# Brush Control Considerations: A Financial Perspective

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Although brush control has long been one of the quickest ways to increase forage for livestock, ranchers are showing increased concern over its financial effectiveness. The question of whether brush control is financially sound or unsound depends on a number of criteria. These include potential for natural recovery, rate of return from different brush control options, government subsidies, rate of return from alternative investments, risk of failure, short and long term vegetation effects, present livestock prices and ranching costs, and projected livestock prices and ranching costs. We will examine these considerations in determining the financial effectiveness of brush control, and develop guidelines that should help range managers in brush control decisions.The effect of government subsidies on brush control decisions are also explored.

## Criteria for Financial Success

Often when brush control projects have been evaluated financially, criteria for success have been vague or undefined with no adjustment for biological risk. We consider a minimum of a 13% return on investment necessary to justify brush control financially. This gives recovery of investment in 10 years plus a 3 percent premium for illiquidity. These criteria are based on the expected return from the stock market over the past 45 years which has averaged 10 percent. These stocks are liquid investments that can be converted into cash by a phone call. In contrast brush control benefits can only be recovered indirectly through sale of livestock or wildlife and require a higher return to compensate for illiquidity. We have added a 3 percent illiquid premium although some ranchers might want an even higher premium if there is a good chance they might need the cash for some other purpose within 10 years.

Next is an adjustment to the minimum required rate of return (13%) for the biological risk associated with the particular practice. The literature indicates that generally herbicides involve more risk than burning or mechanical control. However, arid ranges often lack sufficient understory for burning and mechanical control is quite costly. Presently, (1994) burning cost will be $1-5/acre, herbicide costs $12-20/acre and mechanical control costs $25-50/acre.

On southwestern ranges the chances for success in controlling mesquite are no more than 65% with present herbicides. Success might be defined as killing half the mesquite and increasing forage production by 300 lbs/acre for 10 years. To adjust the risk the required rate of return (13%) is divided by 0.65. This means the required liquidity/risk adjusted rate of return necessary to justify the investment is 20%.

Generally big sagebrush is easier to kill than mesquite. Success probabilities of 90% with herbicidal control would be reasonable based on the literature. Therefore, a required risk/liquidity adjusted rate of return of 15% might be reasonable.

We have made no attempt to adjust for inflation because no one is certain what the future might bring. Based on history since the 1970's, inflationary conditions have enhanced returns from range improvements while returns have been diminished under deflationary conditions. Livestock prices have generally been elevated relative to production costs when inflationary spirals occurred. The reverse has been the case under deflationary conditions.

In Table 1 we have provided some guidelines on per acre returns from different range types when land condition and management are good. As a rule it is financially unsound for a rancher to spend more than 10 times these returns on any range improvement practice.

## How Much Increase in Forage Production?

Generally ranchers are most interested in how much they can increase grazing capacity if they control brush. Related to this issue are how long will the forage increases last and how dependable is the increase among years. Increased forage in drought years is more beneficial than increased forage in average or above average years. Under the financial criteria we have developed most brush control projects require a longevity of 15-20 years to be justifiable. The first 10 years are required to recover the investment.

Usually the consistency of forage increase among years is as important as the total increase in forage through time. If the increase is erratic among years, most ranchers will have a hard time stocking their range to use the extra forage when it does occur.

During the first 5-6 years big sagebrush control has consistently doubled or tripled forage yields compared to areas without control (Bartolome and Heady 1988, McDaniel et al. 1992). Forage increases of around 300-600 lbs/acre per year can be expected for the first 5 years. After 10 years the effect of big sagebrush control on forage yields dimin-

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**Table 1. Forage production (lbs/acre) and financial returns ($/acre) from different range types in the United States under good range condition and good management.**

| Range Type | Type of Operation | State | Forage Production lbs/acre | Financial Returns $/acre |
|---|---|---|---|---|
| Southern pine forest | cattle-cow | Louisiana | 2500-4000 | 8-14 |
| Tallgrass prairie | cattle-cow | Kansas | 2500-3500 | 9-12 |
| Coastal prairie | cattle-cow | Texas | 2500-3500 | 9-12 |
| Coastal prairie | wildlife/cattle | Texas | 2500-3500 | 25 (15 wildlife + 10 cattle) |
| Southern mixed prairie | cattle-cow | Texas | 2000-3000 | 6-8 |
| Southern mixed prairie | cattle-wildlife | Texas | 2000-3000 | 17 (10 wildlife + 7 cattle) |
| High plains-shinnery | cattle-cow | New Mexico | 800-1700 | 3.00 - 4.00 |
| Oak-savannah | sheep/goats | Texas | 2000-3000 | 8-14 |
| Oak-savannah | wildlife/cattle | Texas | 2000-3000 | 28 (20 wildlife + 8 cattle) |
| Shortgrass prairie | cattle-cow | New Mexico | 800-1400 | 4.50-5.50 |
| Shortgrass prairie | cattle-yearling | New Mexico | 800-1400 | 4.00-10.00 |
| Shortgrass prairie | sheep | Wyoming | 600-1000 | 3.80-4.50 |
| Desert prairie | cattle-sheep | New Mexico | 500-900 | 2.50-3.50 |
| Northern mixed prairie | cattle-cow | Montana | 900-1600 | 2.50-3.00 |
| California annual grassland | cattle-cow | California | 300-1500 | 1.00-3.00 |
| Palouse prairie | cattle-cow | Oregon | 500-800 | 1.25-2.50 |
| Palouse prairie | wildlife-cattle | Oregon | 500-800 | 4 (2.50 wildlife + 1.50 cattle) |
| Chihuahuan desert | cattle-cow | New Mexico | 300-700 | 0.60-1.00 |
| Sonoran desert | cattle-cow | Arizona | 100-400 | 0.30-0.60 |
| Salt desert | sheep | Utah | 150-350 | 0.30-0.70 |
| Salt desert | cattle-cow | Nevada | 150-350 | 0.15-0.40 |
| Mojave desert | cattle-cow | California | 50-200 | 0.10-0.30 |
| Big Sagebrush | cattle-cow | New Mexico | 250-500 | 0.50-0.80 |
| Big Sagebrush | cattle-cow | Wyoming | 300-800 | 1.00-2.00 |
| Big Sagebrush | cattle-cow | Nevada | 150-400 | 0.50-1.50 |
| Pinyon juniper | cattle-cow | New Mexico | 100-500 | 0.25-1.00 |
| Coniferous forest | cattle-cow | Eastern Oregon | 400-800 | 2.00-3.00 |
| Coniferous forest | cattle-cow | New Mexico | 400-1000 | 2.40-3.00 |

ished on most southeastern Oregon sites (Bartolome and Heady 1988).

In contrast mesquite control has resulted in more erratic initial increases forage yields occurring primarily in wet years (Dahl et al. 1977, Martin and Cable 1974). A southern New Mexico study on long term impact of mesquite control on forage yield indicated areas with 65% kill of mesquite yielded no more than non-control areas 20 to 30 years after treatment (Warren 1993). On an experimental area in Arizona a site with 100% kill of mesquite yielded about 40% more forage than an equivalent site without control 10 years after treatment (Galt et al. 1982). It is important to recognize that for ranchers 100% control of mesquite would be impractical because repeated treatments are necessary, making the costs excessive.

In the shinnery oak ranges of Texas and New Mexico, a 600-800 lb/acre/year increase in perennial grass yield occurred the first few years after herbicidal control on the more mesic/sandier sites (Pettit 1979). However on some of the drier sites there has been little increase to no increase in perennial grasses. Here brush control can be a disadvantage since shinnery oak helps to stabilize the site and receives some browsing use by livestock. Because the cost of shinnery oak control with herbicides is high ($16-18/acre), a rancher has to ask the question "Are the rewards when everything goes right worth the risk of investment loss if things go wrong?".

## Does the Reward Justify the Risk?

We favor approaching the risk/reward question using the best case scenario. Basically what is needed for a best case scenario is reasonable information on ranching costs, livestock prices, brush treatment costs, and the amount of possible forage increase.

As an example we have selected big sagebrush control in northwestern New Mexico since 6 years of brush control data using tebuthiuron across 9 sites are available (McDaniel et al. 1992). Detailed ranch budgets for northwestern New Mexico area are provided by Torell and Word (1991). In this area burning is seldom possible due to lack of understory, and excessive cost ($30/acre) rules out plowing. In northwestern New Mexico the herbicide 2, 4-D has not worked well on big sagebrush in contrast to Oregon, Idaho, Wyoming, and Utah.

On big sagebrush ranges of northwestern New Mexico an average annual increase in forage of 420 lbs/acre for at least six years with tebuthiuron herbicide treatment is a reasonable expectation. At 1993 prices the herbicide and added cattle costs would be $16/acre and $14.60/acre, respectively, for a $30.60/acre total. If the rancher treated 3,000 acres of private land, his total costs would be $91,800. However if the Soil Conservation Service covered 65% if the herbicide treatment cost under their cost-sharing program the combined expenses would be reduced to

**Table 2. Production and efficiency characteristics for medium-sized 250 animal unit cattle ranch in northwestern New Mexico without big sagebrush control on 3000 acres of private land.**

| Characteristic | Without Sagebrush Control | With Sagebrush Control |
|---|---|---|
| Ranch size (acre) | 28,614 | 28,614 |
| Number AUY | 250 | 310 |
| Number of mature cows | 186 | 230 |
| Replacement rate % | 14 | 14 |
| Bull to cow ratio | 1:15 | 1:15 |
| Calf crop % | 80 | 80 |
| Calf death loss % | 2.5 | 2.5 |
| Steer calf weight (lb) | 450 | 450 |
| Average forage production, lbs/acre/year | 155 (Entire ranch) | 575 (Treated area) |
| %use of forage | 50 (Entire ranch) | 35 (Treated area) |

$20.20 per acre for a total of $60,600. Using the financial information in Tables 2 and 3 a rancher could expect an extra annual return on investment of $11,936 or $3.98/acre. Without cost-sharing 7.69 years would be required to recover the investment and with cost-sharing 5.08 years would be required. The rates of returns on investment are 13% without and 20% with cost-sharing. Here we have stocked the brush control area for 35% use of forage (50% use overall ranch) and we have assumed that no correction for distance from water, slope or deferment period is necessary.

If the rancher borrowed the money necessary for this investment at 10% interest for 10 years, his annual payments would be $14,557 without SCS cost-sharing and $9,530 with cost-sharing. The annual negative cash flow of $2,621 associated without cost-sharing would nullify the investment for the rancher who had to borrow the money.

The question might also be asked "What if the rancher controlled brush to improve land condition and livestock performance rather than increase grazing capacity?" In this situation we'll assume the rancher controlled big sagebrush on the same area in the above example but did not increase his cattle numbers. This should allow him to lower the level of forage use on the ranch from 50% to 38%. An increase in calf crops of 5% and in calf weaning weights of 25 lbs might be a reasonable expectation. What would be the reward versus risk from this investment?

In this situation the only cost would be the $16/acre ($48,000 total) for herbicide treatments. Fixed and variable

**Table 3. Budget costs and returns for a 250 animal unit cattle without and with big sagebrush on 3,000 acres of private land.**

| | Gross Returns | | | | | |
|---|---|---|---|---|---|---|
| | Without brush control Number | with brush control Number | $.CWT | Lbs sale wt. | Total$ without brush control | Total$ with brush control |
| Yearlings | 23 | 28 | 82.00 | 550 | 10,373 | 12,628 |
| Calves | 121 | 150 | 96.00 | 425 | 49,368 | 61,200 |
| Cull bulls | 3 | 4 | 60.00 | 1,475 | 2,655 | 3,540 |
| Cull cows | 24 | 29 | 50.00 | 900 | 10,800 | 13,050 |
| | | | | | 73,196 | 90,418 |

| Cost type | #/Unit | $/Unit | Total Production Costs without brush control | Total Production Costs with brush control |
|---|---|---|---|---|
| A. **Variable Costs** | | | | |
| 1. Grazing fees | | | | |
| State Lease | 4,070 (acres) | 0.60 | 2,431 | 2,431 |
| BLM/Forest Service fees | 1,896 (AUM's) | 3.00 | 2,883 | 2,883 |
| 2. Supplemental feed | | | 10,672 | 13,233 |
| 3. Livestock Expenses | | | | |
| Purchased bulls | | | 2,700 | 3,348 |
| Fuel & repairs | | | 5,410 | 5,410 |
| Veterinary & medicine | | | 1,546 | 1,917 |
| Property taxes (livestock) | | | 1,212 | 1,502 |
| Maintenance | | | 3,276 | 3,276 |
| Other | | | 500 | 620 |
| 4. Hired labor | | | 5,400 | 6,696 |
| Total Variable Costs | | | 36,030 | 41,316 |
| B . **Fixed Costs** | | | | |
| Electricity | | | 1,440 | 1,440 |
| Telephone | | | 800 | 800 |
| Butane & heating | | | 1,200 | 1,200 |
| Insurance | | | 5,200 | 5,200 |
| Depreciation | | | 14,535 | 14,535 |
| Property Taxes | | | 1,182 | 1,182 |
| Total Fixed Costs | | | 24,357 | 24,357 |
| Total Cash Costs | | | 60,387 | 65,673 |
| C. **Net Ranch Income ($)** | | | 12,809 | 24,745 |

cost would essentially stay constant for the ranch defined in Table 2 and 3. Annual added income from the improved cattle performance would be $7,400. A total of 6.5 years would be required to recover the investment without cost-sharing and 2.3 years would be required with cost-sharing. The rates of return on investment without and with cost-sharing would be 15% and 44%, respectively. If the rancher borrowed the money for brush treatment at 10% for 10 years, his annual payments would by $7,549 without cost-sharing and $2,220 with cost-sharing. In this case the investment would be sound with and without cost-sharing if financed by the rancher. Clearly the investment would be unsound without cost-sharing if bank financed since net cash flow would be a negative $159.

Brush control to increase livestock performance and land condition is a low risk/low reward proposition compared to increasing grazing capacity. However, it may have greater benefits in the 10-30 year period based on several studies that show long term increases in grazing capacity from conservative stocking (see reviews by Holechek et al. 1989 and Vallentine 1990). In contrast brush control with full use of forage appears to be decaying asset after 5-10 years, but this needs better study.

The previous example demonstrates how government cost-sharing can greatly alter the financial effectiveness of a range management practice. It is our analysis that under present economic conditions brush control with herbicides in desert and semi-arid areas to increase grazing capacity is usually unprofitable without government cost-sharing.

## Implications

Brush control to increase grazing capacity on western rangelands under the most favorable conditions is often financially unsound. It is economically and ecologically more justifiable if the goal is to improve land condition and livestock performance. Government subsidies make it economically more rational to graze at levels that are not sustainable. This increases the supply of livestock by masking true production cost, and to some extent has adversely impacted livestock prices for non-subsidized livestock operations. This problem is exacerbated by the government emergency feed subsidy administered by the USDA Agricultural Stabilization and Conservation Service that compensates ranchers monetarily for the extra feed they need in drought years. Ranchers who practice sustainable grazing and do not use these programs are negatively impacted by lower prices they create through expanded supply.

Discontinuation of federal government brush control and emergency feed subsidies would force ranchers who use unsustainable grazing practices to reap the consequences of their actions. Higher livestock prices from reduced supply could make privately funded brush control more cost-effective.

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