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Big Game Depredation to Crops and Orchards in Seven Counties of Northern and Central Utah: A Case Study

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BIG GAME DEPREDATION TO CROPS AND ORCHARDS IN SEVEN COUNTIES OF NORTHERN AND CENTRAL UTAH: A CASE STUDY

by

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KERRY MCBRIDE

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ABSTRACT

Big-Game Depredation to Crops and Orchards in Seven Counties of Northern and Central Utah: A Case Study

by

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Depredation to crops and orchards is a problem for agricultural producers in many states where big game are in close proximity to land used for ag-production. Heavy snowfall has created a serious big game depredation in Utah in recent years. Heavy snowfall covers big game feed during winter months, which creates a serious demand on cultivated land to maintain the big game herds at current levels. Many operators believe that current big game herd sizes are too large available feed, and should be reduced to prevent damage to agricultural production. Many big game managers believe otherwise.

This study looked at losses to ag-producers in the past five years (1981-1986) in an effort to determine the location and magnitude of losses to big game depredation.

A questionnaire, developed to survey damaged ag-producers, separated big game depredation into four categories: 1) unharvested or standing crops, 2) feed or

harvested crops, 3) orchards and 4) range or rangelands. Each category was broken down by type of damage; 1) consumption, 2) spoilage (for feed), 3) trampling (for standing crops and rangelands), 4) fence damage, 5) nuisance costs and 6) permanent damage (damage affecting more than one year's revenue from the enterprise). The questionnaire also sought information concerning State assistance to ag-operators for damage received. There were also questions concerning income from hunting club leases and private trespass permit sales, which provide income from big game sources.

Estimates were made of dollar damages in the categories noted above. All information was summarized by county and in total. Tables of information collected are provided in the appendix. Comparisons were made between mean losses and mean income (hunting club leases, private trespass permits and/or state assistance) using simple large sample tests of hypotheses.

Permanent damage was also evaluated for one orchard in which deer had abused the orchard to the point where it had to be removed and replanted. The assertion was made that the depredation created a loss of revenue over a five year period, and losses were evaluated using capital budgeting techniques. Respondents comments, which did not lend themselves to quantitative evaluation, were also summarized.

(115 pages)

CHAPTER I

INTRODUCTION

Wildlife resources are important to Utah for a number of reasons. Wildlife are associated with a valued heritage of hunting and fishing in the state. Wildlife are also enjoyed for non-consumptive uses such as, viewing or wildlife photography etc. (Pearse, 1969). Some may contend that the well-being of wildlife is a barometer of how well man cares for the environment. The peaceful coexistence of man and wildlife is not a reality in this state. There are conflicts of land use between wildlife and crop production, livestock production, residential uses, economic developments of various kinds, timber and mining.

Views of the problems with wildlife and other land uses cover the spectrum. One view is that wildlife were here first, and man is destroying their environment and habitat. Thus, man has a responsibility to allocate resources for their survival. Others argue that many species of wildlife are pests and should be destroyed.

Big game (BG) animals seem to be high on most people's list of "desirable" wildlife that should be dealt with in such a way as to enhance their particular benefits. Thus, wildlife topics incite the emotions of a segment of Utah's population as do few other natural-resource issues.

Wildlife is unique in that all of us own it, yet not all of us pay equally to maintain it. In Utah, the Division

of Wildlife Resources (DWR) is given the responsibility of managing the state's wildlife.

Feed

Where do BG obtain feed and cover to sustain life? Most BG spend a great deal of time on public lands in the state. Over 50% of the state's land is administered by federal and state agencies. Many people, however, agree that winter feed on private farm and ranch lands is essential to a viable BG animal resource. The costs of deer and elk use to private range and cropland in proximity to deer herd unit 19, (Coalville Utah) was $233,287.00 according to a case study done in 1983-84 (Table 1) (Nielsen and Lytle 1985). While some private landowners may benefit from BG, others may only incur costs. Feeding wildlife to prevent wintertime starvation may add to private landowner's problems because, depending on the location of the feeding, this may train or encourage the animals to come to populated areas and make these areas their permanent places of residence.

Occasionally, private landowners who are incurring damage losses year after year resort to drastic measures. Destroying BG animals usually attracts media attention, making the private landowner the villain. Many private landowners believe that traditional property rights are being ignored and/or threatened. If Utah is to maintain any widespread cooperation among DWR, sportsmen, and private landowners, this problem must be addressed.

TABLE 1. Damage Costs Caused by Deer and Elk in Utah Deer Herd Unit 19.

Use of Rangeland		Use of Cropland		Use and Damage costs by Both Deer and Elk	
Deer	Elk	Hay	other	Fence Maint. & related costs	Total Dmg value
Ac. 52,308	31,350	3,896	520		
$ 63,815	117,249	39,609	6,964	6,550	233,287

Objectives

1) Identify ag-operators with a BG damage problem.

2) Identify specific damage problems to crops, orchards or range. Collect data from ag-operators on costs of damage, and report the data.

3) Identify areas where ag-operators may receive benefits from BG presence. Collect practical data on the actual dollars of benefit, and report the benefits.

4) Compare data on costs with data on benefits in an attempt to ascertain whether or not ag-operators who incur losses from BG damage can recover the losses.

Problems

The problem of BG invading and damaging orchards and other crops is many-fold but can be reduced to four major areas:

1) Annual Crop Damage - The physical damage which affects the immediate year's crop, thus adversely affecting the farmer's income for only one year.

2) Permanent Crop Damage - The physical damage which not only affects the year's crop, but is detrimental to subsequent year's costs or revenue. Permanent damage is usually associated with perennial crops such as alfalfa and, more particularly, orchards.

3) Nuisance Cost - Costs incurred by a producer as a result of the presence of BG in the area. This primarily includes costs of implementing and maintaining depredation prevention techniques.

4) Maturity Prevention - This happens when a young crop is never allowed to mature because of over-browsing or other damaging activities which inhibit crop growth or destroy the young crop before it is able to produce. This type of damage is prevalent in orchards.

Annual crop damage occurs when the major browsing by BG is done in such a way that the crop is not permanently affected. In orchards the animals, primarily deer, browse mostly on buds which make up the next fruit crop. Loss of fruit represents a direct loss of revenue to the orchardist. In addition, his variable costs are also affected by the increase in pruning and general tree care required to overcome the effects of BG use. Other crops are also said to be damaged. Alfalfa, small grains, and corn are all adversely affected by the grazing of these animals. BG also compete

with domestic livestock on rangeland for feed. This may also represent an economic loss to the rancher in the form of an opportunity cost. The term "damage" may be a bit misleading when referring to range or rangelands. For this study, "damage" to range refers to any BG activity on rangeland which requires the rancher to alter his management practices in any way.

Some people have asserted that BG do little or no damage to the current fruit crop, "they only eat the fruit that would be pruned anyway." While this may be true, identification of any actual damage will be made in order to ascertain the extent of the damage.

Permanent crop damage seems to carry the greatest potential for economic loss to the orchardist or farmer because of the total loss of revenue from the crop until it is replaced. Permanent damage or potential permanent damage in orchards comes in many forms. Dr. Alvin Hamson (1986), Extension Horticulturist, Utah State University, said in a personal interview that the damages range from the breaking off of young trees by elk running through the orchard to disease, a fungus known as cytospora caused by the rough cut of a deer's teeth. Cytospora can form at each bud as a result of deer chewing, and, if this occurs, pruning each bud is required to prevent the spread of the disease. If a major branch (scaffold) is infected and lost, it could cause the loss of the whole tree. In addition to the economic cost

of losing the current crop from a lost tree, re-establishing takes from 2-3 years for a semi-dwarf tree to 8-12 years for a full-size tree. If not damaged in any other way and properly cared for, an apple tree normally produces for 25-30 years, peach trees produce for 8-10 years, pears for 15-20 depending on the area, and apricots for 30-40 years (Hamson 1986).

Permanent crop damage will take away an alfalfa farmer's revenue over the time he is re-establishing his crop. Re-establishment of alfalfa usually takes one year, where a tree takes from 2 to 12 years to re-establish. Therefore, potential loss to permanent BG damage is greater to an orchardist than a farmer.

There is a potential for permanent damage or benefit to rangeland. This occurs when the composition of the range is permanently altered away from or toward feed for domestic livestock. Change in range plant composition is caused by heavily grazing certain plants more palatable to certain animal species and allowing plants more palatable to another animal species to take over. While a biological change study will not be done, the producers' "perceived" permanent loss of feed will be assessed.

Nuisance costs also occur as a result of BG damage. In anticipation of depredation the producer may try some prevention techniques. Building tall fences to prevent access to the crops or attempting to keep the animals away from the

crops by driving and/or feeding away from crops may also be tried. Each of these alternatives represent costs borne by the producer.

Other nuisance costs may also occur. BG may consume or destroy harvested crops such as hay or silage. They may also have a tendency to climb in mangers and contaminate the feed to the point that livestock will not eat it. A farmer may be required to spend time repairing damage to existing fences or performing inconvenient tasks such as opening and closing gates as a consequence of damage prevention devices.

The final cost is related to "Permanent Crop Damage" and will be referred to as "maturity prevention". The crop is planted and maintained, yet never is able to produce a return because of BG browsing. This type of damage can occur as a result of: 1) killing the young crop outright by breaking the tree off, ripping the plant out by the root, or crown damage in the case of alfalfa, or 2) excessive browsing which does not allow the plant to mature. This type of damage will only be considered in the perennial crops. Any depredation in annual crops, which doesn't allow the crop to mature, will only affect the crop for one year since the crop would be replanted the following year in any case.

This study only attempts to discover damage costs to ag-operators individually. Whether or not resources are allocated efficiently between agriculture and wildlife will only be considered in the review of literature. The data

collected will only pertain to individual ag-operators, and will not include any examination of marginal social benefits or tradeoffs.

CHAPTER II

LITERATURE REVIEW

Costs and Damages Associated with Big Game on Farms and Orchards

Virtually all the literature cited concerning damage to cultivated crops and orchards agree that where consumption or some other damage to crops occurs, there is some potential for loss of revenue to the ag-operator. However, there is a divergence of opinion on how much damage is being done, and how it should be estimated.

Unharvested Crops

Alfalfa

In Guidelines for Evaluating Annual Crop Losses Due to Depredating Big Game, Austin and Urness (1987a) give two methods of estimating damage to alfalfa. The first is the animal count method. Animals are spotlighted and counted 1/2 to 2 1/2 hrs. after sunset, three times during the crop production period. Efforts should be made to get a representative count -- First, of the crop by counting at three equal intervals during the production cycle of each crop; and second, of the day of the week so as not to bias the sample. Week ends should be avoided when heavy highway traffic can disturb the animals. Mean "big game-days use" should be representative of the whole crop cycle, not just one

period of the crop. "Mean daily consumption rate" is adjusted to determine an equivalent level of consumption of dry hay. This amount is multiplied by a market value of hay to determine economic loss. The authors note that trampling and bedding losses have not been estimated, but consumption figures were increased using fall weights of the animals, which they believe potentially overestimates rather than underestimates hay loss.

The second method of estimating alfalfa loss mentioned by Austin and Urness (1987a) is the basket method. Baskets are placed randomly in the field to protect plants inside from damage. Just before harvesting the crop, the baskets are removed from the field and the alfalfa inside clipped, dried, and weighed to determine potential production levels. Corresponding plots of unprotected alfalfa are clipped, dried, weighed and compared to the protected plots. The loss (difference between protected and unprotected production) can only be detected when use is high. The authors indicate that this method has a 90% chance of detecting depredation only when use exceeds 20%. Twenty percent requires nightly use of four to six deer per acre. After the samples are dried and weighed, damage is estimated on the entire field, and dollar losses are determined when multiplied by the market value of hay.

Palmer, et al. (1982) used the basket method or exclusion cage method for determining alfalfa losses to

white tailed deer in Pennsylvania. They estimated densities of 11.5-10.5 deer/km^2. A 3.3 ha field approximately 175 m from the tree line was used. Using $0.12/kg of dry hay they estimated a loss of $622.00 (1979) and $756.00 (1980) on the 3.3 ha field. This represents $188.00 and $229.00/ha and 17% and 22% loss per year respectively. In addition to the consumption losses, he also cites Smith (1975) on other ways ag-operators can incur losses to depredation in alfalfa. When plants are grazed frequently during the growing season or in late fall, they are forced to go into winter with low food reserves. This causes them to be more susceptible to disease, or can cause the death of the plant. He also cites Mullen and Rongstad (1979) on carry-over effects of grazing first crop alfalfa to subsequent second and third crops. Areas of heavy use thinned out the stand and allowed grasses to increase thereby reducing the value of the crop.

Austin and Urness (1987b) used another method of enclosing deer and elk in pens and offering them alternative feeds including fresh alfalfa. When given alternatives of various shrubs and alfalfa, the animals diet consisted of 38% alfalfa for deer and 29% for elk. Over the 4 days of the experiment the preference moved toward alfalfa. This, they concluded, was because of the less desirable condition of the browse over time. They also cited Tebaldi and Anderson (1982) on the importance of additional losses due to trampling and bedding. The Tebaldi and Anderson (1982)

experiment used fecal analysis and showed a 30% diet contribution of alfalfa. They recommended, however, a 50% diet contribution rate in determining depredation because of the more complete digestion of green alfalfa compared to other shrubby species, and the trampling and bedding damage mentioned.

Cereal Grains

Other crops that can be damaged are the cereal grains. In total dollar terms, cereal grains receive the largest crop damage in The United States (Harder 1968). Several studies have concluded that a majority of the yield loss to grain is due to depredation after the beginning of the joint stage (Austin and Urness 1987a, Dunphy, et al. 1982, Putman 1986). Most authors admit that any damage shows widely varied results. An experiment was done by clipping forage from different varieties of cereal grains at various stages of maturity by Dunphy, et al. (1984). The study showed that 4%-85% of the crop was lost depending on the variety of grain, when the it was clipped, and other undetermined factors. They also cite several studies which show varied results. Foraging cereal grains prior to harvest gave results from increasing yield to a marked decrease in yield. They did mention that in those cases where yield increased, it was due to lodging in undamaged test plots in two out of three cases. They also emphasize that losses to grazing may vary from their estimates because of factors not considered

in the test plots from simply clipping.

Putman (1986) took observations from roe deer feeding on cereal grains adjacent to woodlands in England. His results showed that the type of cover adjacent to the crop could have a significant effect on the amount of damage. He observed that no more than 5% of any field observed was damaged. On the other hand, he cited two studies in Poland which showed that in an area where there wasn't significant cover adjacent to the grain field, deer used a larger portion of grain in their diet. One of the studies by Kalzinski (1982), indicated that over 90% of deer diets during a certain period were immature grain heads. Wiggers, et al. (1984) concluded that grain greatly improved the diets of white tailed deer on fee hunting preserves in the Texas panhandle.

None of the studies cited above included the opportunity cost of the forage taken by deer. By showing that the diets of deer improve when grain is planted to improve the winter range, the Texas example provides evidence that forage from grain has a positive value. Although forage taken after joint formation was evaluated by Austin and Urness (1987a), the total value of the forage taken was not considered. Even though the yield may not be measurably affected by BG, the forage taken is the property of the farmer, and is protected as either a fixture to real property or personal property (Howell, et al. 1978).

Stored Crops

Little has been written about stored crop damage. Obviously, once a stored crop is consumed or ruined there is little doubt as to the fact that there was actual economic loss. Methods of estimating the damage are given by Austin and Urness (1987a). The bale count method requires counting the number of bales eaten or knocked down, or the number of strings laying on the ground. Multiply the estimated number of bales eaten by the average weight of the bales to get the tons lost. Multiply tons lost by a market value of hay for the total dollars lost. Austin and Urness (1987a) also take into account the fact that hay may be ruined or wasted. The other method mentioned is the animal count method similar to that used in estimating losses in alfalfa fields. They note that this method doesn't consider waste, so additional adjustments need to be made.

The major thrust in stored crops is to prevent damage by fencing since haystacks are generally small and inexpensive to fence (Tully and Greene 1981, Austin and Urness 1987a). Colorado provides several different types of fencing depending on the types of operations and convenience of the ag-operator (Tully and Greene 1981).

Orchard Losses

Mature Orchards

Big Game damage to orchards has been a major problem for many years, and the ways they damage orchards are varied (Harder 1968). Some of the problems are due to increasing deer populations; while others may be attributed to increased recreation pressure and the fact that many traditional winter feeding grounds have become orchards and other agricultural production enterprises (Nielsen, et al. 1982). Harder (1968) explained the evolution of deer populations in the United States. He cited Young (1956), who stated that before 1900 deer were killed for hides by "market hunters". In 1900, however, the Federal Lacey Act, which regulated interstate commerce in game, ended market hunting. This and other laws protecting BG, enacted shortly thereafter, helped cause a marked increase in herd populations. By 1935 the conflict between wildlife and agricultural interests had begun.

Economic losses in orchards due to the increased populations of deer and other species come in several forms. The first and most prevalent form is nipping off small shoots and buds affecting the crop (Harder 1968, Austin and Urness 1987a). This type of damage is evaluated by comparing the number of nips to the number of buds, or by comparing the number of blossoms within the browsing zone to the number of blossoms out of the browsing zone. Katsma and

Rusch (1980) simulated bud nipping by snipping trees at various stages of the growing season with dull pruning shears. Their results showed .17 apples lost per snip on young trees. For more mature trees, they learned that snipping statistically reduced yields in McIntosh apple trees when snipping reached the 40% level (40% of the buds were snipped), and reduced yields in Golden Delicious apple trees when snipping reached the 60% level.

The second damaging activity to orchards usually by deer is rubbing antlers during the fall. Scott and Townsend (1985) and others have shown that antler rubbing, though not as common, can cause more damage than bud nibbling. A preliminary survey at the Donhaven Tree Farm of Ohio in 1979 indicated that "buck rubbing was causing more damage than all insect and disease pests combined" (Nielsen et al. (1982) p. 341-342).

Harder (1968) cites Bittner (1949) as to how severe rubbing damage can be to trees. He also cites Reigan (1958) stating that a young fruit tree will be scarred or broken off, many times rendered useless, because of the rough texture of a deer's antlers used in twisting motions. Scott and Townsend (1985) also mention several ways a tree can be damaged affecting more than just one year's crop. Hamson (1986) mentioned the rough cut of deer's teeth, and potential disease if each nip isn't pruned out. Hamson (1986) also said that permanent damage can come from losing a major

scaffold due to breaking or disease caused by BG damage.

Young Trees

Young trees have the greatest susceptibility to BG damage (Katsma and Rusch 1980). Scott and Townsend (1985) report that trees 7 1/2 years old and younger were the most frequently damaged. Harder (1968) cited Lutz and Chapman (1944) who indicated that the average diameter of branches damaged by antler rubbing was 1.5 inches, with an average height of 20 inches from the ground. Maximum damage to the branches themselves averaged 45% of the circumference of the branch, but sometimes girded the stem. Leaf damage is also more serious in younger trees, where a larger proportion of the photosynthetic surface is destroyed compared to a larger tree (Scott and Townsend 1985). Scott and Townsend (1985) also cite Caslick and Decker (1979) who found that younger more succulent trees are preferred by deer. Hamson (1986) recalled an instance where young trees, stabilized by wires and stakes against the wind, were broken off by elk running past and brushing the wires tied to the trees.

The only method of evaluating losses to juvenile trees mentioned by Austin and Urness (1987a) is a bud counting method similar to the method mentioned in evaluating crop loss in mature orchards. No attempt is made in any of the literature to evaluate the loss to the orchardist of potential crop revenue 3 to 5 years hence, when the young

tree should be producing. Each time growth is stunted or a tree has to be replaced as a result of BG damage, one or more potential crops are lost some time in the future.

Range

Range and Rangeland Conflicts

Little has been written about depredation to rangelands. The notion itself may seem contradictory since range is one of the main sources of food for BG. Some people consider it the right of this wildlife to occupy and use rangeland no matter what the consequences. Heavy livestock use in the early 1900's caused the ranges to shift toward brush cover which made excellent deer range (Gruell 1986). BG use rangelands to the extent the range will support them. Gruell (1986) showed that the changing dominance of plant species on rangelands in the western U.S. to superior mule deer habitat increased herd size in the early 1900's. A study by Austin et al. (1986) was conducted in Red Butte and Emigration canyons east of Salt Lake City, Utah where grazing by domestic livestock has been reduced or eliminated. Where livestock grazing has been eliminated, plant communities slowly change from high quality deer range, to more grasses which are preferred by domestic livestock. This succession to more grasses is accelerated by deer grazing during the winter period. As plant communities succeed to grasses, the deer population in those areas is expected to decline.

When domestic livestock are grazed on rangeland traditionally used by BG, a conflict between wildlife managers and livestock managers can occur. Wildlife managers believe that livestock grazing is detrimental to BG by competing for the limited potential feed on rangelands. On the other hand, livestock producers believe that wildlife take away valuable feed from cattle or other livestock, and threaten their livelihood. Gruell (1986) points out that the cooperative use of wildlife management, livestock management, and other range management techniques is necessary to keep from depleting the range to the point where it is unusable for either livestock or wildlife. While most people will agree that management of rangeland is important, methods of evaluating and allocating this resource are not easily agreed upon. Multiple use, the concept of allowing several different uses of public land such as wildlife and livestock grazing, and camping and hiking etc., is the most popular range management strategy among government agencies.

Recreation vs. Agriculture

Pearse (1969), in describing methods of balancing recreation (BG hunting etc.) and agriculture, characterizes the notion of tradeoffs in the form of a "production possibilities curve", (PPC) or product-product relationship. He asserts that the optimal choice is one where the slope of the social marginal rate of substitution (MRS) is tangent to the possible production (PPC). This tangency point maximizes

output given the technical relationships described by the PPC and social values described by the MRS. Hall (1964) cites Hopkin (1956) who uses the same theory for evaluating optimal sheep/cattle use mix on range. Hall (1964), however, asserts that the simple substitution of cattle and sheep is based on the homogeneous product assumption in classical economic theory which assumes one cow or sheep has the same value alone or in a group. He points out that deer are not homogeneous in the same way, since the product is not deer, but hunting or recreation, and more deer make a better hunt or easier sightings of the animals. He points out that the technical ability to substitute deer for cattle on the range is not the basis for good recreation management. Arguments for evaluation of wildlife delve even deeper into the benefits of wildlife. Cocheba and Langford (1978) assert that just seeing the wildlife should be a consideration when evaluating the "collective good" of wildlife. Workman, et al. (1987), suggest that the assumption of perfectly elastic supply curves doesn't reflect the actual picture of benefits vs. costs in recreation policy making. They assert that to allocate resources efficiently, analyses must be broadened to include supply response/cost functions.

Compensation for damage is not considered on publicly owned range. Ensminger (1983) points out that the multiple use range policies of the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), and other government

agencies, also talked about by Hall (1964) and Pearse (1969), helped create the conflict between ranchers and government agencies. The Taylor Grazing Act allows for cancellation of grazing privileges whenever lands are determined to be more suitable for other purposes (Ensminger 1983). Many ranchers believe that government agencies are allowing increases in BG populations at the expense of the ranchers' operations, which are crowding them off publicly owned rangelands. Ensminger (1983) reports that ranchers become confused working with so many different agencies, policies, and programs, and bad feelings can follow. He further states that there have been errors in administration of public lands, but he also states that public rangelands have improved under USFS and BLM management.

Another complaint from ranchers is that they spend their time and money improving the condition of a publicly owned grazing allotment, only to find the increased carrying capacity is to be allocated to BG animals. This complaint is even more adamant when BG are transplanted into an area (Nielsen 1988).

Private Range Compensation

For the most part, damage to private range goes unchecked. In Utah there are no provisions for compensation for BG use and/or damage on private range. Austin and Urness (1987a) say nothing about evaluating damage to private

range, and the Utah law provides for no damage awards since it limits payments to "cultivated crops from or upon cleared and planted land" (Utah Code 1987-88). Colorado, unlike Utah and most other states, allows damage payments for depredation on private rangelands (Tully and Greene 1981). The method of estimation involves determination of how much feed should have been available for the livestock from historical records, proving BG responsibility for the damage, and several other conditions, all of which must be met before compensation will be awarded.

Externalities

The normal concept of an externality as Buchanan and Stubblebine (1962, p. 371) describes it is:

> external economies and diseconomies, divergence between marginal social and private cost or product, spillover and neighborhood effects, collective or public goods.

Externalities are important to this discussion because BG depredation has an external effect on farmers and ranchers -- much the same as the train that sets a field on fire when the engine sends off sparks as it goes past. Coase (1972) argues that simply making the railway liable for the fires it causes is not necessarily desirable. He argues that if the farmer is going to receive market value for his crop, regardless of whether it is burned by the railway or not, he will be indifferent as to whether he receives it from the market or the railway. If the railway is not liable for the

fires it causes, the farmer will likely take the land, for which destruction by fire is likely to reduce receipts below an acceptable net return, out of production. A change from no liability by the railway to liability by the railway would therefore lead to an increase in cultivation of land adjacent to the railway, and consequently, an increase in railway-caused fires.

Coase's (1972) argument is that instead of assuming that removing the deficiencies in the system is always desirable, we should examine the situation as it exists, as well as the proposed policy changes to see if in total the changes would make us better or worse off. It is important to note that Coase (1972), also points out that transaction costs are assumed nonexistent in his examples, and that such costs, when considered, play an important role in deciding the final benefits. Transaction costs play a vital role in the problem of allocating wildlife costs and benefits. The large number of hunters in Utah makes it very difficult to negotiate an agreement between landowners and the beneficiaries of the BG resource.

CHAPTER III

PROCEDURES

Population

When estimating total damage in a state or area, a population estimate is essential. However, for this study there is a problem with population definition. No list of producers who are actually receiving damage is available. Therefore, farm organizations with information on damage reports were used as a data source for sampling. DWR damage lists were also used as data sources and combined with data from farm organizations to compile a list of producers being damaged. Operators reporting damage were then interviewed using a detailed questionnaire as a guideline. They were also asked about damage on neighbors' property, and additional names were added to the list.

Since organization lists and word of mouth were the only available methods of determining ag-operators with BG damage, random and independent samples of all operators with BG damage were impossible to obtain. Therefore, large sample hypothesis testing will only be accurate for operators reporting damage to the organizations or neighbors contacted. However, if one assumes that all "significant" BG damage is reported, or operators with "significant" damage will apply for remuneration, then the statistical results can be applied to all "significant" BG damage in the areas con-

sidered.

Since the parameters of the population of interest are not known, a case study approach was undertaken. Names obtained from the various sources were compiled by county. Seven counties with the largest number of agricultural operators reporting big game damage were selected for study. A questionnaire was developed detailing the different types of damage possibilities to unharvested crops (crops in the field), stored crops (feed), orchards, and range and rangelands. The questionnaire was used in interviews with landowners to determine the costs of BG damage to their operations.

Questionnaire

Section 1

Section one is general in nature with personal information about age and education of the owner and/or manager of the operation. It also includes information to determine what type of operation, and what type of damage is occurring. In addition, section one includes information about total miles of fence, (DWR) assistance, and trespass permits. DWR assistance includes questions about damage payments, fence materials, and whether or not the damage payments were adequate and why. These questions were included to determine if the operators were receiving compensation from the State of Utah directly relating to

damage. The question on the adequacy of compensation was to determine where the payments were judged as inadequate in providing remuneration to those damaged.

The final part of section one concerns fees obtained from private trespass permits or hunting clubs. The purpose was to ascertain any possible benefits from BG to the land owner.

Section 2

Section two of the questionnaire, while dealing directly with unharvested crops, sets the general format for the last four sections:

1) What was damaged in terms of crop, acreage and type (perennial, annual and age).

2) What animal was causing how much damage.

3) Annual damage, (the damage which affects only one year's crop or crop revenue).

4) Permanent damage, (the damage which affects more than one year's crop or crop revenue).

1) Part one of section two deals with the crop being damaged and how much of the crop is lost. Knowing this, the damage impact is established in terms of different criterion such as per acre, per acre damaged, per crop type, and percent of acres damaged etc. Permanent damage potential is also estimated in this part by questions about whether the crop was annual or perennial, and if it was mature when damaged.

2) Part two concerns the percent of damage done by which type animal. These damage estimates are in terms of percent damaged, dollars lost, and number of acres damaged by deer, elk or other animal.

3) Part three allows for operator estimates of actual damage based on the four criterion previously discussed -- consumption, trampling, fence damage, and other nuisance costs.

Consumption of crops by BG animals is the most obvious damage, but with unharvested crops it is difficult to estimate. Several methods of estimating damage are used. The DWR will often use the basket method, previously discussed, to determine how much feed is lost. A farmer, however, will likely have an intuitive feel for what he has lost on a particular parcel of land. It is believed that after having been over a parcel of land for a long period of time, and growing largely the same crop year after year, he will know when he's been damaged, and in large measure, how much damage has been done. The counting method discussed previously provides another means of assessing consumption damage on a crop. Whether the animal feeds all the time it is there, or if it is only there part of the day yet consumes most of it's daily ration there, may be difficult if not impossible to ascertain. As may be obvious by now, much of the expected consumption loss in unharvested crops throughout the state will be hay (alfalfa and other), since

yields are reduced when grazed. Grain and corn crops create a more difficult scenario in damage estimation because the harvest consists of the grain which might not be formed when the plant is being nipped back. Therefore, it is more difficult to estimate how much yields are reduced by BG. Other row crops have similarly difficult estimation problems because of the nature and maturity of the plant when the damage occurs.

This study isn't concerned with determining the "best" method of damage estimation. Therefore, whatever method is used by the operator will be assumed accurate and viable for study. If the operator can't estimate the damage, he may have some information usable in estimating damage in the following ways:

a) Number of animals on his land for a certain number of days. This data can then be used to determine the number of AUM's of forage consumed.

b) Estimates on crop loss percentage, combined with 5 year average yields for the particular county (Utah Department of Agriculture 1987) or from the operator[1] may also be used to determine consumption.

c) Average prices obtained from Utah Department of Agriculture (1987), or from the operator for the past 5

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1) Operators' estimates used instead of official state statistics may be more accurate on a particular parcel of land.

years, combined with either 1 or 2 above will provide dollar damage estimates.

Trampling is the next cost considered. Trampling is separated from consumption because it can sometimes have a more detrimental impact on the crop. If BG trail across a field during periods when the ground is wet (primarily spring or fall weather, or during irrigation), plants in the areas stepped on are usually completely destroyed because in the wet soil the animals' hooves penetrate the ground and disturb the roots. Even if the crop is not killed, hoof marks can leave the land rough and difficult to work. Alfalfa can require extra digging and smoothing practices to facilitate harvesting. Crops knocked down by BG lying on them are also considered in this category. Frost heaving causes damage on trampled alfalfa fields where un-trampled fields have little or no damage from this phenomenon.

Separating the effects of consumption and trampling damage may be difficult, if not impossible, for an individual farmer. In such situations, the damage is combined in the consumption column. Separating the two costs is not as important as knowing them. For this analysis these costs will be combined into the " annual damage" category rather than the other separations.

Fence construction, maintenance and repair will be easy to separate from consumption, but it may be difficult to separate the damage caused by BG and other non-BG animals.

Farmers were asked to assess the damage and repair expense caused only by BG. They were asked to consider materials and labor in these costs. However, they were instructed to exclude those materials provided by the DWR. Costs of erecting DWR fences and any materials purchased by the operator for such fences are included. These expenses are direct costs to the operator over and above the government participation. A five year average was obtained for all other fence material and repair costs on all other fences maintained by the operator. Most of the fence provided by the DWR would be built in one year. However, many operators spend several years fencing all their affected land with DWR fencing materials. Most fences provided by the DWR are built around stack yards which are treated in section three. Other privately purchased and built fences are found around cropland, rangeland, and orchards.

Nuisance Costs. Other nuisance costs include anything the operator can quantify and relate directly to BG being on his property:

a) Time spent opening and closing gates in fences erected to prevent damage.

b) Time spent driving BG from their property,

c) Travel to deal specifically with BG problems.

d) Any other time or capital spent, as a result of BG problems.

4) Part four of section two deals with permanent

damage. Permanent damage is described as that damage done in one year which reduces revenues for more than one year. This includes damage which requires the replacement of all or part of the crop, where the crop would have produced the next year without replacement. Permanent damage may justifiably be seen as difficult, if not impossible, to measure accurately (Harder 1968). However, the ramifications of permanent damage are large enough that it warrants consideration. Despite the difficulty of accurately measuring permanent loss, an operator should have an intuitive feel for where his crop is as opposed to where it should be if depredation did not occur. These judgmental estimates were used to measure permanent loss.

There is a part at the end of the last four sections dedicated to "other problems". This section allowed the operator to express opinions, discuss the non-quantifiable, or estimate any subjective damage not covered by the other questions in the section. Explanations or calculations of the previous costs were also treated here.

Sections three through five of the questionnaire have the same general format as described for section two except that they concern different types of, or parts of, an operation. The final portion of the description will detail any differences in the previously described format which pertain to the specific type of, or part of, the operation.

Section 3

Section three details stored crop damage. Permanent damage does not apply to these losses because stored crops do not renew themselves. Another significant difference is spoilage. Oftentimes deer will get up on stacks or pits and urinate, defecate, or otherwise spoil and render the feed unusable. Undermining stacks to the point that they tip over can also increases loss due to spoilage.

Section 4

Section four details orchard damage. Orchards represent a special case, since all trees are perennial, they are separated by maturity and age. Young non-producing trees are tender and preferred by BG (Harder 1968). However, young trees do not produce any revenue, so the immediate cost to the orchardist may not be large. Costs of time and effort to raise the young tree will be lost when a young tree is damaged. A young tree may be killed or stunted in growth after three or four years of being nipped back. If stunting occurs the tree would not mature in the normal time period (Hamson 1986), causing a loss of revenue by delaying the crop. Orchardists incur costs when they must replant, or nurse trees longer than normal. Mature producing trees which are permanently damaged cause greater concern. Costs of replanting and care are small compared to immediate losses of revenue. Time necessary for trees to mature is from 2 to 12 years (Hamson 1986). Losses of potential revenue due to

BG damage for those years can be very substantial.

Section 5

Section five details rangeland damage. Currently, rangeland damage is not compensated for under Utah Code 23-16-4 which states:

> Whenever big game animals have damaged or destroyed cultivated crops from or upon cleared and planted land, the division of wildlife resources may pay to the crop owner or owners for the actual damage Utah Code (1987-88) (italics added).

It is interesting to note that damage to rangelands is paid in Colorado (Tully and Greene 1981). Even though range damage is not paid by the state, the assertion is made that economic loss can be sustained as a result of BG damage on rangeland, and such damage is considered in this study.

Data Summary and Analysis

Several avenues were used to summarize and analyze the data collected from the questionnaire. First the data were put on a computerized spread sheet to facilitate mathematical operations and extraction of the data for reporting. As the size of the tabulations are very large, all data will not be reported, but summary tables will give all pertinent information taken from the data relating to this study (see the Appendix).

Summaries of losses from the total operations and the four major categories (unharvested crops, stored crops,

orchards, and range) are reported by: total, average, standard deviation, number (count) of operators in the category, high, and low for each. Total losses are reported on the basis of total per year (average) loss to the entire operation to BG for all ag-operators interviewed (combined). Unharvested crops are reported on the basis of average loss and average loss per acre of the damaged crop grown. Stored crops are reported strictly on the basis of single season loss, because permanent loss does not apply. Average total loss and average total loss per ton stored are reported. Orchard losses are reported in the same manner as unharvested crop losses, except that Box Elder and Utah counties are reported separately because other counties had few, if any, orchardists who incurred losses and were interviewed. Range, though it has permanent damage potential, is reported only on the single season basis, because there were limited estimates on permanent damage. Fence damage is eliminated from most individual category reports because most of the operators interviewed reported fence damage to their total operations. Very few operators were able to separate fence damages for individual crops or enterprises from their overall operations. Fence damage is reported for total operation losses, and used in later comparisons.

Page one of the questionnaire provides information on government assistance for BG damage. This information is summarized and reported on a per operation basis. These data

allow a comparison with average payment and fence assistance data provided by the DWR. This comparison provides one estimate of the assistance received by the operators as compared to the overall assistance provided by the state. Those who indicated that they received no assistance, and those who couldn't estimate the average yearly assistance, were eliminated from the sample to provide a more accurate comparison with DWR data.

Average total operation loss including fence damage is compared with government assistance in two ways. First, assistance data provided by the farmers is compared to operation losses, and a Large-Sample Test of Hypothesis is performed to determine if there is a significant difference between the mean loss and assistance provided. Second, the maximum assistance per operation provided by Utah state law, $2000.00, is assumed for each operator and compared to the mean loss. A Test of Hypothesis is performed to determine if there is a significant difference between the actual operator perceived loss and the maximum recompense provided by law.

A final analysis is performed on one particular orchard operation to illustrate the potential permanent loss due to damage under certain circumstances. The orchard chosen had a 10 acre peach orchard destroyed in 1983 by deer depriving the owner of revenues from that section for a minimum of 5 years. The average yearly gross revenue figures provided by

the orchardist are used to determine the loss. Other costs such as replanting, replacement tree costs, and ground preparation were not sought and are ignored. Other deferred costs, such as harvesting and marketing costs, will also be ignored and only potential lost gross revenue for the pertinent years is considered. Capital budgeting techniques are used to determine actual losses to date and potential future losses. Though there is the possibility of frost or other damage taking the potential crop, average figures were used to smooth the other natural loss potential to the orchard. There can be no doubt as to whether the crop was lost because trees were destroyed, and there is a definite interruption to the production cycle of the land.

Methods

Large-Sample Test of Hypothesis

The Large-Sample Test of Hypothesis technique used is taken from Business Statistics by Example by Sinich (1982), but similar analyses are common to virtually all basic statistics texts as follows:

Null Hypothesis: HO: $\mu_1-\mu_2 = D_o$ (= mean of population 1)

Alternate Hypothesis HA: $\mu_1-\mu_2 \neq D_o$ (= mean of population 2)

If the difference between μ_1 and μ_2 is large enough, then one rejects the null hypothesis HO: and concludes that there is a significant difference in the two population means. If the difference between μ_1 and μ_2 is not large enough, then one

fails to reject HO: and concludes that there is insufficient evidence to say that the two means differ.

The Large-Sample Test of Hypothesis has two essential assumptions:

1) The sample sizes n_1 and n_2 are sufficiently large such that:

$$n_1 \geq 30$$
$$\text{and } n_2 \geq 30$$

2) The two samples are selected randomly and independently from the target populations.

This method was chosen because there are two means being compared in each analysis, and the samples are sufficiently large. The two tailed test was chosen because it is a more general case.

The large-sample test of hypothesis is performed as follows:

n = Sample size

$\bar{X}$ = Sample mean

s = Sample standard deviation

Z = Test statistic

$Z_{\alpha/2}$ = Tabulated or observed test statistic

Computation of the test statistic is as follows:

$$Z = \frac{(\bar{X}_1 - \bar{X}_2) - D_o}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

We will reject HO: if $Z < -Z_{\alpha/2}$
or if $Z > Z_{\alpha/2}$

and conclude that there is a significant difference between μ_1 and μ_2. Otherwise we accept HO: and conclude that there is insufficient evidence that μ_1 and μ_2 differ.

Capital Budgeting[1]

Permanent BG damage to crops, particularly orchards, causes losses of revenue over a period of years. Such losses have two effects: first, they impact operator income immediately because of the loss of the current crop, and second, they impact operator income in the years following because of the of subsequent crops lost due to BG damage in the first year. Since permanent damage causes a loss of dollars over a period of time, it is important to evaluate dollars lost using techniques which take into consideration the time value of money.

The time value of money (or capital budgeting technique) is based on the notion that money has value over time; ie. 10 dollars is more valuable now than it will be a

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1) Capital Budgeting analysis from Barry, et al. (1979)

year from now. In simplistic terms if we put 10 dollars in the bank, it will have earned interest in the year, and be worth the original value, 10 dollars, plus the interest, say 5%: \$10 + (\$10*.05) = \$10.50. or in more general terms as follows:

For Future Value Analysis:

a) $V_N = V_o(1 + i)^N$

where V_N = value today

V_o = value in the original period

i = interest rate

and N = number of periods.

Equation a shows the conversion of a single sum compounded each N period.

This analysis requires the use of a more complicated calculation which incorporates a payment each period. Equation a is expanded thus:

b) $V_N = \sum_{n=0}^{N} P_n(1 + i)^{N-n}$

where V_N = value in the N^{th} period (or future value of payments)

P_n = payment for period n

n = (0,1,2,...,N)

i = interest rate.

For an annuity, or uniform payment each year, the equation is as follows:

$$c) \quad V_N = A \left[\frac{(1 + i)^N - 1}{i} \right]$$

where A = the uniform payment each year, or the annuity.

For Present Value Analysis:

Solve for V_o in equation a:

$$d) \quad V_o = V_N(1+i)^{-N}$$

For a payment each period equation d is expanded:

$$e) \quad V_o = \sum_{n=0}^{N} \frac{P_n}{(1 + i)^n}$$

For an annuity, or uniform payment each year, the equation is as follows:

$$f) \quad V_o = A \left[\frac{1 - (1 + i)^{-N}}{i} \right]$$

CHAPTER IV

RESULTS

After interviews with the agriculturists from seven counties were completed, the results were summarized and can be found in the Appendix. Responses to questionnaire questions were varied, and some of the questions gave interesting outcomes which will be discussed.

Tests of Hypothesis Using Normal Distributions

Tables 2 - 5 give the results of the comparisons of means, or tests of hypothesis as described in chapter three. The first analysis (Table 2) compares compensation for BG damage, which includes dollars received from DWR damage payments, DWR fence assistance, the sale of private trespass permits, and leasing land to hunting clubs with total damage which includes total dollar losses from all categories including dollars for fence damage. Table 2 shows average total loss of $5,094.79 per operation per year, and average total BG compensation of $572.15 per operation per year. The statistical measure used is the Z statistic. The calculated Z statistic is - 3.21, which is less than -2.58 (the observed or tabulated Z statistic), the lower limit of the acceptance region (or the normal distribution) at the 99% confidence level or (α =.01). One concludes with 99% confidence, that, on the average, total losses to BG damage

TABLE 2. Comparison of Mean Compensation and Mean Total Loss Attributed to BG Damage.

	MEAN	STANDARD DEVIATION	NUMBER OF OBSERV-ATIONS	Z STATISTICS CALCU-LATED	Z STATISTICS TABU-LATED
μ_1= BG COMPENSATION	$572.15	$719.78	52		
μ_2= TOTAL LOSS TO BG DAMAGE	$5,094.79	$10,131.90	52		
Z				-3.21077	
TABLE α = .05					$\pm$ 1.96
α = .01					$\pm$ 2.58

(Sincich 1982).

TABLE 3. Comparison of Mean Damage Payment to Operators Interviewed and Mean of all Damage Payments From DWR in Seven Counties Studied.

	MEAN	STANDARD DEVIATION	NUMBER OF OBSERV-ATIONS	Z STATISTICS CALCU-LATED	Z STATISTICS TABU-LATED
μ_1 = DAMAGE PAYMENTS (from inter-view data)	$443.33	$659.69	52		
μ_2 = DAMAGE PAYMENTS (from DWR data)	$219.32	$188.95	224		
Z				2.43853	
TABLE α = .05					$\pm$ 1.96
α = .01					$\pm$ 2.58

(Sincich 1982).

TABLE 4. Comparison of Mean Total Loss and an Assumed $2,000.00[1] Damage Payment to Each Operator in the Study.

	MEAN	STANDARD DEVIATION	NUMBER OF OBSERVATIONS	Z STATISTICS CALCULATED	Z STATISTICS TABULATED
μ_1 = TOTAL LOSS TO BG DAMAGE	$5,094.79	$10,131.90	52		
μ_2 = $2000.00 PER OPERATION	$2,000.00	$0.00	52		
Z				2.02632	
TABLE α = .05					$\pm$ 1.96
α = .01					$\pm$ 2.58

(Sincich 1982).

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1) $2,000.00 is the maximum damage payment allowed by Utah law

TABLE 5. Comparison of Mean Total Loss and Mean Actual Damage Payments to Operators Studied.

	MEAN	STANDARD DEVIATION	NUMBER OF OBSERV-ATIONS	Z STATISTICS CALCU-LATED	Z STATISTICS TABU-LATED
μ_1 = TOTAL LOSS TO BG DAMAGE	$5.094.79	$10,131.90	52		
μ_2 = DAMAGE PAYMENTS (from DWR data)	$219.32	$188.95	224		
Z				3.46972	
TABLE α = .05					$\pm$ 1.96
α = .01					$\pm$ 2.58
(Sincich 1982).					

were greater than total dollars of BG compensation to the operators in the study.

The second analysis (Table 3) compares average DWR damage payment to the interviewed operators, $446.33, to the average of all DWR damage payments ($219.32) in the seven counties considered over the five year period. The calculated Z statistic is 2.44, which is greater than 1.96, the upper limit of the acceptance region at the 95% confidence level or (α =.05), but less than 2.58, the upper limit of the acceptance region at the 99% confidence level or (α =.01). Thus one concludes, with 95% confidence, that the operators interviewed had a greater average BG damage payment than the average damage payment in the seven counties studied. On the other hand, one cannot conclude the same with 99% confidence. This indicates that payments for

operators interviewed are not significantly different from average DWR payments in the seven counties studied if considered at the 99% confidence level.

The third comparison (Table 4) is of average total loss $5.094.79 (same as in Table 2), and an assumed $2,000.00 payment for each of the 52 operators, the maximum payment allowable by state law. The calculated Z statistic is 2.20, which is greater than 1.96, the upper limit of the acceptance region at the 95% level of confidence or (α = .05), but less than 2.58, the upper limit of the acceptance region at the 99% level of confidence or (α = .01). Thus, one concludes with 95% confidence that on the average there was more total damage to the operators in this study than the state allows compensation for in damage payments. However, one cannot conclude that the $2,000.00 limit is inadequate with 99% confidence.

In Table 5, the average total loss of $5,094.79 (Tables 2 and 4), is compared with the average of all DWR damage payments in the seven counties studied, $219.32. This yields a Z statistic of 3.47, which is greater than the 1.96 upper limit of the acceptance region at the 95% level of confidence or (α =.05), and greater than 2.58, the upper limit of the acceptance region at the 99% level of confidence or (α =.01). One can conclude with 99% confidence that on the average there was more total BG damage to the operators studied than was compensated for by DWR damage

payments.

Average DWR payment in Tables 3 and 5 was calculated from data provided by the Utah State DWR for the seven counties considered. All payments for each operation were averaged over the five year period of 1981-82 through 1985-86. There were 224 operators who received damage payments in that period. All other data in Tables 2 - 5 were five year average data from personal interviews with operators in the counties indicated. Operators were interviewed on a willingness basis, which may indicate a tendency for greater loss, and bias the estimates upward.

Permanent Damage to One Orchard

In the winter of 1983-84, deer came into a ten acre peach orchard in North Willard, Box Elder county Utah, and did enough irreparable damage to the trees that they all had to be removed and replaced. The replacement trees were young and immature, and the orchardist estimated that it would take four to five years for the orchard to become fully productive again. The orchardist also estimated from past performance that the orchard produced an average 200 bu. of peaches per acre per year, and that the peaches could be sold for an average of $10.00 per bu., giving a gross revenue of $2,000.00 per acre per year. Table 6 shows the loss of gross revenue, and/or potential gross revenue, to this one time permanent BG damage.

TABLE 6. Potential Revenue Loss to Permanent BG Damage Over a Five Year Period Until the Orchard Can be Brought Back into Production. (Losses on a per acre basis)

YEAR:	1983-84	1984-85	1985-86
REVENUE LOST THIS YEAR:	$2,000.00	$2,000.00	$2,000.00
INTEREST RATE USED:	5.00%	5.00%	5.00%
NUMBER OF YEARS THE ORCHARD HAS NOT PRODUCED REVENUE:	1	2	3
NUMBER OF YEARS UNTIL THE NEW ORCHARD WILL PRODUCE REVENUE:	4	3	2
VALUE TODAY OF POTENTIAL FUTURE REVENUE LOSSES FOR THE YEARS UNTIL THE ORCHARD BECOMES PRODUCTIVE:	$7,091.90	$5,446.50	$3,718.82
VALUE TODAY OF ACTUAL REVENUE LOSSES SINCE THE ORCHARD WAS DAMAGED, WHILE THE NEW ORCHARD WAS MATURING:	$2,000.00	$4,100.00	$6,305.00
TOTAL REVENUE LOSS POTENTIAL: (EACH YEAR REPRESENTS TOTAL LOSS IF EVALUATED THAT YEAR)	$9,091.90	$9,546.50	$10,023.82

TABLE 6. (Continued)

YEAR:	1986-87	1987-88
REVENUE LOST THIS YEAR:	$2,000.00	$2,000.00
INTEREST RATE USED:	5.00%	5.00%
NUMBER OF YEARS THE ORCHARD HAS NOT PRODUCED REVENUE:	4	5
NUMBER OF YEARS UNTIL THE NEW ORCHARD WILL PRODUCE REVENUE:	1	0
VALUE TODAY OF POTENTIAL FUTURE REVENUE LOSSES FOR THE YEARS UNTIL THE ORCHARD BECOMES PRODUCTIVE:	$1,904.76	$0.00
VALUE TODAY OF ACTUAL REVENUE LOSSES SINCE THE ORCHARD WAS DAMAGED, WHILE THE NEW ORCHARD WAS MATURING:	$8,620.25	$11,051.26
TOTAL REVENUE LOSS POTENTIAL: (EACH YEAR REPRESENTS TOTAL LOSS IF EVALUATED THAT YEAR)	$10,525.01	$11,051.26

Row one of Table 6 shows the year under consideration and if one desired to evaluate a loss of gross revenue in this manner, row four gives the year in the permanent BG damage cycle in a more general way. Permanent BG damage loss is given in per acre terms, and when multiplied by the total number of acres gives the total gross revenue loss. Row five of Table 6 gives the number of years until the new orchard will become productive again. This number is used in evaluating the present value of potential future gross revenues from the orchard had it not been destroyed (row six). Row seven gives the future value of gross revenues lost as a result of the damage. Both future value and present value methods are required because, depending on the moment in the cycle the analysis is being performed, some of the gross revenues may be potential gross revenues not yet received and should be discounted to the present, and some of the gross revenues may have already been lost and should have interest added. 1983-84 was the first year the orchard was unproductive. Assuming the gross revenue for each season would have been received by the end of that season, the actual gross revenue loss was the $2,000.00 not received that year because of the BG damage. The potential loss from future gross revenue flows was $7,091.90 giving a total loss of $9,091.90 per acre if the evaluation was done the first year of the cycle. It is not intended that the figures be added year to year and totaled. This evaluation

shows total gross revenue loss per acre to BG damage 1983-84 season. Each column includes all gross revenue losses, including potential gross revenue losses in subsequent seasons, if evaluated that season.

This analysis has been performed on gross revenue losses from a peach orchard, ignoring other costs. One may desire to perform an analysis of permanent BG damage considering net revenue losses. When considering net revenue losses, costs should be broken down into three categories:

1) One-time costs, including replacement trees, special ground preparation costs required in replacing an orchard, and other costs not normally incurred on a productive orchard.

2) Non-deferred costs, which include pruning, irrigation, and fixed costs, etc., which are incurred in a growing orchard whether the orchard is newly planted, or mature and productive.

3) Deferred costs, which include harvesting, etc. These costs are not incurred when the orchard is not productive.

Normally, to figure net revenue, costs are subtracted from gross revenue. However, if permanent damage occurs, gross revenue becomes a liability. Therefore, additional costs during the non-productive cycle are added to potential gross revenue rather than subtracted from it. When estimating net revenue losses to permanent BG damage, one time costs are added only to the first year's loss of gross reve-

nue. Annuity calculations used in Table 6 must then be modified to include non-uniform revenues each year. Non-deferred costs may be ignored, because generally they neither add to nor subtract from losses incurred. Although non-deferred costs may add to losses because of the timing of the costs, ignoring them usually will not measurably affect the analysis. Deferred costs are subtracted from potential gross revenue loss because they are not incurred during the non-productive cycle. After net revenue loss is calculated, and the formula adjustments are made, net revenue can replace gross revenue in Table 6, and net loss to permanent BG damage may be calculated.

The interest rate used is arbitrary, but represents a rate that could be received by the orchardist should he take the money and place it in a pass book savings account in a bank. Arguments could be made for other interest rates such as rates paid by the operator for operating capital, etc. No attempt is made here to assign a "best interest rate" to use.

State Compensation and Private Income

Tables 7 and 8 detail the assistance given operators by the state DWR for damage. Total yearly income from state and other sources, averaged over the five years considered (1981-1986), is shown in Table 8 under "Yearly BG Income". This income includes BG-proof fences provided by the DWR to

TABLE 7. Yearly Assistance From DWR to Operators Claiming Damage -- Total Operators Interviewed.

	YEARLY $ FENCE ASST.[a]	DWR ASSISTANCE DMG PMTS	$/DAMAGE PAYMENT	PAYMENT $/YEAR	ADEQ Y/N[b]
Total:	$24,512.95	117	$34,332.00	$23,209.40	11[c]
Count or # resp:	22	42	42	42	42
Average:	$1,114.23	3	$817.43	$552.60	
Std Dev:	$1,655.58	2	$696.35	$692.87	
High:	$8,000.00	5	$3,000.00[d]	$3,000.00	
Low:	$0.00	1	$40.00	$8.00	
% of total:	42.31%[e]		88.77%[e]		26.19%[f]

a) Ave. value of fence assistance rec. for the past 5 yrs.
b) Were the payments adequate to cover losses to BG.
c) Number of Y responses. d) Reported for 2 families.
e) Percent of operators with assistance.
f) Percent of Y responses.

TABLE 8. Income Derived from BG Sources Both Private and Public.

	TRESPASS PERMITS		HUNTING CLUB[g]		
	$/PERMIT	#SOLD	$/ACRE	# AC	YEARLY BG[h] INCOME
Total:		24	$1,250.00	tot[i]	49,722.35
Count or # resp:	2	2	1	1	52
Average:	$60.71		$1,250.00		$956.20
Std Dev:	$39.29		$0.00		$1,385.93
High:	$100.00		$1,250.00		$8,197.20
Low:	$21.43		$1,250.00		$0.00

g) Trespass permits, and hunting club leases total per year.
h) Averages include all operators with or without BG income. Yearly BG income = yearly fence assistance + payment $/year + yearly $ for trespass permits (approx. = $/permit * # sold) + yearly $ for hunting club leases (approx. = $/acre * # ac leased).
i) Reported on a total basis, number of acres not estimated.

prevent BG damage, damage payments from the DWR, and any other income generated from the sale of private trespass permits, and/or hunting club leases.

In total, 22 operators received $24,512.95 in fence assistance per year, for an average of $1,114.23 per operator per year. Forty-two operators received $34,332.00 per year in BG damage payments from the DWR, an average of $817.43 per operator per year (Table 7).

Rich county had the largest total BG income with 12 operators receiving $21,402.20 per year, an average of $1,783.52 per operator per year. In total, 52 operators received $49,722.35 per year over the five year period, for an average of $956.20 per operator per year. The highest

income received by any single operator was $8,197.20 per year. The minimum income received was $0.00 per year. Data also indicate whether the damage payments were adequate (Table 7). Of the 42 operators who said they had received damage payments from the DWR, 26% indicated that the payments were adequate to cover the losses to damage. The other 31 of those surveyed believed that the payments were inadequate, or did not cover damage losses.

Field or Unharvested Crop Damage

Tables 9 - 10 describe damage to field or unharvested crops in the operations considered. Of the total 5,683 acres of field crops grown, 3,717 acres (approximately 65%) were alfalfa. Corn, barley and others (grass hay and wheat, etc.) made up the other 1,966 acres (Table 9). Table 9 also shows the acres in each category of crop, i.e. annual and perennial. For instance, in Emery county, approximately 484 acres of the field crops grown by those interviewed were perennial, and approximately 138 acres were annual. In total, approximately 4809 acres of the crops reported were perennial and approximately 874 acres were annual. Table 9 also shows percentage of damage by each animal species (See Figure 1).

Table 10 describes damage to the operations, as estimated by operators in dollar terms. Yearly fence damage has been deleted from this section because it was generally not reported by enterprise. Table 10 also gives the BG damage

TABLE 9. Total Acres of Unharvested Crops Affected by BG Damage - Percent of Damage by Animal Species Also Shown.

TOTAL	total acres	% DAMAGE		
		DEER	ELK	OTHER
TOTAL:	5683			
COUNT OR # RESP:	39	39	39	0
MEAN:	145.71	72.67%	27.33%	0.00%
STD DEV:	182.79	0.37	0.37	0.00
HIGH:	1000	100.0%	100.0%	0.00%
LOW:	5	0.00%	0.00%	0.00%
ALFALFA:	3717			
BARLEY:	70			
CORN:	47			
OTHER:	1849			
ANNUAL:	4809			
PERENNIAL:	874			

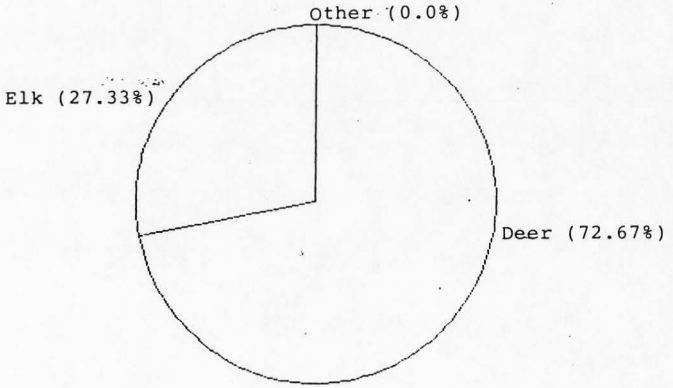

Figure 1. Percent of Damage to Unharvested Crops by Animal Species (See Table 9).

TABLE 10. Total Single Season Losses to Damage in Unharvested Crops (excluding fence).

	Total	Count or # Resp	Mean	Std Dev	High	Low
CONSUMPTION	$84,994.00	29	$2,930.83	3760	$15,750.00	$37.50
TRAMPLING	$1,004.00	3	$334.67	171	$504.00	$100.00
OTHER NUISANCE	$9,341.90	11	$849.26	1085	$4,181.90	$115.50
TOTAL NO FENCE	$95,339.90	32[b]	$2,979.37	3774	$16,250.00	$100.00
TOTAL PER ACRE[a]		32	$30.92	30	$106.67	$1.52

a) $ lost (excluding fence costs) per total acre grown.
b) Of the 39 operators estimating total acres grown, only 32 estimated dollars of damage. Only 32 operations were considered in estimating dollars of damage /acre.

directly attributable to field crops. Total BG damages to field crops per year, and total damages per acre are shown. In total there were $95,339.90 lost per year to field crops for an average of $2,979.37 per operation per year or, $30.92 per acre per year (32 of the 52 operators interviewed had field crop damage).

Harvested Crops or Feed Damage

Tables 11 - 13 describe the BG damage to stored feed

TABLE 11. Direct Feed Damage Costs -- Tons of Feed Stored, Consumed, and Spoiled -- Also Expressed as Percentage of Three Feed Types.

	TOTAL TONS STORED	TONS CONS BY BG	TONS SPLD BY BG	TOTAL DIR[a] $ FEED LOSS	TOTAL DIR $ FEED LOSS/ton
TOTAL:	19932	301.50	302.02	$39,467.45	
% OF TOTAL[b]::	100.00%	1.51%	1.52%	79.97%	
COUNT OR # RESP:	37	32	20	38	37
MEAN:	538.70	9.42	15.10	$1,038.62	$5.48
STD DEV:	678.35	11.07	18.15	1636.42	10.79
HIGH:	3500	50	70	$0.00	$0.00
LOW:	2	0.025	0.5	$7,200.00	$60.00
% ALFALFA[c]:	71.83%	89.96%	93.13%		
% CORN SILAGE:	10.61%	8.62%	2.65%		
% OTHER:	17.56%	1.42%	4.22%		

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a) Direct feed loss includes consumption and spoilage tons (Table 11) * Average $/ton (table 12).
b) % of Total losses Table 13.
c) % of tons in each column of each type feed.

TABLE 12. Average Feed Prices as Estimated by Farmers.

BY COUNTY	AVE $ /TON HAY	AVE $ /TON CORN SILAGE	AVE $ /TON OTHER
COUNT OR # RESP:	32	4	1
MEAN:	$64.69	$23.25	$98.00
STD DEV:	10.96	2.05	0.00
HIGH:	$40.00	$20.00	$98.00
LOW:	$90.00	$25.00	$98.00

TABLE 13. Indirect Feed Damage Costs -- Combined Direct and Indirect Feed Loss Also Shown.

	$ FOR BG[d] FENCE BY FARMER	OTHER TOTAL[e] NUISANCE COSTS	INDR $ FEED LOSS	TOTAL[f] $ FEED LOSS	TOTAL[g] $ FEED LOSS/TON
TOTAL OPERATORS INTERVIEWED					
TOTAL:	$4,905.25	$4,978.30	$9,883.55	$49,351.00	
% OF TOTAL:	9.94%	10.09%	20.03%		
COUNT OR # RESP:	19	11	24	39	37
MEAN:	$258.17	$452.57	$411.81	$1,265.41	$7.31
STD DEV:	295.42	529.53	441.12	1833.45	11.54
LOW:	$22.00	$22.50	$22.00	$0.00	$0.00
HIGH:	$1,200.00	$1,980.	$1,980.	$8,400.00	$60.00

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d) any fence repair, erection costs or materials for BG fence.
e) Nuisance costs + $ for fence.
f) Indirect loss + direct loss.
g) Total feed loss per ton stored.

per year in the operations studied. The data in Table 11 indicate tons stored by the farmers per year, and tons consumed and spoiled per year by BG. Lines eight through ten of Table 11 show the percentage of tons stored in each of three types of feed alfalfa, corn silage and, other (mostly grassy type hays, but also some barley, etc.) (See Figure 2). Data in this table also indicate the total direct feed loss including consumption and spoilage.

There were 19,932 tons of feed stored, or approximately 539 tons per operation per year. Approximately 72% (14,377 tons) were alfalfa. Approximately 11% (2,115 tons) were corn silage. Approximately 18% (3,500 tons) were other, mostly grassy hays. Of the total tons stored 301 tons

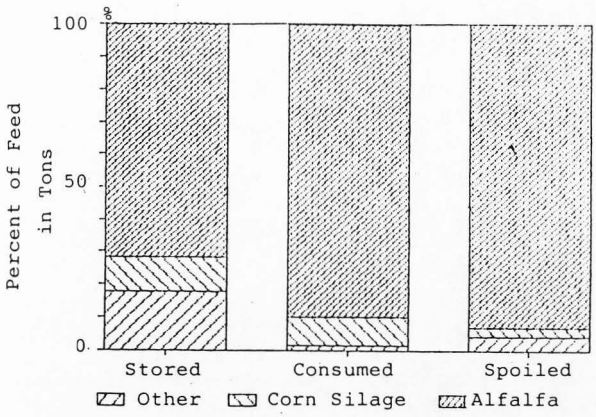

Figure 2. Crops Stored: 1) Alfalfa, 2) Corn Silage, and 3) Other. Reported as a Percentage of: a) Total Tons Stored, b) Tons Consumed, and c) Tons Spoiled by BG. (Table 11).

(approximately 1.51%) were consumed by BG, 302 tons (approximately 1.52%) were spoiled by BG (32 operators estimated direct feed losses, 20 operators estimated feed losses to spoilage). This equates to an average of 9.42 tons consumed, and 15.10 tons spoiled per operation per year. Percent of yearly damage by animal species is illustrated in Figure 3. An average of approximately 69% of the feed damage per operation per year was attributable to deer, and approximately 31% was attributable to elk. Although there was some concern over antelope and moose etc., no estimates of damage percentages attributable to these animals were given.

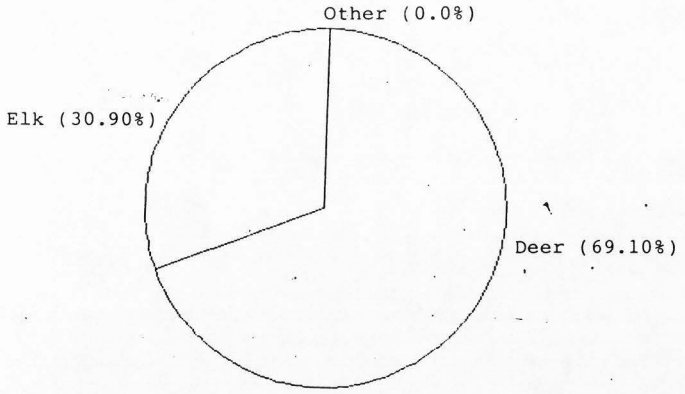

Figure 3. Percent of Damage to Stored Crops by Animal Species.

Table 13 gives the average prices of feed per ton over the five year period, as estimated by the farmers. Table 13 also includes loss per ton stored per year and percent of tons lost by feed type. Losses per ton consider only those operators who estimated total tons stored.

In total, 38 operators reported $39,467.45 direct losses per operation, for an average of $1,038.62 per operation per year. Direct feed loss accounted for approximately 80% of the total feed loss per year.

The data in Table 13 show yearly indirect losses to BG damage. It also adds direct and indirect feed losses (Tables 11 and 13), and reports total losses per ton stored (Table

11). Dollars for BG fence have been included here because many BG fences provided by the DWR are built around stack yards, and farmers were better able to associate BG fence costs to feed loss. Care has been taken to not include DWR fencing costs twice. A total of $49,351.00 per year, or approximately $1,265.41 per operation per year, was lost to direct and indirect costs. This equates to approximately $7.31 per ton of feed initially stored per year.

Orchard Damage

Tables 14 - 16 indicate damage done to the orchards studied. In general, most of the orchardists interviewed were in Box Elder and Utah counties. These are the only counties reported separately. Orchardists in other counties that were interviewed were added in the total operators interviewed section.

Table 14 shows total acres and total damaged acres to those surveyed. Maturity and species of the trees are also given as a percentage of total acres (Figures 4 and 5). Table 14 also includes percentage of damage by animal species (Figure 6). In total, 15 operators interviewed had some damage to orchards. A high percentage of the acres damaged in Box Elder county were peaches, and a high percentage of the acres damaged in Utah county were apples and cherries.

Table 15 shows a single season loss of revenue in

TABLE 14. Total Acres in Orchards With Damage - Number of Damaged Acres -- Percent of Orchard Damage by Animal Species Also Shown.

	total acres	acres damaged	% DAMAGE		
			DEER	ELK	OTHER
TOTAL:	446.26	401.26			
% OF TOTAL[a]:	100.00%	89.92%			
COUNT OR # RESP:	15	15	15	15	15
MEAN:	29.75	26.75	72.30%	27.70%	0.00%
STD DEV:	52.44	52.48	0.43	0.43	0.00
HIGH:	200	200	100.00%	100.00%	0.00%
LOW:	0.08	0.08	0.00%	0.00%	0.00%
% MATURE[b]:	47.32%				
% YOUNG:	6.74%				
% MIX[c]:	45.94%				
% APPLE:	40.34%				
% CHERRY:	45.04%				
% PEACH:	13.45%				
% MIX OR OTHER[d]:	1.17%				

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a) % of total acres reported (operators only reported those acres in orchards where damage had been established).
b) % of trees mature, (etc.) reported by acre.
c) Where age was not established, or a large portion of both young and mature trees were mixed.
d) Where variety of tree was not established, or many varieties in the same orchard were used in estimating the damage.

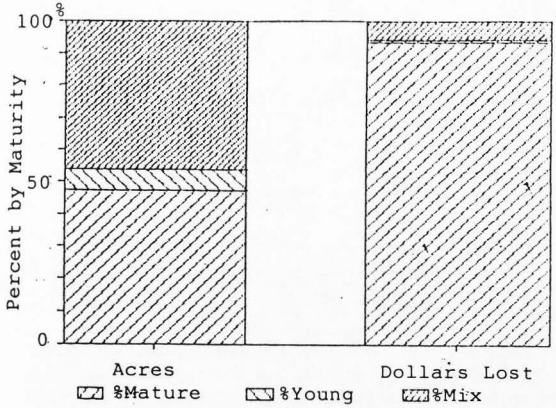

Figure 4. Trees Mature, Young and a Mixture of Both Given as a Percentage of Total Acres and Dollars Lost (Tables 14 and 16).

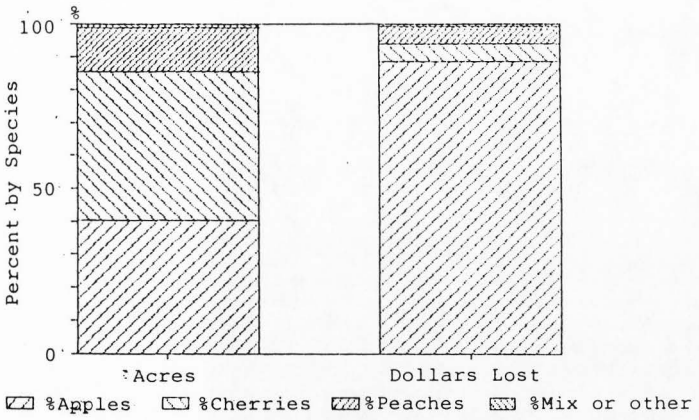

Figure 5. Apple, Cherry, Peach and a Mixture or Other Trees, Given as a Percentage of Total Acres and Dollars Lost (Tables 14 and 16).

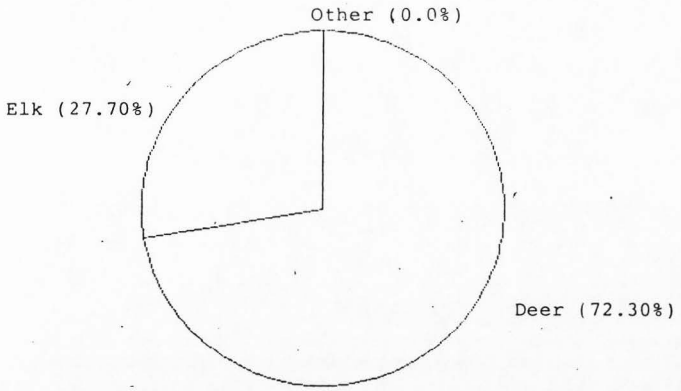

Figure 6. Percent of Damage in Orchards by Animal Species (Table 15).

TABLE 15. Dollars Lost or Spent in a Single Season as a Result of Damage in Orchards.

	CONSUMPTION	EXTRA PREP[e]	FENCE[f] incl build	OTHER NUISANCE
TOTAL:	$93,662.86	$2,388.00	$3,001.00	$1,025.00
% OF TOTAL:	93.59%	2.39%	3.00%	1.02%
COUNT OR # RESP:	10	4	7	3
MEAN:	$9,366.29	$597.00	$428.71	$341.67
STD DEV:	20419.79	409.91	365.62	137.38
HIGH:	$70,000.00	$1,000.00	$1,150.00	$500.00
LOW:	$270.00	$88.00	$55.00	$165.00

e) Any extra materials or labor expended as a result of BG damage.
f) $ spent by the operator for materials and/or labor for repair of fences due to BG damage, or to build BG fence provided by The DWR.

TABLE 16. Total Dollars Lost or Spent as a Result of Damage in Orchards -- Total Acres Reported With Permanent BG Damage Also Shown.

	TOTAL DOLLARS SINGLE SEASON LOSS PER			PERMANENT DAMAGE
	TOTAL	ACRE GROWN	ACRE DAMAGED	ACRES DAMAGED
TOTAL:	$100,076.86			171.23
COUNT OR # RESP:	15	15	15	12
MEAN:	$6,671.79	$292.49	$352.49	14.27
STD DEV:	17169.93	393.36	426.65	27.40
HIGH:	$70,000.00	$1,500.00	$1,500.00	100.00
LOW:	$0.00	$0.00	$0.00	0.03
% MATURE:	93.65%			82.13%
% YOUNG:	0.60%			17.52%
% MIX:	5.75%			0.35%
% APPLE:	88.59%			93.15%
% CHERRY:	5.50%			0.88%
% PEACH:	5.40%			5.90%
% MIX OR OTHER:	0.52%			0.08%

various categories of damages. Consumption damage includes both the eating of buds which are an embodiment of the next fruit crop, and extra preparation required as a result of BG damage. Fence damage is also included. Most orchardists obtain most, if not all of their income, from the orchard enterprise. Therefore most, if not all of the fence damage, can be included in orchard damage. Other nuisance costs are also included.

In total, $93,662.86, or an average of $9,366.29 per orchard per year were reported lost to consumption by 10 orchardists. This is approximately 94% of the total yearly loss to BG in orchards.

Table 16 describes single season dollar losses to BG

damage in orchards by total per year (Figures 4 and 5), total per acre per year, and total dollars per damaged acre per year. These are the sum of single season losses in Table 15. Table 16 also shows the acreages reported to have permanent damage. Estimates of permanent dollar damage were not reported because timing and other considerations, not collected in the interviews, are important in capital budgeting techniques used to determine actual losses over time.

In total, $100,076.86 per year in single season losses were reported by orchard operators. This equates to an average of approximately $292.49 per acre per year, and approximately $352.49 per damaged acre per year. Approximately 99% of this total was found in mature or some mix of mature and young trees. Approximately 89% of the loss was to apples, 6% to cherries, and 6% to peaches. There were 171 acres reported as having yearly permanent damage. This represents about 14 acres per operation per year. Approximately 82% of the permanently damaged acres were mature, and 18% were young or immature. Ninety three percent of this damage was to apples and 6% to peaches.

Range and Rangeland Damage

Tables 17 - 19 describe BG damage to rangeland. Table 18 gives the acres of rangeland managed and damaged yearly as estimated by those surveyed who reported range damage. Table 18 also includes the percentage of damage by animal species (Figure 7). There were 75,970 acres reported, of

TABLE 17. Acres of Rangeland Managed - Acres of Rangeland Damaged -- Percent of Damage by Animal Species Also Shown.

TOTAL	TOTAL ACRES	DAMAGED ACRES	% DAMAGE DEER	% DAMAGE ELK	% DAMAGE OTHER
TOTAL:	75970	66610			
% OF TOTAL:	100.00%	87.68%			
COUNT OR #:	14	14	14	14	14
MEAN:	5426.43	4757.86	66.36%	31.93%	1.71%
STD DEV:	8051.80	7890.10	0.41	0.29	0.06
HIGH:	31000	31000	100.00%	90.00%	24.00%
LOW:	120	120	0.00%	0.00%	0.00%

TABLE 18. Dollar Damage Estimates from Ranchers Interviewed, by Type of Damage.

	SINGLE SEASON LOSS TO		
	CONSUMPTION	TRAMPLING	OTHER NUISANCE
TOTAL:	$9,730.31	$0.00	$905.00
% OF TOTAL:	91.49%	0.00%	8.51%
COUNT OR #:	3	0	1
MEAN:	$3,190.10	$0.00	$905.00
STD DEV:	2262.55	0.00	0.00
HIGH:	$5,000.00	$0.00	$905.00
LOW:	$0.00	$0.00	$905.00

TABLE 19. Total Dollar Damage Estimates on Rangeland -- Per Acre Losses Also Shown.

	TOTAL LOSS	TOTAL LOSS PER ACRE	TOTAL LOSS PER DAMAGED ACRE
TOTAL:	$10,635.31		
COUNT OR #:	14	14	14
MEAN:	$759.67	$2.80	$2.91
STD DEV:	1661.61	9.89	9.87
HIGH:	$5,000.00	$38.46	$38.46
LOW:	$0.00	$0.00	$0.00

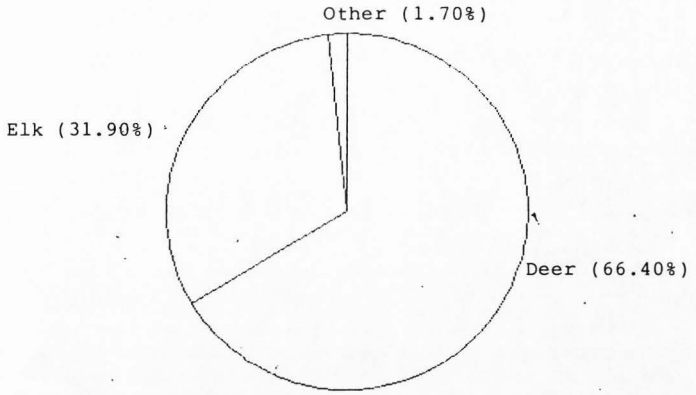

Figure 7. Percent of Damage to Rangelands, by Animal Species (Table 17).

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which 66,610, or approximately 88%, was reported to have some kind of yearly damage. Most of the estimated yearly damage reported was caused by deer (66%), with lesser amounts by elk (32%), and other BG animals (2%).

Table 17 shows estimated single season losses on rangelands. $9,730.31 was estimated lost per year to consumption. No trampling loss was reported, and $905.00 was reported lost to other nuisance costs. There were $10,635.31 estimated total losses per year to BG on rangeland (Table 20). This equates to approximately $759.67 per operation per year, or $2.80 per acre managed, and $2.91 per damaged acre per year.

Fence Losses

Table 20 shows fence losses to BG damage. The first column shows a total of all fence losses and expenses per year as reported by those surveyed (this does not include DWR provided fencing). The next two columns show the total miles of fence reported and the total fence losses per mile per year. The last column shows the total dollars, averaged over the five year period, expended by the operator to build DWR provided BG fences. In total, $7,488.45 was reported lost to BG fence damage per year (not including building DWR provided BG fence). This equates to $277.35 per operation per year, or $92.20 per mile to the 27 operators reporting this type fence damage. $8,155.75 per year were spent by operators to build BG fences provided by the DWR. This equates to $281.23 per operation for the 29 operators receiving BG fence material from the DWR.

TABLE 20. Dollars Spent or Lost on Fences Due to BG Damage.

	TOTAL FENCE[a]	MILES OF FENCE	AVE TOTAL $/MILE	AVERAGE $ TO BLD BG FENCE[b]
TOTAL:	$7,488.45	245.62		$8,155.75
COUNT OR # RESP:	27	25	25	29
MEAN:	$277.35	9.82	$92.20	$281.23
STANDARD DEV:	$310.97	8.74	$189.46	$412.60
HIGH:	$1,500.00	33	$945.95	$1,844.50
LOW:	$22.00	0.37	$2.20	$0.00

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a) Dollars for maintenance of fences not specifically designed to keep BG out.
b) Dollars spent by the agriculturist to build BG fences with materials provided by the DWR.

CHAPTER V

RESPONDENTS COMMENTS

DWR Assistance

Operators' comments to section one of the questionnaire were varied. When asked if the damage payments from the DWR were adequate, 31 of 42 (73.8%) operators receiving payments said that they were inadequate. When queried "why", the response was usually that damages were higher than payments received. Even some of those who said the payment was adequate, were disillusioned with the method of assessment or cooperation from the DWR in settling damage claims. Methods of preventing damage were also seriously questioned by many of those interviewed. It was difficult to erect fences provided by the DWR, because gates were not commonly provided. Furthermore, these fences caused serious problems in terms of getting equipment in and out of an enclosure. Stack yard fences are at least an inconvenience or nuisance. In the case of dairy yards, the fence is intolerable in terms of moving big trucks in and out for milk pick up, hay or other feed delivery, and any other movement in and out of the barnyard. All the dairy farmers interviewed indicated that fencing the yard would be too confining in terms of moving equipment. Some of those interviewed indicated that the type of fencing provided was unsatisfactory for their operation. One individual reported purchasing fencing

materials and keeping the elk out of his haystack without DWR assistance. Most of those interviewed indicated that after the fence was erected the damage problem generally subsided. However, more than one individual indicated that deer would climb through or under the fence to get to the feed.

Fee Hunting

Only three of the 51 operators interviewed indicated that they had ever provided private trespass permits or leased to hunting clubs. Two of the three had sold permits only a few times. The third regularly leases to a hunting club at a nominal fee. Responses from the other operators indicate that they do not want to sell trespass permits or have anything to do with hunting clubs. Some of the operators, such as some in the south part of Cache county, had land near BG winter range, and had few, if any BG, on their land during hunting season. Some of these landowners were emotionally distraught because of the recent development of a hunting club excluding them from hunting on land where they had traditionally hunted. This particular hunting club caters to "out of state" hunters, and charges a substantial fee for hunting rights. Landowners interviewed believe that the hunting clubs' exclusive hunting was causing the elk herd to increase in size, which put more pressure on their cropland and private range for BG winter feed. If this is the case, in addition to losing the

privilege of hunting on those areas, these landowners are incurring increased expenses due to the hunting club.

Trespass

This survey did not attempt to undertake the evaluation of costs to private landowners resulting from trespass. However, because of the overwhelming response by those interviewed, some mention of trespass will be made at this point. One farmer indicated that it required three men on horseback 10 hrs. a day over the duration of the deer hunting season to prevent fence damage and to keep hunters from shooting his cattle. One farmer indicated that a tractor left out on his property had been damaged. Still another farmer indicated that persons trespassing were destroying ancient Indian petroglyph art. He even indicated that he thought the destruction of this irreplaceable artifact far outweighed the damage deer were doing to his fences and crops yearly. From the general nuisance of having to round up cattle because of gates being left open by trespassers to the more serious examples of general destruction, the impact of trespassers on agricultural producers is apparent. It is fair to say that a large portion of damage comes from hunters, either during the season or in preparation for it. BG presence then becomes a leading factor in trespass damage. It is generally believed that a small number of hunters are responsible for most of

the damage. However, it takes only a few people with guns or other equipment to cause a great deal of damage.

Population

Another area of great concern to operators, especially those in areas of highest impact, are increases in BG populations. Operators in the more remote locations such as the Randolph-Woodruff areas of Rich county, Sanpete, Emery and Uintah counties, and even some closer to urban areas like Hyrum in Cache county, expressed concerns with BG population growth. They believe that the DWR policies are causing or allowing BG population increases to accommodate the increased recreational demand and that private landowners are being asked to absorb much of the economic impact. Such a policy would require the private landowner to subsidize the program by involuntarily feeding the animals most of the winter months. Operators who are dependant on public lands for range feed believe that increasing wildlife populations are affecting grazing policies and causing government agencies to reduce AUM (animal unit month) allocations from livestock to accommodate the extra wildlife.

CHAPTER VI

CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

Figures indicate the monetary damage to farmers, orchardists, and ranchers in the seven counties of this study (Tables 7-20). A significant portion of the problem seems to go beyond the feed or crops consumption. Fence costs average $277.35 per operation per year and $92.20 per mile of fence maintained by the operator (this does not include costs to build and maintain DWR provided fences) (Table 20). Costs to build and maintain DWR provided fence totaled $8,155.75 for 29 operators, or $281.23 per operation (Table 20). Other costs also contribute in large measure to losses from damage. For instance, in damage to harvested crops, as many tons of feed were spoiled as were actually consumed (Table 11). Trampling losses (Table 10) were minimal in total -- only three operators evaluated losses totaling $1,004.00 per year. However, many more indicated that this was a problem, yet were unable to estimate the costs. This could lead one to suspect that there are many potential underlying costs to BG which are difficult to estimate.

Operational Losses

Orchards

Orchardists appear to have the greatest potential for

damage loss. Several attributes of orchards contribute to excessive damage potential: 1) trees are generally an available source of feed year around, 2) fruit is a high value and vulnerable crop and 3) length of time required to mature an orchard makes loss of revenue and potential revenue over time a real possibility. The mean single season damage loss was $10,461.54 per operation per year. In addition to single season losses, there were over 171 acres with permanent damage (damage considered to extend beyond one year) in the orchards studied (Table 16). Potential permanent damage was over $9,000.00 per acre actual and potential gross revenue loss in one orchard. This damage resulted from a year when deer came in and damaged the trees to the point where they had to be replaced (Table 6). Losses and potential damage losses to orchards damage must obviously be considered when evaluating BG damage.

Unharvested Crops and Feed

There were 625,000 acres of hay (470,00 acres of alfalfa) grown in Utah in 1986 which yielded 2,135,000 tons of hay (1,833,000 tons of alfalfa hay) (Utah Department of Agriculture 1987). It is not surprising to find that unharvested crops and feed, both consisting of a high percentage of hay, are second and third in terms of the dollar damage losses among the operators studied here.

Damage to crops and feed come in many varied ways. The major contributors included consumption of crops and feed,

and ruining feed. Other contributors to damage are also significant to these two categories. Trampling and other nuisance costs contributed over $10,000.00 per year to damage costs to un-harvested crops. Building and maintaining BG fences provided by the DWR contributed $4.905.25 per year. When combined with nuisance costs, fence maintenance contributed almost $10,000.00 of indirect feed costs per year, which is over 20% of the damage costs to feed (Table 13).

Range

Damage to rangeland is not as easily defined as are the other damages indicated above. Some benefits from deer grazing may be evident in terms of plant composition (Austin, et al. 1986). Many producers, on the other hand, would argue that timing and fence damage are major considerations. It takes a considerable length of time for the over-grazing of BG to effect a change of plant composition from shrubby plants to the grassy plants preferred by domestic livestock. Timing makes management, which depends on BG to change plant composition, cost prohibitive.

Many of the livestock producers interviewed considered rangeland as native to BG, and didn't desire to see them removed. They did feel threatened by what they saw as attempts by the DWR to increase wildlife herd sizes and

moves by other government agencies to cut grazing permit privileges.

Remuneration

No attempt has been made in this study to assign responsibility for the damages. The ownership and responsibility for wildlife claimed by the state was assumed, and data were collected in an attempt to find out if the remuneration available covered the losses.

The data clearly show that, for the operations in this study, remuneration attempts fall short of compensating the operators for their losses. The best indicator of the shortfall in compensation is the comparison between a mean damage loss of $5,094.79 per operation and mean compensation of $572.15 per operation. This suggests the distance between losses to damage and income from BG sources to the landowners in the study. While there are some who benefit from BG on their land, the people in this study who are paying for the maintenance of wildlife are receiving few, if any of the benefits.

Many of the operators who received fencing material from the DWR, said that the damage had been substantially reduced. However, in some cases, the costs of erecting and/or maintaining BG fences made them cost prohibitive, even when the materials were provided by the DWR.

Further Research

Many areas of research are needed to obtain a better understanding of the problem Ag-producers face from BG presence. In order to establish an aggregate impact, total figures in terms of number of operators and dollar damage losses are needed. In addition, further research into permanent damage is needed to understand the potential for damage which is not immediate, but is long lasting. A greater understanding of the benefits and/or costs of BG fencing should be sought, as well as other determinations of how well current benefits are working. Many producers saw trespass as being a major problem relating to the presence of these animals. Although this problem was not included in this study, it merits additional research.

Cooperation Advised

Losses, when compared to total inventory, may seem small. However, when losses come off the top, profit margin, which is small at best in agricultural production, suffers. This difference can be the difference between making a profit or incurring a loss in some cases.

Even though it may be difficult to estimate damage on a field crop such as barley, or on some rangeland. The farmers' estimates found in this study should be of interest to policy makers. "Perceived" damages, though they may or may not be accurate, indicate the level of anxiety and interest of landowners in policies regarding wildlife and

damage payments. Potential damage is affected by those rules and policies set to direct the management of wildlife. Even though those people whose anxieties are heightened by the presence of these animals don't represent a large proportion of voters, and their activities cannot have a significant impact on the state economically, their actions can have a grave impact on the wildlife in question. Cooperation between those administering wildlife, and landowners affected by it, is essential if both wildlife and private landowners are to enjoy the benefits available from the land of the state.

More sensitivity and understanding by state agencies toward landowners could help ease tensions on this volatile subject. A greater effort by landowners to be educated about the possible advantages to them of BG presence would also help ease the problems experienced. Both agricultural production and BG management could be enhanced by this cooperative effort.

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APPENDIX

TABLE 21. Yearly Assistance From DWR to Operators Claiming Damage.

BY COUNTY	DWR ASSISTANCE YEARLY $ FENCE ASST.[a]	# DMG PMTS	$/ DAMAGE PAYMENT	PAYMENT $ /YEAR	ADEQ Y/N[b]
BOXELDER COUNTY					
Total[c]:	$1,000.00	5	$100.00	$100.00	0
Count or # resp:	1	1	1	1	1
Average:	$1,000.00	5	$100.00	$100.00	
Std Dev:	$0.00	0	$0.00	$0.00	
High:	$1,000.00	5	$100.00	$100.00	
Low:	$1,000.00	5	$100.00	$100.00	
% of total:	25.00%[d]		25.00%		0.00%[e]
CACHE COUNTY					
Total:	$4,075.00	25	$7,595.00	$6,569.00	3
Count or # resp:	5	8	8	8	8
Average:	$815.00	3	$949.38	$821.13	
Std Dev:	$670.55	2	$951.33	$1,022.27	
High:	$2,000.00	5	$3,000.00[f]	$3,000.00	
Low:	$10.00	1	$65.00	$13.00	
% of total:	55.56%		88.89%		37.50%
EMERY COUNTY					
Total:	$3,620.00	17	$2,365.00	$1,626.00	1
Count or # resp:	5	7	7	7	7
Average:	$724.00	2	$337.86	$232.29	
Std Dev:	$636.16	2	$259.92	$260.95	
High:	$1,500.00	5	$650.00	$650.00	
Low:	$120.00	1	$40.00	$8.00	
% of total:	71.43%		100.00%		14.29%
RICH COUNTY					
Total:	$12,950.00	32	$10,761.00	$6,752.20	3
Count or # resp:	5	11	11	11	11
Average:	$2,590.00	3	$978.27	$613.84	
Std Dev:	$2,845.77	2	$598.34	$548.29	
High:	$8,000.00	5	$2,000.00	$1,925.00	
Low:	$0.00	1	$150.00	$30.00	
% of total:	41.67%		91.67%		27.27%

TABLE 21. (Continued)

BY COUNTY	DWR ASSISTANCE YEARLY $ FENCE ASST.	# DMG PMTS	$/ DAMAGE PAYMENT	PAYMENT $ /YEAR	ADEQ Y/N
SANPETE COUNTY					
Total:	$400.00	8	$2,200.00	$640.00	1
Count or # resp:	1	4	4	4	4
Average:	$400.00	2	$550.00	$160.00	
Std Dev:	$0.00	2	$388.91	$86.89	
High:	$400.00	5	$1,200.00	$250.00	
Low:	$400.00	1	$250.00	$50.00	
% of total:	14.29%		57.14%		25.00%
UINTAH COUNTY					
Total:	$1,167.95	7	$4,060.00	$912.00	1
Count or # resp:	3	5	5	5	5
Average:	$389.32	1	$812.00	$182.40	
Std Dev:	$317.66	0	$655.27	$115.75	
High:	$831.60	2	$2,000.00	$400.00	
Low:	$100.00	1	$200.00	$80.00	
% of total:	60.00%		100.00%		20.00%
UTAH COUNTY					
Total:	$1,300.00	23	$7,251.00	$6,610.20	2
Count or # resp:	2	6	6	6	6
Average:	$650.00	4	$1,208.50	$1,101.70	
Std Dev:	$550.00	2	$606.96	$738.25	
High:	$1,200.00	5	$2,000.00	$2,000.00	
Low:	$100.00	1	$351.00	$70.20	
% of total:	25.00%		75.00%		33.33%
OF TOTAL OPERATORS INTERVIEWED					
Total:	$24,512.95	117	$34,332.00	$23,209.40	11
Count or # resp:	22	42	42	42	42
Average:	$1,114.23	3	$817.43	$552.60	
Std Dev:	$1,655.58	2	$696.35	$692.87	
High:	$8,000.00	5	$3,000.00	$3,000.00	
Low:	$0.00	1	$40.00	$8.00	
% of total:	42.31%		88.77%		26.19%

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a) Ave. value of fence assistance rec. for the past 5 yrs.
b) Were the payments adequate to cover losses to BG.
c) Number of Y responses.
e) Percent of operators with assistance.
f) Percent of Y responses.
d) Reported for 2 families.

TABLE 22. Income Derived from BG Sources Both Private and Public.

BY COUNTY	TRESPASS PERMITS $/PERMIT	TRESPASS PERMITS #SOLD	HUNTING CLUB[g] $/ACRE	HUNTING CLUB[g] # AC	YEARLY BG[h] INCOME
BOXELDER COUNTY					
Total:		0	$0.00	0	$1,100.00
Count or # resp:	0	0	0	0	4
Average:	$0.00				$275.00
Std Dev:	$0.00				$420.57
High:	$0.00				$1,000.00
Low:	$0.00				$0.00
CACHE COUNTY					
Total:		3	$0.00	0	$10,944.00
Count or # resp:	1	1	0	0	9
Average:	$100.00				$1,216.00
Std Dev:	$0.00				$1,208.07
High:	$100.00				$3,500.00
Low:	$100.00				$13.00
EMERY COUNTY					
Total:		0	$0.00	0	$5,246.00
Count or # resp:	0	0	0	0	7
Average:					$749.43
Std Dev:					$807.49
High:					$2,100.00
Low:					$8.00
RICH COUNTY					
Total:		21	$1,250.00	TOT[i]	$21,402.20
Count or # resp:	1	1	1	1	12
Average:	$21.43	21	$1,250.00		$1,783.52
Std Dev:	$0.00	0	$0.00		$2,158.96
High:	$21.43	21	$1,250.00		$8,197.20
Low:	$21.43	21	$1,250.00		$0.00

TABLE 22. (Continued)

BY COUNTY	TRESPASS PERMITS $/PERMIT	TRESPASS PERMITS #SOLD	HUNTING CLUB $/ACRE	HUNTING CLUB # AC	YEARLY BG INCOME
SANPETE COUNTY					
Total:		0	$0.00	0	$1,040.00
Count or # resp:	0	0	0	0	7
Average:					$148.57
Std Dev:					$159.50
High:					$450.00
Low:					$0.00
UINTAH COUNTY					
Total:		0	$0.00	0	$2,079.95
Count or # resp:	0	0	0	0	5
Average:					$415.99
Std Dev:					$324.00
High:					$943.60
Low:					$80.00
UTAH COUNTY					
Total:		0	0	0	$7,910.20
Count or # resp:	0	0	0	1	8
Average:					$988.78
Std Dev:					$989.26
High:					$2,700.00
Low:					$0.00
OF TOTAL OPERATORS INTERVIEWED					
Total:		24	$1,250.00	tot	$49,722.35
Count or # resp:	2	2	1	1	52
Average:	$60.71		$1,250.00		$956.20
Std Dev:	$39.29		$0.00		$1,385.93
High:	$100.00		$1,250.00		$8,197.20
Low:	$21.43		$1,250.00		$0.00

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g) Trespass permits, and hunting club leases total per year.
h) Averages include all operators with or without BG income. Yearly BG income = yearly fence assistance + payment $/year + yearly $ for trespass permits (approx. = $/permit * # sold) + yearly $ for hunting club leases (approx. = $/acre * # ac leased).
i) Reported on a total basis, # of acres not estimated.

TABLE 23. Total Acres of Unharvested Crops Affected by BG Damage - Percent of Damage by Animal Species Also Shown.

BY COUNTY	total acres	% DAMAGE DEER	ELK	OTHER
BOXELDER COUNTY				
TOTAL:	200			
COUNT OR # RESP:	1	1	0	0
MEAN:	200	100.00%	0.00%	0.00%
STD DEV:	0	0.00	0.00	0.00
HIGH:	200	100.00%	0.00%	0.00%
LOW:	200	100.00%	0.00%	0.00%
ALFALFA:	200			
BARLEY:	0			
CORN:	0			
OTHER:	0			
PERENNIAL:	200			
ANNUAL:	0			
CACHE COUNTY				
TOTAL:	850			
COUNT OR # RESP:	6	6	6	6
MEAN:	141.66	36.67%	63.33%	0.00%
STD DEV:	110.36	0.37	0.37	0.00
HIGH:	350	100.00%	100.00%	0.00%
LOW:	40	10.00%	0.00%	0.00%
ALFALFA:	800			
BARLEY:	50			
CORN:	0			
OTHER:	0			
PERENNIAL:	708			
ANNUAL:	142			
EMERY COUNTY				
TOTAL:	622			
COUNT OR # RESP:	9	9	9	9
MEAN:	69.11	98.89%	1.11%	0.00%
STD DEV:	42.50	0.03	0.03	0.00
HIGH:	140	100.00%	10.00%	0.00%
LOW:	10	90.00%	0.00%	0.00%
ALFALFA:	600			
BARLEY:	0			
CORN:	12			
OTHER:	10			
PERENNIAL:	484			
ANNUAL:	138			

TABLE 23. (Continued)

BY COUNTY	total acres	% DAMAGE		
RICH COUNTY		DEER	ELK	OTHER
TOTAL:	1986			
COUNT OR # RESP:	11	11	11	11
MEAN:	180.54	54.09%	36.82%	0.00%
STD DEV:	272.42	0.46	0.45	0.00
HIGH:	1000	100.00%	100.00%	0.00%
LOW:	12	0.00%	0.00%	0.00%
ALFALFA:	932			
BARLEY:	20			
CORN:	0			
OTHER:	1034			
PERENNIAL:	1625			
ANNUAL:	361			
SANPETE COUNTY				
TOTAL:	1315			
COUNT OR # RESP:	6	6	6	6
MEAN:	219.16	60.83%	39.17%	0.00%
STD DEV:	185.36	0.21	0.21	0.00
HIGH:	600	90.00%	75.00%	0.00%
LOW:	5	25.00%	10.00%	0.00%
ALFALFA:	590			
BARLEY:	0			
CORN:	0			
OTHER:	725			
PERENNIAL:	1315			
ANNUAL:	0			
UINTAH COUNTY				
TOTAL:	710			
COUNT OR # RESP:	6	6	6	6
MEAN:	118.33	94.00%	6.00%	0.00%
STD DEV:	119.18	0.13	0.13	0.00
HIGH:	380	100.00%	35.00%	0.00%
LOW:	35	65.00%	0.00%	0.00%
ALFALFA:	595			
BARLEY:	0			
CORN:	35			
OTHER:	80			
PERENNIAL:	592			
ANNUAL:	118			

TABLE 23. (Continued)

TOTAL	total acres	% DAMAGE		
		DEER	ELK	OTHER
TOTAL OPERATORS INTERVIEWED				
TOTAL:	5683			
COUNT OR # RESP:	39	39	39	0
MEAN:	145.71	72.67%	27.33%	0.00%
STD DEV:	182.79	0.37	0.37	0.00
HIGH:	1000	100.0%	100.0%	0.00%
LOW:	5	0.00%	0.00%	0.00%
ALFALFA:	3717			
BARLEY:	70			
CORN:	47			
OTHER:	1849			
PERENNIAL:	4809			
ANNUAL:	874			

TABLE 24. Single Season Losses to Damage in Unharvested Crops (excluding fence).

BY COUNTY	SINGLE SEASON LOSS		
	CONSUMPTION	TRAMPLING	OTHER NUISANCE
BOXELDER COUNTY			
TOTAL:	$15,750.00	$0.00	$500.00
COUNT OR # RESP:	1	1[b]	1
MEAN:	$15,750.00	$0.00	$500.00
STD DEV:	0	0	0
HIGH:	$15,750.00	$0.00	$500.00
LOW:	$15,750.00	$0.00	$500.00
CACHE COUNTY			
TOTAL:	$936.00	$504.00	$1,181.00
COUNT OR # RESP:	2	1	2
MEAN:	$468.00	$504.00	$590.50
STD DEV:	412	0	57.5
HIGH:	$880.00	$504.00	$648.00
LOW:	$56.00	$504.00	$533.00
EMERY COUNTY			
TOTAL:	$28,542.50	$400.00	$2,347.90
COUNT OR # RESP:	8	1	5
MEAN:	$3,567.81	$400.00	$469.58
STD DEV:	4252.34	0	245.76
HIGH:	$12,000.00	$400.00	$800.00
LOW:	$37.50	$400.00	$150.40
RICH COUNTY			
TOTAL:	$6,809.00	$0.00	$5,197.50
COUNT OR # RESP:	6	0	2
MEAN:	$1,134.83	$0.00	$2,598.75
STD DEV:	766.14	0	1583.15
HIGH:	$2,600.00	$0.00	$4,181.90
LOW:	$122.00	$0.00	$1,015.60
SANPETE COUNTY			
TOTAL:	$17,437.50	$100.00	$115.50
COUNT OR # RESP:	6	1	1
MEAN:	$2,906.25	$100.00	$115.50
STD DEV:	2622.18	0	0
HIGH:	$7,540.00	$100.00	$115.50
LOW:	$100.00	$100.00	$115.50

TABLE 24. (Continued)

BY COUNTY	SINGLE SEASON LOSS		
	CONSUMPTION	TRAMPLING	OTHER NUISANCE
UINTAH COUNTY			
TOTAL:	$15,519.00	$0.00	$0.00
COUNT OR # RESP:	6	0	0
MEAN:	$2,586.50	$0.00	$0.00
STD DEV:	1848.19	0	0
HIGH:	$5,880.00	$0.00	$0.00
LOW:	$437.50	$0.00	$0.00
OF TOTAL OPERATORS INTERVIEWED			
TOTAL:	$84,994.00	$1,004.00	$9,341.90
COUNT OR # RESP:	29	3	11
MEAN:	$2,930.83	$334.67	$849.26
STD DEV:	3760.26	171.28	1085.35
HIGH:	$15,750.00	$504.00	$4,181.90
LOW:	$37.50	$100.00	$115.50

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b) Responded positive to question, but had no dollar value.

TABLE 25. Total Single Season Losses to Damage in Unharvested Crops (Excluding Fence).

BY COUNTY	SINGLE SEASON LOSS CONTD' TOTAL (NO FENCE)	TOTAL PER ACRE$_C$
BOXELDER COUNTY		
TOTAL:	$16,250.00	
COUNT OR # RESP:	1	1
MEAN:	$16,250.00	$81.25
STD DEV:	0	0
HIGH:	$16,250.00	$81.25
LOW:	$16,250.00	$81.25
CACHE COUNTY		
TOTAL:	$2,621.00	
COUNT OR # RESP:	4	4
MEAN:	$655.25	$6.21
STD DEV:	136.55	3.72
HIGH:	$880.00	$11.20
LOW:	$533.00	$1.52
EMERY COUNTY		
TOTAL:	$31,290.40	
COUNT OR # RESP:	9	9
MEAN:	$3,476.71	$38.98
STD DEV:	4328.80	34.87
HIGH:	$12,800.00	$106.67
LOW:	$100.00	$2.00
RICH COUNTY		
TOTAL:	$12,006.50	
COUNT OR # RESP:	6	6
MEAN:	$2,001.08	$38.13
STD DEV:	1797.57	33.61
HIGH:	$5,181.90	$106.34
LOW:	$122.00	$10.17
SANPETE COUNTY		
TOTAL:	$17,653.00	
COUNT OR # RESP:	6	6
MEAN:	$2,942.17	$20.27
STD DEV:	2598.07	15.90
HIGH:	$7,540.00	$43.09
LOW:	$200.00	$2.25

TABLE 25. (Continued)

BY COUNTY	SINGLE SEASON LOSS CONTD'	
	TOTAL (NO FENCE)	TOTAL PER ACRE
UINTAH COUNTY		
TOTAL:	$15,519.00	
COUNT OR # RESP:	6	6
MEAN:	$2,586.50	$30.33
STD DEV:	1848.19	23.58
HIGH:	$5,880.00	$73.50
LOW:	$437.50	$10.42
OF TOTAL OPERATORS INTERVIEWED		
TOTAL:	$95,339.90	
COUNT OR # RESP:	32[d]	32
MEAN:	$2,979.37	$30.92
STD DEV:	3773.76	30.20
HIGH:	$16,250.00	$106.67
LOW:	$100.00	$1.52

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c) $ lost (excluding fence costs) per total acre grown.
d) Only 32 of the 39 farmers estimating total acres grown, estimated dollars of damage. Only acres in the 32 operations estimating dollar damage were used in the dollars /acre estimate.

TABLE 26. Percent of Damage to Stored Feed Crops, by Animal Species -- Tons Stored -- Direct Feed Damage Also Shown as a Percentage of Three Feed Types.

BY COUNTY	% DAMAGE [a] DEER	ELK	OTHER	TOTAL TONS STORED	TONS CONS BY BG	TONS SPLD BY BG
BOXELDER						
TOTAL:				1020	0.5	0.5
% OF TOTAL:					0.05%	0.05%
COUNT OR # RESP:	2	2	2	2	1	1
MEAN:	100.00%	0.00%	0.00%	510	0.5	0.5
STD DEV:	0.00	0.00	0.00	490.00	0.00	0.00
HIGH:	100.00%	0.00%	0.00%	1000	0.5	0.5
LOW:	100.00%	0.00%	0.00%	20	0.5	0.5
% ALFALFA[b]:				100.00%	100.00%	100.00%
% CORN SILAGE:				0.00%	0.00%	0.00%
% OTHER:				0.00%	0.00%	0.00%
CACHE						
TOTAL:				4467	112.15	93.37
% OF TOTAL:					2.51%	2.09%
COUNT OR # RESP:	12	12	12	11	12	5
MEAN:	62.08%	37.92%	0.00%	406.09	9.35	18.67
STD DEV:	0.44	0.44	0.00	308.77	10.34	15.63
HIGH:	100.00%	100.00%	0.00%	1000	31.13	43.87
LOW:	0.00%	0.00%	0.00%	2	0.025	3.5
% ALFALFA:				55.23%	76.80%	91.43%
% CORN SILAGE:				44.77%	23.18%	8.57%
% OTHER:				0.00%	0.02%	0.00%
EMERY						
TOTAL:				1500	60.5	77.5
% OF TOTAL:					4.03%	5.17%
COUNT OR # RESP:	7	7	7	7	5	4
MEAN:	85.71%	14.29%	0.00%	214.29	12.10	19.38
STD DEV:	0.35	0.35	0.00	244.59	19.01	29.23
HIGH:	100.00%	100.00%	0.00%	800	50	70
LOW:	0.00%	0.00%	0.00%	25	0.5	1.5
% ALFALFA:				92.33%	100.00%	100.00%
% CORN SILAGE:				7.67%	0.00%	0.00%
% OTHER:				0.00%	0.00%	0.00%

TABLE 26. (Continued)

BY COUNTY	% DAMAGE DEER	% DAMAGE ELK	% DAMAGE OTHER	TOTAL TONS STORED	TONS CONS BY BG	TONS SPLD BY BG
RICH						
TOTAL:				9730	103.35	117.65
% OF TOTAL:					1.06%	1.21%
COUNT OR # RESP:	9	9	9	9	9	7
MEAN:	63.89%	36.11%	0.00%	1081.11	11.48	16.81
STD DEV:	0.39	0.39	0.00	1049.11	7.58	13.11
HIGH:	100.00%	100.00%	0.00%	3500	25	37.5
LOW:	0.00%	0.00%	0.00%	180	3.6	5
% ALFALFA:				64.03%	95.89%	89.16%
% CORN SILAGE:				0.00%	0.00%	0.00%
% OTHER:				35.97%	4.11%	10.84%
SANPETE						
TOTAL:				1600	14	0
% OF TOTAL:					0.87%	0.00%
COUNT OR # RESP:	4	4	4	3	2	0
MEAN:	56.25%	43.75%	0.00%	533.33	7.00	0.00
STD DEV:	0.37	0.37	0.00	94.28	3.00	0.00
HIGH:	100.00%	100.00%	0.00%	600	10	0
LOW:	0.00%	0.00%	0.00%	400	4	0
% ALFALFA:				100.00%	100.00%	0.00%
% CORN SILAGE:				0.00%	0.00%	0.00%
% OTHER:				0.00%	0.00%	0.00%
UINTAH						
TOTAL:				1600	10.5	7.5
% OF TOTAL:					0.66%	0.47%
COUNT OR # RESP:	3	3	3	3	2	1
MEAN:	83.33%	16.67%	0.00%	533.33	5.25	7.50
STD DEV:	0.24	0.24	0.00	577.83	2.75	0.00
HIGH:	100.00%	50.00%	0.00%	1350	8	7.5
LOW:	50.00%	0.00%	0.00%	100	2.5	7.5
% ALFALFA:				100.00%	100.00%	100.00%
% CORN SILAGE:				0.00%	0.00%	0.00%
% OTHER:				0.00%	0.00%	0.00%

TABLE 26. (Continued)

BY COUNTY	% DAMAGE			TOTAL TONS	TONS CONS	TONS SPLD
	DEER	ELK	OTHER	STORED	BY BG	BY BG
UTAH						
TOTAL:				15	0.5	5.5
% OF TOTAL:					3.33%	36.67%
COUNT OR # RESP:	2	2	2	2	1	2
MEAN:	50.00%	50.00%	0.00%	7.50	0.50	2.75
STD DEV:	0.50	0.50	0.00	2.50	0.00	2.25
HIGH:	100.00%	100.00%	0.00%	10	0.5	5
LOW:	0.00%	0.00%	0.00%	5	0.5	0.5
% ALFALFA:				100.00%	100.00%	100.00%
% CORN SILAGE:				0.00%	0.00%	0.00%
% OTHER:				0.00%	0.00%	0.00%
OF TOTAL OPERATORS INTERVIEWED						
TOTAL:				19932	301.50	302.02
% OF TOTAL:					1.51%	1.52%
COUNT OR # RESP:	39	39	0	37	32	20
MEAN:	69.10%	30.90%	0.00%	538.70	9.42	15.10
STD DEV:	40.81%	40.81%	0.00%	678.35	11.07	18.15
HIGH:	100.00%	100.00%	0.00%	3500	50	70
LOW:	0.00%	0.00%	0.00%	2	0.025	0.5
% ALFALFA:				71.83%	89.96%	93.13%
% CORN SILAGE:				10.61%	8.62%	2.65%
% OTHER:				17.56%	1.42%	4.22%

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a) % damage in Table 6.a indicates percent damage done by each species to a particular operation.
b) % tons in each column of each type feed.

TABLE 27. Average Feed Prices as Estimated by Farmers -- Total Direct Feed Loss Also Shown.

BY COUNTY	AVE $ / TON HAY	AVE $ / TON C SLG	AVE $ / TON OTHER	TOTAL DIR[C] $ FEED LOSS	TOTAL DIR $ FEED LOSS/ton
BOXELDER					
TOTAL:				$65.00	
% OF TOTAL[A]:				49.62%	
COUNT OR # RESP[B]:	2	0	0	2	2
MEAN:	$65.00	$0.00	$0.00	$32.50	$1.63
STD DEV:	0.00	0.00	0.00	32.50	1.63
HIGH:	$65.00	$0.00	$0.00	$65.00	$3.25
LOW:	$65.00	$0.00	$0.00	$0.00	$0.00
CACHE					
TOTAL:				$14,557.45	
% OF TOTAL:				88.32%	
COUNT OR # RESP:	8	3	1	12	11
MEAN:	$75.00	$22.67	$98.00	$1,213.12	$6.78
STD DEV:	$12.85	$2.05	$0.00	1913.09	9.25
HIGH:	$90.00	$25.00	$98.00	$5,625.00	$32.50
LOW:	$50.00	$20.00	$98.00	$2.45	$0.08
EMERY					
TOTAL:				$8,180.00	
% OF TOTAL:				84.34%	
COUNT OR # RESP:	6	1	0	7	7
MEAN:	$56.67	$25.00	$0.00	$1,168.57	$3.25
STD DEV:	7.45	0.00	0.00	2465.62	3.44
HIGH:	$60.00	$25.00	$0.00	$7,200.00	$9.00
LOW:	$40.00	$25.00	$0.00	$0.00	$0.00
RICH					
TOTAL:				$13,375.00	
% OF TOTAL:				68.97%	
COUNT OR # RESP:	9	0	0	9	9
MEAN:	$64.44	$0.00	$0.00	$1,486.11	$2.89
STD DEV:	7.24	0.00	0.00	885.47	2.33
HIGH:	$75.00	$0.00	$0.00	$3,000.00	$7.50
LOW:	$50.00	$0.00	$0.00	$585.00	$0.34

TABLE 27. (Continued)

BY COUNTY	AVE $ / TON HAY	AVE $ / TON C SLG	AVE $ / TON OTHER	TOTAL DIR $ FEED LOSS	TOTAL DIR $ FEED LOSS/ton
SANPETE					
TOTAL:				$1,740.00	
% OF TOTAL:				89.69%	
COUNT OR # RESP:	3	0	0	4	3
MEAN:	$58.33	$0.00	$0.00	$435.00	$0.41
STD DEV:	6.24	0.00	0.00	371.05	0.34
HIGH:	$65.00	$0.00	$0.00	$1,000.00	$0.83
LOW:	$50.00	$0.00	$0.00	$0.00	$0.00
UINTAH					
TOTAL:				$1,200.00	
% OF TOTAL:				94.58%	
COUNT OR # RESP:	2	0	0	2	3
MEAN:	$67.50	$0.00	$0.00	$600.00	$3.33
STD DEV:	7.50	0.00	0.00	0.00	2.49
HIGH:	$75.00	$0.00	$0.00	$600.00	$6.00
LOW:	$60.00	$0.00	$0.00	$600.00	$0.00
UTAH					
TOTAL:				$350.00	
% OF TOTAL:				79.91%	
COUNT OR # RESP:	2	0	0	2	2
MEAN:	$55.00	$0.00	$0.00	$175.00	$32.50
STD DEV:	5.00	0.00	0.00	125.00	27.50
HIGH:	$60.00	$0.00	$0.00	$300.00	$60.00
LOW:	$50.00	$0.00	$0.00	$50.00	$5.00
OF TOTAL OPERATORS INTERVIEWED					
TOTAL:				$39,467.45	
% OF TOTAL:				79.97%	
COUNT OR # RESP:	32	4	1	38	37
MEAN:	$64.69	$23.25	$98.00	$1,038.62	$5.48
STD DEV:	10.96	2.05	0.00	1636.42	10.79
HIGH:	$40.00	$20.00	$98.00	$0.00	$0.00
LOW:	$90.00	$25.00	$98.00	$7,200.00	$60.00

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c) Direct feed loss includes consumption and spoilage tons (Table 6.a) * Average $/ton (table 6.b).
d) % of total loss include indirect losses Table 6.c.

TABLE 28. Indirect Feed Damage Costs -- Combined Direct and Indirect Feed Loss Also Shown.

BY COUNTY	$ FOR BG[e] FENCE BY FARMER	OTHER NUISANCE COSTS	TOTAL[f] INDR $ FEED LOSS	TOTAL[g] $ FEED LOSS	TOTAL[h] $ FEED LOSS/TON
BOXELDER					
TOTAL:	$66.00	$0.00	$66.00	$131.00	
% OF TOTAL:	50.38%	0.00	50.38%	100.00%	
COUNT OR # RESP:	2	0	2	2	2
MEAN:	$33.00	$0.00	$33.00	$65.50	$2.77
STD DEV:	11.00	0.00	11.00	21.50	2.68
HIGH:	$44.00	$0.00	$44.00	$87.00	$5.45
LOW:	$22.00	$0.00	$22.00	$44.00	$0.09
CACHE					
TOTAL:	$924.00	$1,000.80	$1,924.80	$16,482.25	
% OF TOTAL:	5.61%	6.07%	11.68%	100.00%	
COUNT OR # RESP:	3	3	5	12	11
MEAN:	$308.00	$333.60	$384.96	$1,373.52	$8.40
STD DEV:	72.07	220.51	114.74	1937.33	10.42
HIGH:	$400.00	$600.00	$600.00	$5,965.80	$32.50
LOW:	$224.00	$60.00	$284.00	$2.45	$0.08
EMERY					
TOTAL:	$1,354.00	$165.00	$1,519.00	$9,699.00	
% OF TOTAL:	13.96%	1.70%	15.66%	100.00%	
COUNT OR # RESP:	4	1	4	7	7
MEAN:	$338.50	$165.00	$379.75	$1,385.57	$4.09
STD DEV:	497.95	0.00	478.30	2869.45	4.09
HIGH:	$1,200.00	$165.00	$1,200.00	$8,400.00	$12.00
LOW:	$22.00	$165.00	$22.00	$0.00	$0.00
RICH					
TOTAL:	$2,304.50	$3,712.50	$6,017.00	$19,392.00	
% OF TOTAL:	11.88%	19.14%	31.03%	100.00%	
COUNT OR # RESP:	7	6	9	9	9
MEAN:	$329.21	$618.75	$668.56	$2,154.67	$5.40
STD DEV:	236.23	648.50	514.67	1088.32	5.15
HIGH:	$750.00	$1,980.	$1,980.	$3,818.00	$17.40
LOW:	$82.50	$22.50	$142.50	$834.00	$0.53

TABLE 28. (Continued)

BY COUNTY	$ FOR BG FENCE BY FARMER	OTHER NUISANCE COSTS	TOTAL INDR $ FEED LOSS	TOTAL $ FEED LOSS	TOTAL $ FEED LOSS/TON
SANPETE					
TOTAL:	$100.00	$100.00	$200.00	$1,940.00	
% OF TOTAL:	5.15%	5.15%	10.31%	100.00%	
COUNT OR # RESP:	1	1	2	4	3
MEAN:	$100.00	$100.00	$100.00	$485.00	$0.63
STD DEV:	0.00	0.00	0.00	348.82	0.26
HIGH:	$100.00	$100.00	$100.00	$1,000.00	$1.00
LOW:	$100.00	$100.00	$100.00	$100.00	$0.40
UINTAH					
TOTAL:	$68.75	$0.00	$68.75	$1,268.75	
% OF TOTAL:	5.42	0.00%	5.42%	100.00%	
COUNT OR # RESP:	1	0	1	3	3
MEAN:	$68.75	$0.00	$68.75	$422.92	$3.64
STD DEV:	0.00	0.00	0.00	300.36	2.61
HIGH:	$68.75	$0.00	$68.75	$668.75	$6.00
LOW:	$68.75	$0.00	$68.75	$0.00	$0.00
UTAH					
TOTAL:	$88.00	$0.00	$88.00	$438.00	
% OF TOTAL:	20.09%	0.00%	20.09%	100.00%	
COUNT OR # RESP:	1	0	1	2	2
MEAN:	$88.00	$0.00	$88.00	$219.00	$41.30
STD DEV:	0.00	0.00	0.00	81.00	18.70
HIGH:	$88.00	$0.00	$88.00	$300.00	$60.00
LOW:	$88.00	$0.00	$88.00	$138.00	$22.60
OF TOTAL OPERATORS INTERVIEWED					
TOTAL:	$4,905.25	$4,978.30	$9,883.55	$49,351.00	
% OF TOTAL:	9.94%	10.09%	20.03%		
COUNT OR # RESP:	19	11	24	39	37
MEAN:	$258.17	$452.57	$411.81	$1,265.41	$7.31
STD DEV:	295.42	529.53	441.12	1833.45	11.54
LOW:	$22.00	$22.50	$22.00	$0.00	$0.00
HIGH:	$1,200.00	$1,980.	$1,980.	$8,400.00	$60.00

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e) any fence repair, erection costs or materials for BG fence.
f) Nuisance costs + $ for fence.
g) Indirect loss + direct loss.
h) Total feed loss per ton stored.

TABLE 29. Total Acres in Orchards With Damage - Number of Damaged Acres -- Percent of Orchard Damage by Animal Species Also Shown.

BY COUNTY	total acres	acres damaged	% DAMAGE		
			DEER	ELK	OTHER
BOXELDER					
TOTAL:	63.5	18.5			
% OF TOTAL[a]:	100.00%	29.13%			
COUNT OR # RESP:	3	3	3	3	3
MEAN:	21.17	6.17	100.00%	0.00%	0.00%
STD DEV:	20.56	2.78	0.00	0.00%	0.00%
HIGH:	50	10	100.00%	0.00%	0.00%
LOW:	3.5	3.5	100.00%	0.00%	0.00%
% MATURE[b]:	100.00%				
% YOUNG:	0.00%				
% MIX[c]:	0.00%				
% APPLE:	5.51%				
% CHERRY:	0.00%				
% PEACH:	94.49%				
% MIX OR OTHER[d]:	0.00%				
UTAH					
TOTAL:	377.5	377.5			
% OF TOTAL:	100.00%	100.00%			
COUNT OR # RESP:	9	9	9	9	9
MEAN:	41.94	41.94	53.89%	46.11%	0.00%
STD DEV:	63.29	63.29	0.47	0.47	0.00%
HIGH:	200	200	100.00%	100.00%	0.00%
LOW:	1	1	0.00%	0.00%	0.00%
% MATURE:	39.07%				
% YOUNG:	7.95%				
% MIX:	52.98%				
% APPLE:	46.75%				
% CHERRY:	53.25%				
% PEACH:	0.00%				
% MIX OR OTHER:	0.00%				

TABLE 29 (Continued)

BY COUNTY	total acres	acres damaged	% DAMAGE DEER	% DAMAGE ELK	% DAMAGE OTHER
OF TOTAL OPERATORS INTERVIEWED					
TOTAL:	446.26	401.26			
% OF TOTAL:	100.00%	89.92%			
COUNT OR # RESP:	15	15	15	15	15
MEAN:	29.75	26.75	72.30%	27.70%	0.00%
STD DEV:	52.44	52.48	0.43	0.43	0.00
HIGH:	200	200	100.00%	100.00%	0.00%
LOW:	0.08	0.08	0.00%	0.00%	0.00%
% MATURE:	47.32%				
% YOUNG:	6.74%				
% MIX:	45.94%				
% APPLE:	40.34%				
% CHERRY:	45.04%				
% PEACH:	13.45%				
% MIX OR OTHER:	1.17%				

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a) % of total acres reported (operators only reported those acres in orchards where damage had been established).
b) % of trees mature, (etc.) reported by acre.
c) Where age was not established, or a large portion of both young and mature trees were mixed.
d) Where variety of tree was not established, or many varieties in the same orchard were used in estimating the damage.

TABLE 30. Dollars Lost or Spent in a Single Season as a Result of Damage in Orchards

	SINGLE SEASON LOSS			
BY COUNTY	CONSUMPTION	EXTRA PREP[e]	FENCE[f] incl build	OTHER NUISANCE
BOXELDER				
TOTAL:	$4,300.00	$1,000.00	$100.00	$0.00
% OF TOTAL:	79.63%	18.52%	1.85%	0.00%
COUNT OR # RESP:	2	1	1	0
MEAN:	$2,150.00	$1,000.00	$100.00	$0.00
STD DEV:	1850.00	0.00	0.00	$0.00
HIGH:	$4,000.00	$1,000.00	$100.00	$0.00
LOW:	$300.00	$1,000.00	$100.00	$0.00
UTAH				
TOTAL:	$89,092.86	$1,300.00	$2,901.00	$860.00
% OF TOTAL:	94.62%	1.38%	3.08%	0.91%
COUNT OR # RESP:	7	2	6	2
MEAN:	$12,727.55	$650.00	$483.50	$430.00
STD DEV:	23594.35	350.00	367.36	70.00
HIGH:	$70,000.00	$1,000.00	$1,150.00	$500.00
LOW:	$350.00	$300.00	$55.00	$360.00
OF TOTAL OPERATORS INTERVIEWED				
TOTAL:	$93,662.86	$2,388.00	$3,001.00	$1,025.00
% OF TOTAL:	93.59%	2.39%	3.00%	1.02%
COUNT OR # RESP:	10	4	7	3
MEAN:	$9,366.29	$597.00	$428.71	$341.67
STD DEV:	20419.79	409.91	365.62	137.38
HIGH:	$70,000.00	$1,000.00	$1,150.00	$500.00
LOW:	$270.00	$88.00	$55.00	$165.00

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e) Any extra materials or labor expended as a result of BG damage.
f) $ spent by the operator for materials and/or labor for repair of fences due to BG damage, or to build BG fence provided by The DWR.

TABLE 31. Total Dollars Lost or Spent as a Result of Damage in Orchards -- Total Acres Reported With Permanent BG Damage Also Shown.

BY COUNTY	TOTAL DOLLARS SINGLE SEASON LOSS PER			PERMANENT DAMAGE
	TOTAL	ACRE GROWN	ACRE DAMAGED	ACRES DAMAGED
BOXELDER				
TOTAL:	$5,400.00			10.1
COUNT OR # RESP:	3	3	3	2
MEAN:	$1,800.00	$46.67	$346.67	5.05
STD DEV:	2268.63	41.10	462.26	4.95
HIGH:	$5,000.00	$100.00	$1,000.00	10
LOW:	$0.00	$0.00	$0.00	0.1
% MATURE:	100.00%			100.00%
% YOUNG:	0.00%			0.00%
% MIX:	0.00%			0.00%
% APPLE:	0.00%			0.00%
% CHERRY:	0.00%			0.00%
% PEACH:	100.00%			100.00%
% MIX OR OTHER:	0.00%			0.00%
UTAH				
TOTAL:	$94,153.86			161
COUNT OR # RESP:	9	9	9	8
MEAN:	$10,461.54	$299.64	$299.64	20.13
STD DEV:	21290.32	243.12	243.12	31.85
HIGH:	$70,000.00	$700.00	$700.00	100
LOW:	$0.00	$0.00	$0.00	0.5
% MATURE:	93.52%			81.06%
% YOUNG:	0.64%			18.63%
% MIX:	5.84%			0.31%
% APPLE:	94.16%			99.07%
% CHERRY:	5.84%			0.93%
% PEACH:	0.00%			0.00%
% MIX OR OTHER:	0.00%			0.00%

TABLE 31. (Continued)

BY COUNTY	TOTAL DOLLARS SINGLE SEASON LOSS PER TOTAL	ACRE GROWN	ACRE DAMAGED	PERMANENT DAMAGE ACRES DAMAGED
OF TOTAL OPERATORS INTERVIEWED				
TOTAL:	$100,076.86			171.23
COUNT OR # RESP:	15	15	15	12
MEAN:	$6,671.79	$292.49	$352.49	14.27
STD DEV:	17169.93	393.36	426.65	27.40
HIGH:	$70,000.00	$1,500.00	$1,500.00	100.00
LOW:	$0.00	$0.00	$0.00	0.03
% MATURE:	93.65%			82.13%
% YOUNG:	0.60%			17.52%
% MIX:	5.75%			0.35%
% APPLE:	88.59%			93.15%
% CHERRY:	5.50%			0.88%
% PEACH:	5.40%			5.90%
% MIX OR OTHER:	0.52%			0.08%

TABLE 32. Dollars Spent or Lost on Fences Due to BG Damage.

BY COUNTY	TOTAL[a] FENCE	MILES OF FENCE	AVE TOTAL $/MILE	AVERAGE[b] $ TO BLD BG FENCE
BOXELDER				
TOTAL:	$557.70	21		$0.00
COUNT OR # RESP:	3	2	2	2
MEAN:	$185.90	10.5	$22.00	$0.00
STANDARD DEV:	$44.30	4.5	$5.50	$0.00
HIGH:	$247.50	15	$27.50	$0.00
LOW:	$145.20	6	$16.50	$0.00
CACHE				
TOTAL:	$1,875.50	83		$2,206.75
COUNT OR # RESP:	5	4	4	7
MEAN:	$375.10	20.75	$22.02	$315.25
STANDARD DEV:	$287.95	7.36	$20.68	$251.99
HIGH:	$858.00	33	$57.20	$750.00
LOW:	$110.00	15	$6.88	$0.00
EMERY				
TOTAL:	$740.00	11.5		$0.00
COUNT OR # RESP:	2	2	2	1
MEAN:	$370.00	5.75	$61.00	$0.00
STANDARD DEV:	$170.00	1.75	$11.00	$0.00
HIGH:	$540.00	7.5	$72.00	$0.00
LOW:	$200.00	4	$50.00	$0.00
RICH				
TOTAL:	$603.25	44		$2,821.00
COUNT OR # RESP:	5	5	5	7
MEAN:	$120.65	8.8	$32.07	$403.00
STANDARD DEV:	$127.73	6.42	$35.74	$602.07
HIGH:	$371.25	17.5	$100.00	$1,844.50
LOW:	$22.00	1	$2.20	$22.00
SANPETE				
TOTAL:	$2,615.00	64.87		$944.00
COUNT OR # RESP:	5	5	5	5
MEAN:	$523.00	12.97	$220.52	$188.80
STANDARD DEV:	$517.12	9.89	$364.33	$307.80
HIGH:	$1,500.00	30	$945.95	$800.00
LOW:	$50.00	0.37	$5.50	$0.00

TABLE 32. (Continued)

BY COUNTY	TOTAL FENCE	MILES OF FENCE	AVE TOTAL $/MILE	AVERAGE $ FOR BG FENCE
UINTAH				
TOTAL:	$100.00	0.5		$1,596.00
COUNT OR # RESP:	1	1	1	3
MEAN:	$100.00	0.5	$200.00	$532.00
STANDARD DEV:	$0.00	0	$0.00	$499.25
HIGH:	$100.00	0.5	$200.00	$1,200.00
LOW:	$100.00	0.5	$200.00	$0.00
UTAH				
TOTAL:	$997.00	20.75		$588.00
COUNT OR # RESP:	6	6	6	4
MEAN:	$166.17	3.46	$98.02	$147.00
STANDARD DEV:	$125.04	3.01	$116.60	$142.33
HIGH:	$400.00	10	$333.33	$342.00
LOW:	$50.00	0.75	$15.40	$4.40
OF TOTAL OPERATORS INTERVIEWED				
TOTAL:	$7,488.45	245.62		$8,155.75
COUNT OR # RESP:	27	25	25	29
MEAN:	$277.35	9.82	$92.20	$281.23
STANDARD DEV:	$310.97	8.74	$189.46	$412.60
HIGH:	$1,500.00	33	$945.95	$1,844.50
LOW:	$22.00	0.37	$2.20	$0.00

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a) Dollars for maintenance of fences not specifically designed to keep BG out.
b) Dollars spent by the agriculturist to build BG fences with materials provided by the DWR.