

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search http://ageconsearch.umn.edu aesearch@umn.edu

Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C. An Economic Evaluation of Waterponding

P F Penman Agricultural Economist NSW Soil Conservation Service TAMWORTH

A Paper Presented to the 32nd Annual Conference of the Australian Agricultural Economics Society, Melbourne, February 8-11, 1988.

AN ECONOMIC EVALUATION OF WATERPONDING

P F Penman*

INTRODUCTION

The establishment of the Marra Creek Waterponding Demonstration Programme in 1984, involving 18 properties and 87,000 hectares with a total of 17,200 hectares of scald to be treated, formed the basis for a realistic and practical evaluation of both the technical and economic components of waterponding.

The technical aspects of waterponding are detailed elsewhere in this journal. Given that scalded areas in the fully eroded state support no stock and consequently, have basically no benefits except as catchment areas for stock water supply tanks, the assessment of benefits to landholders emanating from the waterponding programme can be accurately identified.

This article uses a hypothetical property in the Marra Creek Demonstration Area to evaluate, from the landholders viewpoint, the economics of waterponding on scalded areas. Since the evaluation is for a hypothetical property, consideration is given to those parameters which significantly influence the economics of the programme, and how they affect the 'break-even' time of the programme and the benefit-cost ratio.

THE PROPERTY

The hypothetical property is 8000 hectares in size, of which scalded areas requiring waterponding constitute 25 per cent. The carrying capacity for the total property prior to treatment, is one dry sheep equivalent (dse) to 1.6 hectares, with a flock size of 2500 merino ewes.

The merino ewes are currently returning \$25.57/ewe, incorporating a weaning percentage of 80% and cutting 5.5 kg/head of wool.

* Agricultural Economist, NSW Soil Conservation Service, Tanworth. Determining realistic land values are currently extremely difficult, due to lack of sales within the area and the large variation between proporties. However, for the hypothetical property, the area of scalded country has been valued at \$11.00/hectare, while heavy clay country and improved waterponded country is valued at \$53.00/hectare. These values do not purport to be statistically representative, or to relate to any specific properties. They are to enable a meaningful assessment of cost/benefit of water onding to take place, and attempt to reflect the significant cocline in land value where country is badly scalded.

BENEFITS AND COSTS OF WATERPONDING

The Costs

The size of a waterpond is usually 0.4 hectares with an establishment cost of \$12.00. An on-going maintenance cost of \$4.00/pond in each of two years during the revegetation period is needed for optimum results. For this property, 5000 ponds are required to treat the 2000 hectares of scald, which will initially cost \$60,020, with two maintenance costs of \$20,000 each in the second and fifth year.

The finance for undertaking the waterponding programme may be obtained through the following sources:

- (a) Cash reserves
- (b) SCS Advance
- (c) 50% Cash and 50% Commercial loan.

Priced Benefits

The ability to initiate vegetative growth on previously unproductive scalded country, presents the landholder with a number of management options which allow him to reap benofit from the expense on waterponds. These options initially involve either keeping stock numbers the same and utilizing a more reliable feed source and increasing per head production, or increasing stock numbers.

Lack of research data makes it difficult to place monetary values on the benefits of waterponding. To overcome this vacuum, a survey of the landholders involved in the Marra Creek Demonstration Area was undertaken. The data used in this analysis are derived from the survey, to allow the benefits to be priced.

 These values were derived from information relating to relevant property sales, received from the State Bank Valuers, Dubbo.

Maintenance of Stock Numbers

The potential benefits which may accrue to the landholder if he chooses to maintain stock numbers are:

- (i) Weaning percentages will increase, moving from the present level of 80% to 85%, increasing at a constant rate of 1% p.a. over a five year period.
- (ii) Wool cuts would be expected to improve from the present 5.5 kg/ewe to 6.0 kg/ewe, increasing at a constant rate of 0.1 kg/head/year over a five year period.
- (iii) A further benefit under this option is the ability to carry stock further into prolonged dry periods for a longer time and to provide stock with better quality feed. This is clearly difficult to price, but from the survey undertaken of landholders, it was valued very highly in that all respondents chose to maintain existing stock numbers rather than increase their flock size.

Increase in Stock Numbers

Alternatively, landholders may consider the option of utilizing the additional feed available through the waterponding programme to increase stock numbers, thus increasing the grazing rate of the property. This however, was considered impractical by the landholders in the Marra Creek area, who strongly preferred the option of keeping constant stock numbers and providing a better feed source. Clearly if the option of increasing stock numbers was undertaken, the ability to carry stock through prolonged dry periods would be reduced or negated. Since landholders choose not to increase stock numbers, they clearly value very highly the ability to carry stock through dry periods.

Improved Capital Value of Land

On the basis that the revegetation of the land will be complete after seven years from the commencement of waterponding, the land value of the previously scalded area will be equal to the adjoining heavy clay country after that period. The inclimproved land value in the assessment of benefits can be The inclusion of undertaken in a number of ways. Firstly, it may be incorporated pro-rata over the first seven years of the programme. This work reflects a measure of total equity the landholder has in his property. Secondly, it may be incorporated at completion of the programme, which would be an estimate of the planning horizon for the landholder. Clearly the improved land value of the programme will not be realised until the property is sold, although it will improve the landholders equity in his property from the outset of the programme. Finally, for those landholders who believe they would never sell, land value would not be incorporated in the model, and the viability of the programme would be dependent on other programme benefits.

This improved equity position would then be beneficial to the landholder in the continuing operation of his business.

Taxation Benefits

Capital expenditure on waterponding is tax deductible in the year of expenditure. Additionally, the interest component of loan instalments (i.e. waterponds funded through a Soil Conservation Service Advance) is also tax deductible.

For the purpose of this analysis, an average tax rate of \$0.42 in the dollar is assumed. If in fact the taxable income of the landholder was below the capital expenditure of \$60,000, the tax benefit of implementing a waterponding programme would be carried over to ensuing years.

DISCOUNTING OF FUTURE COSTS AND RETURNS

When comparing streams of benefits and costs, it is necessary that all costs and benefits occuring at different points in time are converted to a single, relative value at one point in time. Discounting is a method of converting future values back to the present. Two forms of discounting are used in this analysis. Firstly, net present value (NPV) which is defined as the present value of future benefits less the present value of future costs, using a given rate of interest. Secondly, the internal rate of return (IRR) calculates the rate of interest which allows the sum of discounted costs to equal discounted benefits, i.e. the NPV equals zero. The interest rate to be used here represents a real rate of return (i.e. inflation free) available on alternative investment. Accordingly, a rate of 5% is used in this evaluation with the IRR indicating the return to the investment.

THE RESULTS

Table 1 presents an economic evaluation of a waterponding programme for this hypothetical property. The evaluation is in the form of a cash flow budget over a 15 year period, for a landholder paying for the work using 50% cash and 50% commercial borrowings at an interest rate 16% p.a. over a 5 year period.

From Table 1, the benefit cost ratio of the work is 1.39, with a net present value (i.e. cumulative future returns less cumulative future costs) of \$41,037. The breakeven year is year 7 when the cumulative returns are for the first time, greater than the cumulative costs.

The tax benefit, which allows for expenditure on soil conservation to be deductible in the year of expenditure, is a significant benefit for the programme. Further tax benefits are obtained in the following year, for the interest instalments on the commercial loan.

The inclusion of increased land value at a pro-rata rate in the early years of the programme, improves the landholders' equity, and the cumulative benefit of the programme. However, this benefit will not be realized (if at all) until the property is sold.

Table 2 gives a comparison of the profitability of the waterpordiing programme financed under a Soil Conservation Service Advance. The Advance covers the full cost of implementing the works, i.e. \$60,000, and is borrowed at a rate of 8% per annum over a ten year period. In this instance, although the programme has a slightly lower benefit-cost ratio of 1.42, and a net present value of \$44,642, the availability of low interest finance allows the programme to break even from the first year. The tax benefit is significant enough to offset the loan repayments, and although an annual deficit is incurred in a number of ensuing years, the cumulative benefit is always positive.

Table 3 summarises the benefit-cost ratio, net present value and break-even years, of the programme, for changes in the source of finance and the incorporation of improved land values.

Finance	Impr Valu	oved Land e Pro-rat	Improved Land Value at Year 15				
Source	NPV Ş	B/C Ratio	BE Yr	NPV Ş	B/C Ratio	BE Yr	
100% Cash	45485	1.5	7	19639	1.21	15	
100% S.C.S.	44642	1.42	1	17796	1.17	15	
50% Cash/ 50% Commercial Loan*	41037	1.39	7	14191	1.13	15	

Table 3: Net Present Value of Waterponding (Discount Rate 5%)

Table 4: Internal Rate of Return

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Finance Source	Land Value Pro-rata	Land Value Delayed
100\$	Cash	Ø.29	Ø.14
100%	S.C.6.	0.39	0.15
508 508	Cash/ Commercial Loan*	Ø.14	0.06

* Commercial loan 16% over 5 years

From the above tables, it can be seen that the choice of financial source is fairly insignificant in determining the profitability of the programme. A Soil Conservation Service Advance, while diminishing net present value and benefit-cost ratio, allows the landholder to be in a surplus cash flow position for the duration of the programme. The major variation occurs with the incorporation of the land value. Land value is clearly the major determinant of the viability of the programme. When land value is not incorporated until the end of the programme, in this case year 15, the programme does not breakeven until that land value is included. Irrespective of discount rate and source of finance, the programme does not approach a break-even position until the approved land value component is incorporated.

Internal Rate of Return

Table 4 indicates the internal rate of return for the investment of money into waterponding under different finance sources. The rate of return is very significant between finance sources and the incorporation of land value in the analysis.

Given that the internal rate of return is a 'real' or inflationfree return of investment, the lowest return of 6% indicated in Table 4 illustrates the value of the waterponding programme. Although the incorporation of land value appears important when considering net present values, the internal rate of return demonstrates that waterponding is an attractive and economic investment for landholders with scalded country. For instance, an IRR of 14% for landholders paying cash and not incorporating improved land value until the end of the programme, is an extremely attractive investment relative to other on-farm investments, for primary producers. Certainly, when land values are included in the analysis, internal rates of return in the order of 14% using commercial borrowings and 30% for cash or Soil Conservation Service Advance, make the investment into waterponding extremely profitable.

DISCUSSION

÷

Priced Benefits and Costs of Waterponding

Land Value

The inclusion of improvement in land value over the establishment of the ponds significantly affects the profitability of the programme, in particular the time period until the programme breaks even. While the net present values are reduced by around \$20,000, depending on when the improved land value is incorporated, the programme is still economic. However, even when land values are incorporated, it is the delay in reaching a surplus cash flow position which would be of most concern to landholders. Clearly, it is up to individual as to the importance of incorporating land value, as while it improves the landholders equity in his property, it only becomes a monetary benefit once the property is sold.

Tax Savings

The significance of tax savings will vary from landholder to landholder depending on the specific financial situation. The situation here, where the landholder has a taxable income of \$60,000 prior to undertaking the works allows for the greatest benefit from the tax deductions. However, even if the landholder had a lower taxable income, the effective 'tax losses' would be carried forward to following years. Where the work is financed through borrowings, not only the capital cost of the works, but the interest component over the duration of the loan is tax deductible.

Management Changes

The estimated improvement in wool cuts and weaning percentages are relevant to landholders with average managerial skills. The base from which these wool cuts and weaning percentages commence, is not significant in determining the profitability of the programme. It is the magnitude of their increase as a result of implementing the programme which will affect overall profitability. Management during the establishment of the ponds and of the stock over the longer period is critical for the continued benefits of the programme.

Unpriced Benefits and Costs of Waterponding

The major unpriced benefit of the waterponding programme is the ability of the landholder to carry stock through an extended dry period. Landholders could choose to increase stock numbers following successful revegetation of scalded areas, but this is rarely the case. With the uncertainty of feed supplies in the western areas of NSW, landholders choose to use the revegetation of scalded areas as a 'feed reserve' for prolonged dry periods, with the advantage of improved wool cuts and weaning percentages from existing stock.

While the evaluations based on those cost and benefits which can be easily priced shows the programme to be viable, this particular unpriced benefit would significantly improve the viability and profitability of the waterponding programme. Its inclusion would have a significant effect on the net present value and benefit-cost ratio of the programme.

CONCLUSION

Importantly, wateponding on the hypothetical property is a viable investment for landholders, regardless of the financial sources. The timely inclusion of the improved capital value of the land adds to the attractiveness of the results, being the major determinant to the profitability of the programme.

The finance source has very little bearing on the results. The payment of cash providing an overall higher benefit-cost ratio and net present value, but not breaking even until year 7, whereas there is an immediate cash benefit with a soil Conservation Service Advance. The optimum finance source would clearly depend on the individual landholder's financial position.

Although the benefit-cost ratio and net present value are not excessive for the time period studied, it is important to remember that the benefits will accrue well beyond the time period of this study with no further costs to be incurred. Furthermore, the important unpriced benefit of available feed supplies through extended dry periods is not costed in this analysis, but is clearly valued highly by landholders, indicated both through the landholder survey undertaken and the benefits foregone by not increasing stock numbers as a result of waterponding.

The internal rate of return places the investment in some perspective relative to the returns achievable from alternative investments. Real rates of return in the order of 15% are not often obtained in agriculture, and are not often available offfarm without the incorporating of substantial risk. The investment of money into waterponding is an extremely attractive investment for landholders with scalded country, regardless of how they view the improvement in capital value of their property.

Figure 1 WHIEFFCSEDS EVALUATION: 50% Cash/50% Commercial Loan

a bine a construction of each of the state of the

Property Size: Scalded Great: Cerrying Contexty: Topreved Conital Value: Conital Value of Scald; Enterprise Types: Flock Size: Sream Kargin(GR): Afamet Afamet Venning X:	844 200 \$.425 dss/ 33.0 11.0 for1se Bra 250 25.5 12.7 80.6	9 hectares 9 hectares 1.0 hectares 9/hectare 8	1 2114)			Finance Sou Cash Borraulage Januity F Pand Casts Maintenance Foud Sizes Discount Ma Recurry Due	eres sector custs tes retions	50.602 50.602 0.305 30.00 10.00 0.44 5.002 1 4v yrs in 7	/hectare /hectare /hectare					
Si Changes		e shar salara	18- 2 78451	•		•								
Ven	4.70	E				ianale à B	renctions	40000.00						
1/650	a.10					KARLTE ITT	Ratas	9.42						
Current Haal Cat(Lu/hd):	****	r i												
Ent .	3.5	• ·												
Racia	1.0						•							
llaggets.	5.0													
Increases	6.10	kg/weed in	r annua for	5 years)										
fil Casper		ę ,,		- ,										
97 mat	.300													
\$(\$371	4,150													
				٠		¢	ASH FLOW DEV	ELOPMENT BUDGET						
	4	1	2	3	4	5		· ,			16	11	19	17
COSTS		•	-	-	•	-	4		•	1	14	**	15	11
Pood Establishments														
Casa	\$0000.00	0.00	0.60	0.00	0.00	0.60	0.00	0.69	0.00	ð. 00	0.00	0.00	6.60	6 60
SCS Myrace	7112.00	9162.00	9162.00	9162.00	9162.00	9.00	8.06	0.00	0.00	0.00	0.08	0.00	0.60	0.60
rung Kalasangai	9 ,00	Q.94	20000.00	9.00	0.00	20000.00	0.00	0,00	9.00	8.0>	0.00	Q. QQ	0.00	0.00
TATLE FORTE LALL	-													
BISCRETTE (P1)	18115 AA	1142.00 0336 31	27162.90	9162.00	9162.00	20000.00	0.00	0.00	0.00	9.00	9.00	0.00	0.00	0.00
*********	91104146	U 63-71	20130-11	////.48	7537.49	15670.52	0.00	0.00	Ŷ.00	9.00	\$.00	9.60	0.00	0.00
REFITS														
screesed Seance I:	0.00	0.00	570.00	1040.00	14LG AA	448A AA								
acreased licel Cuty	0,00	0.00	750.00	1566.00	1750 00	2084.00	2500.00	2400.00	2600.09	7600.00	2609.00	2500.00	2500.00	2409.00
acreased Land Values	9.00	0.00	14900.00	12800.08	11800 00	14000 00	3730.00	3750.00	3750.00	3759.00	3759.09	3750.00	3750.00	3750,00
educed Tax Paynontes						(10000.00	19864144	0.00	Q. QQ	0.00	4.40	0.00	9.00	5.08
Cash	12400.00	0.00	0.00	0.00	0.00	0.00	A 10	A AA	ă AA	6 6 6	0.44	A 44	A 45	
garcenteês	14616.00	1722.97	1382.85	785.42	530.88	9.13	0.00	0.00	0.00	¥,¥V A AA	V. VV	0.04	V.VV A #A	0.00
								****	4.44	4.44	v.vv	V. VV	4.44	V. VV
INTAL MEMEFITS (9):	.7216.00	1722.87	19452.85	20328,42	21140.58	21880.13	23150.00	A350.00	4350.00	6350.00	A150.00	6350.00	4350.00	4350.00
atpenning (a)s	27214.00	1640.03	17444.31	17560.45	17392.65	17143.65	17274.89	4512.83	4297.93	4093.27	3898.35	3712.71	3535.92	3347.54
ALI BLALFIJA LOVAJI Alerninica Jos	*11749.00	-/437.13	-9709.15	11146.42	11978.28	1880.13	23150.00	6350.00	6350.00	6350.00	6359.00	6350.00	4350.00	\$350.00
atmanits itti	-11148.09	*10#4°88	+\$\$Q\$,49	9645,97	9855.05	1473.13	17274,89	4512.83	4297.93	4093.27	3898.35	3712.71	3535.92	3367.54
CUMMATIVE SEMEFITY	-11946.00	-10105 11	-7808# 75		5040 r*									
DISCOUNTED (F):	-11946.00	-19836, RA	-77817.19	-18181 40	-2948.99	~4068.84	19081.14	25431.14	31781.14	38131.14	44481.14	50831.14	57181.14	63531.14
		*******	તા મના ર તે (10111140	-8398*73	-6563.22	10411,67	14924.49	19222,42	23315.29	27214.04	30926.75	34462.67	37839.21
NET PRESENT VALUE:	41037.39													
INTERNAL RATE RETURN:	4.11													
NEWEFIT COST RATIO	1.37													

.

14

4.00 0.64 0.00

0.09 9.00

2600.00 3750.00 0.00

> 0.00 0.00

4350.09 3287.18 144498.51

6350.00 3207.18

49881.14 41037.39 105441.11

41037.39

Figure 2

14

0.00

0.09 0.00

2600.00 3758.00 0.00

> 0.00 0.09

62008.77 44642.17

1350.00 3207.18 150937.21

6350.00 3207.18 44642.17

٠

0.09 9.09 105295.04

13

0.00

0.00

0.00 0.00

2600.00 3750.00

9.00

0.00

0,00

1350.00 3317.54

6350.00 5367.54

55658.77 41434.99

WATEFPOWEING EVALUATION: SCS Advance

Prosecty Elze: Scalded Areas Carrying Capecity: Taereyed Capital Value:	ter 2002 seres 19 2002 seres 19 4.625 dr s.tbres 19 4.625 dr s.tbres				Finance Severes Cash SCS Advance (S annuity factor			0.001 109.092 0.149						
Canital Value of Scalds	1 穷唐	ectorn							A					
Catarorisa Types	fata finedi	ng Llows s 21	(se)		1	Poad Costa		20.00	17851428	·.				
Flack Sizes	2504 +	***		•	6	AINTERANCE CO	asti	10,09	289554F8					
Grace Margin (Gil):						fond Sizes		0.49	INTELOUT					
\$/set:	25.57				P	iscount Rates	5	5.001						
\$/ dsai	12.79				R.	uconach bary	Li GAL	2 BA ALB TH 1						
Weaking It	84.04													
tecreases.	1.002 1	per annua foi	r 5 years)											
SH CLIMAN:					ĩ	arable Y Bedi	uctions	60000.00						
View	0,208				A	verage Tax Ri	ater	0,42						
1/64	0.10¥													
Current Most Cutilig/Melt														
Euro	5.50													
1446	8.00													
Hospets	5.00													
Increases	Ø.10 k	g/beak (per :	tanua for S	yearsi										
Sit Changes		-												
f/me:	4.300													
1/6201	0.158													

	CASH FLOW DEVELOPMENT DUDGET													
	*	i	2	3	4	5	4	7	1	9	10	11	12	
COSTS														
Pand Febrilishamts													0.00	
TAN	0.00	0.00	0.00	0.60	0.00	0.02	0.00	9.00	9.00	9.69	0.00	0.00	0.99	
SEE Advance	2740.00	8740.00	8949.00	8940.00	8740.00	2940.00	8949.00	8940.00	8940.00	8949.00	0.00	4.44	6.40	
Paud Kiintanaach:	0.00	0.00	20009.00	0.00	0.00	20000.00	0.00	0,00	0.00	\$.00	4.44	4.04	6.44	
a feine and an an an an an a	,,									-		a 66	0.00	
TOTAL COSTS (A):	8740.00	8740.00	28940.00	8749.00	\$940.00	28940.00	8749.00	8740,00	8440.00	8946.70	0.00	0.00	0.00	
SISCOUNTED (C):	8949.00	8514.29	24249.43	7722.71	7354.95	22175.25	\$\$71.17	6353.49	2020.74	2/41.10	8.84	4.44	4.00	
NEWEF115										-	7144 68	7400 00	7100 00	
Incruised Beauty In	0.00	0.00	520.00	1040.00	1510.00	2080.00	2500.00	2600.00	2400.00	7509.90	1590.00	1760.00	1254 04	
Increased Meal Cuts	0.45	0.00	750.00	1509.00	2250.09	3099.00	3750.00	3750,00	1750.00	3750.00	3120.00	3730.00	3/20.90	
Increased Land Values	0.00	0.09	15000.00	16800.00	16509.00	14800.00	16800.00	0,00	9.00	9.19	0.00	0.00	4.44	
Romend Tax Payantits												6 0 0	A AA	
Cash	0.00	0.00	0.00	0.09	0,00	0.00	0.00	0.00	0.00	0, 20	0.00	V.VV	0.00	
SCE Advance	27214.00	1876.90	1726.64	1564.41	1389.10	1199.93	995.54	774,80	534.40	278.43	0.04	Q ,44	4.94	
4-8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	•										1780 60	1750 00	1350 00	
THTM. NEWEFITS (1);	27216,00	1876.99	19796.66	20904.41	21999.18	23079.43	24145.54	7124.80	6845.40	6848.33	822V.VV	1719 71	1414 47	
HISCOUNTED (8):	27214.00	1787.52	17956.16	19038.02	18099.78	19093.75	18017.78	5043.44	4880.33	4213-41	981e*99	2644+64	4044110	
•• •											1780 00	1386 00	6350 00	
WET MEMEFITS (\$-A):	18276.00	-7043.10	-7143.34	11954.41	13059.18	-5840.07	15205.54	-1815.20	-2053.40	-2311.97	\$330.00 7838 76	1719 71	1515 47	
DISCOUNTED (E):	10276.00	-6726.77	-8293.28	10335.31	10743.82	-4571.52	11346.61	-1290.03	~1307.9 4	-1493.14	3014.32	2134.71	2444414	
					*****			71107 48	17448 81	10259.77	34408.77	42958.77	49308,77	
CONLATIVE NEWFIT:	19275.00	11212.50	2049.55	14033.97	27093.15	21233.07	20438.63	34623.93	26267+62 78114 70	76970 AL	10010.01	34531.53	38067.45	
BISCOMITES (F):	12276.00	11549.23	3255.96	13591.27	24335.09	19743.57	31079.18	29800.16	18414° 1A	49149140	10618191			
NET PRESENT VALUE: Internal Rate Return: Relefit Cost Ratio:	44642,17 \$,3 3 1,42													