United States
Department of
Agriculture

**Natural
Resources
Conservation
Service**

National Economics Handbook

Part 610

(200-vi, NEHWQ, August 1995)

Issued May 1995

National Economics Handbook

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United States Department of Agriculture

Natural Resources Conservation Service

Part 610 National Economics Handbook

Chapter 1 Benefits and Costs

Chapter 1 Benefits and Costs

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610.0100 Introduction

(a) Purpose and scope

This chapter provides guidance in identifying both onsite and offsite benefits and costs of conservation, and sheds some light onto how economics fits into and influences the planning process.

As consumers, we weigh the benefits and costs of our decisions. Many of those decisions are influenced by aspects that cannot be measured in dollars. However, most often we still try to compare the benefits of a purchase or investment to its costs. For example, someone considering the purchase of a computer to help manage his/her business might compare the benefits of a more organized and efficient business to the cost of time required to learn how to use a computer system and incorporate business records.

Decisionmaking for the land user in farming or ranching is the same as any other decisionmaking. Once a problem is identified, physical and monetary effects of alternatives can be compared. One of the land user's many concerns is whether potential benefits from installing new conservation measures would outweigh the costs.

(b) Conservation effects for decisionmaking (CED)

When assisting a land user with these questions, it is often crucial to discern the important effects which are the basis for the decision making process. The Conservation Effects for Decisionmaking (CED) framework (presented in chapter 4) provides general background information on how to go about organizing concerns, effects, and other information to assist the land user in making conservation decisions. The Conservation Effects for Decisionmaking Workbook provides a comprehensive training program for those individuals who wish to learn how to use the CED framework to help make effective conservation plans with the land user.

610.0101 Economics and the planning process

(a) Objectives

The NRCS National Procedures Handbook (NPH) relays policy that will help NRCS assist people in making informed decisions, resulting in wise use and conservation of resources. The key to this is involving the land user, or client, in the planning process. NRCS helps land users to achieve both their objectives and those of society for sustained use of soil, water, air, plant, and animal resources. NRCS uses a planning and implementation process to:

- help land users understand their resources, resource management needs, potentials, and problems;
- identify alternative solutions to these problems;
- determine effects of alternative solutions, including comparison of effects expected if the problems remain untreated;
- choose alternative solutions that are consistent with the land user's objectives; and
- implement and maintain feasible solutions as rapidly as is practical.

(b) The nine step planning process

NRCS uses a specific planning and implementation process consisting of nine steps. This process is used in all instances where assistance is provided to land users (client and land user are interchangeable throughout this handbook), regardless of the expected outcome or scope of the planning effort, the type of conservation treatments involved, or the source of funding to be used for implementation.

The degree of detail used in the planning process varies with the type, method, and scope of assistance, the complexity of the planning situation, and the recipient. Using the nine steps of the process in sequence creates a consistent method nationwide. The nine steps in planning and implementation are:

- Step 1 Identify the problem
- Step 2 Determine objectives
- Step 3 Inventory the resources
- Step 4 Analyze the resource data
- Step 5 Formulate (feasible) alternative solutions
- Step 6 Evaluate alternative solutions
- Step 7 Client determines a course of action
- Step 8 Client implements the plan
- Step 9 Evaluate results of the plan

This planning process requires the use of skills from many disciplines, such as agronomy, soils, and engineering, to achieve the highest quality of assistance. Economics is one of those that should play an important role throughout the planning process. It enters into the process most heavily at the evaluation stage (step 6) through the use of CED. For more detailed information on CED, consult chapter 4.

610.0102 Benefits of conservation

Benefits from conservation are numerous, and occur offsite as well as onsite. Onsite benefits are benefits that occur at or very close to the location of the conservation activity, generally to the owner or user of the resource where the conservation activity was undertaken. These benefits can be divided into at least two types: maintaining or restoring productivity, and decreasing production costs. Offsite benefits occur in a different location than the conservation activity, and may occur to different owners or users. They will be examined separately. A detailed record of conservation effects that can be expected in specific resource settings should be found in Sections III and V of the Field Office Technical Guide.

(a) Onsite benefits

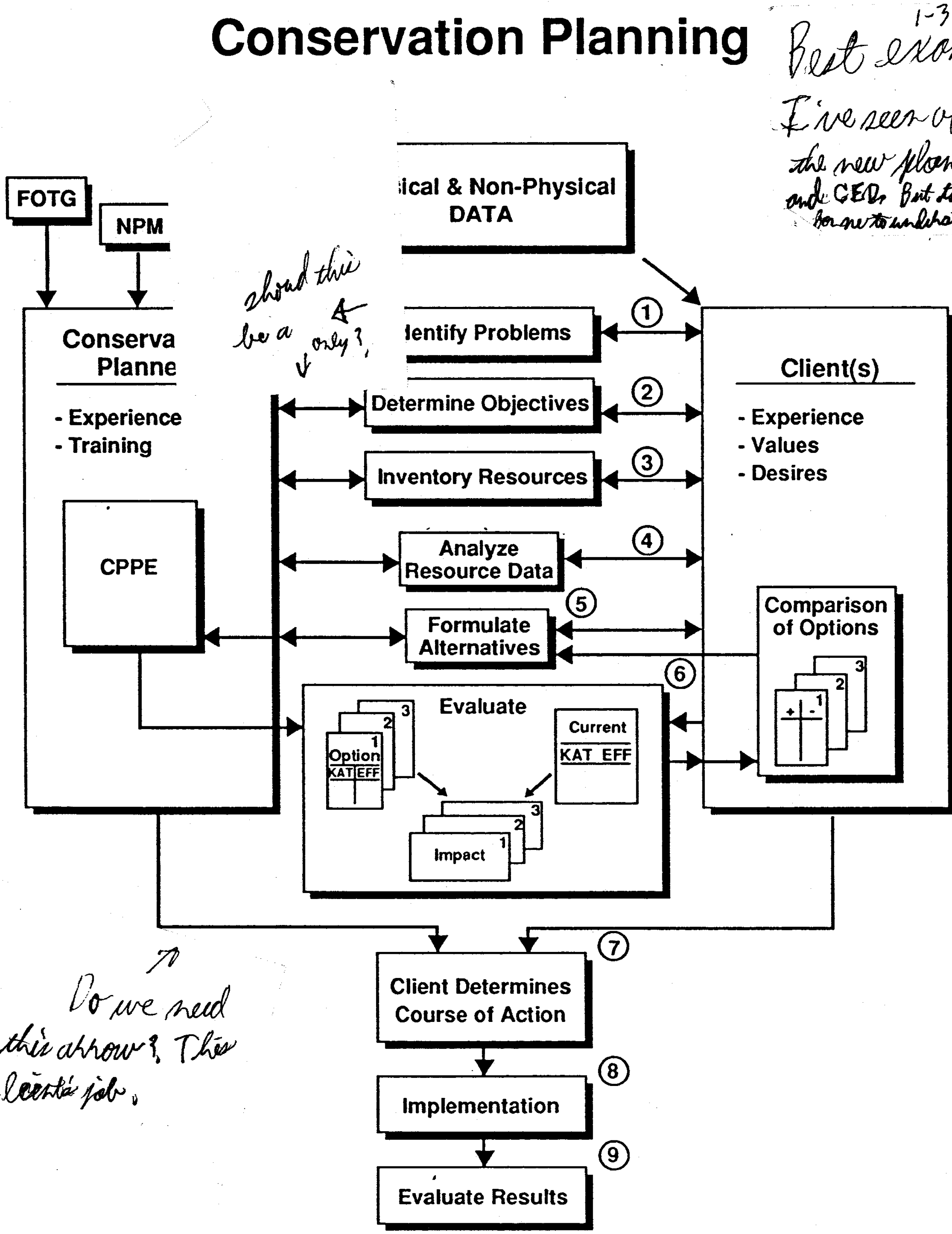
(1) Maintaining productivity

Maintaining productivity means maintaining crop yields by protecting the soil from erosion, as well as conserving water. Crops need sufficient nutrients and water and a soil profile with adequate tilth and organic matter for their passage, which allows adequate root growth.

When erosion occurs, crops often cannot absorb their basic needs. Through the removal of topsoil, wind erosion reduces the capacity of the soil to hold moisture, and degrades the soil profile. Water erosion similarly removes topsoil, reducing the quality and quantity of the soil, and causing nutrients to be lost. Water erosion can also cause onsite crop damage by forming gullies and depositing sediment. Both of these effects lower productivity by reducing and sometimes eliminating crop stands in certain areas.

When conservation practices are used to reduce soil loss and conserve moisture, yields can be maintained, and in some cases even enhanced. These practices are designed to keep soil, nutrients, and water where needed.

Figure 1–1 Conservation Planning



(2) Decreasing production costs

Some conservation practices are beneficial to the land user because they may reduce the costs of growing a crop. Practices like conservation tillage and no-till reduce the number of trips over the field. This saves the land user time, fuel, and machinery wear, but weed and insect control costs may be increased. Other measures that convert row crops to other land uses permit the land user to use less fertilizer and fewer chemical inputs on these areas. Examples of this are field borders and grassed waterways. Both of these measures involve converting sometimes low yielding row crop areas such as end rows and watercourses to grass. The land user saves production costs because these converted areas usually require fewer inputs than the row crops they displaced.

(b) Offsite benefits

Offsite damages, which may include sediment deposition and reduced water quality, result as eroded soil is transported and deposited by the actions of wind and/or water. The sediment can fill in ditches, plug culverts, reduce the useful life of reservoirs and ponds, destroy fences, destroy and damage crops, and transport farm pesticides and fertilizers.

Conservation practices can be installed to reduce offsite damages. This reduction is considered an economic benefit, and should be considered in the decision making process. Through conservation, the transport of these materials that pollute the ecosystem, damaging wildlife and aquatic habitat, can be dramatically reduced.

The most effective way to avoid offsite pollution is to keep the soils and chemicals on the fields where they are applied. Practices that reduce soil loss, sediment, and chemical pollutants may be useful in maintaining or improving water quality. This may not be true in all cases. For example, with a soil where the leaching of soluble phosphorous is a problem, no-till might in some circumstances make the problem worse.

610.0103 Costs of conservation

(a) Expenditures

(1) Up-front costs

Given the potential onsite and offsite benefits of conservation, possibly one reason it is not more widely adopted is that conservation involves up *front* investment costs. The most obvious cost is installing the practice. This may include the materials, land, labor, and equipment necessary to get the conservation practice on the ground according to NRCS specifications.

(2) Operation and maintenance

Operation and maintenance (O&M) are costs that occur throughout the lifetime of the practice. These insure that it continues to function properly. Fertilization of a waterway, operating a pump, or reseeding a terrace backslope are examples of O&M.

Changing tillage practices may cause other costs to be incurred. For example, in some soils, applications of fertilizers and pesticides must be increased when switching to conservation tillage or no-till. Increased production costs must be accounted for in these situations. These costs may be partially offset by fewer operations, better timing of operations, and lower equipment repair costs due to the elimination of gullies.

(b) Lost production

Another cost for some conservation practices is the cost of lost production. When certain practices are installed, previous production from the area is foregone. Waterways take land away from cropland, as do certain types of terraces. If the yields from these areas were initially low, then the loss would be small. However, if previous yields were high, then the cost of installing waterways, for example, would also be high in terms of lost production.

610.0104 Agricultural business environment effects on conservation purchases

Commonly accepted benefits and costs of conservation have been discussed. However, a decision that is economically sound (i.e., where the net benefits from all sources have been maximized) may not be a good decision for the farmer. A land user's economic situation should be considered before recommendations are made. How the agricultural business environment (interest rates, the farm program, politics) affects a land user's decision about applying conservation needs to be addressed.

(a) Economic prosperity

During times of prosperity, land users usually can invest in long term conservation. Installation of conservation practices is often a good way to reduce the tax burden in a year of high profits, making conservation an intelligent investment. However, since benefits from conservation sometimes take time to materialize, while the costs are up front, liquidity, cash flow, or profitability can become a big problem for many land users considering conservation investments. (See appendix C.)

(b) Economic stress

Practices with high installation costs and benefits that take time to materialize may be a good alternative from a conservation viewpoint, but not feasible for the land user. In times of economic stress, applying part of a system that will yield some benefits may be better than not applying a practice at all. When the land user's economic situation improves, the remaining practices of the long term conservation plan could be applied. This would enable the land user to reap the full benefits of conservation.

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Chapter 2 Basic Considerations and Economic Principles

Chapter 2 Basic Considerations and Economic Principles

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Chapter 2 Basic Considerations and Economic Principles

610.0200 Introduction

(a) Purpose and scope

This chapter defines and illustrates economic principles and procedures that can contribute to effective conservation planning and decisionmaking. Major emphasis is placed on the identification and accounting of effects for purposes of comparison and selection. Chapter content is based on the perspective that economics is inseparable from planning and should be used to provide professionally responsible information that enables decisionmakers to comfortably make informed decisions about implementing conservation.

(b) Background

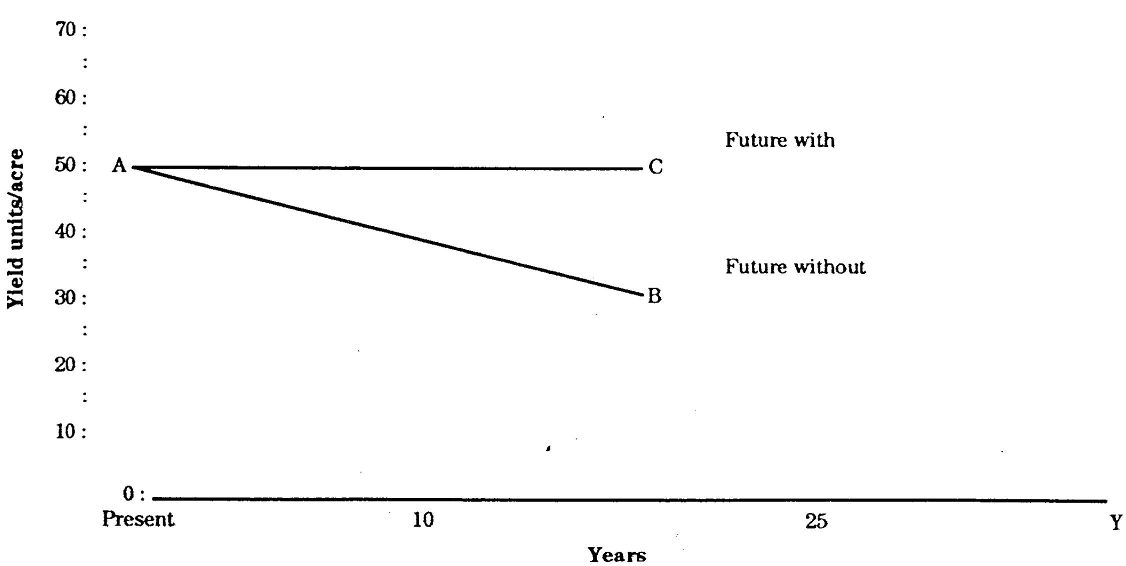
(1) Options with and without

Conservation planning is based on the premise that some physical situation, such as erosion or yield level, is currently, or expected to be, at a condition that is undesirable, unacceptable, or less than possible. Additionally, it can be corrected, if desired, by actions or activities called conservation practices. The estimated future situation without conservation practices should be compared to the situation expected with their implementation. The difference between the *without* and *with* options is the impact of conservation. The future *without* situation serves as a benchmark for the analysis. Identifying the benchmark situation is the first step in the decisionmaking framework.

(2) Example: Salts in the root zone

Estimating future effects is important; they should be stated objectively and must be made in reference to time. Consider an example where current management is causing an accumulation of salts in the root zone of the soil profile. Without treatment, continuing accumulations are expected to have a damaging effect on crop yield (see line AB in fig. 2–1). With adoption of a conservation system, salt which has accumulated in the root zone will be reduced and crop yields will be maintained (see line AC in fig. 2–1). The change in yield due to adoption of the conservation system is t! area ABC, when evaluated over the 25 year period. If additional labor is the only cost of implementing the conservation system and yield change is the only gain, determination of the relative worth of adoption is made by comparing the value of the yield gain to the cost of additional labor.

Figure 2–1 Expected yield levels over time, without and with conservation.



Estimates of future conditions without and with treatment are commonly made by using an inventory of the current situation as a starting point. Historical trends are then projected while current relationships and foreseeable developments are considered. Projections should reflect the views of the decisionmakers, research, and other published data such as soil surveys. It is very important that the expectations of the future without situation and the *with* treatment alternative be tempered by local judgment.

610.0201 Decisionmaking

Effective conservation planning must involve both the land user and the conservation planner. Together they need to identify the important physical and/or economic factors that are to be examined, and look into the future to identify any changes in conditions without and with conservation. In addition, the land user needs to identify the relevant time horizon. Ultimately, the land user must also place relative values on gains and losses for the final analysis.

The process of decisionmaking is one of balancing the gains against the sacrifices of each option to determine which one produces the largest net gain or the smallest net loss. Once those options are identified, the decision making process enables comparison among them to select the most desirable option.

(a) Relative weights

The land user must place relative values on gains and losses to determine their individual weight in the decisionmaking process. Often the factors compared are not compatible in kind, place, or time. Some effects may have a common denominator, such as a market price, while others do not. Landscape appearance and the presence of endangered wildlife species are two examples where commonly held absolute values do not exist.

Actions taken in one place, or by one individual, may create change in another location, or to another individual. For example, a change in a feed crop resource may impact grazing resources, or the downstream/offsite impacts of erosion may affect water quality for recreation. Similarly, actions taken in one time period create effects in another.

The effect of current soil erosion on the ability of future generations to produce food and fiber, and the impact of the current management regime on the options for future management of native plant communities, are two examples.

The process of decisionmaking is not limited to factors that have common denominators, but allows the comparison of tradeoffs within and between alternatives. Ultimately, decisions are made which place relative weights on each consideration. The land user, not the assisting professional, places value on the quantities identified in the planning process.

(b) Level of detail

Assistance is normally provided up to the point where land users can comfortably make an informed decision about conservation actions. The kind and amount of information will be different for every individual and every situation.

The simplest evaluation may consist of identifying the most obvious physical impacts stemming from the problem and estimating the costs of the conservation practices which address these problems. For example, upon learning that ephemeral gully erosion will be eliminated by a terrace system costing $40 per acre, some land users would be ready to make a decision. Most of the questions posed by land users can be answered with this approach.

An intermediate evaluation could be done for more specific resource questions that often require more detailed answers. Chapter 4, Evaluation Techniques, presents and discusses some useful ways to enable a more detailed evaluation of a particular option.

When the land user requests a very detailed analysis, the conservation planner may need to request direct assistance from a state office economist. In some cases, the land user may need financial or cash flow analysis. If NRCS does not have this type of assistance available, a farm management specialist may be required.

(c) Period of analysis

Two analytical concerns in decisionmaking are determining the length of time over which individual effects are to be considered, and assuring that these effects are considered on a common time basis. The length of time over which effects are considered is called the period of analysis. The land user is responsible for its identification. General factors affecting the land user in the determination include sociological ones such as age of the land user and whether the children will farm.

Economic factors that constrain the period of analysis include the physical deterioration of capital investment (farm equipment, conservation practices, etc.) and obsolescence due to improvements in technology. The period of analysis should not exceed the shorter of the planning horizons; the repayment period, or the physical life of the alternative. However, if the selected planning horizon is shorter than the physical life of the alternative, care must be exercised to account for the benefits that accrue beyond the period analyzed.

A period of analysis is established so that gains and losses may be compared on the same or equivalent time basis. The common time basis for comparison of effects can be any one year during the period of analysis or an average annual amount over the period. For example, all effects can be capitalized and compared at the end of the period or discounted and compared in present value terms. Frequently, gains and losses are calculated and stated in average annual terms. Further definitions and procedures for expressing values on a common time basis are provided in Chapter 5, Time and Money.

610.0202 Economic factors influencing private decisions

Thus far, the general discussion of analytical principles and the decisionmaking process has been within the context of comparing all gains and all losses over an identified time period. The criteria used is that when gains exceed losses, the option is economic, and that the selected best option tends toward the optimum economic option. However, from a private land user's view, a number of factors can significantly alter the judgment of whether an alternative is feasible and which among the alternatives is best.

(a) Distributing costs and benefits

An important consideration from an individual's view- int is, Who pays the cost and *who receives the nefits?* On the gains side of the situation, quantified effects must be recognized—*To who does the gain accrue?* The conclusion should not be made that only personal gains have value to land users.

On the losses side of the situation *Who pays the costs?* must be considered. Monetary costs, considered a loss, may be greatly impacted by cost share or income tax treatment. Cost share and current provisions for investment tax credit on some conservation treatment components can directly reduce out-of-pocket costs to the individual.

(b) Balancing gains and losses

To balance gains against losses, individuals must give weights, or prices, to items considered. Items such as commodities are generally priced based upon future market expectations, tempered by past and current conditions. However, items such as labor may not be readily priced even though a labor market may exist. Commitment of or savings in labor may not change out-of-pocket cash costs or add to cash revenue. ving in labor have cash value only when cash pay- ents to labor are reduced or cash revenue is generated from use of the saved labor in an alternative activity. However, saved labor may have psychic value as leisure time. Similarly, commitment of labor has cash cost only when additional cash payment is made to labor or committed labor reduces cash revenue when taken out of employment in an alternative activity.

The example of labor value demonstrates the economic concept of opportunity cost, which relates the value of a good or service to the opportunities available for alternative employment. It is important to remember that the land user must place the values, or prices, on the items considered as gains or losses. Therefore, quantification of effects, gains, and losses should begin with physical measures such as bushels, gallons, hours, and pounds when possible.

(c) Timing

Proper accounting and valuation of effects anticipated over a period of analysis may lead to conclusions on economic feasibility, and identification of the economically best alternative, but may not lead to implementation. A close examination of when gains are realized and when losses are required may reveal that short-term financial demands exceed short-term ability to pay. Comparing the timing of gains and losses defines the financial term cash flow. Options that require near term losses, or expenditures, to achieve benefits in a longer term are susceptible to financial unfeasibility even though total gain exceeds total loss.

Comparison of gains and losses on an equal time basis requires the use of concepts described in Chapter 5, Time and Money. A framework for evaluating various options is provided in Chapter 4, Conservation Effects for Decisionmaking.

(d) Interest Rates

An aspect of the economic concepts presented in chapter 5 is the interest rate used to equate items in time. It can have a substantial effect on the judgment about economic feasibility and an individual's selection of the best option. As the interest rate used in evaluation is increased, effects occurring further into the future have relatively less value. Selection of the interest rate used in evaluation is the responsibility of the land user. It should reflect what earning power is given up (the opportunity cost) or what must be paid.

When self-owned resources are committed to implementation of an option, the earnings of those resources in their alternative employment must be forfeited. That rate of earning power forfeited is the appropriate interest rate. Borrowed resources require rental payments to the owner of the resource because of its earning power. The rate of rental payment is the appropriate interest rate. It is important to recognize that in a situation where self-owned resources are committed, even though total gains exceed total losses, the cash position of the land user would not be improved unless net gains exceeded the earnings that would have been realized from an alternative use of the resources.

(e) Depreciation

Depreciation is the anticipated reduction in the value of an asset over time, caused through physical use or obsolescence. In accounting, depreciation refers to the process of amortizing, or allocating a portion of the original cost of a fixed asset, such as a tractor, to each accounting period. The value is gradually used up (written off) during the asset's estimated useful life. Allowance may be made for the ultimate estimated resale value of the fixed asset (its residual value) to remain at the end of its useful life to the enterprise. There are two principal types of depreciation methods:

Straight-line depreciation—allocates the cost of a fixed asset in equal amounts for each accounting period.
Accelerated depreciation—allocates a larger proportion of the original cost to earlier accounting periods and a smaller proportion to later periods.

(f) Inflation

An increase in the general price level of an economy is inflation. Inflation occurs when the quantity of money in circulation rises relative to the quantity of goods and services available. The result is too much money chasing too few goods, and prices are bid up. At high rates of inflation, people begin to lose confidence in money. The quantity of money in circulation increases relative to expenditures in current prices, as people tend to hold (hoard) goods rather than money. Inflation is associated with a rise in gross national expenditure at current prices that is greater than the increase in the real supply of goods and services.

In watershed project analysis (PL-566 projects) the customary analytical approach is to work in constant prices rather than current prices, and to assume that inflation will affect the prices of nearly all costs and benefits equally. Specified costs and benefits are varied in comparison with the others so that their relative prices change. Using constant prices allows the analyst to avoid making risky estimates of future inflation rates and to simplify the analytical procedures.

610.0203 Evaluating options

(a) Least cost option

(1) Comparing losses

In situations where defined objectives require the achievement of a minimum level of performance or output, the problem is reduced to searching out the option that requires the least amount of loss (least cost). Usually the question does not include determination of economic feasibility. However, implementation continues to be dependent upon the measurable monetary aspects of the option considered by the land user. The problem can therefore be viewed as a comparison of the losses of one option against those of another, and a search for that option that costs the least. Again, the land user must place a value on items considered in the balancing process, and must be cognizant of factors described above. Analytical prin-ʻoles are employed which define effects by examining e future *with* and *without* situations and comparing them on an equal time basis.

(2) Example: water quality

Consider an example where plans and laws such as the 1972 Clean Water Act as amended (Section 208) are used to enforce minimum standards for water quality and maximum standards for permissible discharge. For a land user such as a dairy owner to continue in business, the choices faced may be reduced to compliance or jail. Assuming jail is not a desirable option, the problem is reduced to finding the least cost means of compliance.

(3) Considerations

From an economic viewpoint, any conservation practice selected for installation should not be more costly than any other reasonable means of accomplishing the same level of conservation. Comparison of costs for all alternatives considered is essential and should include the estimate of operation and maintenance expenditures and the average annual installation costs.

Any costs occurring in the future, monetary or non-monetary, need to be identified and converted to a common time base. Some particular non-monetary, ɔsts, such as the potential loss in water quality in a creek that would receive runoff from a grass waterway, may not be easily expressed in dollars. This, however, does not mean that they are not important, and certainly does not exclude them from the evaluation process.

(b) Maximization of net gains (Income)

(1) The best option

In the decisionmaking process described above and in chapter 4, the best option is that alternative with the greatest net gain from the viewpoint of the individual land user. The best alternative would be considered the economic optimum if selection was made from a very large number of alternatives. The selection process is one of replacing the benchmark situation only when another alternative is found with more net gain. Another view of the process is the comparison of the change in gains between alternatives to the change in losses between alternatives, using the criteria that as long as added gains exceed added costs (losses), additional net gain is realized. In other words, additional losses are made only to the point where they are offset by added gains. In the formulation of alternatives that are comprised of separate practices, each practice should be examined to determine if that practice adds more gain than loss.

(2) Example: animal waste

For example, consider the land disposal portion of an animal waste management alternative where application of manure on either or both of two field crops is possible (all other factors held constant). The nutrient value of the manure would be allocated where the most net gain could be expected. Optimum economic allocation would be achieved by allocating increments (tons or gallons) to the crops in order of highest value of crop response to the nutrients. This requires recognition of another important physical concept. Successive units of manure (crop nutrients) applied to a crop will begin to have smaller and smaller effects on crop yield until, finally, it will have a negative effect on the crop if applied beyond a certain level. This diminishing response to inputs is called diminishing returns. It is important because at some level of allocation of manure to one of the crops, yield response, and therefore value, is reduced to the point where application should be shifted to the other crop. The final allocation may therefore be determined after several successive shifts between crops, until either total manure is allocated or gains no longer exceed costs.

(3) Non-quantified values

An important exception to the above discussion is that gains are usually expressed only in dollars. Therefore, any non-quantified values would be excluded from net gains or net loss figures. Because of the presence of these non-quantified personal or societal values, land users will often seek to achieve a level of conservation that is different from the level that maximizes only monetary net gains.

(c) Types of analysis

(1) Sensitivity analysis

Sensitivity analysis can be used to test systematically what happens to the feasibility of a conservation plan if events differ from the estimates made in planning. It is a means of dealing with uncertainty about future events and values. A sensitivity analysis is done by varying one element or a combination of elements and determining the effect of that change on the outcome. With a conservation plan, it may be useful to test for the effects on earning capacity of changes in prices, cost, delay in implementation, and changes in yield. Sensitivity tests need not be directed at the effect of a change on project worth. A sensitivity test may be made, for example, to determine the effect of a delay in benefits on the cash position of a farmer who has borrowed for an irrigation pump. Variations on sensitivity analysis may also include evaluation of items such as risk, interest rates, and prices.

Risk is the probability or chance that something will or will not occur as planned. For example, what is the chance that yield will reach the prescribed level? What is the likelihood that the system will be more costly than expected? The impact of these occurrences can be tested using sensitivity analysis. They can also be evaluated using a formal procedure called risk analysis.

(2) Risk analysis

Risk analysis can be more narrowly described as an analytical technique in which probabilities of occurrence are determined for all critical conservation option elements. Then, by computer, repeated computations of a measure of option worth are made, each element entering in successive computations according to its probability of occurrence. The result is most commonly reported in the form of a cumulative probability curve, plotted on a graph in which the vertical axis represents the probability a measure of option worth will fall below a stated value and the horizontal axis represents the values of the measure of option worth.

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Chapter 3 Why Land Users Adopt Conservation

Chapter 3 Why Land Users Adopt Conservation

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610.0300 Introduction

Land users adopt new conservation practices when they seem to be in their best interests. However, disagreements arise when the question, Why don't land *users adopt new conservation practices, such as residue management systems?* is asked. Strategies to promote the adoption of new conservation practices must take the answer into account, to help land users make decisions that are economically, agronomically, and environmentally sound. It can serve as the basis for increasing adoption. Understanding why land users refuse to adopt new practices is central to developing appropriate information to help them make informed decisions (see chapter 4).

610.0301 Reasons for non-adoption

Land users do not adopt conservation technologies for two basic reasons: they are either unable or unwilling. These reasons are not always easily distinguishable from one another. Land users can be able yet unwilling, willing but unable, and, of course, both unable and unwilling. These may sound like minor distinctions, but the difference between a land user being unwilling or unable is crucial when designing the appropriate conservation adoption strategy.

(a) Being unable to adopt

Being unable to adopt a new conservation practice implies that there is some obstacle or situation that causes the decision not to adopt to be rational and correct. The land user is making a sound decision in rejecting a conservation practice because of this obstacle. The important point is that the land user may be willing to adopt the practices, but for one or more reasons is unable to make this decision. Among those reasons are:

- Information is lacking or scarce.
- Costs of obtaining information are too high.
- Complexity of the practice is too great.
- Too expensive of a conservation practice.
- Labor requirements that are considered to be excessive.
- Planning horizon is too short.
- Availability and accessibility of supporting resources is limited.
- Inadequate managerial skills.
- Little or no control over the adoption decision.

Information is lacking or scarce.—A land user may be unable to adopt a practice because some of the basic information necessary for a sound economic and agronomic analysis is missing.

Costs of obtaining information are too high.—The time, expense, and difficulty of obtaining site-specific information may be too high. Obtaining relevant information is not cost-free to the land user.

Complexity of the practice is too great.—An important characteristic of any new technology is its simplicity or ease of use. Extensive research literature is available showing that the complexity of a technology is inversely related to the rate and degree of adoption. Conservation practices that are too complex make some land users unable to adopt this technology.

Too expensive of a conservation practice.—Investment, costs, and influence on net returns are major concerns of today's land user. Designing a practice that is agronomically sound but has too high of a price tag will make many land users unable to adopt.

Labor requirements that are considered to be excessive.—Land, labor, and capital still determine the nature of the farm or ranch firm. If the labor requirements associated with a new conservation practice are thought to be too high relative to the capabilities of the farm or ranch, then the farm or ranch manager will be unable to adopt the technology.

ınning horizon is too short.—Conservation prac-.ces may be rejected by a land user because of the current planning horizon relative to the time associated with recouping initial investments, learning costs, or depreciation of the present equipment line. Many of today's land users may not be farming or ranching in a few years because of retirement or other transitional forces. Asking them to make a long-term investment within the context of a short planning horizon will result in them being unable to adopt.

Availability and accessibility of supporting resources arelimited.—Few land users adopt innovative conservation management systems without significant support. This support can take the form of local equipment or agrichemical dealers willing to take the risk of investing in products not currently being used in their trade areas, other land users using conservation practices who are willing to share both successes and failures, and a U.S. Department of Agriculture information and assistance network capable of answering land users' questions. The lack of any one of these could be the obstacle that creates a situation where the land user is unable to adopt.

ıadequate managerial skills.—As in the case of the .ıysical resource base they manage, there is tremendous diversity among land users. A dimension of this diversity is managerial skill. Too often conservation practices are designed for the average or above average manager. Local assistance networks are also oriented to this group because of the performance and evaluation systems used in USDA. All of this can create a situation where land users with less than average management capabilities receive little or no assistance in building these skills. These land users will then make the correct decision in rejecting the conservation practice because they lack the requisite managerial skills or the opportunity to develop them.

Little or no control over the adoption decision.—Viewing the land user as some independent decisionmaker who calls all the shots is common. The land user, therefore, becomes the focal point of most efforts to transfer new technologies. In many situations, however, a decision cannot be made without the approval of a partner, source of financial credit, landlord, or some other third party. If these other interests are not convinced of the merits of a new conservation practice, then the land user will be unable to adopt.

(b) Being unwilling to adopt

Land users may be unwilling to adopt a new practice. This implies that they have not been persuaded that the technology will work or is appropriate for the farm or ranch operation. There are a number of reasons why this persuasion does not occur. As in the case of inability to adopt, many of these situations are beyond the land user's control; therefore, making a correct decision in rejecting the practice. Until the correct form of persuasion is offered, this will not change.

Land users may be unwilling to adopt because:
- Information conflicts or inconsistency.
- Poor applicability and relevance of information.
- Conflicts between current conservation goals and the new technology.
- Ignorance on the part of the land user or promoter of the conservation practice.
- Practice is inappropriate for the physical setting.
- Practice increases risk of negative outcomes.
- Belief in traditional practices.

Information conflicts or inconsistency.—:Land users may be unwilling to adopt a practice because of inconsistency or even outright conflicts in the information about the practice.

Concerned about water quality in a vulnerable area, the land users may hear that a particular conservation practice always requires more pesticides, that it may require more pesticides, or about the experiences of another local land user who claims it requires fewer pesticides. They will often remain unwilling to adopt until these divergent messages become more consistent.

Poor applicability and relevance of information.—To make a sound decision, land users need information that is applicable and relevant to their farm or ranch. Data from a neighboring state or even across the county line may be judged as not meeting local conditions. Until this data is adapted and made available relative to local situations, the land user will remain unwilling to adopt.

Conflicts between current conservation goals and the new technology.—New technologies do not always fit into existing conservation practices and the policy context in which they operate. In these cases, the general expectation is that land users will adapt the operation to meet the adoption requirements of the technology. This can be contrasted with a situation where a flexible technology is designed so that it can be adapted to fit into a land user's operation. Land users may be unwilling if it is felt that too much adaptation is required for adoption.

Ignorance on the part of the land user or promoter of the conservation practice.—Ignorance is not a degrading term. Instead, it implies a situation where an individual has not had the opportunity to learn. One could be ignorant of the basic economic and agronomic facts of the practice, or there could be a lack of sensitivity to the basic needs of a potential adopter. Regardless of the reason, the outcome of this ignorance is the same; land users will remain unwilling to adopt.

Practice is inappropriate for the physical setting.—The land users may be expected to adopt a practice that is inappropriate for the physical setting of the farm or ranch operation. Potential yield losses, inefficient use of inputs, or even negative environmental impacts can result from this situation. Some land users, recognizing this incompatibility, remain unwilling to adopt.

Practice increases risk of negative outcomes.—A conservation practice can increase the probability of a negative outcome in many ways. A relatively wet versus dry year can have many implications for pest control, nutrient amount and placement, and the timing of tillage operations. Relying on agrichemicals for pest control can make the land user more dependent on weather patterns and increase the potential costs of rescue operations. The complexity of a practice, importance of the timeliness of operations, and the interdependence of inputs all can increase perceived or real uncertainty and risk. Some land users are simply unwilling to make major decisions under conditions of uncertainty or where there is significant risk.

Belief in traditional practices.—Although traditional beliefs and practices in agriculture are often scorned. one should not forget that those traditional land use continue to survive in today's competitive environment, while thousands of their innovative or progressive neighbors have gone out of business. Some land users are unwilling to change because those traditional practices present the least risk in dynamic agricultural markets.

(c) Using decisionmaking information

A way to use knowledge about land user decisionmaking is to place it in 2 x 2 matrix format (see figure 31). Land users' reasons for adopting or rejecting agricultural practices can be categorized into one of the four cells.

Initially the specific groups of land users (target groups) whose cooperation is required for a particular program or project need to be identified. For each target group an assessment is made of the reasons they are able or unable and willing or unwilling to adopt the recommended conservation practices. Based on each groups reasons for adopting or rejecting a recommended practice, target groups are sorted int the cell that best represents their decisionmaking rationale. These reasons for adoption or rejection can be determined by interviews with key informants, focus group discussions, NRCS personnel, or other such methods. State sociology coordinators and the NTC sociologists can assist with this task. Examples of different target populations and different conservation practices are provided in figures 3-1 through 3-3. Figure 3-4 can be adapted for a particular situation.

Using the matrix to organize target groups' reasons for adopting or rejecting NRCS recommendations can assist state office planners and field office personnel in determining the appropriate actions necessary to implement a successful program or project. Matrix provided by Tom Makowski, sociologist, NRCS.

(d) Example: Matrices

The following matrices summarize all the various combinations of land users' reasons for adoption and rejection of new practices and technologies. Three sample matrices are presented and a blank matrix is provided for your own use. The table can be read across each row or down each column. For example, in the first table for Low Initial Cost Systems, if the land user has never heard of a low initial cost system from NRCS but has a history of adopting conservation innovations, then that land user would fit into the category of being unable and willing.

Identifying the category an individual land user falls into should help the conservation planner tailor their conservation adoption strategy to the needs and concerns of that particular land user. Realization of a land user's reasons for adoption or rejection should enable the conservation planner to avoid ignorance and insensitivity to the land user's needs, and help get more conservation on the land.

610.0302 Observations about adoption

One can make at least three general observations from the lists presented in this section about why land users are unable or unwilling to adopt conservation practices. First, increasing the adoption of conservation practices or any other new technology depends upon addressing reasons why land users are unable or unwilling to adopt, and then removing these impediments.

Second, many of the factors causing land users to be unable or unwilling to adopt are beyond their control. In many cases it is not so much a land user *failure* as it is a *system failure.*

Third, broad-scale use of any one or even several of the remedial strategies suggested are doomed to failure. A shotgun approach to using technical, financial, or educational assistance will seldom be the answer. One must be able to deliver the specific type of assistance the land user needs in a format compatible with his or her capabilities.

The promotional strategies that worked for the early adopters will not be as effective with late adopters. If accelerated rates of adoption for conservation systems are wanted, then we must be as willing to accept new ideas and methods as we are expecting potential adopters to be.

Adapted from an article titled "Farmer Adoption of Production Technologies" written by Pete Nowak, a professor in the Department of Rural Sociology, University of Wisconsin, Madison, 53706.

Figure 3–1 Low initial cost systems

Reasons for landuser adoption and rejection of new practices and technologies

Landuse is	Unable	Able
Willing	*Unable* 1 The landuser has never heard of a LICS from NRCS but ... *Willing* has a history of adopting conservation innovations	*Able* 2 The landuser was assisted by the NRCS field office in planning LICS,... *Willing* and a LICS will meet the landuser need on leased land
Unwilling	*Unable* 3 There is no one available in the county who can help the landuser implement a LICS... *Unwilling* and, thus far, a LICS seems no better than doing nothing.	*Able* 4 A medium-size, stable operation, the landuser has heard of LICS, but... *Unwilling* has heard conflicting information about the effectiveness of LICS.

Figure 3–2 Crop residue management

Reasons for landuser adoption and rejection of new practices and technologies

Landuse is	Unable	Able
Willing	*Unable* 1 Landuser can not get information or assistance on CRM appropriate to his operation but... *Willing* has a plan which requires CRM and continue to receive his base payments.	*Able* 2 Landuser has tried CRM on a limited basis and ... *Willing* can fit it into current cropping rotation.
Unwilling	*Unable* 3 First heard of CRM when plan was signed and never before used anything but a mold borad plow *Unwilling* The landuser is suspicious of government assistance and is relatively isolated from main stream agriculture.	*Able* 4 NRCS district conservationists has offered to assist the landuser implement CRM on land, but... *Unwilling* The landuser is afraid of changing the way they have always prepare the fields.

Figure 3–3 Agroforestry—Windbreak technologies

Reasons for landuser adoption and rejection of new practices and technologies

Landuse is	Unable	Able
Willing	*Unable* 1 An eastern Colorado landuser has no local source from which to obtain stock, but... *Willing* the landuser grew up in Missouri and wants trees on his land.	*Able* 2 Field office staff has information and the ability to assist landusers plan a windbreak planting, and *Willing* several landusers recently requested a forest stewardship workshop in their county.
Unwilling	*Unable* 3 The landuser has never planted a tree in his life and... *Unwilling* conventional wisdom is that trees can't grow here; "Never have. Never will."	*Able* 4 The county has a *total tree care* program but... *Unwilling* the landuser doesn't see how trees will improve either the efficiency or effectiveness of the operation.

Figure 3–4 Reasons for landuser adoption and rejection of new practices and technologies worksheet

Reasons for landuser adoption and rejection of new practices and technologies

Landuse is	Unable	Able
Willing	*Unable* 1 *Willing*	*Able* 2 *Willing*
Unwilling	*Unable* 3 *Unwilling*	*Able* 4 *Unwilling*

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Part 610 National Economics Handbook

Chapter 4 Conservation Effects For Decisionmaking: A Framework For Economic Evaluation

Chapter 4 Conservation Effects For Decisionmaking: A Framework For Economic Evaluation

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Chapter 4 Conservation Effects For Decisionmaking: A Framework For Economic Evaluation

610.0400 Introduction

(a) Purpose and scope

Conservation Effects for Decisionmaking (CED) enables NRCS planners to display and evaluate the effects of various conservation options available to the land user.

The CED process can be used to assist land users with their conservation decisions by:

- Providing a framework in which to organize and present information that facilitates comparison of the positive (gains) and negative (losses) effects of a conservation option.
- Permitting consideration of all physical, sociological, and economic values pertinent to the evaluation.
- Encouraging the employment of analytical tools at appropriate levels of sophistication to provide information.
- Capitalizing on the knowledge and experience of our agency professionals and clients to foster interaction throughout the decisionmaking process.

(b) The planning process

The CED process is completely consistent with the planning process outlined in the National Planning Procedures Handbook. CED is not a new system, but a method of thought organization. It provides a way to evaluate the continuum of all alternatives available to the land user, and is intended to make conservation planning and application easier and more efficient.

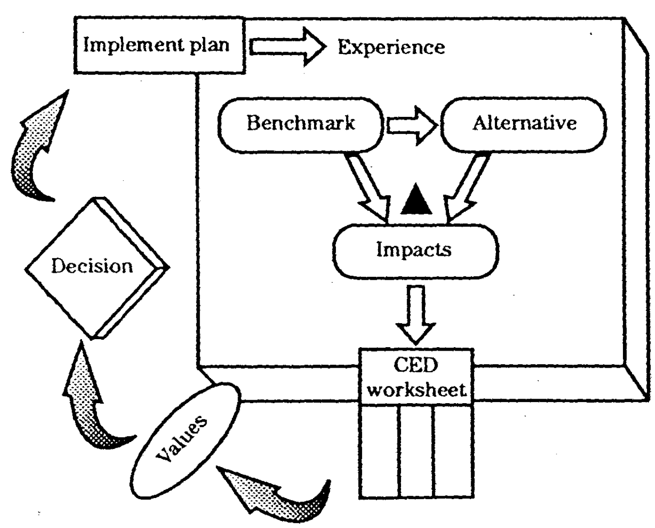
(c) Collecting and recording information

The collecting and recording of effects information for the CED process is not a new approach; it has been the major thrust of conservation management systems (CMS), and of planning in general. The CED idea emerged from a national economic application work group. It links the planning process with economic input and emphasizes the end objective. The identification of the expected effects from applied conservation allows decisions to be made and actions to be taken. The CED framework is applicable to all NRCS programs and planning situations. Consequently, it is also the theme and organizational tool for this handbook, which has an explanation of the steps in the process of evaluation, a diagram of the decisionmaking process, and examples of evaluation approaches. Case studies have been included in appendix B from each of the four Technical Center Regions. Subsequent chapters explain the various economic principles, tools, and techniques available for use if one wishes to carry evaluations to a more detailed level of analysis.

(d) The framework

The CED framework has information from many disciplines combined, so that a comprehensive and effective evaluation can be made. For more guidance on how to carry out a CED analysis, consult with you state office about CED training, the CED Training Manual, and the CED Workbook. The workbook contains step-by-step instructions and explanation of each step of the process. Lessons and questions are provided for self study. Always keep in mind that economics is just one of the many tools available to help NRCS do a better job and to help the land user make more informed decisions. Figure 4–1 is a chart presented to graphically explain the CED decisionmaking process.

Figure 4-1 CED decisionmaking process



610.0401 Steps in the CED process

(a) Benchmark

Field office level planning efforts should always first identify the benchmark condition. The planner and land user work together to develop a picture of existing conditions, trends, problems, opportunities, and objectives. The assistance provided is based upon soil, water, and other natural and cultural resource information. The description of benchmark conditions could include:

- Other inventories and evaluations
- Description of current crops, farming practices, livestock type and condition, and available equipment
- Consideration of sociological and economic characteristics

Planning objectives and the complexity of each situa-
ɿn determine the level of detail necessary for inven-
ies and evaluations.

The objectives of the land user will usually affect the kind and amount of information gathered and evaluated. However, the formulation of planning objectives requires that the objectives of society as well as those of the land user be considered. The planning process should also identify opportunities. This creates a broader view that goes beyond the search for resource problems to recognize where resource enhancements may be achieved. For example, if a given area does not have a significant soil resource problem onsite, opportunities may still exist to make on-farm improvements that could increase efficiency and profitability, while at the same time reducing negative water or air quality effects offsite.

(b) Alternatives

Alternatives that meet both individual and societal objectives need to be considered after a picture of the benchmark situation and expected future trends are developed. The CMS (Conservation Management System) formulation process will normally be used to develop alternatives that provide a desirable view of the future.

Proposed alternatives enable planners to develop a picture of the conditions that could exist on the farm or ranch with conservation treatment. Alternatives represent the world of possibilities, a vision of what could be, based on predictive models, professional judgment, and experience with the expected effects of each action or set of actions considered. They are the different options that are proposed to deal with current and future problems or issues arising from the existing situation.

An alternative is generally a Resource Management System (RMS), but could also be an Acceptable Management System (AMS), or Alternative Conservation System (ACS) for plans developed for the 1985 Food Security Act. It could be a single practice or simply an adjustment to present farming operations. Proposed alternatives must be consistent with Sections III and IV of the Field Office Technical Guide (FOTG), and must also be within the approval authority of the planner. Apart from the FOTG, the experience and knowledge of the planner and decisionmaker are the main sources of information used for selection.

To achieve a specific alternative, certain steps or actions need to be taken. Examples of actions include a change in cropping sequence, land use, time of seeding, tillage or timing of cultivation, structural improvements to the farm, or simply lowering the speed of a single tillage operation. Each individual has a different experience base which can be increased by on-the-job training, specialized training courses, field trials, or the use of models. A useful learning experience for planners is to visit land users with successful conservation treatments already applied. Technology transfer through exposure in this manner rapidly broadens an employee's perspective and improves their expertise and confidence. If successful on-farm experiences are documented and shared as case studies, the knowledge base of others within and outside the agency could also be easily enhanced. Such experiences should be recorded first in physical and biological terms rather than monetary ones, because monetary values are simply a translation of the former and can be expressed in current dollars at any time.

(c) Impacts

The completed alternative is compared with the benchmark condition to estimate the impacts of the actions. The impacts of applied conservation options are the differences between the benchmark or current condition and trends and the proposed alternative situation. Quantification of the impacts is dependent upon the degree of detail used to describe or measure the benchmark and expected alternative conditions. The impacts should be described in narrative form at a minimum, and in quantitative terms to the extent possible. They should also be recorded in an easy to understand manner for consideration by the decisionmaker.

Conservation Effects or Impacts Worksheets can be used to record this information. Differences in erosion rates, habitat values, water quality, acres farmed, bushels harvested, labor and fuel requirements, pesticides used, etc., should all be documented to the extent that such information is needed by the land user or is required by the agency. The time frame when the impacts occur might also be identified, because certain actions such as pasture improvements can result in immediate costs, but the resulting yield increases may be delayed and then occur for an extended period of time.

(d) Values

Each individual's values will affect the relative merits of an impact. Ten additional quail may be a positive impact to one person and a negative one to another. An individual's set of values may be in harmony with society's best interest or it may be in direct conflict. Once it has been applied to the impacts, the positive and negative points may be listed. This listing can start out generally and be expanded to increasingly detailed levels. The procedure may involve traveling completely back through the decisionmaking process, or it may involve increasingly sophisticated levels of detail on the same impacts. The process is continued until the land user has enough detail to make an informed decision. In most cases, the planner will identify the costs and describe necessary maintenance for each of the options. Often a limited amount of detailed information will be enough. Occasionally, however, a more complex analysis will be necessary, and the concepts presented in this handbook may help.

610.0402 Comparison of the NRCS planning process and CED

Table 4–1 compares the steps of the NRCS planning process and the concurrent activities of the CED process.

Table 4–1 Conservation Planning versus CED Process

Conservation Planning	CED Process
(1) Identify the problem—All significant resource problems relating to the five resources (soil, water, air, plants, and animals) are identified and documented.	*(1) Benchmark/experience*—The Benchmark part of CED also starts with identifying the problem. A key factor is the necessity to document the current conditions for later comparison with the Alternative, or future conditions to determine Impacts. The CED Benchmark part also overlaps Steps 2, 3, and 4, Determine the Objectives, Inventory the Resources, and Analyze the Resource Data. Experience, especially individual experience, is required in every part of CED that calls for judgment.
(2) Determine the objectives—This step establishes the level of detail for the planning effort based upon objectives. The client's objectives are clearly documented. This step includes determining the client's expectations, to try capabilities, characteristics, tenure, values, and limitations; NRCS policy and technical requirements; community traditional values; financial constraints; and legal requirements.	*(2) Alternative/values/experience*—The client's objectives are needed in CED for you to produce an Alternative, or future condition. The client's Values also affect the choice of which Conservation Management System
(3) Inventory the resources—Factual data sufficient to analyze problems and to develop and evaluate alternatives are available and recorded in suitable formats.	*(3) Benchmark/experience*—Recording factual data in a suitable format can be considered the end product of establishing the Benchmark in CED. Experience is used to decide what kind of data is important to record.
(4) Analyze the resource data—Data must be analyzed to verify the problems, determine their causes, and determine if the data are sufficient to use in formulating proposed solutions. Data are analyzed to quantify identified problems and to forecast conditions and effects without action.	*(4) Benchmark/experience*—Benchmark is quantifying problems and forecasting conditions and effects of resource problems. Experience is a CED contribution to this step of the conservation planning process of resource problems through the use of user experience documentation from Section V of the FOTG.
(5) Formulate alternative solutions—Alternative solutions are developed that produce the effects of solving or alleviating identified problems and meeting the client's objectives.	*(5) Alternative/experience*—If the client does not like the results of a proposed CMS, a new Alternative CMS is proposed and the CED process is cycled through again.
(6) Evaluate alternative solutions—Alternative solutions are analyzed and compared, using CED and other tools, to determine if they meet the client's objectives, NRCS policy, and technical and legal requirements. Effects of alternatives are evaluated individually and compared to Benchmark conditions as to their ability to solve or alleviate the problems and meet the client's objectives.	*(6) CED*—This is the most important part of the CED process.
(7) Client determines a course of action.—The alternative solutions selected is based on the client's clear understanding of the effects of each alternative, and the selected solution is recorded in the proper format.	*(7) Values/CED worksheet/hierarchy of analysis/experience*—The intended result of the CED process using Values, CED Worksheet, Hierarchy of Analysis, and Experience is a clear understanding of the proposed Alternative and how it would affect the operation.
(8) Client implements the plan—Client has adequate information to implement, operate, and maintain the planned treatments. Completion of this step alleviates or solves the problem.	*(8) CED*—The CED goal is to involve the client in the decisionmaking process, so that the client is fully committed to carrying out the conservation plan.

Table 4–1 Conservation Planning versus CED Process—Continued

Conservation Planning	CED Process
(9) *Evaluation of the results of the plan*—This step, which could also be called monitoring or follow-up, assesses the success of the NRCS assistance in solving the identified problems and meeting the client's objectives. It includes recording the client's experience with the plan as implemented. This provides NRCS with effects information for use with other clients with similar resource problems.	(9) *Experience*—The experience part of CED directly relates to this step of the conservation planning process. Because the CED process documents the effects in Section V of the FOTG, it will provide a growing base of experience to draw upon when working with other clients with a similar resource setting.

610.0403 Case studies

Information regarding the effects of conservation can be collected from any source possible, but without extensive research results or local expert knowledge, a case study is a convenient and relevant way to collect this information. A case study enables the conservation planner to document conservation systems currently used in a farming or ranching community, along with the motivations that led to their adoption. Having ready data about the effects and impacts of conservation systems will enhance NRCS's ability to implement effective conservation technologies and policies. A case study is also a way to record conservation effects information using the CED process. The CED process is a multi-discipline effort often including information from agronomy, engineering, geology, and economics. Resulting case studies felt to be useful should become part of the FOTG, Section V, Part B (Conservation Effects).

(a) What to record

The conservation practice effects that a land user experiences can be used to project what may happen when the same practice is applied to a different farm or ranch with similar resource characteristics and problems. In a case study, NRCS conservationists systematically record resource settings and conditions, before and after a conservation option is implemented. The changes or effects that occur as a result are the important things to record.

The value of the case study concept is establishment of a systematic method for NRCS field staffs to record the effects they observe when conservation has been applied. Conservationists and land users can then use this information when choosing which conservation option will best suit their needs.

(b) Format choice

The choice of a case study format is based on the ease with which one can document a wide variety of factors influencing an individual's conservation decisions—including those factors that may be non-quantitative in nature. While the initial focus of a case study may be a single land use, the study can be expanded to include relevant social and environmental factors.

Case studies may provide the land user and conservation planner with information such as:

- Effectiveness of conservation and resource management systems
- New innovative practices
- Educational tools for field staff, farmers, and ranchers
- Planning and marketing tools
- Insight into the impacts of policy and technology changes.

(c) Procedure

Section V of the Field Office Technical Guide contains procedural references on Guidance for the Development and Use of Case Studies as a Source of Conservation Effects Information. This might be a useful reference for those interested in developing their own case study files. Case studies can be used to examine a variety of topics, including but not limited to soil conservation, pesticide use, archaeological and historical preservation, water quality, and wetland preservation. The documented topic is usually determined by the land user.

A detailed outline of the information sought in the interview of the land user should be made beforehand. To facilitate comparisons among case studies, it is useful to decide upon a format for answers (i.e., qualitative, quantitative or mixed). Questions that can be answered with a yes or no should be avoided. Informal, neutral questioning is usually effective with this type of study, as is individual opinions, descriptions of practices, and recommendations. Questioning should be structured to minimize note taking so that concentration can be focused on observing responses and stimulating a natural flow of conversation.

The interview should begin with an explanation of how the information will be used and by whom. Responses are often less guarded and more enthusiastic when the person interviewed knows that they will not be quoted in the local paper, and that the information generated may be useful at the local, state, regional, or national level. It is helpful to make arrangements to provide the land user being interviewed with a draft of the study after it has been completed along with the option to edit his/her own responses. This review process is an important means of ensuring the accuracy of each case study.

Case studies allow the analysis of any number of factors relevant to the land user. Since such a vast amount of information can be obtained, not all of it can or should be used in the final report. It is important to remember that brevity and concise observations are valuable assets for effective use of a case study.

Some case studies can last several years, when the land user is willing to keep track of costs and yields. This is probably the most useful situation since the extra data add reliability to the findings.

(d) Types of case studies

Case studies can be of three types:

- A comparison of the before and after treatment conditions on a single site.
- A comparison of two separate but comparable resources and land use situations (sites) on different farms or even on the same farm, i.e., one site with and one without treatment.
- A simple recording of farmer experiences with treatment on a single site regardless of the earlier conditions.

The first and second types mentioned above require that data be collected for both the before treatment or benchmark situation and the after treatment condition arising from the adoption of conservation.

The third type of case study represents the simplest approach, but inherently involves the greatest risk of misunderstanding the cause and effect relationships. It focuses on *with treatment* conditions only. This may not be important for the immediate future, as the optional situation with any conservation is considered more desirable than the present situation. However, a more precise understanding of the cause and effect relationships of conservation is of great importance when considering the long run.

(e) Hierarchy of analysis

The following notes should be helpful when constructing a case study for which a greater level of detail is requested.

- The hierarchy of analysis refers to different levels of analysis needed to assist the land user in making an informed choice. Any number of levels may be used, depending on the amount of detail desired by the land user.
- The level numbers are not intended to have specific definitions other than relative to other levels.
- The impact information on the account ledger is not intended to be read across as single lines. Instead, the combination of positive impacts is compared to the combination of negative impacts.
- Information obtained from models and tools can be used to better determine the impacts when going to higher levels of analysis.
- Sometimes a higher level of analysis is needed in order to include an impact not previously considered, even though it may not involve refining information already displayed.
- Information should be presented in the manner most helpful for the land user, such as total amounts for the treatment unit rather than per acre amounts.

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Chapter 5 Time and Money (Interest and Annuities)

Chapter 5 Time and Money (Interest and Annuities)

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(200-vi, NEH, draft May 1995)

Chapter 5 Time and Money (Interest and Annuities)

610.0500 Introduction

(a) Purpose and scope

During the decisionmaking process, the land user occasionally wants more detailed information than the first or second level of analysis provides. In cases where investment and return information is required, the conservationist will need a basic understanding of interest and annuities to perform an in-depth analysis and comparison of an alternatives available.

The intent of this chapter is to provide a basic understanding of more detailed concepts such as interest and annuities, and to show how they can be used to compare and analyze alternatives. The interest and annuity factors needed for these calculations appear with the examples and can also be found in Appendix A. You should contact your state economist or resource conservationist if you need help locating the tables for other interest rates you may need. This chapter also gives formulas and examples for calculating the factors. For practice examples, consult appendix A. Finally, spreadsheet software programs have functions for many of the formulas.

(b) The time value of money

Money can be invested and used to make more money over time. Thus, one dollar received today could be put in a bank or invested elsewhere, where it would become worth more than one dollar a year from now. This is known as the time value of money. Land users may make decisions about purchasing one piece of equipment versus another, or making no purchase at all, based upon the use of money over time.

(c) Opportunity costs

The time value of money can be thought of in two forms. First, if the land user borrows money for a purchase, the time value of money is the interest paid on the loan. When land users use their own money, the time value is the return they gave up from another investment (savings account, certificate of deposit, and IRA) by making the purchase.

When a land user considers purchasing conservation, the time value of money concept applies. There is a cost above and beyond the purchase of the conservation practice. If the land user borrows to pay for the practice, that additional cost will be equal to the interest that must pay on the loan. Otherwise, the additional cost is equal to the return that money would have earned on some other investment.

610.0501 Timing

(a) One-time values, annuities, and lags

The benefits and costs of conservation do not necessarily occur at the same time. Certain costs and benefits may occur at one point in time while others occur over a number of years.

Those values that occur at a single point in time, like installation costs, are called one-time values. Values that occur over an extended period of time are called annual flows or annuities. Annuities can be generalized as constant, decreasing, or increasing over time, depending on their characteristics. Many of the benefits from conservation occur as annuities. A one-time value can occur today or at some point in the future. If it occurs at some point in the future, it is said to be delayed or lagged. Annuities can also be lagged. If benefits from a terrace do not start until a year after installation, then those benefits are said to be lagged one year. Deferred grazing following range seeding is another common example of a lagged annuity.

(b) Average annual values

To properly compare benefits and costs, they must be considered in the same timeframe. A standard form in which we can consider them is average annual values, which describes an annual flow that is not lagged. In table 5–1, the middle column gives four examples.

Table 5-1 Examples of one-time values, annuities, and lagged values

One-time value	Annuities	Lagged values
Installation Cost	(Avg. Annual Values) Conservation Benefits Average Returns Average Costs O&M Costs	Any value which does not begin this year

Average annual values are significant because the accounting system in most businesses, including farming and ranching, are based on them. Therefore, the costs and benefits of conservation, once converted to average annual values, can be added to the annual costs and returns of the farm or ranch business.

Two useful tools for converting the benefits and costs of conservation into average annual values are amortization key and interest and annuity (I&A) tables (see appendix A, Part I of the FOTG, or your state economist).

The conversion of costs and benefits into average annual values without the help of I&A tables would involve the use of many difficult calculations and much time. The tables were constructed to simplify the process by presenting coefficients developed from the formulas, thus providing much simpler and faster calculations. Formulas and examples are provided.

Interest and annuity tables are available for a wide range of interest rates. An interest rate of 10 percent has been used in the following examples. The typical table that NRCS uses has seven columns:

- Column 1 number of years hence
- Column 2 present value of 1
- Column 3 amortization
- Column 4 present value of an annuity of 1 per year
- Column 5 amount of an annuity of 1 per year
- Column 6 present value of an increasing annuity
- Column 7 present value of a decreasing annuity.

All of these except number of years hence are discussed in detail later in the chapter. Number of years hence is the number of years in which calculations are considered. Several factors may influence this determination including the measures may have a short or long useful life or an individual may want to recover their costs in a certain time period. Three items that are discussed in detail but are not found directly in the tables are: simple interest, compound interest, and sinking fund.

610.0502 Interest

Interest is the earning power of money; what someone will pay you for the use of your money, or the rent you are willing to pay for the use of someone else's. Interest is usually expressed as an annual percentage rate (APR) and is most often compounded.

(a) Simple interest

Simple interest is money paid or received for the use of money, generally calculated over a base period of one year at a set interest rate, but is not commonly used. Figure 5–1 is a graph of simple interest.

$$I = (p)(i)(n)$$

where :

I = interest
p = principal
i = rate of interest
n = number of periods (years).

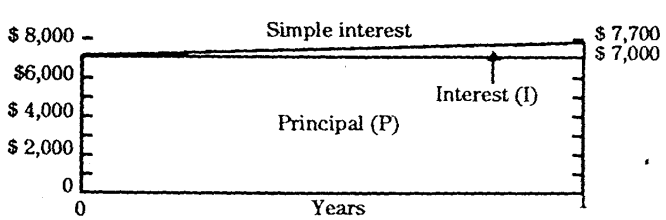
Example: $7,000 is borrowed at 10 percent interest (APR) for 1 year. Use the interest formula to compute how much money will be needed to pay off this loan when it is due.

I = 7,000 x .10 x 1=	$700	interest due
	7,000	principal due
	$7,700	Total needed to pay the loan.

Example: To compute how much interest is earned if $3,000 is put into a savings account for 6 months at 10 percent interest, multiply the principal times the interest times the number of years.

I = 3,000 x .10 x .5 = $150 will be earned.

Figure 5–1 Simple interest



(b) Compound interest

Compound interest is earned for one period and immediately added to the principal, thus resulting in a larger principal on which interest is computed for the following period.

$$CI = (1+i)^n$$

where:

n = number of periods
i = periodic rate of interest
1 = one dollar since the formula results in a factor that is multiplied by the principal dollar amount.

If the interest rate is 10 percent (APR) compounded quarterly for five years, then i = .10 divided by 4 (four payments in a year) or .025; n = 5 x 4 (four payments in a year) or 20. The factor to be multiplied by the principal amount is (1 + .025)20 = 1.63862.

Example: At the end of 7 years the depositor will have $4,871.79 if $2,500 is put into a savings account paying ten percent interest compounded annually.

$$(1+.10)^7 = 1.948717$$

$$1.948717 \times 2,500 = \$4,871.79$$

If compounded semiannually,
(1 + .05)14 = 1.9799316
1.9799316 x $2,500 = $4,949.83
If compounded quarterly,
(1 + .025)28 = 1.9964950
1.9964950 x $2,500=$4,991.24
If compounded monthly,
(1+.0083333)84=2.0079146
2.0079146x$2,500=$5,019.79
If compounded daily,
(1 + .0002740)2555 = 2.0136997
2.0136997 x $2,500 = $5,034.25

For comparative purposes, compounding gives these results: $2,500 invested for 7 years at 10 percent:

Compounded annually	$4,871.79
Compounded semiannually	$4,949.83
Compounded quarterly	$4,991.24
Compounded monthly	$5,019.79
Compounded daily	$5,034.25

Compound interest factors are not shown by column heading in the tables. However, the same answer can be obtained by dividing by the appropriate *present value of 1* factor, since the present value of 1 factor is the reciprocal of the compound interest factor. Since these are *annual* tables, this method will work only if compounding on an annual basis.

Example: \$2,500 in seven years will be worth \$4,871.78 if it earns ten percent interest compounded annually.

1/.51316 (from the interest tables, present value of 1, 7 years hence at 10 percent) = 1.948710 (the same factor was obtained by using the formula).

1.948710 x \$2,500 = \$4,871.78.

Compound interest is shown in graph form in figure 5–2.

610.0503 Calculating Interest And Annuities

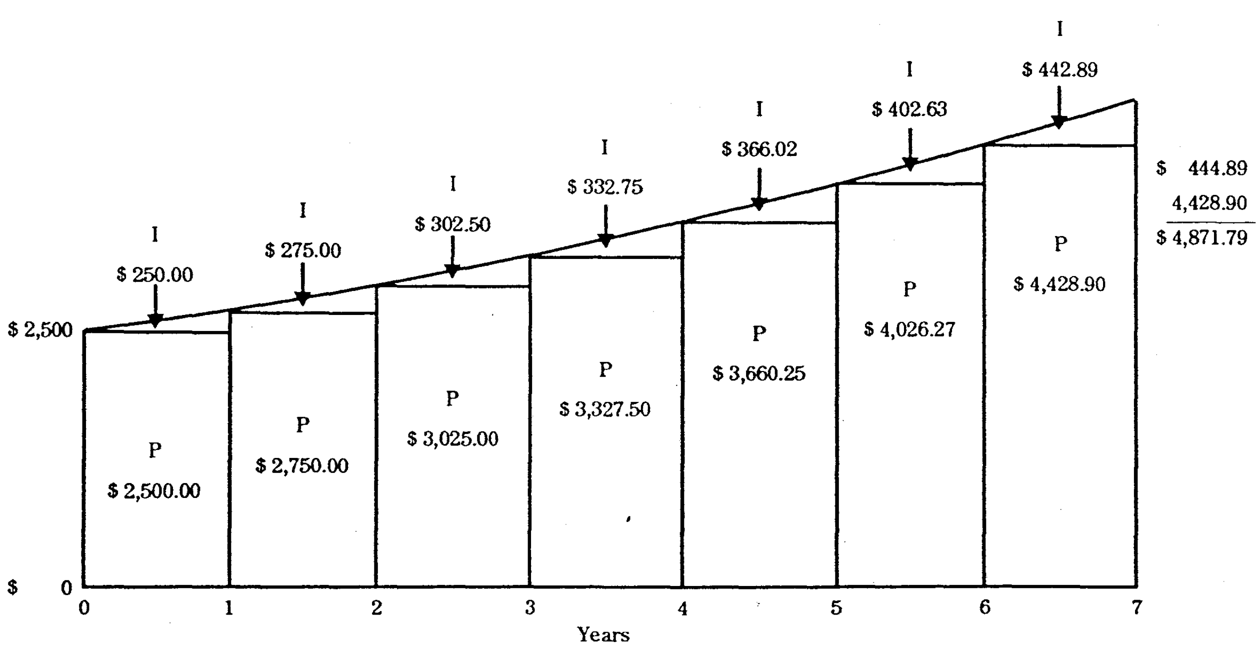
(a) Present value of one

The present value of one is the amount that must be invested now at compound interest to have a value of one at the end of a given time period. Put another way, it is what \$1.00 due in the future is worth today. It is also known as the present worth of one or discount factor. The graph is shown in figure 5–3.

$$PV = \frac{1}{(1+i)^n}$$

The *present value of 1* factor is the reciprocal of the *compound interest* factor.

Figure 5-2 Compound interest



Example: $4,000 will be needed 5 years from now. You would need to invest $2,483.68 now at 10 percent interest compounded annually to be worth $4,000 in 5 years.

$$\frac{1}{(1+10)^{5}} = \frac{1}{1.61051} = .62092$$

$$.62092 \times 4,000 = \$2,483.68$$

The factor can also be found in the ten percent interest table in the *present value of 1* column for 5 years hence.

Example: If $923 is invested at 10 percent interest compounded annually and left alone for 25 years, it would have a value of $10,000 at the end of the 25 years (the power of compounding), or $10,000 to be received in 25 years is worth $923 today.

.09230 (from the table) x $10,000 = $923.

(b) Amortization

Amortization is also called partial payment or the capital recovery factor. It is the *paying off* a financial obligation in equal installments over time. The amortization factor will determine what annual payment must be made to pay off the principle and interest over a given number of years (average annual cost).

$$A = \frac{i(1+i)^{n}}{(1+i)^{n}-1} \text{ or } \frac{i}{1-\frac{i}{(1+i)^{n}}}$$

Example: A farmer borrows $7,000 to install a conservation system. The interest rate is 10 percent and the repayment schedule is set up for 10 years.The farmer must pay $1,139.25 each year for 10 years to pay off the $7,000 loan and interest. A total of $11,392.50 will have been paid to close out this loan ($7,000 of principal and $4,392.50 of interest).

$$1^{.10} - \frac{1}{(1+10)^{10}} = \frac{.10}{1-.38554} = \frac{.10}{.61446} = .16275$$

$$.16275 \times \$7,000 = \$1,139.25$$

Table 5-2 displays what occurs each year during the 10 year period.

Figure 5–3 Present value of 1

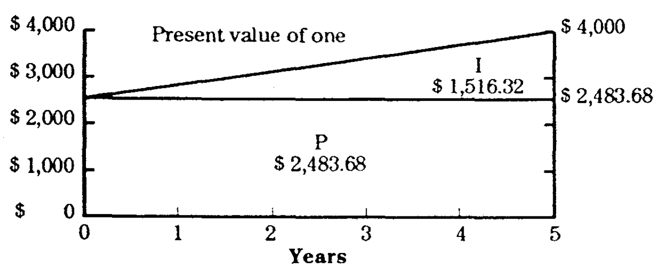


Table 5-2 Ten-year period

Year	Amount of loan	Annual payment	Payment Principal	Payment Interest	Remaining Balance
1	$7000.00	$1139.25	$439.25	$700.00	$6560.75
2	6560.75	1139.25	483.17	656.08	6077.58
3	6077.58	1139.25	531.49	607.76	5546.09
4	5546.09	1139.25	584.64	554.61	4961.45
5	4961.45	1139.25	643.11	496.14	4318.34
6	4318.34	1139.25	707.42	431.83	3610.92
7	3610.92	1139.25	778.16	361.09	2832.76
8	2832.76	1139.25	855.97	283.28	1976.79
9	1976.79	1139.25	941.57	197.68	1035.22
10	1035.22	1139.25	1035.73	103.52	0
Total	–	$11392.50	$7000.00	$4392.50	–

The factor can also be found in the ten percent interest table in the amortization column for ten years hence.

Note:The amortization factor is the reciprocal of the present value of an annuity of 1 per year factor, which means that the same answer can be obtained by dividing by the present value of an annuity of 1 per year factor. Using the above problem, the solution is:

$$\frac{7,000}{6.14457} = \$1,139.22$$

(c) Amortization key

In many plant sciences or botany courses a tool called a key is used to identify plant species by helping the observer to answer a series of questions. This keying out process is useful because it allows non-experts to identify species of plants that are unknown to them. By answering a series of questions, the amortization key serves as a guide for using the interest and annuity tables to convert benefits and costs of conservation to average annual values. The first question on the key is whether the value is an annuity, such as benefits from a terrace that occur regularly over time; or a one-time value, such as terrace installation costs.

If it happens to be a one-time value, follow down the key to the question, *Is it lagged?* A value that will be realized sometime in the future is considered lagged, because there is a lag period between now and the time the value will occur. Assuming the value is not lagged, one only needs to amortize the value over the life of the project or evaluation period.

A one-time value is amortized when it is multiplied by the amortization factor (located in the I&A tables found in your Economics Reference Handbook). The result of this multiplication is an average annual value. Had the value been lagged, the one-time value would first have to be multiplied by the *present value of 1* factor for the lag period, and then multiplied by the amortization factor.

To convert an annuity to an average annual value, it is important to determine whether it is constant, increasing, or decreasing. If the annuity is a constant flow of value, then it should be multiplied by the *present value of a constant annuity* factor for the period (number of years) of the annuity. This factor is in the I&A tables under the column called *present value of an annuity of 1 per year.*

Figure 5-4 Amortization

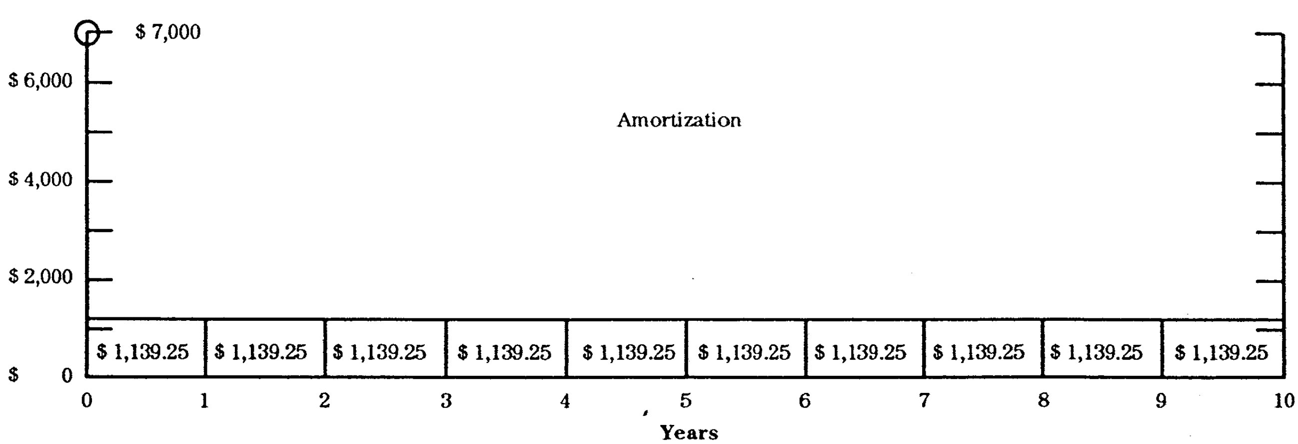
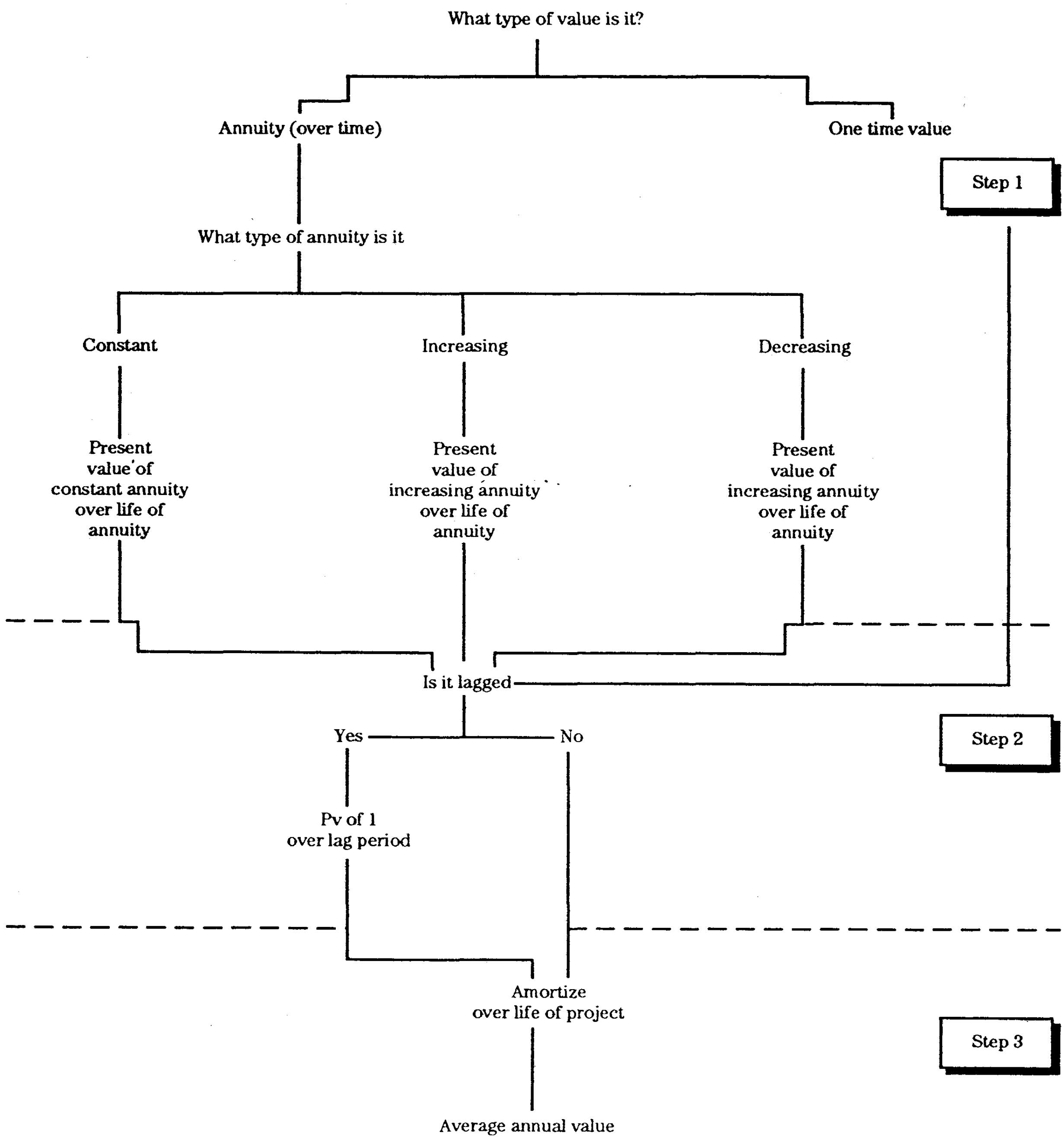


Figure 5-5 Amortization key



The result would then be multiplied by the amortization factor, if the annuity was not lagged. If the annuity period was lagged, it would be multiplied by the *present value of 1* factor for the lag period before being amortized.

For an increasing or decreasing annuity, the value multiplied by the factor is the yearly average increase or decrease. For example, with an increasing annuity that begins at zero and rises to $500 after 5 years, the yearly average increase would be 500 divided by 5, or 100. That value would be multiplied by the *present value of an increasing annuity* factor for 5 years. To do so, locate the factor in the 5 year row under the *present value of an increasing annuity* column and multiply it by 100. If the annuity is lagged, that answer is multiplied by the *present value of 1* factor over the lag period. It is simply amortized if the annuity begins in the first year. The same steps would be taken for a decreasing annuity using the appropriate factors.

There are three basic steps in the process:

Step 1 Convert annuities to one time values

Step 2 Adjust for lags

Step 3 Amortize

Not all the steps are used each time. The key guides you through the proper process. For example, if a one time value is considered, the key moves you past step 1. If the annuity or one time value is not lagged, the key moves you past step 2. Remember, this process is necessary to convert benefits and costs of conservation into values that can be easily incorporated into a land user's records and decisionmaking system.

(d) Present value of an annuity of 1 per year

Present value of an annuity of 1 per year is also referred to as a constant annuity, present worth of an annuity, or capitalization factor.

This factor represents the present value or worth of a series of equal payments or deposits over a period of time. It tells us what an annual deposit of $1.00 is worth today. If a fixed sum is to be deposited or earned annually for n years, this factor will determine the present worth of those deposits or earnings.

$$PV \text{ of } A = \frac{(1+i)^n - 1}{i(1+i)^n}$$

Example: You want to provide someone with $1,200 each year for 10 years. The interest rate is 10 percent. You must deposit $7,373.48 now to produce an annuity of $1,200 for 10 years, and a total of $12,000 will be received. The interest amounts to $4,626.52.

$$\frac{(1+10)^{10}}{.10(1+10)^{10}} - 1 = \frac{(1.10)^{10}}{.10(2.59374)} - 1 = \frac{1.59374}{.259374} = 6.14457$$

$$.6.14457 \times 1,200 = \$7,373.48$$

The factor can also be found in the ten percent interest table in the *present value of an annuity of 1 per year* column for 10 years hence.

The present value of an annuity factor is the reciprocal of the amortization factor. Therefore, the same answer can be obtained by dividing by the amortization factor as follows.

$$\frac{1,200}{.16275} = 7,373.27$$

(e) Amount of an annuity of 1 per year

The amount of an annuity of one per year is the amount that an investment of $1 per year will accumulate over a certain period of time at compound interest.

$$A \text{ of one} = \frac{(1+i)^n - 1}{i}$$

Example: \$2,000 per year will be invested for 30 years in an individual retirement account (IRA) paying ten percent interest compounded annually. The value of the IRA account at the end of 30 years is \$328.988.04.

$$\frac{(1+.10)^{30}-1}{.1}=\frac{16.449402}{.10}=164.49402$$
$$164.49402\times 2,000=\$328,988.04$$

The factor can also be found in the ten percent interest table in the *amount of an annuity of 1 per year* column for 30 years hence.

(f) Sinking fund

The sinking fund factor is used to determine what size annual deposit is necessary for accumulation of a certain amount of money in a certain number of years at various rates of compound interest.

$$SF=\frac{i}{(1+i)^n-1}$$

Example: \$6,300 will be needed in 4 years. The amount, \$1,357.46, must be deposited annually for 4 years at 10 percent interest compounded annually to accumulate the \$6,300.

$$\frac{.10}{(1+.10)^4-1}=\frac{.10}{.4641}=.21547$$
$$.21547\times 6,300=\$1,357.46$$

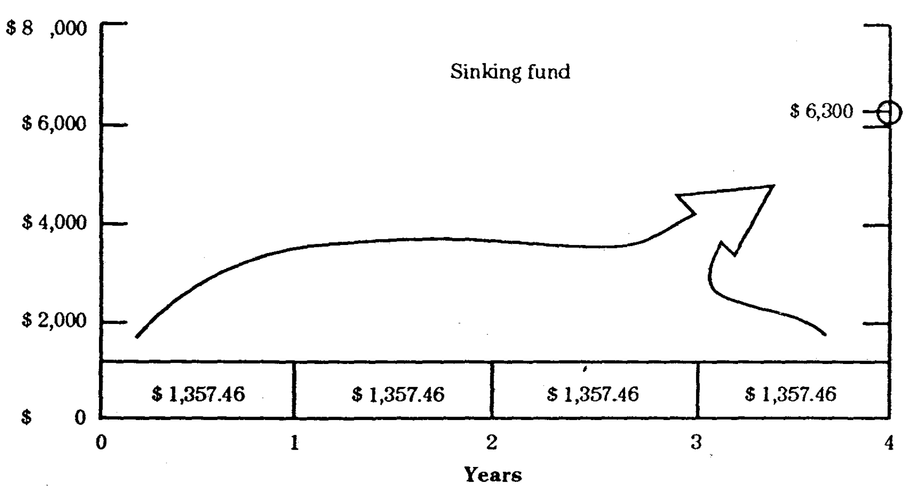
The sinking fund factor is not shown in the tables, but the same answer can be obtained by dividing by the appropriate *amount of an annuity of 1 per year* factor. This is because the amount of an annuity of 1 per year factor is the reciprocal of the sinking fund factor.

$$\frac{6,300}{4.64100}=\$1,357.46$$

The sinking fund factor is also equal to the amortization factor minus the interest rate.

$$.31547-.10=.21547$$
$$.21547\times \$6,300=\$1,357.46$$

Figure 5–6 Sinking fund



(g) Present value of an increasing annuity

The present value of an increasing annuity is a measure of present value of an annuity that is not constant but increases uniformly over a period of time. When using this factor, it is important to note that the value of $1 (which is multiplied by the factor) is the annual rate of increase and not the total increase during the period. This is shown in figure 5–7.

$$PV \text{ of } IA = \frac{(1+i)^{n+1} - (1+i) - n(i)}{(1+i)^n (i)^2}$$

Example: A farmer renovates a pasture and estimates that it will reach full production in 4 years. The improvement will increase uniformly over the 4-year period and at full production will improve net income $20 per year per acre. Using an interest rate of 10 percent, the present value of this increasing annuity is 7.54798.

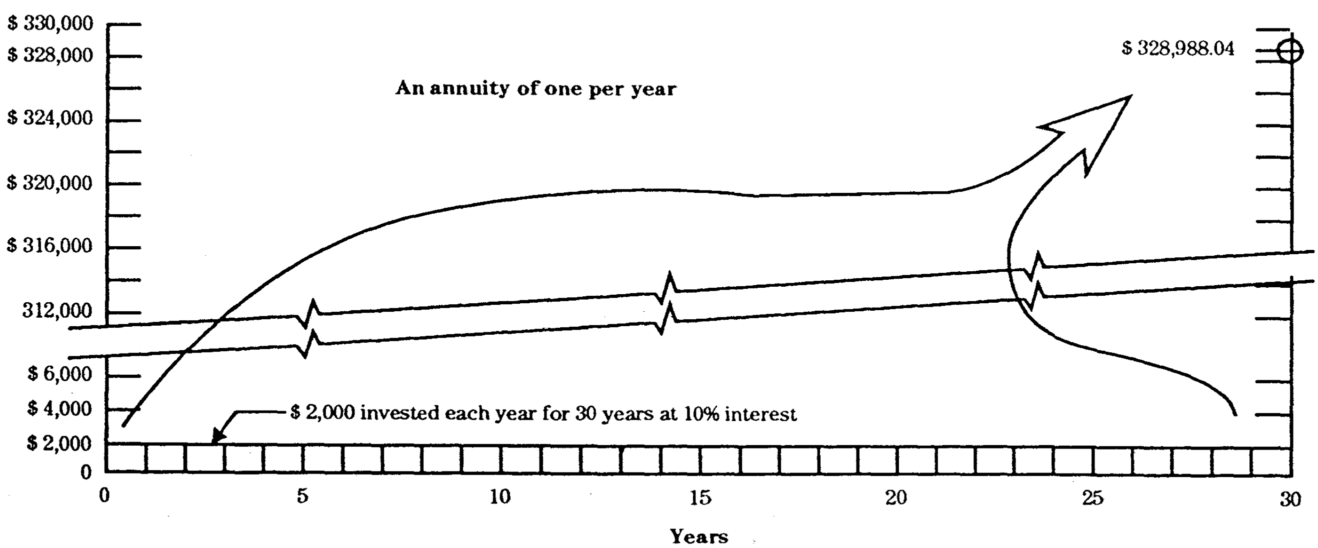
$$\frac{(1+.10)^5 - (1+.10) - 4(.10)}{(1+.10)^4(.10)^2} = \frac{1.61051 - 1.1 - .4}{1.46410 \times .01}$$

$$\frac{.11051}{.014641} = 7.54798$$

The annual rate of increase needs to be determined. The annual rate of increase is $20 divided by 4 or $5. This is not to say that the annuity is constant or the same each year, but that the land user will receive income of $5 the first year, $10 the second, $15 the third, and $20 the fourth (uniform increases of $5 per year). The present value of this increasing annuity or income stream is 7.54798 x $5 or $37.74. If you deposited $37.74 in an account paying 10 percent interest compounded annually, you could withdraw $5 at the end of year one, $10 at the end of year two, $15 at the end of year three, and $20 at the end of year four, and there would then be a balance of $0.00.

The factor can also be found in the 10 percent interest tables in the *present value of an increasing annuity* column for 4 years hence.

Figure 5–7 Present value of an increasing annuity



(h) Present value of a decreasing annuity

The present value of a decreasing annuity factor is used to determine how much something is presently worth that will provide an annuity that decreases uniformly each year. Again, it is important to note that the value of $1 (which is multiplied by the factor) is the annual rate of decrease and not the total decrease during the period.

$$PV \text{ of } DI = \frac{n(i) - 1 + \frac{1}{(1+i)^n}}{(i)^2}$$

Example: A gravel pit is producing $28,000 income annually. Due to a decreasing supply that is more costly to remove, income will drop at a steady rate until it equals zero in seven years. At 10 percent interest, the present value of the gravel is $21.31581.

$$\frac{7(.10) - 1 + \frac{1}{(1+.10)^7}}{(.10)^2} = \frac{-.3 + \frac{1}{1.1^7}}{.01}$$

$$\frac{.3+.51.158}{.01} = \frac{.213158}{.01} = 21.31581$$

We now need to determine the annual rate of decrease, which is $28,000 divided by 7, or $4,000.00. The annuity is not constant or the same each year; rather, the land user will receive income of $28,000 the first year, $24,000 the second, $20,000 the third, etc., until the supply runs out on the seventh year and becomes $0.00. The present value of this decreasing annuity or income stream is 21.31581 x $4,000 or $85,263.24; this is the amount that would need to be deposited now to produce the identified decreasing annuity.

The factor can also be found in the ten percent interest table in the *present value of a decreasing annuity* column for 7 years hence.

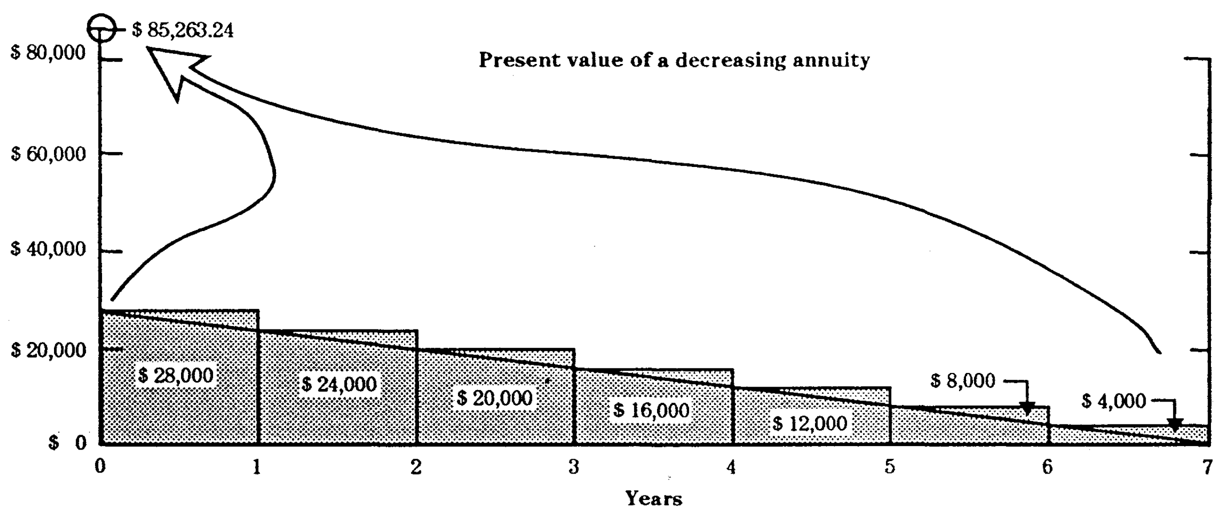
(i) Rule of 72

The rule of 72 states that 72 divided by the interest rate received will result in the number of years it will take to double your money at compound interest.

Example: To compute how long it takes to double an investment of $150 at 8 percent compound interest, divide 72 by 8.

$$\frac{72}{8} = 9 \text{ years}$$

Figure 5–8 Present value of a decreasing annuity



PV of one, 9 years hence, at 8 percent equals .50025 (from I&A tables).

$$.50025 \times \$300 = \$150$$

or

Dividing 72 by the number of years you want to double your money gives you the interest rate you need.

Example: To compute the interest rate needed to double $150 in 9 years, divide 72 by 9.

$$\frac{72}{9} = 8\%$$

$$\frac{150}{.50025} = 300$$

Compound interest factors are not shown by column heading in the I&A tables. However, the answer can be obtained by dividing by the appropriate present value of 1 factor (.50025) since the present value of 1 factor is the reciprocal of the compound interest factor. Since these are annual tables, this method will work only if compounding on an annual basis.

United States
Department of
Agriculture

**Natural
Resources
Conservation
Service**

Part 610 National Economics Handbook

Chapter 6 Evaluation Techniques

Issued May 1995

Chapter 6 Evaluation Techniques

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610.0600 Partial Budgeting

This chapter contains a description of evaluation techniques and procedures such as partial budgeting, break even analysis, and using an index. The information is in no particular order. You may easily add new material as it becomes available. This chapter and its appendices contain evaluation techniques which will be helpful in integrating economics, at a more detailed level, into your conservation planning activities.

For more practice with interest and annuity type problems see appendix A.

Useful technical notes to consult are Shortcut Evaluation Procedures November 1988: ECN — 200-LI-4, and "The Economics of Nutrient and Pest Management" July 1990: ECN — 200-LI-5.

If additional help is needed contact your state economist.

(a) Method

A partial budget is an orderly and logical method of estimating what will happen to profits if partial changes are made in farm operations. Examples of partial changes include: adding another crop, switching from alfalfa to potatoes, or investing in farm storage. Since partial costs affect only certain components, only the cost and income changes for the affected crops need to be considered. Partial budgeting will help answer questions such as: How much will the partial changes cost? Will income increase as a result of the partial change? Will net income change?

(b) Example

The example form shows how to display the information. A short example of partial budgeting used to answer a buy or rent problem then appears. Finally, there is a series of questions in appendix C that will help in conducting a complex partial budget evaluation. It will provide the resulting net change in profits, an analysis of the answer and how it was estimated, and a basis for deciding about operational changes.

610.0601 Breakeven Analysis

(a) Method

Breakeven analysis provides useful information when small changes in specific conservation situations are being evaluated. This technique can be used to determine how much of an investment can be made based on the expected returns. Examples of breakeven questions include: How much can I afford to spend? How long will it take to get my money back? What rate of return will I receive? How much net gain do I need?

Each of the above questions involve an unknown variable, such as cost, time, interest rate, and change in net returns, respectively. Each question can be answered if the other three variables are known. Generally, three of the following four pieces of information must be available to solve for the other:

- Cost—cost of applying the conservation
- Time—system life, loan period
- Interest rate—producers' borrowing or saving interest rate
- Change in yield or net returns—the difference created by applying conservation.

The following problems and solutions will provide a better idea of how breakeven analysis can be used.

An opportunity exists to develop a water source (a spring) and improve grazing distribution. This will allow the harvest of 30 AUMS in an area where only 10 are harvested at present.

Figure 6–1 Partial Budget worksheet

Partial budget

Problem:

Additional Costs:

Additional Revenue:

Reduced Revenue:

Reduced Costs:

A. Total additional costs
and reduced revenue $ ____________

B. Total additional revenue
and reduced costs $ _________

$ _________

Net Change in Profit (B minus A) $ _________

Figure 6–2 Partial Budgeting Example

Partial budget—Buy or Rent

Problem: A farmer has made a decision to no-till 600 acres. Now the choice is to rent a drill for $7.50/acre or purchase a new drill. A new drill would cost $24,000, have a salvage value of $4,000, and a useful life of 10 years, and the farmer's opportunity cost of capital is 10%. The same tractor would be used to pull either drill, so there will be no change in tractor costs. Annual repairs on the drill are estimated at $300 per year, and taxes and insurance at $50 per year. Should the farmer purchase the new drill? (Purchasing would be the change.)

Solution:

Additional Costs:

Capital recovery (purchase drill) $3,255
($24,000 - 4,000) x (amort. factor 10 yr. @ 10%)

Interest on Salvage Value 400
$4000 @ 10%/year

Taxes & Insurance 50

Repairs 300

Additional Revenue:

None

Reduced Revenue:

None

Reduced Costs:

Machine rent
600 A. x $7.50 4,500

A. Total additional costs and reduced revenue $ $4,005

B. Total additional revenue and reduced costs $ 4,500

$ 4,005

Net Change in Profit (B minus A) $ 495

Buying the new drill is a beneficial change!

Figure 6–3 **Breakeven worksheet**

Breakeven cost:

Change in yield × value of yield/unit × proper annuity factor, given years & interest rate = breakeven cost

At any cost lower than breakeven cost plus cost sharing, the producer will profit from the conservation investment.

Breakeven time:

$$\frac{\text{Conservation after cost sharing}}{\text{Value of change in yield}} = \text{calculated cost, annuity factor}$$

Using the appropriate interest rate column, find the time period row which approaches the calculated annuity factor. This time period is the breakeven rate of return; that is, the rate of return needed to breakeven on the conservation investment.

Breakeven interest rate:

$$\frac{\text{Conservation after cost sharing}}{\text{Value of change in yield}} = \text{calculated cost, annuity factor}$$

Using the appropriate time period row, find the interest rate which approaches the calculated annuity factor. This inteest rate is the breakeven rate of return; that is, the rate of return needed to breakeven on the conservation investment.

Breakeven value per unit of yield:

$$\text{Conservation cost, after cost sharing} \times \frac{\text{amortization factor for given years and interest rate}}{\text{change in yield (i.e., 30 bushels, 20 AUMs)}}$$

At any price recieved greater than the breakeven value, the conservation investment will pay for itself.

Figure 6–4 Sample problems and solutions

Example 1: Breakeven Cost

Problem: How much can the cooperator afford to spend for the stockwater development if the system life is 20 years, the interest rate is 12 percent, and an AUM is valued at $7?

Solution: 20 AUMS (change in yield) x $7 per AUM = $140. $140 x 7.46944 (present value of an annuity of 1 per year for 20 years at 12% interest) = $1,045.72. The cooperator's breakeven point is a capital cost of $1,045.72. At any cost below the breakeven point the cooperator will profit from stockwater development.

Example 2: Breakeven Time

Problem: What is the period of capital recovery or minimum life expectancy for the proposal if the capital cost is $1,000, an 8 percent interest rate is used, and the value of the change in AUMs produced is $120 per year?

Solution: $1,000 (capital cost) divided by 120 = 8.333. Using the 8% compound interest and annuity table, read down the column labelled PV of an annuity of one per year, until a factor close to 8.333 is found. Then read left to the number of years hence column. The factor of 8.333 occurs among 14 and 15 years. The conclusion is that the period of capital recovery, or breakeven time, is about 15 years.

Example 3: Breakeven Interest Rate

Problem: What is the breakeven interest rate or internal rate of return when capital cost is $1,000, effects are evaluated over a 20 year time period and the value of the change in AUMs produced is $180 per year?

Solution: The PV of an annuity of one per year factor for the breakeven interest rate is $1,000/180 = 5.555. Reading across interest tables we find that the PV of an Annuity of one per year factor for 20 years at 16% interest = 5.92884, 17% interest = 5.62777, and 18% interest = 5.35275. Since the factor for 17% interest is closest to but not less than the breakeven factor of 5.55556, we conclude that the breakeven interest rate is slightly greater than 17% interest.

Example 4: Breakeven Value

Problem: What must an AUM be worth to break even when capital cost is $1,400, evaluation is 20 years, and benefits are discounted at 11% interest?

Solution: $1,400 x .12558 (amortization factor, 20 years, 11% interest) = $175.81. 175.81 divided by 20 = $8.79 per AUM. Given the level of the other variables, an AUM must be worth $8.79 to break even.

Note: Farmers may not adopt practices at breakeven levels because of risk and other factors.

610.0602 Cost And Price Indexes

(a) Inflation

The reason the value of the dollar has constantly changed in recent history, has been inflation. Although economists might like to be more technical about it, inflation can generally be described as what happens when the volume of money and credit in an economy increases faster than the supply of goods, thus driving up the price of the goods that are available for purchase. Even though there is more money, everything costs more, so no one really gains. Or do they?

The answer depends on whether increases in income (and expenses) keep pace with the rate of inflation, exceed it, or trail along behind it. The calculation of ose relative changes has been complicated enough, ntil recently, to confuse and discourage nearly everyone who isn't a trained economist or accountant.

(b) Commonly Used Indexes

Four of the most commonly used indexes in agricultural work are Prices Paid by Farmers (fig. 6-2), Prices Received by Farmers (fig. 6-1), the Consumer Price Index (CPI, fig. 6-4), and the Engineering News Record (ENR) construction cost index (fig. 6-5). The following example uses the farm index in table 6–2 to illustrate the procedure for using an index. This procedure can be applied to any index. The choices of which index to use depends upon the nature of the numbers you are trying to update. In general, the indexes for Prices Paid and Prices Received by Farmers are more specific to agriculture than the CPI or ENR indexes.

Indexing is a method of quickly adjusting cost and return information for inflation or deflation over time. Indexes of Prices Paid by Farmers and Prices Received by Farmers are calculated monthly by the National Agricultural Statistics Service (NASS). These ndexes are published monthly and annually in the gricultural Prices Report by the NASS and many State Crop and Livestock Reporting Boards. The indexes are also published annually in the United States Department of Agriculture's Annual Statistics.

The indexes published in the Agricultural Statistics for 1990 use 1977 for the base year. The base year is expressed in the index tables as "1977=100" and is changed periodically. Indexes are adjusted to a new base by dividing the prices for all other years into the prices for the selected base year.

Enterprise cost and returns, or crop budgets, may be adjusted over time or updated using price indexes. The index of items used in production (all commodities), "Prices Paid," is the commonly used index for total costs in a budget (fig. 6-2). Total costs may be broken down, for example, into seed, fertilizer, and machinery, and the respective individual indexes applied. The total change in costs resulting from use of the aggregate index will be the same as the change in costs resulting from use of the individual indexes, within rounding differences.

Indexes of Prices Received (fig. 6-1) may also be used to adjust total returns in crop budgets. However, it is usually preferable to obtain current prices of the commodity since prices are usually readily available.

(c) Example: Soybean Budget

A soybean budget dated 1987 is available. Cost and returns for soybeans are needed for 1989. Current price for soybeans is $5.95.

Soybean Budget, 1987:

35 bushels x $5.20 = $182
Production cost = 170
Net returns = $ 12

Index of items used in production from Table 2:

1987	147
1988	157
1989	165

To obtain the factor for adjusting 1987 costs to 1989, divide the 1989 index by the 1987 index:

1989 index of 165 divided by 1987 index of 147 equals 1.1224.

The 1987 costs are then multiplied by the adjustment factor to get the 1989 adjusted costs:

$170 x 1.1224 = $190.80.

A 1989 adjusted budget is then constructed, using the current price of soybeans as follows:

35 bushels x $5.95 = $208
Adj. production cost = 191
Net returns = $ 17

Indexes may also be averaged for two or more years to obtain an average index for any chosen period. For example, a 1987-89 (three years) average *Prices Paid* index may be obtained as follows:

$$147+157+165=\frac{469}{3}=156$$

The average index may then be used to adjust a base year cost to an average cost for 1987-89. Indexes may also be used to adjust budgets for current years to previous years. Except in rare cases, it is recommended that the adjustment periods be kept to five years or less, because using indexes to adjust budget costs assumes technology is constant.

(d) Prices received and prices paid by farmers

The Consumer Price Index (CPI) and the Engineering News Record Index (ENR) can be used in an identical fashion to that of the "Prices Received" and "Prices Paid" indexes.

(e) Consumer price index

A number of indexes can be used to convert costs and other numerical figures from different time periods to dollars of constant purchasing power. The Consumer Price Index (CPI) is commonly used, and is appropriate for most applications. The conversion process is best explained with an example. Average monthly earnings of a farm laborer in 1909 were $21.30. How much would it have taken in 1988 to equal the same purchasing power? Multiply $21.30 by the CPI for 1988: 118.3, and divide by the CPI for 1909: 9.0.

$$21.30\times\frac{118.3}{9}=\$279.97$$

(f) Engineering News Record Index

The Engineering News Record Index (ENR) is another index that can be used to convert cost information from different time periods to dollars of constant purchasing power. The ENR is commonly used to update cost information in watershed plans and similar types of projects. Use of this index is identical to that described for the CPI. Although monthly data is printed on this table, only annual averages should normally be used in NRCS work.

Table 6-1 Prices received by farmers: Index numbers by groups of commodities and ratio, United States, 1975-89 (1977=100)

Year	Food grains	Feed grains and hay	Cotton	Tobacco	Oil bearing crops	Fruit	Fruit for fresh market[1]	Commercial vegetables	Commercial vegetables for fresh market	Potatoes, sweetpotatoes, and dry edible beans	All crops	Meat animals	Dairy products	Poultry and eggs	Livestock and livestock products	All farm products	Ratio[2]
1975	155	127	68	93	81	85	84	92	88	108	105	100	90	103	98	101	113
1976	129	120	99	93	85	80	80	91	88	104	102	101	100	102	101	102	107
1977	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1978	122	101	91	109	93	137	144	105	106	104	105	134	109	106	124	115	106
1979	147	114	96	118	103	144	151	110	109	92	116	166	124	111	147	132	107
1980	165	132	114	124	102	124	128	113	110	129	125	156	135	112	144	134	97
1981	166	141	111	140	110	130	132	136	135	177	134	150	142	116	143	139	92
1982	146	120	92	153	88	175	186	126	120	125	121	155	140	110	145	133	84
1983	148	143	104	155	102	128	131	130	129	123	128	147	140	118	141	135	84
1984	144	145	108	153	109	202	220	133	133	157	138	151	139	135	146	142	87
1985	133	122	93	153	84	180	192	129	122	124	120	142	131	119	136	128	79
1986	109	98	91	138	77	169	177	130	123	114	107	145	129	128	138	123	77
1987	103	85	99	129	79	181	194	144	147	126	106	163	129	107	146	126	78
88	138	120	95	138	108	184	196	144	137	124	127	168	126	118	150	138	85
9[3]	156	128	98	136	102	190	200	156	146	187	134	174	139	138	160	147	84

[1] Fresh market for noncitrus, and fresh market and processing for citrus
[2] Ratio of Index of Prices Received (1977=100) to Index of Prices Paid (1977=100)
[3] Preliminary

National Agricultural Statistics Service. These indexes are computed using the price estimates of averages for all classes and grades for individual commodities being sold in local farm markets. In computing the group indexes, prices of individual commodities have been weighted by average quantities sold during 1971-73.

Source: United States Department of Agriculture, Agricultural Statistics, 1990, page 386.

Table 6–2 Prices paid by farmers: Index numbers by groups of commodities, United States, 1975-89 1 (1977=100)

Year	Production indexes															Production, interest, taxes, and wage rates	Commodities interest, taxes, and wage rates[4]
	Production (all commodities)	Feed	Feeder livestock	Seed	Fertilizer	Agricultural chemicals	Fuels and energy[2]	Farm and motor supplies	Auto and trucks	Tractors and self-propelled machinery	Other machinery	Building and fencing	Farm services and cash rent[2]	Interest	Taxes	Wage rates[3]		
1975	91	100	85	94	120	102	88	102	82	82	80	90	86	77	87	85	89	89
1976	97	103	97	92	102	111	93	100	94	94	95	94	92	88	94	93	95	95
1977	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1978	108	98	140	105	100	94	105	104	106	109	108	108	107	117	100	107	109	108
1979	125	110	185	110	108	96	137	115	117	122	119	118	117	143	107	117	125	123
1980	138	123	177	118	134	102	188	134	123	136	132	128	144	174	115	127	139	138
1981	148	134	164	138	144	111	213	147	143	152	146	134	157	211	123	138	151	150
1982	153	122	164	141	144	119	210	152	159	165	160	135	169	242	124	144	157	159
1983	152	134	160	141	137	125	202	152	174	174	171	138	145	250	129	148	159	161
1984	155	135	154	151	143	128	201	147	182	181	180	138	152	248	133	151	161	16[illegible]
1985	151	116	154	153	135	128	201	146	193	178	183	136	150	228	136	154	156	1[illegible]
1986	144	108	153	148	124	127	162	144	198	174	182	136	145	211	138	1529	150	15[illegible]
1987	147	103	179	148	118	124	161	145	208	174	185	137	147	189	144	166	151	162
1988	157	128	192	150	130	126	166	148	215	181	197	138	148	182	148	171	1960	169
1989	165	139	194	165	137	132	181	155	223	193	208	141	158	177	152	185	167	177

[1] Index values for 1973 through 1975 were revised and published in May 1976 using 1971-73 weights. Indexes were reordered and several new indexes introduced.
[2] New indes; values for years prior to 1973 are not available
[3] Simple avereage of seasonally adjusted quarterly indexes
[4] Family living component included.
National Agricultural Statistics Service

National Agricultural Statistics Service. These indexes are computed using the price estimates of averages for all classes and grades for individual commodities being sold in local farm markets. In computing the group indexes, prices of individual commodities have been weighted by average quantities sold during 1971-73.

Source: United States Department of Agriculture, Agricultural Statistics, 1990, page 386.

Table 6-3 Consumer Price index, 1982-84=100

Year	CPI	Year	CPI	Year	CPI	Year	CPI
1900	8.3	1925	17.5	1950	24.1	1975	53.8
1901	8.3	1926	17.7	1951	26.0	1976	59.9
1902	8.7	1927	17.3	1952	26.5	1977	60.6
1903	9.0	1928	17.1	1953	26.7	1978	65.2
1904	9.0	1929	17.1	1954	26.9	1979	72.6
1905	9.0	1930	16.7	1955	26.8	1980	82.4
1906	9.0	1931	15.2	1956	27.2	1981	90.3
1907	9.3	1932	13.6	1957	28.1	1982	96.5
1908	9.0	1933	12.9	1958	28.9	1983	99.6
1909	9.0	1934	13.4	1959	29.1	1984	103.9
1910	9.3	1935	13.7	1960	29.6	1985	107.6
1911	9.3	1936	13.8	1961	29.9	1986	109.6
1912	9.7	1937	14.3	1963	30.2	1987	113.6
1913	9.9	1938	14.1	1963	30.6	1988	118.3
1914	10.0	1939	13.9	1964	31.0	1989	124.0
1915	10.0	1940	14.0	1965	31.5	1990	130.7
1916	10.9	1941	14.7	1966	32.4		
17	12.88	1942	16.3	1967	33.4		
1918	15.0	1943	17.3	1968	34.8		
1919	17.3	1944	17.6	1969	36.7		
1920	20.0	1945	18.0	1970	38.8		
1921	17.9	1946	195	1971	40.5		
1922	16.7	1947	22.3	1972	41.8		
1923	17.0	1948	24.1	1973	44.4		
1924	17.1	1949	23.8	1974	49.3		

Source: 420 SSC - TECH NOTE 1, July 1991

Table 6-4 Construction cost index history, 1906-1992 (Source: Engineering News Record. March 1991)[1]

Annual average[2]							Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual avg.
1906	95	1929	207	1952	569	1975	2103	2128	2128	2135	2164	2205	2248	2274	2275	2293	2292	2297	2212
1907	101	1930	203	1953	600	1976	2305	2314	2322	2327	2357	2410	2414	2445	2465	2478	2486	2490	2401
1908	97	1931	181	1954	628	1977	2494	2505	2513	2514	2515	2541	2579	2611	2644	2675	2659	2660	2576
1909	91	1932	157	1955	660	1978	2672	2681	2693	2698	2733	2753	2821	2829	2851	2851	2861	2869	2776
1910	96	1933	170	1956	692	1979	2872	2877	2886	2886	2889	2984	3052	3071	3120	3122	3131	3140	3003
1911	93	1934	198	1957	724														
1912	91	1935	196	1958	759	1980	3132	3134	3159	3143	3139	3198	3260	3304	3319	3327	3355	3376	3237
1914	89	1937	235	1960	824	1982	3707	3728	3721	3731	3734	3815	3899	3899	3902	3901	3917	3950	3825
1915	93	1938	236	1961	847	1983	3960	4001	4006	4001	4003	4073	4108	4132	4142	4127	4133	4110	4066
1916	130	1939	236	1962	872	1984	4109	4113	4118	4132	4142	4161	4166	4169	4176	4161	4158	4144	4146
1917	181	1940	242	1963	901														
1918	189	1941	258	1964	936	1985	4145	4153	4151	4150	4171	4201	4220	4230	4229	4228	4231	4228	4195
1919	198	1942	276	1965	974	1986	4218	4230	4231	4242	4275	4303	4332	4334	4335	4344	4342	4351	4295
1920	251	1943	290	1966	1019	1987	4345	4352	4359	4363	4369	4387	4404	4443	4456	4459	4453	4478	4406
1921	202	1944	299	1967	1074	1988	4470	4473	4484	4489	4493	4525	4532	4542	4535	4555	4567	4568	4519
1922	174	1945	308	1968	1155	1989	4580	4573	4574	4577	4578	4599	4608	4618	4658	4658	4668	4685	4615
1923	214	1946	346	1969	1269														
1924	215	1947	413	1970	1381	1990	4680	4685	4691	4693	4707	4732	4734	4752	4774	4771	4787	4777	4732
1925	207	1948	461	1971	1581	1991	4777	4773	4772	4766	4801	4818	4854	4892	4891	4892	4896	4889	4835
1926	208	1949	477	1972	1753	1992	4888	4884	4927										
1927	206	1950	510	1973	1895														
1928	207	1951	543	1974	2020														

[1]How ENR builds the Index: 200 hours of common labor at the 20-city average of common labor rates, plus 25 cwt. of standard structural steel shapes at the mill price, plus 22.56 cwt (1.128 tons) of portland cement at the 20-city price, plus 1,0888 board-ft of 2 x b lumber at the 20-city price.
[2]Base: 1913=100

610.0603 Cost Effectiveness

(a) Method

Cost effectiveness analysis is an appraisal technique used when benefits cannot be reasonably measured in monetary terms. It can be used in two forms:

- The *constant effects* method, which uses least-cost analysis to determine the alternative for meeting a stated level of benefits, including intangible ones.
- The *constant cost* method, which calculates the cost per unit of benefit, or the cost effectiveness ratio, and requires that means exist for quantifying benefits (but not necessarily for attaching a monetary price or economic value to the benefits).

analysis is used to determine the most cost effective .ieans of production among option technologies, it is most often in the form of the constant effects method and called least-cost analysis. One should keep in mind that it is impossible to obtain a measure of product worth from cost effectiveness analysis since it is done without reference to user value.

610.0604 Marginal Analysis

(a) Method

Marginal analysis is the analysis of the change in one variable when a small change is made in another. An example of its application is the marginal value product. This is the amount that production is changed when a small change is made in an input, all other inputs being held constant. For instance, one could measure how different amounts of fertilizer affect wheat production.

Marginal analysis is an important concept underlying most economic analyses. *On (or at) the margin* refers to a small change in the total of some input or in production.

Figure 6–8 Computing average annual cost life-cycle cost analysis

Determine least costly alternative.

Situation: Two alternatives are being considered to provide pressurized water at a given point, a pump and motor or a gravity pressurized pipeline, each with a 20-year life expectancy. The installation cost (capital cost) of the pump and motor is estimated to be $5,000, and of the gravity pipeline, $10,000. Average annual operation and maintenance cost for the pump and motor is estimated to be $1,000, and for the gravity pipeline, $300. Notice the contrasts in installation and annual operation and maintenance costs between alternatives - $5,000 plus $1,000 versus $10,000 plus $300.

Questions:

When compared over a 20-year life at 20 percent interest, which is the least costly alternative?
If the interest rate used is 5 percent which is least costly?
What general conclusions can we draw from this example?

Solutions: Computing average annual cost life-cycle
Cost analysis
Determining Least Cost Alternative

To determine which option, pump or motor or gravity pipeline, is least costly, the installation and average annual operation and maintenance (O&M) costs of each must be considered on a single common time base that is frequently used is average annual total cost. An average annual equivalent of the installation cost can be derived by amortizing the one-time installation cost at the evaluation interest rate over the evaluation period, which is the life expectancy in this problem. O&M costs are already calculated on an annual basis. Hence, the total average annual cost can be determined by adding together the average annual equivalent of instaiollation costs and the O&M costs. When average annual total cost at a given interest rate has been determined for each option, comparison will reveal which is the least costly means of providing equal service. It is important to realize and understand that economic comparison of costs to determine the least costly option is only valid when each option provides the same level of service or output.

Comparison Over 20 Years at 20 Percent Interest

Average Annual installation cost (Factor = 0.20536)	$1,027	2,054
Average annual O&M	$1,000	300
Average annual total cost	$2,027	2,354

Conclusion: When compared over 20 years at 20 percent interest, the pump and motor option is less costly than the gravity pipeline option.

Comparison Over 20 Years at 5 Percent Interest

Average Annual installation cost (Factor = 0.08024)	$ 401	$ 802
Average annual O&M	$1,000	$ 300
Average annual total cost	$1,401	$1,102

Figure 6–8 Computing average annual cost life-cycle cost analysis—Continued

Conclusion: When compared over 20 years at 5 percent interest, the gravity pipeline is less costly than the pump and motor option.

General conclusion: High interest rates tend to push decisionmakers away from higher installation costs in favor of higher operation and maintenance costs. Low interest rates tend to do the opposite, by making one-time installation costs look relatively more favorable than recurring annual operation and maintenance costs. Viewed from another perspective, high interest rates tend to move decisionmakers away from options that require large and relatively irreversible commitments and toward operations with low initial commitment and high flexibility for change. Low interest rates indicate more expected stability in future economic conditions, and therefore make initial commitment more comfortable for decisionmakers.

An important factor that confounds and partially negates the above conclusions is inflationary impact on recurring annual costs. Inflation is one factor that influences the market rate of interest. Generally, when high interest rates prevail, higher prices for most goods and services are expected in the future. If all goods and services increase at the same rate, the stated general conclusions remain valid. However, above average increases in price may occur. The market for a particular good adjusts to expected increases in demand or shortages in supply. When high inter- rates reflect a differential price increase of a good, that increase is considered price escalation. Expected price escalation must be considered separately from inflation, and partially negates the general conclusions as well. Expected price escalation effects on decision making are considered in the next section.

United States
Department of
Agriculture

**Natural
Resources
Conservation
Service**

Part 610
National
Economics
Handbook

Chapter 7 Computer Tools

610.0700 Cost and Return Estimator (CARE)

This chapter contains a discussion of computer programs (tools) which may be useful for analytical tasks, including the development of crop budgets and the evaluation of conservation systems. Information on additional software programs should be added as it becomes available.

For instructions on use of the CARE program, see the CARE User Manual.

(a) Formats

The budget output formats available in the CARE program are:

- Quick Budget Report
- Quick Budget Comparison Report
- Summary Budget Report
- Detailed Budget Report

Selection of a budget output format should be based upon the need for a particular degree of detail. A simple yet quite detailed format that would meet the needs in most field office applications is the Quick Budget Report.

Quick Budget provides an easy way to interactively modify the summary results of the CARE Budget Analysis Report. It starts by creating a budget from data bases maintained in the main CARE system, or by loading a Quick Budget saved from a previous session. CARE converts the budget into a spreadsheet that can be edited, allowing the user to make changes to the operations, materials, yields, and prices. The effect on costs and returns can then be assessed. Quick Budget also allows the user to construct a budget from scratch without going through the full CARE budget construction.

Quick Budget Comparison Report enables comparison between two budgets, and displays the changes that could occur when one system is switched to another; for example, conventional tillage to no-tillage. A sample output for this example and the comparison report are included in this chapter.

Other budget formats available are the Summary Budget Report and the Detailed Budget Report.

(b) Example: Quick Budget Outputs and Comparison Report

The first four pages of the following sample output capture budget information for two land users: Farmer A raises corn and uses residue management, and Farmer B also raises corn but uses conventional management. The next two pages of Quick Budget output contain the comparison report that enables a very quick comparison of the two systems used by Farmers (See fig. 7–2 - 7–5).

For questions concerning the detail of this output, please refer to the CARE User Manual or contact your State economist.

Figures 7-1 Care schematic

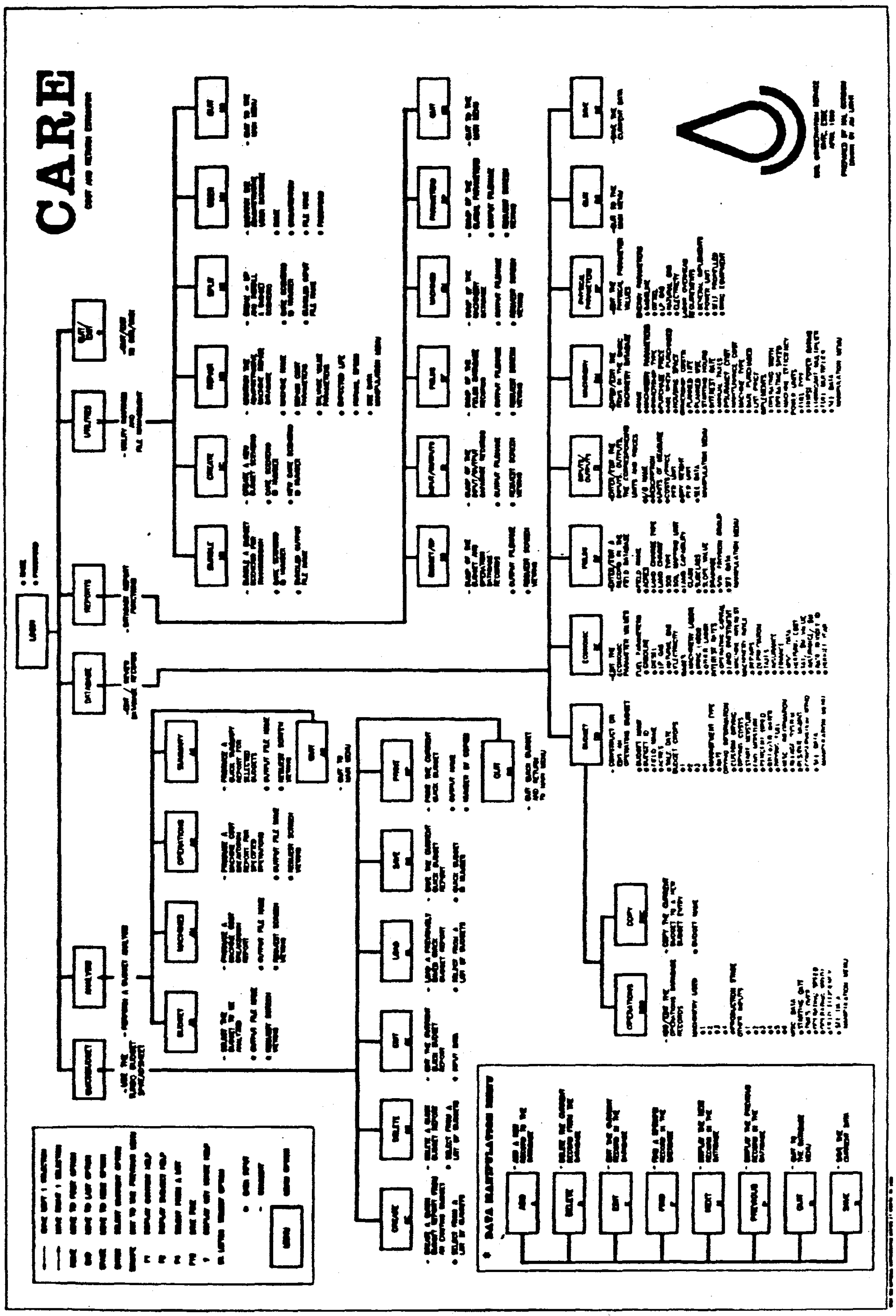

Figure 7-2 Quick Budget output

Farmer A Corn GR Residue Quick Budget Report–(US-021-00210, 105 Bushels of Corn Grain Land is 1 acres of Somewhere, USA at No Charge
Prepared for Planning Purposes Only.

I. Parameters

Title	:	Farmer A Corn Gr Residue	Budget ID	:	US-021-0021
Field Name	:	Somewhere, USA	Acres	:	1
Land Charge Type	:	No Charge	Land Charge	:	0.00
Mgmt. Charge Type	:	None	Mgmt Charge	:	0.000

II. Revenue	Quant	Price	Value		Total
Crop Name	Units	ity	/Unit	/Unit	Revenue
Corn Grain	Bushels	105.00	2.00	210.00	210.00
Total Crop Revenue			210.00		210.00

III. Machinery Operations	Acres	Times

610.0701 Interactive Conservation Evaluation (ICE)

For instructions on use of the ICE program, see the ICE User Manual.

(a) Program and Worksheets

The Interactive Conservation Evaluation (ICE) program provides a computerized evaluation process to assist land users in evaluating and comparing alternative conservation management systems.

The program will analyze and compare the *without condition* with up to nine additional conservation options. Soil loss, future yields with soil depletion, and average annual costs of conservation practices are all calculated. Using crop budget data, ICE will calculate ~oss returns, costs of production, and net returns. ıer effects, such as impacts on wildlife and water quality, may also be recorded.

An ICE Pre-Evaluation Worksheet has been developed to facilitate use of the ICE program. The worksheet is useful when gathering and organizing input data needed for the program, especially if the district conservationist is visiting farmers or does not have immediate access to a computer. The worksheet is also extremely useful as a training aid since it shows what information is needed and organizes it into the proper sequence for entry. Contact your State economist if worksheets are required.

(b) Example: Sheet and Rill Erosion

A flow chart of data entry (data viewing screens) for the ICE program follows this page. Following the flow chart of ICE screens, summary screens are shown for the Sheet and Rill Erosion Without Condition; Alternative 1, which includes crop residue use (CRU), contour farming (CR), and field borders (FB); Alternative 2 which includes crop residue use (CRU), contour ning (CF), field borders (FB), and terraces (Ter); d a comparison of the Without, Alternative 1, and Alternative 2. The Without Summary for Ephemeral Gully and Alternative Summary for Ephemeral Gully are also shown.

Figures 7-6 through 7-9