

COST-BENEFIT ANALYSIS
GRINDSTONE PROJECT
1974 - 1980

MENDOCINO NATIONAL FOREST
REGION II, CALIFORNIA DEPARTMENT OF FISH AND GAME
GLENN COUNTY

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GRINDSTONE PROJECT COST-BENEFIT ANALYSIS

A. OBJECTIVE

Determine the value (cost benefit) of the Grindstone Project.

B. INITIAL ASSUMPTIONS

1. An area which has been burned will not (cannot) reburn in a wild-fire for 15 years.
2. Sprouting vegetation is of high value for deer and livestock forage for 3 years; returns to pre-treatment value levels at 7 years.
3. Water yield increase returns to normal at ten years.

C. BENEFITS

1. Water Yield Increase

Prescribed burning in Grindstone Canyon will result in (at least) an increased run-off of 100,000 gallons (1/3 acre foot) per acre the first year. About 50% of the increase comes as run-off in the winter; the remaining 50% as an extended flow into the dry summer. The latter increase is especially valuable to wildlife and livestock on site with minor value to outdoor recreation and fire protection. Run-off also has an off-site value because all water is behind Black Butte Reservoir (flood control, irrigation, recreation) and the Central Valley Project system.

Water can be purchased from the Bureau of Reclamation at Willows for \$6.60 per acre foot, indicating a value of \$2.20 per acre for our manufactured increase. An acre-foot of domestic water (at Willows) costs about \$1,500, indicating a value of \$500 per acre. However, these figures essentially reflect the cost of delivery of water, not its value. Water's value is found in its use; land with water is more valuable because it can be used for more things.

On-site value of water (for our project) is assumed to be reflected (Included) in the increased productivity associated with livestock and wildlife outputs. These increases could not fully occur without an increase in available water generated by the project on-site.

Water flowing off-site is best valued by the same method, the outputs generated from its most likely use. In our area, the most likely use of "new water" would be irrigation. Rice would be the crop, if possible.

ASSUME

- a. Straight line declining yield (of water increase) over ten years.
- b. 50% of increased water yield is useable, 50% of that amount lost in evaporation and seepage during delivery (25% gross increase useable off-site).
- c. Six acre feet are needed to irrigate one acre of rice.
- d. Rice yield estimated at 60 sacks/acre, valued at \$10.00/CWT.
- e. Any available water in California is likely to be used.

2. FORAGE INCREASE (Livestock)

Prescribed burning rejuvenates brush species and often causes a "flush" of annual grasses and forbs which produces the following increase in range productivity (forage).

1st year - 2/3 AUM/acre
 2nd year - 1 AUM/acre
 3rd year - 1 AUM/acre
 4th year - 1/2 AUM/acre
 5th year - 1/3 AUM/acre
 6th year - 1/4 AUM/acre
 7th year - 1/8 AUM/acre

Based on a 1976 analysis (3 ranches on the Stonyford District) which calculated the income stream produced over the life of cattle, an AUM is worth \$12.00 (using a breeding success ratio of 80%). Also pasture is commonly leased locally for \$10 to \$12.00 per AUM, \$8.00 for yearlings (1977 agreements).

ASSUME

- a. Forage increase worth \$12.00 per AUM.

b. Only 25% of the total forage produced by the burned acreage is useable by cattle for reasons of terrain, water availability, level of management, etc; 50% by sheep, probably 100% by goats.

3. WILDLIFE

Data is available at this time to value only deer. However, deer are a prime beneficiary of prescribed burning and of highest priority to the California Department of Fish and Game. Also, the Grindstone Project was originally aimed at deer.

a. Based on tag returns/tags sold in Zone B-2 in 1978, there was a 6.7% hunter success ratio. Assuming that an overriding motive of deer hunting is to "fill you tags," each hunter is risking \$18.00 against 15:1 odds, indicating that the hunter assigns a "payoff value" (the buck) of \$270.00.

Based on check station and FPT counts taken at Stonyford in 1978, the 1978 kill in Glenn County, and a "first weekend kill factor" developed locally in 1975, the Glenn County success ratio is 27% (approximately) 4:1). Glenn County hunters are only "risking" roughly \$72.00 for their sport.

Assuming the difference in success ratio arises from the habitat improvement that provides more animals and better hunting access, the work that has been accomplished to date has an indicated value of \$198.00 per buck taken.

b. Another indication of value is the worth of the venison. An experienced restaurant owner in San Rafael (who also owns a cattle ranch at Leesville) has previously estimated he could retail venison (if legal) at \$3.50 per pound. The average buck from the Grindstone area now averages 95 to 100 pounds field dressed and would cut-out about 60 pounds of meat, indicating value of \$210.00 per buck.

c. Hunting clubs oriented toward deer in the foothills of Colusa County have been bringing \$200.00 per member before the drought (1976-77). The same is currently true for Mendocino County (about \$250-\$300). What "sells" a hunting club is a high success ratio and deer in good condition.

d. Illegal kills in this area usually bring a (maximum) fine of \$500 plus court expenses (usually around \$100-\$125) plus confiscation of the gun, valued usually from \$100 to \$200.

Punitive damages are triple in Civil Code, indicating a value range of, from \$230 to \$260 per animal. A "tag violation" (as opposed to deliberate poaching) is usually fined at \$300 plus expenses. Damages in this case would be double, again indicating a value of about \$200.

ASSUME

a. A buck is worth \$200.

b. Assume Grindstone has reached its maximum hunter success in 1978 and harvest over future years will average the 1978 increase.

Alder Springs herd kill in 1978...409 bucks. Alder Springs herd kill in 1974...131 bucks. Increase due to project...278 bucks valued at \$200...\$55,600 (due to project).

c. Assume a straight line relationship:

Year 1 (1974) ...	\$11,000
Year 2 (1975) ...	\$22,000
Year 3 (1976) ...	\$33,000
Year 4 (1977) ...	\$44,000
Year 5 (1978) ...	\$55,000
Year 6 (1979) ...	\$55,000
Year 7 (1980) ...	\$55,000

4. FIRE

Fire benefits relate and accrue from the project in two ways:

a. Any area treated will not reburn in 15 years, therefore saving (in theory at least) the fixed cost of prevention and suppression modules.

FY79 fire budget ...	\$1,727,400
Acres protected ...	1,079,483

A case could be made that fixed costs are "skewed" toward the brushland; that modules are weighed and located toward this maximum hazard. Conversely some modules such as Air and Hotshot capability affect areas greater than the Mendocino's protection zone. For purposes of this analysis, these factors are assumed to offset each other. Fixed cost of fire protection...\$1.60/acre.

b. A prescribed burning/type conversion program will at some point remove the risk of catastrophic fire and "save" suppression and rehabilitation costs:

Large Brush fires 1969-79 ...	10
Acreage burned ...	29,614
Cost of suppression ...	\$3,256,449
Average size ...	2961 acres
Average cost ...	\$110/acre

ASSUME

a. A large fire cannot occur within the area once the cycle (prescribed burning) begins to repeat (20 years).

b. Assume one fire/10 years within the project area.

c. Assume the benefit occurring at the midpoint of the rotation cycle (10 years). (2,961 acres) (\$110)...\$325,710 at year 10. (would in theory also repeat at year 20).

D. EVALUATIONPresent Worth (discounted at 10%)

1. Benefits

(a) Water

Year	Area Burned (ac)	Water Yield (ac ft)							TOTAL
1974	504	168							168
1975	725	151	242						393
1976	206	134	218	69					421
1977	362	118	194	62	121				495
1978	1,278	101	169	55	109	426			860
1979	2,000	84	145	48	97	383	667		1,424
1980	2,980	67	121	41	85	341	600	934	2,189
1981		50	97	34	73	298	534	841	1,927
1982		34	73	28	60	256	467	747	1,665
1983		17	48	21	48	213	400	654	1,401
1984		0	24	14	36	170	334	560	1,138
1985			0	7	24	128	267	467	893
1986				0	12	85	200	374	671
1987					0	43	133	280	456
1988						0	67	187	254
1989							0	93	93
1990								0	0

14,448 ac ft

168 ac ft (.25)	(\$545.45/ac)	/ 6 ac ft/ac	\$ 3,818
393 ac ft (.25)	(\$495.87/ac)	/ 6 ac ft/ac	8,120
421 ac ft (.25)	(\$450.79/ac)	/ 6 ac ft/ac	7,908
495 ac ft (.25)	(\$409.81/ac)	/ 6 ac ft/ac	8,452
860 ac ft (.25)	(\$372.55/ac)	/ 6 ac ft/ac	13,450
1,424 ac ft (.25)	(\$338.68/ac)	/ 6 ac ft/ac	20,095
2,189 ac ft (.25)	(\$307.90/ac)	/ 6 ac ft/ac	28,083
1,927 ac ft (.25)	(\$279.91/ac)	/ 6 ac ft/ac	22,474
1,665 ac ft (.25)	(\$254.46/ac)	/ 6 ac ft/ac	17,653
1,401 ac ft (.25)	(\$231.32/ac)	/ 6 ac ft/ac	13,503
1,138 ac ft (.25)	(\$210.29/ac)	/ 6 ac ft/ac	9,971
893 ac ft (.25)	(\$191.18/ac)	/ 6 ac ft/ac	7,113
671 ac ft (.25)	(\$173.80/ac)	/ 6 ac ft/ac	4,895
456 ac ft (.25)	(\$158.00/ac)	/ 6 ac ft/ac	3,002
254 ac ft (.25)	(\$143.63/ac)	/ 6 ac ft/ac	1,520
93 ac ft (.25)	(\$130.58/ac)	/ 6 ac ft/ac	506
			<u>\$170,563</u>

(b) Forage

1974 projects	(\$35.25/ac)	(504/ac)	/ 4	\$ 4,441
1975 projects	(\$32.06/ac)	(725/ac)	/ 4	5,811
1976 projects	(\$29.14/ac)	(206/ac)	/ 4	1,501
1977 projects	(\$26.48/ac)	(362/ac)	/ 4	2,396
1978 projects	(\$24.09/ac)	(1,278/ac)	/ 4	7,697
1979 projects	(\$21.89/ac)	(2,000/ac)	/ 4	10,945
1980 projects	(\$19.90/ac)	(2,980/ac)	/ 4	14,826
				<u>\$47,617</u>

(c) Wildlife

1974 projects discounted at 10%	\$ 10,000
1975 projects discounted at 10%	18,181
1976 projects discounted at 10%	24,793
1977 projects discounted at 10%	30,052
1978 projects discounted at 10%	34,150
1979 projects discounted at 10%	31,046
1980 projects discounted at 10%	28,224
	<u>\$176,446</u>

(d) Fire

(1) Direct

1974 projects (\$1.60) (504) discounted at 10%..\$733 (15 yrs.) =	\$10,995
1975 projects (\$1.60) (725) discounted at 10%..\$959 (15 yrs.) =	14,385
1976 projects (\$1.60) (206) discounted at 10%..\$248 (15 yrs.) =	3,720
1977 projects (\$1.60) (362) discounted at 10%..\$396 (15 yrs.) =	5,940
1978 projects (\$1.60) (1278) discounted at 10%..\$1270 (15 yrs.) =	19,050
1979 projects (\$1.60) (2000) discounted at 10%..\$1806 (15 yrs.) =	27,090
1980 projects (\$1.60) (2980) discounted at 10%..\$2447 (15 yrs.) =	36,701
	<u>\$117,881</u>

(2) Indirect

\$325,710 discounted at 10 years = \$125,575

(e) Total

Water	\$170,563
Forage.....	47,617
Wildlife.....	176,446
Fire.....	243,456
	<u>\$638,082</u>

2. Costs

1974 projects (\$ 11,103) not discounted =	\$11,103
1975 projects (\$ 17,687) discounted at 10% =	\$16,079
1976 projects (\$ 15,297) discounted at 10% =	\$12,642
1977 projects (\$ 8,735) discounted at 10% =	\$ 6,562
1978 projects (\$ 20,205) discounted at 10% =	\$13,800
1979 projects (\$ 14,000) discounted at 10% =	\$ 8,692
1980 projects (<u>\$ 22,000</u>) discounted at 10% =	<u>\$12,418</u>
	<u>\$109,027</u>
	<u>\$81,296</u>

*Breakdown to \$54,800 California Department of Fish and Game, \$4,000 Glenn County, \$50,227 USFS.

3. Cost-Benefit Ratio

Other benefits of prescribe fire/fire management are recognizable but cannot be valued at this time. They include wildlife and vegetative diversity, a change in color and texture brought to essentially monotonous landscape, dispersed recreation other than hunting (such as ORV), a partial alternative to herbicide treatments with their underlying political/social considerations,

an increase or maintenance of T&E plant populations for several species intolerant of brush competition, a noted increase in cougar, peregrine and prairie falcons foraging in the burns, a decrease in lost hunters and recreationist (rescue efforts) and smoke occurring on burn days rather than randomly through wildfires. Chamise is also not good watershed cover. There possibly is a long-term decrease in soil erosion accruing from management and certainly at least a short-range increase in nutrient levels. Water quality has not deteriorated, mass movement has not occurred and surface erosion seems close to normal levels.

Based on four values: Water quantity, livestock forage, deer, and fire suppression, a cost-benefit ratio of 7.85:1 is calculated for the Grindstone Project for the work occurring since 1974.

APPENDIX

FORAGE INCREASE VALUES

1974 (Year 1)		Total Value	Discounted Value
1.	2/3 AUM/acre	\$ 8.00	\$ 7.27
2.	1 AUM/acre	12.00	9.92
3.	1 AUM/acre	12.00	9.02
4.	1/2 AUM/acre	6.00	4.10
5.	1/3 AUM/acre	4.00	2.48
6.	1/4 AUM/acre	3.00	1.69
7.	1/8 AUM/acre	<u>1.50</u>	<u>.77</u>
		\$46.50	\$35.25
1975 (Year 2)		Total Value	Discounted Value
1.		\$ 8.00	\$ 6.61
2.		12.00	9.02
3.		12.00	8.20
4.		6.00	3.73
5.		4.00	2.26
6.		3.00	1.54
7.		<u>1.50</u>	<u>.70</u>
		\$46.50	\$32.06
1976 (Year 3)		Total Value	Discounted Value
1.		\$ 8.00	\$ 6.01
2.		12.00	8.20
3.		12.00	7.45
4.		6.00	3.39
5.		4.00	2.05
6.		3.00	1.40
7.		<u>1.50</u>	<u>.64</u>
		\$46.50	\$29.14
1977 (Year 4)		Total Value	Discounted Value
1.		\$ 8.00	\$ 5.46
2.		12.00	7.45
3.		12.00	6.77
4.		6.00	3.08
5.		4.00	1.87
6.		3.00	1.27
7.		<u>1.50</u>	<u>.58</u>
		\$46.50	\$26.48

1978
(Year 5)

	<u>Total Value</u>	<u>Discounted Value</u>
1.	\$ 8.00	\$ 4.97
2.	12.00	6.77
3.	12.00	6.16
4.	6.00	2.80
5.	4.00	1.70
6.	3.00	1.16
7.	<u>1.50</u>	<u>.53</u>
	\$46.50	\$24.09

1979
(Year 6)

1.	\$ 8.00	\$ 4.52
2.	12.00	6.16
3.	12.00	5.60
4.	6.00	2.54
5.	4.00	1.54
6.	3.00	1.05
7.	<u>1.50</u>	<u>.48</u>
	\$46.50	\$21.89

1980
(Year 7)

1.	\$ 8.00	\$ 4.11
2.	12.00	5.60
3.	12.00	5.09
4.	6.00	2.31
5.	4.00	1.40
6.	3.00	.96
7.	<u>1.50</u>	<u>.43</u>
	\$46.50	\$19.90

WILDLIFE VALUES1974
(Year 1)

1.	\$11,000	\$ 10,000.00
2.	22,000	18,181.18
3.	33,000	24,793.40
4.	44,000	30,052.57
5.	55,000	34,150.60
6.	55,000	31,045.85
7.	55,000	<u>28,223.80</u>
		\$176,447.40