>
<td>15</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>27</td>
</tr>
<tr>
<td>51-75%</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>76-100%</td>
<td>40</td>
<td>26</td>
<td>13</td>
<td>10</td>
<td>89</td>
</tr>
<tr>
<td>Total</td>
<td>91</td>
<td>70</td>
<td>37</td>
<td>14</td>
<td>212</td>
</tr>
</tbody>
</table>

Chi Square = 14.15977, degrees of freedom = 9, significance = .11675  
Lambda = .06504  
Spearman Rho = .01378, significance = .84175
APPENDIX B

1991 MONTANA FARM AND RANCH SURVEY
We make every effort to work from a current and accurate mailing list. However, it is possible that this questionnaire has been sent to someone who is no longer farming/ranching or someone who owns, but does not operate the farm/ranch himself/herself. To improve the accuracy of our list, please circle the number of the statement below that best describes your current situation.

(Circle only one response)

1 CURRENTLY OPERATING A FARM/RANCH
2 AN OWNER ONLY (DO NOT OPERATE THE FARM/RANCH MYSELF)
3 RETIRED FROM FARMING/RANCHING
4 QUIT FARMING/RANCHING DUE TO FINANCIAL REASONS
5 OTHER (please specify) ________

If you answered something other than "1 CURRENTLY OPERATING A FARM/RANCH", please do not continue. Return this questionnaire in the enclosed envelope.

Thank you for your help.
• All your responses will be absolutely confidential and will appear only in statistical summaries.

• If you have any questions or problems with completing this survey, feel free to call the MSU Survey Research Center, collect: 994-6635.

• If you would like a copy of the survey results, please return the enclosed form with this booklet, and we will be happy to send you a copy.

• To insure confidentiality, please do not put your name on this booklet.
First, we would like your opinions about the general condition of Montana agriculture.

A. How do you feel about the current financial condition of Montana's farmers/ranchers? I think it is: (circle answer)
   1 NOT A PROBLEM
   2 A SLIGHT PROBLEM
   3 A MODERATE PROBLEM
   4 A FAIRLY SERIOUS PROBLEM
   5 A VERY SERIOUS PROBLEM

Now, we would like to ask you about your own operation:

B. How concerned are you about your farm/ranch's financial condition? I am: (circle number)
   1 NOT CONCERNED
   2 SLIGHTLY CONCERNED
   3 MODERATELY CONCERNED
   4 VERY CONCERNED
   5 SEVERELY CONCERNED

C. Over the next five years, do you see the financial condition of your farm/ranch as becoming: (circle number)
   1 MUCH WORSE
   2 SOMEWHAT WORSE
   3 ABOUT THE SAME
   4 SOMEWHAT BETTER
   5 MUCH BETTER

D. How would you rate the overall economic health of your community? (circle number)
   1 EXCELLENT
   2 GOOD
   3 FAIR
   4 POOR

E. In your opinion, to what extent does the economic health of your community depend on agriculture? (circle number)
   1 IT IS NOT DEPENDENT ON AGRICULTURE.
   2 IT HAS A SMALL DEPENDENCE, BUT OTHER INDUSTRIES ARE MORE IMPORTANT.
   3 IT IS MODERATELY DEPENDENT, ABOUT THE SAME AS OTHER INDUSTRIES.
   4 IT IS MOSTLY DEPENDENT ON AGRICULTURE; OTHER INDUSTRIES PLAY A SMALLER ROLE.
   5 IT IS ENTIRELY OR ALMOST ENTIRELY DEPENDENT ON AGRICULTURE.

F. In your opinion, how important is it to develop NON-AGRICULTURAL employment opportunities in your community?
   1 NOT IMPORTANT
   2 SLIGHTLY IMPORTANT
   3 MODERATELY IMPORTANT
   4 VERY IMPORTANT
   5 EXTREMELY IMPORTANT
A number of people have suggested that agriculture in Montana will be undergoing great changes in the 1990's. We would like to know what you think will happen.

A. PRICES: Most farmers and ranchers have thought about what will happen to commodity prices in the near future. Of course, no one knows for sure. The following questions ask you to estimate how much the price of wheat and feeder cattle will change over the next three years. Please give your best estimate.

1. At the time of this survey, the average U.S. price of wheat (all classes) is $2.60. What is your guess about what the price will be in 3 years? Please circle your best estimate:

- 1 less than $1.50
- 2 $1.50-1.74
- 3 $1.75-1.99
- 4 $2.00-2.24
- 5 $2.25-2.49
- 6 $2.50-2.74
- 7 $2.75-2.99
- 8 $3.00-3.24
- 9 $3.25-3.49
- 10 $3.50-3.74
- 11 $3.75-3.99
- 12 $4.00-4.24
- 13 $4.25-4.49
- 14 $4.50-4.74
- 15 $4.75-4.99
- 16 $5.00 or more
- 17 Other: __________

2. At the time of this survey, the average U.S. price of 600-700 lb. feeder steers (medium frame) is $90 per hundred weight. What is your guess about what the price will be in 3 years? (circle your best estimate)

- 1 less than $57
- 2 $58 - 62
- 3 $63 - 67
- 4 $68 - 72
- 5 $73 - 77
- 6 $78 - 82
- 7 $83 - 87
- 8 $88 - 92
- 9 $93 - 97
- 10 $98 - 102
- 11 $103 - 107
- 12 $108 or more
- 13 Other: __________

B. How likely is it that the following will happen in the next 5 years? (circle answer)

1. Government price and income supports for commodities (wheat and feed grains) will drop sharply ....... VERY FAIRLY FAIRLY VERY UNLIKELY UNLIKELY OPINION

2. Montana producers will become more dependent on what happens in world markets ............... VERY FAIRLY FAIRLY VERY UNLIKELY UNLIKELY OPINION

3. The number of farms/ranches in Montana will sharply decline ........ LIKELY LIKELY UNLIKELY UNLIKELY OPINION

4. The economy of my community will seriously decline .................. LIKELY LIKELY UNLIKELY UNLIKELY OPINION

5. Larger commercial farms are more likely to survive than are smaller operations .......... LIKELY LIKELY UNLIKELY UNLIKELY OPINION

6. I will quit farming/ranching for financial reasons (not due to illness or retirement) ............... LIKELY LIKELY UNLIKELY UNLIKELY OPINION
C. What do you think would be the effect on you in the next five years in each of the following situations? (circle the number)

<table>
<thead>
<tr>
<th>IMPACT ON ME</th>
<th>HARMFUL</th>
<th>NO EFFECT</th>
<th>BENEFICIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very</td>
<td>Mostly</td>
<td>Slightly</td>
</tr>
</tbody>
</table>

1. Sharp reduction of price and income supports of commodities such as wheat and feed grains -3 -2 -1 0 1 2 3

2. Sharp increase in grazing fees on public lands -3 -2 -1 0 1 2 3

3. Increased dependence on world markets -3 -2 -1 0 1 2 3

Q3. U.S. GOVERNMENT AGRICULTURAL POLICY: Producers differ in their ideas about what should be the goals of government policy. GIVEN THE CURRENT SITUATION IN AGRICULTURE, how important do YOU THINK it is that each of the following be a part of government programs?

<table>
<thead>
<tr>
<th>HOW IMPORTANT?</th>
<th>Not At All</th>
<th>Slightly</th>
<th>Fairly</th>
<th>Very</th>
<th>No Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Guarantee a minimum level of income for producers 0 1 2 3 NO OP

2. Assure that the U.S. can produce most of its own food 0 1 2 3 NO OP

3. Keep consumer food prices low 0 1 2 3 NO OP

4. Provide disaster (drought, flood, etc) support 0 1 2 3 NO OP

5. Promote rural community development 0 1 2 3 NO OP

6. Safeguard the environment for future generations 0 1 2 3 NO OP

7. Control surplus production 0 1 2 3 NO OP

8. Insure the survival of the moderate size family farm 0 1 2 3 NO OP

B. There are several ways of designing price/income support programs. Below are three different types of approaches. Circle the number of the approach you currently prefer.

1. SET THE LOAN RATE AT A LEVEL TO MAKE COMMODITIES COMPETITIVE IN INTERNATIONAL MARKETS AND PROVIDE SOME LEVEL OF INCOME SUPPORT THROUGH DEFICIENCY PAYMENTS. BASICALLY, THIS POLICY ALLOWS THE MARKET TO DETERMINE COMMODITY PRICES, AND PARTIALLY PROTECTS INCOME THROUGH DEFICIENCY PAYMENTS.

2. RAISE LOAN RATES TO SOMEWHERE ABOUT THE COST OF PRODUCTION AND MANAGE SUPPLY THROUGH STRICT PRODUCTION CONTROLS. THIS POLICY HAS THE GOVERNMENT PLAY AN IMPORTANT ROLE IN KEEPING MARKET PRICES UP USING THE LOAN RATE.

3. ELIMINATE PRICE AND INCOME SUPPORTS WITHIN THE NEXT TWO YEARS.

4. NO OPINION.
Because of changes in the meatpacking industry, we are interested in how producers market their feeder cattle. If you do not have a cattle operation go to Q5 on next page.

A. What production activities are performed in your cattle operation? (circle answer)
   1. Cow/calf .............. NO YES
   2. Stocker/grower ........ NO YES
   3. Finishing .............. NO YES

B. How many calves (approx. 400-900 lbs.) did you market (including retained ownership) in 1990?
   If none, enter "0" and go to Q5 at top of next page.

C. Approximately how many of the calves you sold in 1990 were marketed by each method listed below? (Please check to see that the figures add up to the answer in B above.)
   NUMBER
   ____________ Auctions
   ____________ Order buyers
   ____________ Commission firms
   ____________ Direct sales to feedlot (include retained ownership)
   ____________ Direct sales to stocker/grower (include retained ownership)
   ____________ Other (please specify): ________________________________

D. Of the calves you sold during the last year, about how many went to the following destinations to be finished or backgrounded? Please give your best estimate. (check to see if numbers add up to answer in B above)
   NUMBER
   ____________ Iowa, Nebraska or Illinois
   ____________ Colorado, Kansas, Oklahoma or Texas
   ____________ California
   ____________ Montana, Wyoming or Canada
   ____________ Other (please specify): ________________________________
   ____________ Don't know

E. Of the calves marketed in 1990 (listed in B above), did you retain ownership of any beyond the farm gate?
   1. NO —> Go To Q5 at top of next page
   2. YES

   IF YES: 1. For about how many of those marketed did you retain ownership?______
   2. Overall, do you feel that retained ownership has made your operation more profitable?
      1. NO
      2. YES
Q5: PERSONAL COMPUTERS IN FARM/RANCH BUSINESS!

A. Do you use a personal computer in your farm/ranch business? (circle number)
   1 NO, AND I AM NOT CONSIDERING IT AT THIS TIME. Go to question E below
   2 NO, BUT I AM THINKING OF DOING THIS IN THE NEXT FEW YEARS. Go to question E below
   3 YES, I AM USING A COMPUTER IN MY BUSINESS NOW.

B. About how many years have you used your computer in your farm/ranch business?
   ________________ years

C. Do you use a modem to access any electronic informational services such as pricing
   information, weather data (for ex: Doanes, CIMS, Cattle Fax, Dept. of Agr. Bulletin Board)?
   1 NO
   2 YES

D. Producers use computers for different purposes. For each type of use listed below, please
   indicate by circling "Y" (yes) or "N" (no) whether you use your computer for that purpose.
   Then please indicate how valuable that type of use has been in running your farm/ranch
   operation.

   TYPE OF USE                        Use?   How Much Value To Your Business?
   1. Business correspondence ........ N Y ->   NO LOW MEDIUM HIGH
   2. Financial record keeping         ........ N Y ->   NO LOW MEDIUM HIGH
      (accounting, statements, etc):
   3. Field/herd records ............... N Y ->   NO LOW MEDIUM HIGH
   4. Decision making/forecasting      ........ N Y ->   NO LOW MEDIUM HIGH
      (market analysis, buy-sell
      decisions, whether to take
      part in farm programs, etc):
   5. Production controls .............. N Y ->   NO LOW MEDIUM HIGH
      (Irrigation scheduling/crop
      monitoring, cattle feeding, etc):

E. For each of the following statements, please indicate how strongly you agree or disagree:
   1. Computers are mostly for people younger than I ............ AGREE MOSTLY MOSTLY STRONGLY NO
   2. Computers are becoming a necessity for farm/ranch businesses like mine ............ AGREE MOSTLY MOSTLY STRONGLY NO
   3. I do not trust computers; I prefer to do my computations by hand ............ AGREE AGREE DISAGREE DISAGREE OPIN
   4. Personal computers cost too much compared to the benefits they bring to my farm/ranch business ............ AGREE AGREE DISAGREE DISAGREE OPIN
   5. Learning to use a computer is not worth my time ............ AGREE AGREE DISAGREE DISAGREE OPIN
Q6. CONSERVATION RESERVE PROGRAM: In a few years, the first CRP contracts will expire, and these lands can be returned to annual crop production and/or hayed or grazed. Several alternatives are being proposed to keep these lands from being annually cropped. For each of the following, please indicate how much you favor or oppose:

1. Continue a CRP type program. That is, continue to compensate operators to keep CRP land in conserving use and without haying/grazing.

<table>
<thead>
<tr>
<th>STRONGLY FAVOR</th>
<th>MOSTLY FAVOR</th>
<th>MOSTLY OPPOSE</th>
<th>STRONGLY OPPOSE</th>
<th>NO OPPOSE</th>
<th>OPINION</th>
</tr>
</thead>
</table>

2. Allow former CRP lands to be hayed or grazed and provide USDA payments to make up the difference between returns from haying/grazing and annual crop production.

<table>
<thead>
<tr>
<th>STRONGLY FAVOR</th>
<th>MOSTLY FAVOR</th>
<th>MOSTLY OPPOSE</th>
<th>STRONGLY OPPOSE</th>
<th>NO OPPOSE</th>
<th>OPINION</th>
</tr>
</thead>
</table>

B. Do you currently receive annual CRP payments?

1. NO  
2. YES --------- > Go to Q7 on next page 

C. Which of the following describe your operation: (circle answer)

1. Do you have range livestock on your current operation? ............... NO  YES
2. Do you have haying equipment on your current operation? ............... NO  YES
3. Is your CRP land fenced enough to use for livestock grazing? ............... NO  YES
4. Does any of your land now in CRP have livestock water improvements or access to water? ............... NO  YES

D. About what percentage of the cropland you operate (owned and leased) is in CRP?

   _______%

E. Of the CRP acres you operate, how many do you own, and on how many are you the tenant?

   1. I own ________ CRP acres.  (Enter 0 if none.)
   2. I am the tenant on ________ CRP acres.

F. Under current rules for management of CRP lands beyond the contract period, there are several possibilities. BASED ON WHAT YOU KNOW NOW, how much of your CRP land do you think you would put into the following uses? (Please give your best guess.)

<table>
<thead>
<tr>
<th>OWNED ACRES</th>
<th>LEASED ACRES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Return land to annual crop production .......</td>
<td>.....</td>
</tr>
<tr>
<td>2. Retain in permanent cover and hay or graze ......</td>
<td>.....</td>
</tr>
<tr>
<td>3. Leave in a conserving use, such as native or improved grasses, BUT NOT haying or grazing ...</td>
<td>.....</td>
</tr>
<tr>
<td>4. Other: ...........................................</td>
<td>.....</td>
</tr>
</tbody>
</table>

(Please make sure totals add up to answer in question E above)
G. Suppose you had the option of extending your CRP contract on some or all of the land currently enrolled. That is, you could continue to receive payments at about the same level for keeping this land in conserving use. About how many acres would you:

1. Return to annual cropping? ____________ Acres
2. Keep in CRP? ________________ Acres

H. Suppose you had the option of haying or grazing your CRP lands and receiving payments to make up difference between this activity and annual crop production. About how many of your CRP acres would you:

1. Return to annual cropping? ______________ Acres
2. Hay/graze with compensation? ____________ Acres

Q7. PUBLIC LANDS: Congressional debates continue over the use of public lands. Some call for raising fees; others want to eliminate grazing. We would like your opinion on the following.

A. Some propose replacing the current system of grazing fee calculation used on Federal lands (FS and BLM) with a system in which fees would be set according to the rates charged on comparable private land. How do you feel about this proposal?

STRONGLY FAVOR MODERATELY FAVOR NEUTRAL MODERATELY OPPOSE STRONGLY OPPOSE NO OPINION

B. Under the current public rangelands system, the rights to graze public lands are attached to specific ranches. Some propose changing this system so that anyone could bid for grazing rights on public lands, regardless of whether they now hold a grazing permit. How do you feel about this proposal?

STRONGLY FAVOR MODERATELY FAVOR NEUTRAL MODERATELY STRONGLY OPPOSE MODERATELY OPPOSE NO OPINION

Q8. FORAGE NEEDS: Livestock operators only: If no livestock, go to Q9, top of next page.

A. During 1990, what percent of your total livestock forage needs were obtained from rangeland? (Include all rangeland owned and rented) ______% 

B. Of the total range forage you used in 1990, what percent was obtained from the following sources? Also, please tell us how you rate the overall condition of the rangeland you use.

<table>
<thead>
<tr>
<th>PERCENTAGE</th>
<th>RANGE CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>OF YOUR</td>
<td>ON THE LAND YOU USE</td>
</tr>
<tr>
<td>FORAGE</td>
<td>(circle answer)</td>
</tr>
<tr>
<td></td>
<td>EXCEL GOOD FAIR POOR</td>
</tr>
<tr>
<td>1. Your own farm/ranch</td>
<td>______</td>
</tr>
<tr>
<td>2. Other landowners/operators</td>
<td>______</td>
</tr>
<tr>
<td>3. BLM</td>
<td>______</td>
</tr>
<tr>
<td>4. FS</td>
<td>______</td>
</tr>
<tr>
<td>5. State lands</td>
<td>______</td>
</tr>
<tr>
<td>6. Indian lands</td>
<td>______</td>
</tr>
<tr>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

100%
Q5. CROP INSURANCE: Answer this section only if you grow wheat or barley. If you do not grow wheat or barley, skip this page and the next two, and go to Q10.

Many Montana wheat and barley producers participate in the Federal Crop Insurance Corporation's multiple peril crop insurance program. Currently, Congress and the White House are considering changes in this program. We would like to know your experiences and opinions.

A. Have you purchased multiple crop insurance for either wheat or barley (or both) in any year since 1985?
   1. NO ----> skip to question H on next page
   2. YES

B. For each WHEAT and BARLEY column below, please circle the year if you planted that crop during that year. Then circle "N" (no) or "Y" (yes) to indicate whether you purchased multiple peril crop insurance and if you received payments on that policy to cover losses.

   | CIRCLE | WHEAT | CIRCLE | BARLEY |
   | 1985 ...... | N Y ----> | N Y | 1985 ...... | N Y ----> | N Y |
   | 1986 ...... | N Y ----> | N Y | 1986 ...... | N Y ----> | N Y |
   | 1987 ...... | N Y ----> | N Y | 1987 ...... | N Y ----> | N Y |
   | 1988 ...... | N Y ----> | N Y | 1988 ...... | N Y ----> | N Y |
   | 1989 ...... | N Y ----> | N Y | 1989 ...... | N Y ----> | N Y |
   | 1990 ...... | N Y ----> | N Y | 1990 ...... | N Y ----> | N Y |

C. Please circle the level of yield protection as a percent of average yield that you purchased in each of the following years: (feel free to check your records)

   | Year | WHEAT | Year | BARLEY |
   | 1988 ...... | 50% 65% 75% | 1988 ...... | 50% 65% 75% |
   | 1989 ...... | 50% 65% 75% | 1989 ...... | 50% 65% 75% |
   | 1990 ...... | 50% 65% 75% | 1990 ...... | 50% 65% 75% |
   | 1991 ...... | 50% 65% 75% | 1991 ...... | 50% 65% 75% |

D. For each year, please circle the per bushel price coverage you purchased.

   | Year | WHEAT | Year | BARLEY |
   | 1988 ...... | $2.00 $2.25 $2.60 | 1988 ...... | $1.00 $1.25 $1.50 |
   | 1989 ...... | $2.25 $2.60 $3.00 | 1989 ...... | $1.10 $1.30 $1.60 |
   | 1990 ...... | $2.95 $3.45 $3.45 | 1990 ...... | $1.40 $1.75 $2.10 |
   | 1991 ...... | $2.40 $2.85 $3.00 | 1991 ...... | $1.40 $1.65 $2.20 |
If you do not grow wheat or barley, skip this page.

E. On a scale of 1 to 7, where 1 equals NOT AT ALL IMPORTANT and 7 equals EXTREMELY IMPORTANT, how important was each of the following in your decision to purchase crop insurance? (circle number for each)

<table>
<thead>
<tr>
<th>IMPORTANCE IN DECISION TO PURCHASE INSURANCE</th>
<th>NOT AT ALL</th>
<th>EXTREMELY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. My private lending agency (for ex: commercial banks) recommended that I purchase coverage</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>2. The farm credit or Farmers Home Admin. system required that I purchase it</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>3. My yields are highly variable because of weather</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>4. My crop is sometimes heavily damaged by pests (e.g. grasshoppers)</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>5. I can't count on Federal disaster payments to cover my losses in bad years</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

F. Did you purchase Federal Multiple Peril Crop Insurance through a Federal Crop Insurance Corporation (FCIC) agent, or through a private insurance agent?

1 FCIC
2 PRIVATE

G. Many farmers are not aware of the fact that they can purchase Multiple Peril Crop Insurance through either a FCIC or a private insurance agent. Before reading this, did you know that you could purchase the same multiple peril policies through either?

1 NO
2 YES

H. If you currently purchase crop Insurance, go to Question I on top of next page.

If you have not purchased Multiple Peril Crop Insurance, or have stopped purchasing it, please indicate how important the following factors were in your decision. Use a scale of 1 to 7 where 1 equals NOT AT ALL IMPORTANT and 7 equals EXTREMELY IMPORTANT.

<table>
<thead>
<tr>
<th>IMPORTANCE IN STOP OR NO PURCHASE DECISION</th>
<th>NOT AT ALL</th>
<th>EXTREMELY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Premiums were too high</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>2. I was unlikely to receive any benefits</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>3. My yields always exceed 75% of average</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>4. Collecting and keeping records was too much of a hassle</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>5. The sign-up date for participation is too early</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>6. I expect to receive Federal disaster payments in bad years</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>7. The yield coverage is too low</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>
If you do not grow wheat or barley go to Q10 on next page.

I. Have you received any Federal Disaster Relief Payments between 1985 and 1990?
   1. NO
   2. YES

J. In 1990, did you purchase hail insurance?
   1. NO please skip to question K
   2. YES

   1. Did you purchase hail coverage under the State of Montana plan? ......... NO YES
   2. Did you purchase hail coverage with a multiple peril crop insurance policy? ...... NO YES
   3. Did you purchase hail coverage under a separate, private policy? ............. NO YES

K. In a typical or average year, how many acres of dryland wheat and dryland barley do you plant? What is your average yield per acre? (write 0 if none)

<table>
<thead>
<tr>
<th>Dryland Wheat</th>
<th>Dryland Barley</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVERAGE ACRES PLANTED</td>
<td>AVERAGE YIELD PER ACRE</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

L. Consider your average yield: Most farmers get a lot of variation in their yields; sometimes their yield per acre is above average and sometimes below. Over a TYPICAL 10 year period, please estimate the number of years you expect your yield to be at each of the levels listed below: (Please make sure that each column adds up to ten)

<table>
<thead>
<tr>
<th>NUMBER OF YEARS EXPECTED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>DRYLAND WHEAT</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>15 or more bushels BELOW my average</td>
</tr>
<tr>
<td>10 bushels BELOW my average</td>
</tr>
<tr>
<td>5 bushels BELOW my average</td>
</tr>
<tr>
<td>Average</td>
</tr>
<tr>
<td>5 bushels ABOVE my average</td>
</tr>
<tr>
<td>10 bushels ABOVE my average</td>
</tr>
<tr>
<td>15 or more bushels ABOVE my average</td>
</tr>
<tr>
<td>Total years</td>
</tr>
</tbody>
</table>
Please indicate how well each of the following statements describes you:

<table>
<thead>
<tr>
<th>DESCRIPTIONS ME</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOT AT ALL WELL</td>
</tr>
<tr>
<td>SLIGHTLY WELL</td>
</tr>
<tr>
<td>MODERATELY WELL</td>
</tr>
<tr>
<td>VERY WELL</td>
</tr>
</tbody>
</table>

A. I consider myself in a good position to withstand sharp price fluctuations for my products ......... NOT SLIGHTLY MODERATELY VERY AT ALL WELL WELL WELL

B. I like to turn to various experts (extension specialists, consultants, etc) to get information on new practices or programs ......... NOT SLIGHTLY MODERATELY VERY AT ALL WELL WELL WELL

C. I would prefer to try to play the market rather than be assured of a given price for my products ......... NOT SLIGHTLY MODERATELY VERY AT ALL WELL WELL WELL

D. I would prefer to go back to the days when a farmer/rancher did not need a lot of technology to operate successfully ......... NOT SLIGHTLY MODERATELY VERY AT ALL WELL WELL WELL

ORGANIZATIONS: Farm/ranch organizations often provide legislative and lobbying, economic (such as insurance), and educational/instructional services. Some of these are more valuable to their members than are others. For each organization you belong to, please indicate how much you benefit from each service by being a member.

Under each service there are five choices. Using the following scale, circle the number that best indicates how much you benefit from that service:

<table>
<thead>
<tr>
<th></th>
<th>1 = NO BENEFIT</th>
<th>2 = SMALL BENEFIT</th>
<th>3 = MODERATE BENEFIT</th>
<th>4 = HIGH BENEFIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NS = SERVICE NOT OFFERED</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Member?</td>
<td>Legislative/ Lobbying</td>
<td>Economic (Insur., etc)</td>
<td>Education/ Instructional</td>
</tr>
<tr>
<td>1.</td>
<td>MT Farm Bureau . . . . N Y --&gt;</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
</tr>
<tr>
<td>2.</td>
<td>MT Farmers Union . . . . N Y --&gt;</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
</tr>
<tr>
<td>3.</td>
<td>MT Grain Growers . . . . N Y --&gt;</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
</tr>
<tr>
<td>4.</td>
<td>MT Stock Growers . . . . N Y --&gt;</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
</tr>
<tr>
<td>5.</td>
<td>Other: .. N Y --&gt;</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
</tr>
<tr>
<td>6.</td>
<td>Other: .. N Y --&gt;</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
<td>NS 1 2 3 4</td>
</tr>
</tbody>
</table>

Did you purchase insurance (health, auto, etc) in 1990 from any of the following? If yes, about how much money did you save by purchasing insurance from this source? (give your best estimate)

<table>
<thead>
<tr>
<th>Purchased Insurance?</th>
<th>Approx. Money Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. MT Farm Bureau . . . . NO YES --&gt;</td>
<td>$____________</td>
</tr>
<tr>
<td>2. MT Farmers Union . . . . NO YES --&gt;</td>
<td>$____________</td>
</tr>
<tr>
<td>3. MT Grain Growers . . . . NO YES --&gt;</td>
<td>$____________</td>
</tr>
<tr>
<td>4. Other: .. NO YES --&gt;</td>
<td>$____________</td>
</tr>
</tbody>
</table>

Due to space limitations, we could not list all organizations. Please feel free to write in other groups and make comments on the back cover.
C. Overall, HOW MUCH DO YOU AGREE OR DISAGREE with the positions of the following organizations on major issues of agricultural policy? (Please answer even if you are not a member)

<table>
<thead>
<tr>
<th>Organization</th>
<th>Agree</th>
<th>Mostly</th>
<th>Strongly</th>
<th>Mostly</th>
<th>Strongly</th>
<th>Don't</th>
<th>Mostly</th>
<th>Strongly</th>
<th>Don't</th>
<th>Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Montana Farm Bureau</td>
<td>Agree</td>
<td></td>
<td></td>
<td>Agree</td>
<td></td>
<td></td>
<td>DISAGREE</td>
<td>STRONGLY</td>
<td>DISAGREE</td>
<td>KNOW</td>
</tr>
<tr>
<td>2. Montana Farmers Union</td>
<td>Agree</td>
<td></td>
<td></td>
<td>Agree</td>
<td></td>
<td></td>
<td>DISAGREE</td>
<td>STRONGLY</td>
<td>DISAGREE</td>
<td>KNOW</td>
</tr>
<tr>
<td>3. MT Grain Growers</td>
<td>Agree</td>
<td></td>
<td></td>
<td>Agree</td>
<td></td>
<td></td>
<td>DISAGREE</td>
<td>STRONGLY</td>
<td>DISAGREE</td>
<td>KNOW</td>
</tr>
<tr>
<td>4. MT Stock Growers</td>
<td>Agree</td>
<td></td>
<td></td>
<td>Agree</td>
<td></td>
<td></td>
<td>DISAGREE</td>
<td>STRONGLY</td>
<td>DISAGREE</td>
<td>KNOW</td>
</tr>
<tr>
<td>5. Other</td>
<td>Agree</td>
<td></td>
<td></td>
<td>Agree</td>
<td></td>
<td></td>
<td>DISAGREE</td>
<td>STRONGLY</td>
<td>DISAGREE</td>
<td>KNOW</td>
</tr>
</tbody>
</table>

Q12. NEWS AND INFORMATION: Producers can get AGRICULTURAL NEWS AND UPDATES from many places. For several reasons (convenience, timeliness, etc.), operators find some sources more desirable than others. For each of the following, please circle a number representing how desirable it is for you as a way of getting news, then indicate by circling "N" or "Y" whether you get news from that source:

<table>
<thead>
<tr>
<th>Source</th>
<th>NOT AT ALL DESIRABLE</th>
<th>EXTREMELY DESIRABLE</th>
<th>USE SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Radio</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>2. Television</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>3. Agricultural magazines</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>4. Daily/weekly newspapers</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>5. Extension newsletters</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>6. Satellite or PC tied to information base</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
</tbody>
</table>

B. We are also interested in ways you have obtained IN-DEPTH INSTRUCTION about agricultural topics (for ex.: pesticide certification, CRP enrollment, etc). Please indicate how desirable you think each of the following are as a way to present educational material. Then tell us if you have obtained instruction in that way. (circle answer)

<table>
<thead>
<tr>
<th>Instruction / Activity</th>
<th>NOT AT ALL DESIRABLE</th>
<th>EXTREMELY DESIRABLE</th>
<th>EVER USED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In depth short course at a local site</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>2. Public meetings or tours</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>3. Learn-at-home printed materials</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>4. Learn-at-home using video tapes</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>5. Learn-at-home audio cassette tapes</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>6. Learn-at-home using computer</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>7. Television programs on agriculture</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>8. Radio programs (call-in, instructional, etc)</td>
<td>1 2 3 4 5</td>
<td></td>
<td>NO</td>
</tr>
</tbody>
</table>
Q13. OPERATOR AND FARM/RANCH CHARACTERISTICS: We would like to ask some questions about yourself (primary operator) and your farm/ranch operation.

A. Sex of Operator? (Please circle)
   1. MALE
   2. FEMALE

B. Are you (circle one):
   1. MARRIED
   2. WIDOWED, DIVORCED OR SEPARATED
   3. NEVER MARRIED

C. Age of operator? _____

D. Is farming/ranching your primary occupation? That is, did you spend more than half of your work time in 1990 farming or ranching? (Circle answer)
   1. NO
   2. YES

E. How much formal education have you completed? (Circle the answer)
   1. 8 YEARS OR LESS
   2. SOME HIGH SCHOOL
   3. HIGH SCHOOL GRADUATE
   4. SOME COLLEGE
   5. COLLEGE GRADUATE
   6. POST-GRADUATE (MASTERS OR PhD)

F. Do you have: (circle answer)
   1. Cable Television ...... NO YES
   2. Satellite Dish for TV reception ...... NO YES
   3. VCR for video tapes ...... NO YES

G. As of December 31, 1990, did you have any outstanding debt for your operation? (Circle answer--Do not include CCC debt.)
   1. NO (go to question H in next column)
   2. YES

   a. What was the approximate amount of your total farm/ranch debt? (Include land and buildings, machinery and livestock, and operating)
      $ ____________

GO TO TOP OF NEXT COLUMN

H. Are you a hired manager of this operation? (Circle answer)
   1. NO
   2. YES

I. How long have you been the operator of this farm/ranch? _____YEARS

J. What county is the primary location of your farm/ranch? _______________

K. List the county you live in, if different:
   _______________

L. How is your farm/ranch operation organized? (Legal Status)
   1. SINGLE FAMILY OPERATION
   2. PARTNERSHIP
   3. FAMILY HELD CORPORATION
   4. NON-FAMILY HELD CORPORATION
   5. OTHER ____________

M. Please estimate the approximate value of all your non-farm assets (stock, bonds, real estate, etc):
   $ ________________

N. What percent of the labor on your farm/ranch is provided by hired (non-family) labor? _____%

   1. Number of full-time employees:_______
   2. Number of seasonal employees:_______

O. For how many generations has your family or your spouse's family operated this place? I AM THE:
   1. FIRST GENERATION
   2. SECOND GENERATION
   3. THIRD GENERATION
   4. FOURTH OR MORE

P. Do you use:
   1. Forward contracting as a marketing tool ...... NO YES
   2. Futures as a marketing tool ...... NO YES
   3. Options as a marketing tool ...... NO YES
   4. Cash flow statement for decisions ...... NO YES
Q. APPROXIMATELY what percent of your farm/ranch revenue (including deficiency payments) comes from each agricultural enterprise listed below? DO NOT INCLUDE OFF-FARM WORK. (Please check to see that the figures add up to 100 percent)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>______%</td>
<td></td>
<td></td>
<td>______%</td>
<td></td>
<td>______%</td>
<td></td>
<td></td>
<td>______%</td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

R. Please give us your best estimate of your gross farm/ranch income associated with agricultural products for the past year (1990). (INCLUDE GOVERNMENT PAYMENTS IN THIS AMOUNT, i.e. deficiency, CRP, disaster, and crop insurance payments.)

$_____________________

S. What percent of your total family income is generated from OFF-FARM work? (Include salaries of spouses and other family members)

_______% (write '0' if no off-farm income)

014. PHYSICAL RESOURCES BASE: The last set of items asks for information about the physical resource base of your operation to help us interpret the survey results.

A. How many TOTAL ACRES did you own, rent or use in your operation in 1990? (Please include all land, including CRP, that was part of your operation, regardless of use): _______ TOTAL ACRES

B. Of the total acres in your operation, how many acres did you OWN (Include CRP land): _______ ACRES OWNED

1. Of the acres you OWN, how many were used for the following activities during 1990? List irrigated and non-irrigated separately (If NONE, write 0 in the space)

<table>
<thead>
<tr>
<th>IRRIGATED</th>
<th>NON-IRRIGATED</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CROPLAND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HAYLAND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEEDED RANGELAND/PASTURELAND</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Do not include aftermath grazing)

2. Record any acres you own that are not used for cropland, hayland or pasture? ________________________________ -> _______

Please add up all the acres listed in the "TOTAL" column and check to see if that equals the number of acres you own as listed in B above.
C. Did you rent or lease any range or pastureland from individuals, BLM, FS or the state?
   1. NO (go to question D)
   2. YES
      a. Acres of leased from INDIVIDUALS: (write 0 if none)
         _______ NON-IRRIGATED _______ IRRIGATED
      b. Leased from BLM, FS or state: (write 0 if none)
         _______ ACRES or _______ ANIMAL UNITS

D. Did you RENT OUT or LEASE OUT any of your own range or pastureland to others in 1990?
   1. NO (If no, go to question E, below)
   2. YES
      a. Acres of range/pasture land leased to others: (WRITE 0 IF NONE)
         _______ NON-IRRIGATED _______ IRRIGATED

E. 1990 ASCS base acres: (write 0 if none)
   WHEAT:_____
   BARLEY:_____
   OATS:_____
   CORN:_____

F. Livestock Inventory: (Please give us your best estimate)
   (write zero if none)
   CATTLE:
      COWS, 2 yrs. + ................. BEEF ____
      HEIFERS, BRED ................. DAIRY ____
      UNBRED REPLACEMENT HEIFERS ... (Not born in 1990)
      BULLS .......................... ____
      BULL CALVES, BORN 1990 ....... ____
      HEIFER CALVES, BORN 1990 ....... ____
   SHEEP: TOTAL NUMBER________
   SWINE: TOTAL NUMBER________
   HORSES: TOTAL NUMBER_____

G. Please give your best estimate of the current market value of the buildings located on the acreage you own or lease. Include all farm buildings, your house and the houses of other families supported by the operation, if they are on the land:
   $____________________

H. What is the estimated market value* of ALL machinery, equipment and implements usually kept on this place and used for farm and ranch business? (Include cars, trucks, tractors, combines, disks, pumps, irrigation equipment, dairy equipment, livestock feeders, and mixing equipment, etc.):
   $____________________

* Market value: Value should be an estimate of what the machinery, equipment, etc. would sell for in its present condition, not the replacement or depreciated value.

THANK YOU VERY MUCH FOR YOUR PARTICIPATION IN THIS SURVEY
We are interested in your experiences and feelings about farm/ranch organizations. Please list the names of any you wish to comment on. How do you see them? What do they stand for? Why do you belong, or not belong? Hopefully, we can use these ideas to create questions for the next Survey.

Do you have any additional topics/issues that you would like to see included in the next Farm and Ranch Survey?