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Basic Economic Analysis using T-Charts

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The Natural Resources Conservation Service (NRCS) assists land owners in managing natural resources on private land. Our core "product" is a conservation plan which provides a roadmap for producers to conserve, maintain, and improve their natural resources. The most successful conservation plans address the landowner's resource concerns while maintaining farm or ranch viability. Therefore, it is the policy of the NRCS that economic principles are included in all planning and agency resource allocation activities (GM200- Economics, Subpart A, 400).

Most landowners want to know the benefits and costs of their conservation plan before they make important land use decisions. The level of economic detail depends upon the client, but basic economic information is something most NRCS employees can easily provide.

A good conservation plan utilizing the "nine steps" planning process clearly and concisely presents technical and economic information to the landowner. To fully inform the landowner of the potential benefits and costs of the plan, the conservation planner's responsibilities include:

- Documenting environmental, social and economic effects in the planning process.
- Identifying physical and monetary benefits of implementing conservation systems.
- Identifying negative impacts and costs of conservation systems.

Benefit & Cost Analysis

The goal of a conservation plan is for benefits to exceed costs. Benefits and costs can be quantitative (monetary) and qualitative (non-monetary). If a monetary value cannot be assigned, the environmental or social benefit or cost should be quantified and included in the analysis. Economic analysis requires four steps:

1. Estimate Costs
2. Estimate Benefits
3. Convert to "Like Terms"
4. Compare Costs & Benefits

There are two benefit sub-categories: *Increased Revenue* and/or *Reduced Costs*. Increased revenue may include increased crop yields, livestock production, and hunting fees. Reduced costs may include fewer passes over the field or less labor. There are two cost sub-categories: *Increased Costs* and/or *Reduced Revenue*. Increased costs include purchasing equipment, materials, or hiring more labor. Reduced revenue may include land taken out of production or reduced crop yields. Be

aware that some non-monetary values such as improved wildlife habitat or pretty landscapes may be a benefit to one individual and a cost to another. For example an increase in waterfowl may be a benefit to a bird watcher or duck hunter, but a cost to a farmer experiencing excessive crop loses, trespass or land lost to wetland. Once costs and benefits are estimated, convert them to the same units over the same time period. You cannot compare benefits and costs unless they are reduced to the same terms. Benefits and costs can be summarized as dollars per acre per year ($/acre/year), dollars per head per year ($/head/year) or any unit that producer is comfortable with.

Partial Budgeting

Partial budgeting is a method that systematically displays the benefits and costs of an alternative where only changes from the baseline (or current) condition are considered. This technique simplifies data collection. For example, only the costs and beneficial impacts of installing a conservation practice are considered in the analysis, rather than gathering information about the whole farm enterprise where the practice is installed.

T-Chart

A simple way to conduct economic analysis through partial budgeting is with a T-Chart. A T-Chart systematically identifies only the benefits and costs of an alternative that change. This technique simplifies data collection and analysis. The T-Chart also describes the resource setting, resource concerns and the conservation system. The best information used in the T-Chart comes from your client, a discipline specialist's recommendations, and technical references.

T-Chart

Name: **Location:** **Date:**	**Resource Concerns/Benchmark Condition:**
Conservation Treatment:	
Positive Effects	**Negative Effects**

There can be three levels of analysis using the T-Chart:

- Level I Includes only qualitative statements
- Level II Qualitative statement plus units of measurement and dollars
- Level III Complete economic or financial analysis

The conservation planner should complete as many T-Chart levels as they are comfortable with and then request assistance if the decision maker needs additional analysis. The planner only develops enough information for the client to make an informed decision. The decision maker may lose interest if too much irrelevant information is provided and waste planner's time. A T-Chart can be developed on whatever media the decision maker finds most useful.

T-Chart Example

The following example demonstrates how to use a T-Chart to analyze the benefits and costs of a conservation system. The Level I T-Chart below displays a list of benefits and costs without units of measure or dollars. The qualitative statements identify the "effects" of the conservation system on addressing the resource concerns. Level I may contain enough information for some decision makers to make a decision, but most land users ask for more information.

T-Chart, Level I, Cropland – Soil Quality Improvement

Name: Deep Six Cattle **Location:** Anywhere, Texas **Date:** 2013	**Resource Concerns/Benchmark Condition:** Plant Productivity, inadequate livestock water, sheet and rill erosion. 200 acres producing 4000 lbs of forage/yr. Currently runs 30 head of cows and feeding hay 7 months of year. Pond goes dry most every year and has to haul water for a short time.
Conservation Treatment: Construct Fence Prescribed Grazing with proper stocking rate	
Positive Effects	**Negative Effects**
Reduced Costs Feed Less Hay Reduce Labor Hauling Hay & Water ***Increased Revenue*** Increase Weaning Weight ***Other*** Improved soil and water quality Increase amount of available drinking water Upland wildlife habitat improvement	***Increased Costs*** Construct Fence ***Reduced Revenue*** Less calves to market

Level II includes units of measure and dollar estimates of the conservation "effects". The decision maker may still not be able to make a decision because all the units are not in similar terms (same denominator). Each cost is in different terms ($/bale, $/lb, $/ft).

T-Chart, Level II, Cropland – Soil Quality Improvement

Name: Deep Six Cattle **Location:** Anywhere, Texas **Date:** 2013	**Resource Concerns/Benchmark Condition:** Plant Productivity, inadequate livestock water, sheet and rill erosion. 200 acres producing 4000 lbs of forage/yr. Currently runs 30 head of cows and feeding hay 7 months of year. Pond goes dry most every year and has to haul water for a short time.
Conservation Treatment: Construct Fence Prescribed Grazing Reduce stocking rate by 10 head to meet available forage	
Positive Effects	**Negative Effects**
Reduced Costs • Feed Less Hay 4 bales/10 hd @ $65 $2730 1 bale/20 hd @ $65 $1365 • Reduce Labor 60 hr @ $15/hr $900	***Increased Costs*** • Fence 1000' @ $2.00/ft $2000
Increased Revenue • 35 lbs/calf @ $1.15/lb $805 • Financial Assistance Payment **$1190** 1000' @ $1.19	***Reduced Revenue*** • 10 hd @ 425 lb @ $1.15 $4888
Other • Improved soil and water quality • **By destocking, we increase amount of livestock water.** **10 head @ 15 Gallon/day/365 days 54,750 gal** • Upland wildlife habitat improvement **Total Dollar Benefits = $7340**	**Total Dollar Costs = $7232**
$7340 (Benefits) - $7232 (Costs) = $108	

Level III has converted all benefits and costs to $/head based on the new stocking rate of 20 head. Now all costs and benefits are in similar terms and can be compared by the decision maker.

T-Chart, Level III, Cropland – Soil Quality Improvement

Name: Deep Six Cattle **Location:** Anywhere, Texas **Date:** 2013	**Resource Concerns/Benchmark Condition:** Plant Productivity, inadequate livestock water, sheet and rill erosion. 200 acres producing 4000 lbs of forage/yr. Currently runs 30 head of cows and feeding hay 7 months of year. Pond goes dry most every year and has to haul water for a short time.
Conservation Treatment: Construct Fence Prescribed Grazing Reduce stocking rate by 10 head to meet available forage	
Positive Effects	**Negative Effects**
Reduced Costs • Feed Less Hay 4 bales/10 hd @ $65 $2730 1 bale/20 hd @ $65 $1365 **$205/hd** • Reduce Labor 60 hr @ $15/hr $900 **$45/hd** ***Increased Revenue*** • 35 lbs/calf @ $1.15/lb $805 **$40/hd** • Financial Assistance Payment $1190 1000' @ $1.19 **$60/hd** ***Other*** • Improved soil and water quality • **By destocking, we increase amount of livestock water.** **10 head @ 15 Gallon/day/365 days 54,750 gal** • Upland wildlife habitat improvement **Total Dollar Benefits = $350/hd**	***Increased Costs*** • Fence 1000' @ $2.00/ft $2000 **$100/hd** ***Reduced Revenue*** • 10 hd @ 425 lb @ $1.15 $4888 **$244/hd** **Total Dollar Costs = $344/hd**
$350/hd/yr Total Benefits - $344/hd/yr Total Costs = $6/hd/yr Net Benefits	

Now that all the conservation "effects" are in similar terms, the decision maker can compare the benefits and costs and make an informed decision. In this case the monetary benefits are greater than the costs (net benefits are positive) and the decision maker should feel comfortable adopting the example conservation system from an economic perspective. However, economics is only one factor in decision-making. The land user should also consider environmental and social effects and how this conservation system fits into the overall agricultural operation before making a decision.

Amortization

Amortization is simply converting a one-time value to an annual value. Four pieces of information are required for amortization: 1) initial cost, 2) interest (bank loan) rate, 3) life of the loan (years), and 4) an amortization table. Let's say we purchase a No-Till Drill at a cost $15,000. If the farmer could get a loan for $15,000 from the bank at 6% interest for 5 years, the amortization factor would be .237 (from the amortization table below where the interest column intersects with the year row). By multiplying .237 and $15,000, you generate an annual payment of $3,555/year. Dividing the $3,555 annual payment by 200 acres gives the No-Till Dill a cost of $17.76/acre/year. (Note: this table is for "yearly" payments, a similar table is available for "monthly" payments).

Amortization Table - Yearly

LIFE	% INTEREST RATE												
YEARS	3	4	5	6	7	8	9	10	11	12	13	14	15
2	0.523	0.530	0.538	0.545	0.553	0.561	0.568	0.576	0.584	0.592	0.599	0.607	0.615
3	0.354	0.360	0.367	0.374	0.381	0.388	0.395	0.402	0.409	0.416	0.424	0.431	0.438
4	0.269	0.275	0.282	0.289	0.295	0.302	0.309	0.315	0.322	0.329	0.336	0.343	0.350
5	0.218	0.225	0.231	0.237	0.244	0.250	0.257	0.264	0.271	0.277	0.284	0.291	0.298
6	0.185	0.191	0.197	0.203	0.210	0.216	0.223	0.230	0.236	0.243	0.250	0.257	0.264
7	0.161	0.167	0.173	0.179	0.186	0.192	0.199	0.205	0.212	0.219	0.226	0.233	0.240
8	0.142	0.149	0.155	0.161	0.167	0.174	0.181	0.187	0.194	0.201	0.208	0.216	0.223
9	0.128	0.134	0.141	0.147	0.153	0.160	0.167	0.174	0.181	0.188	0.195	0.202	0.210
10	0.117	0.123	0.130	0.136	0.142	0.149	0.156	0.163	0.170	0.177	0.184	0.192	0.199
11	0.108	0.114	0.120	0.127	0.133	0.140	0.147	0.154	0.161	0.168	0.176	0.183	0.191
12	0.100	0.107	0.113	0.119	0.126	0.133	0.140	0.147	0.154	0.161	0.169	0.177	0.184
13	0.094	0.100	0.106	0.113	0.120	0.127	0.134	0.141	0.148	0.156	0.163	0.171	0.179
14	0.089	0.095	0.101	0.108	0.114	0.121	0.128	0.136	0.143	0.151	0.159	0.167	0.175
15	0.084	0.090	0.096	0.103	0.110	0.117	0.124	0.131	0.139	0.147	0.155	0.163	0.171
16	0.080	0.086	0.092	0.099	0.106	0.113	0.120	0.128	0.136	0.143	0.151	0.160	0.168
17	0.076	0.082	0.089	0.095	0.102	0.110	0.117	0.125	0.132	0.140	0.149	0.157	0.165
18	0.073	0.079	0.086	0.092	0.099	0.107	0.114	0.122	0.130	0.138	0.146	0.155	0.163
19	0.070	0.076	0.083	0.090	0.097	0.104	0.112	0.120	0.128	0.136	0.144	0.153	0.161
20	0.067	0.074	0.080	0.087	0.094	0.102	0.110	0.117	0.126	0.134	0.142	0.151	0.160
25	0.057	0.064	0.071	0.078	0.086	0.094	0.102	0.110	0.119	0.127	0.136	0.145	0.155
50	0.039	0.047	0.055	0.063	0.072	0.082	0.091	0.101	0.111	0.120	0.130	0.140	0.150
100	0.032	0.041	0.050	0.060	0.070	0.080	0.090	0.100	0.110	0.120	0.130	0.140	0.150

Economic Analysis versus Financial Analysis

Economic analysis answers the question: Is it profitable? Financial Analysis determines if it is affordable. This distinction is important. An activity may be economically justified but not financially a wise thing to do. **Economic analysis** compares the benefits and costs over the **useful life** of the alternative. **Financial analysis** compares the benefits and costs over the **life of the finance period** (such as a bank loan).

For example, if the $15,000 No-Till Drill has a useful farm life of 20 years and the farmer can get a bank loan (discount rate) at 6% (amortization factor = 0.087), then the "economic" cost of the drill is $1,305/year (or if divided by 200 acres in crop production $6.53/acre/year). If the bank offered a 5-year loan, the "financial" cost of the drill would be $17.76/acre/year (recognizing that the drill will continue to provide benefits for 15 years beyond when the loan is paid). If the No-Till Drill created benefits of $8.00/acre/year, the purchase of the drill would be "economical" but fall short "financially", and possibly create a "cash flow" concern until the 5-year loan is paid. Conservation

program financial assistance may be available to minimize “cash flow” problems while adopting conservation activities.