Production and Economic Analysis of Brush Control on Range Land

The objective of this decision aid is to summarize production and economic data to evaluate the economics of brush control on rangeland. The analysis is done for an individual pasture or a pasture area that includes a number of pastures.

The economics of brush control are determined by the cost of treatment, follow-up maintenance and the net earnings of the treated land versus the non-treated grazing land. Previous research by Ventassell and Conner recognized the response from treatment, but did not recognize two factors that affect the economic results, including: if brush encroachment is not controlled by the production of usable forage, it will continue to reduce the carrying capacity, which will increase costs associated with gathering cattle and reduce wildlife earnings capacity; and in many situations, the entire pasture does not have to be treated, or because of the land productivity potential, it makes little economic sense to invest in brush control for some areas in a pasture. Incorporating these two considerations in the development of brush control will greatly affect economic results.

The difference in economic returns for treated versus untreated range land is determined by the difference in productivity or acres per animal unit (AV/AU), cost of treatment and maintenance, and the change in land value, if the land is owned, due to the change in the brush infestation level. A net present value analysis of changes over the economic life of the investment is used to evaluate the economics of brush control. Summarized below are descriptions of input data, output results and the formulas used in the decision aid.

Input Data

Brush control response data for production is determined by using the annual carrying capacity and the cost of treatment. The graphs that are produced from the generated input data are shown in functional forms. The cost of treatment and maintenance per acre is reflected on the graphs of accumulated cost.

The user can choose to incorporate the estimated income tax effects on the financial results. The income tax effect is to reduce the cost of treatment by the tax rate, but also to reduce revenue by the tax rate. This is only an estimated effect, as the actual tax implication is much more complex from the standpoint of the total business, but it does help put the economic results into a better perspective.

The user can choose to disregard the tax issue by entering zeros for the tax rate. All data from the stocking rate and cost data are transferred directly to the summary analysis. The user must input the leasing or value of land returns and the owned land value for each year of the analysis. For the individual unit summary, the user must specify the discount rate for each level of land infestation (see definition section for data inputs).

*Prepared by James McGrann, Professor and Extension Economist-Management, Department of Agricultural Economics, Texas Cooperative Extension, Texas A&M University, October 27, 2002.*
The accuracy of the projected analysis is influenced by two important factors, including:

1. The leasing and value of return may overestimate the value if the livestock-stocking rate cannot be adjusted to use the increase/decrease in carrying capacity.

2. Change in carrying capacity is a key variable in determining economics of brush control. Projecting these values is, of course, difficult, but extremely important for accurate estimation of the economic benefits of brush control.

The program will provide a useful tool to assess the economics of brush control. It will facilitate the what-if analysis with a change in specific parameters (e.g., carrying capacity, discount rate, etc.).

The expected production level, expressed as acres per animal unit, is input in the response section of the decision aid or page one of the reports. Response is identified with the treatment and maintenance activities. Cost of the treatment and maintenance are input, as well as any associated improvements that are added (fencing, water, facilities, etc.). These costs are entered during the year.

**Output**

Graphic presentation of all the production response or total annual AUs, annual cash flows, and accumulated cash flows are helpful to observe what the results are based on. These graphics should be printed and observed. After the proper adjustments, data interpretations of the analysis results can be made.

**Interpretation of Output**

The production summary average values in the economic summary should serve as a guide to check if there are potential data errors, especially in change on carrying capacity, land value or treatment cost. They should not be used to draw economic conclusions, however, because of the difference in timing associated with costs and returns. The net present value (NPV) analysis is much more appropriate for arriving at conclusions on economic results.

The economic values associated with brush control are calculated by determining the differences in the net present value (NPV) of treated versus untreated land. The net present value of the difference in net return is the NPV of land returns per acre (leasing or value, plus change in land value per acre) for treated and untreated land minus the NPV treatment cost.

The benefit/cost ratio is calculated by determining the difference in NPV of returns (benefits) divided by the treatment cost. The ratio must be greater than one to be economically feasible (return the defined rate of return, or discount rate). In the total ranch analysis, treatment cost is expressed as a percent of the total NPV of land returns. This should provide the analyst with an idea of the cost incidents of treatment for the total ranch. The percent of the total land treated also is useful in reflecting the level of land treatment considered in the analysis.
Definitions

Brush control, stocking rate, cost of control and maintenance data (response part of software) input should include the following items and their descriptions:

Stocking rate (acres/AU) on treated land is the expected stocking rate given the treatment, other improvements, maintenance and the associated grazing system used. Values for each year in the analysis must be entered.

Stocking rate (acres/AU) on untreated land reflects what would be expected to happen to stocking rate year by year if no investment is made to treat brush. The carrying capacity would be expected to deteriorate if no investment is made.

The annual percentage increase in stocking rate is calculated to assist in viewing the impact of the projected stocking rate change treated relative to untreated.

Net present value (NPV) is the analysis procedure that accounts for the time value of money, or in this case, a brush control investment that produces annual returns for several years. It will reflect the earning potential of this investment (brush control), opposed to the alternative of not controlling brush that can earn the specified discount rate.

The NPV of the net land return would be the amount of money one would need today to earn an equal future return on investments at the specified discount rate. If the NPV is zero or greater for treated versus untreated, it is returning the discount rate of return. If NPV is less than zero, it is not returning the discount rate of return, and one cannot treat the land and generate a greater return than by not treating the land for brush control.

Discount rate is the annual rate of return required for the investment in brush control. The discount rate should be selected such that it provides a rate of return comparable to investment or alternatives with similar risk. The user may wish to use a higher discount rate for treated versus land not treated because of potentially higher risk associated with the effectiveness of the treatment. However, if the brush infestation is expanding the user may wish to use a lower discount rate on treated land to reflect the higher potential long term cost if brush is not controlled.

The higher the discount rate is, the lower the NPV of return to treatment costs will be. Higher rates would also reflect higher earning potentials on the ranch or non-ranch investment activities.

Leasing rate or value of return is the net leasing rate that could be earned for grazing land or the residual to land (value of return) after other costs are paid for the grazing livestock. It is the annual return or opportunity cost for land, and should be the net of land and other ownership costs (maintenance of improvements and property tax).

Change in land value, if owned, is the decrease in land value as the level of brush infestation increases. This should be reflected in lowering of the land values. Conversely, if brush control increases land value, the land value per acre should be increased. If land values are unaffected by the level of infestation, then land value should be held constant.
**Treatment and maintenance cost** is the total cost associated with the treatment (chemical, labor, machinery, application cost, seed, etc.).

**Other improvements** are the total cost of adding improvements to make the investment respond as projected. This would include additional fence, watering facilities, etc.

**Basic Calculations**

Carrying capacity is calculated by multiplying average stocking rate per acre by the number of acres for each year of the analysis. Total leasing, or value return, is the carrying capacity multiplied by the leasing rate or value per acre. The total land value, if owned, is land value times total acres. Change in land value, if owned, is the difference in the land value between years times the total number of acres. If the land is not owned, a zero value will be put into the change in land value cell. This would indicate that a lessor of the land would not realize land value change.

**Economic Analysis Summary**

Average values are sums of row values divided by the number of years in the analysis. Change in land value, if owned, is divided by the years in the analysis.

Economic results for the analysis period are based on the net present value (NPV) of the discount rate specified. All calculations use the NPV function on the values for the total period. The analysis is based on the assumption that payments (leases or values) are received at the end of the year with the exception of treatment costs, which assumes first year costs at the beginning of year one.

Net present value (NPV) \[ \frac{R}{(I + n) n} \]

where R = net return

I = discount rate or rate of return

n = year the income is received

**Reference**