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AN ECONOMIC EVALUATION OF SOIL CONSERVATION PROGRAMMES

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1. Introduction

The economic justification of soil conservation is continually growing in importance, both in terms of justifying public expenditure on conservation programmes, and in seeking the endorsement of landusers in adopting conservation practices. The Soil Conservation Service of New South Wales, is one of the first such organizations to recognise and act, on the importance of incorporating an economic evaluation into soil conservation programmes.

There are two important aspects of assessing the economics of soil conservation:

(i) is soil conservation, per se, economical,

(ii) can the landholder afford to undertake the expenditure associated with on-going soil conservation?

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Furthermore, there are a number of additional issues associated with these questions, such as the relative importance in economic terms of different forms of soil conservation and who should finance soil conservation.

While we must accept that soil erosion causes a productivity decline, soil loss events occur randomly and are extremely difficult to predict. Consequently, any economic assessment of soil conservation programmes is based on long-term data, providing average annual soil loss figures. Nevertheless, the question to be answered is, "Is it economically viable for the landholder to arrest the soil erosion problem?" Further, if a landholder is contemplating a $30,000 loan to implement remedial or preventative soil conservation programmes, can he expect an economic return on that investment? If the answer is 'yes', we have a strong case to push; if the answer is 'no', questions on how important the community think the problem is need to be addressed, so that decisions on whether or not some form of subsidisation, should be available so as the programmes can be implemented.

In this paper, I intend to discuss the means by which these questions can be answered. I will address the question of whether soil conservation is economical, through the utilization of a case study. Further, I will consider the type of information which is required in order for valid assessments to be made of soil conservation programmes. Finally, I will comment on the relative importance of different soil conservation programmes and the question of financing on-going programmes.

2. Economic Considerations

In the rural sector to date, the justification for on-farm soil conservation programmes - structural works in particular - has relied on motherhood type claims about saving the soil for future generations. In terms of land management, the agronomic aspects and short term cash costs and returns have received the main emphasis in developing a 'case' for the adoption of conservation farming practices. However, as soil conservationists we must look to incorporate the 'time dependent' effects on the soil of undertaking poor management practices. Landusers can argue endlessly on the validity of various practices if only the immediate costs and returns of implementing that practice are considered; but clearly it is the effects of undertaking a given practice in the long term (combined of course with short term effects) which is of most interest to us. Soil conservation is a long term planning operation which encompasses both financial and technical considerations.

Consequently, when we look to evaluate the economics of soil conservation programmes, there are number of key aspects which ultimately determine the validity of the analysis.

From the outset, we must accept the premise that soil loss or degradation is causing some economic loss - either in the long or short term and to either the community at large and/or private individuals. To determine the extent of these losses, particularly on-farm, information on the following parameters should be available.

(a) **Soil loss/degradation under different management practices.**

There is currently very little data available on relative soil losses under different management practices, and certainly none on absolute losses. This is essential to allow valid evaluations, for considering land management practices and their incorporation with structural works.

(b) **Productivity decline associated with Soil Loss.**

Given a soil loss event, is the soil less productive, be it through the actual soil loss or through soil degradation. Can the pre-soil loss productivity levels be maintained through increasing input levels?

(c) **If, and how long, before the soil recovers from an erosion event?**

As with (a) and (b) above, this will depend on soil type and slope.

(d) **Landusers attitude to risk, and their preference for financial returns now as opposed to the future.**

Are landholders willing to delay the implementation of soil conservation programmes now in order to receive higher short term returns, or will they opt for some control measures to ensure continued returns in the future?

While evaluation of soil conservation programmes can be undertaken with the current level of information, the committment to refine and provide more extensive data relating to these areas

is essential if the case for preserving the soil is to be sought from a sound base.

Nevertheless, given the availability of the relevant data at this stage, the sensitivity of the important variables can be tested to determine their importance in evaluating soil conservation programmes. The impact on the landholder of land degradation and the implementation of soil conservation programmes, can best be demonstrated through the use of economic modelling techniques.

3. Modelling of Soil Conservation Programmes

The University of New England through funding by the Soil Conservation Service of New South Wales, and the National Soil Conservation Programme (NSCP) has developed an economic model through which on-farm economics of soil conservation can be analysed. The use of this model allows for an economic assessment of implementing the various soil conservation programmes, be them structural or of a management nature, from the landholders view.

Through the use of linear programming techniques, this model aims to maximise the landholder's net worth by developing a farming programme over a number of years, taking an account of all constraints on production, potential activities, and the preferences of the farmer. The major parameters required to evaluate proposed soil conservation programmes are:-

* cropping and livestock activities under different management practices;

* physical property characteristics;

* proposed or recommended soil conservation programmes and associated costs;

* estimates of expected soil loss, soil recovery and productivity decline under different management practices;

* farmer characteristcs relating to fixed or overhead costs, structure of entity and encompassing his personal prefences in the development of a farm programme.

The output of the model can best be demonstrated through use of a case study.

3. Case Study - Merriwa

Evaluation of proposed soil conservation programmes using this model has been undertaken on a number of properties throughout the State. I wish to discuss the results for a 1780 hectare property in the Merriwa area, constituting a mixed farming operation with the majority of black self mulching basalt soil, red hard setting basalts, and the balance being yellow solodic sandstone based with many rocky outcrops. On this property

around 1200 hectares was capable of sustaining a continuous cropping programme; 200 hectares capable of infrequent cropping; and 380 hectares suitable only for permanent pastures. From this property $96,000 of tax deductable fixed costs have to be met in addition to $40,000 of non-deductable living expenses. The initial net worth of the property was given as $200,000 with the aim of the programme being to maximise the increase in this value over the duration of the farm programme. The reason for using maximum net worth as the objective (rather than the maximum income) is the belief that an investment in soil conservation programmes will return some proportion of that investment over the life of the programme. In the case of structural earthworks it is assumed for this case study, that $1.00 invested in earthworks will return $0.80, devaluing over the life of the works.

A report for the landholder is generated from which a number of key components can be identified:

(a) farm programme for the property over the duration of the programme;

(b) the optimum combination of crops and livestock under projected market conditions and management practices;

(c) the area of, and optimum timing of constructing, required earthworks;

(d) best form of financing the proposed works;

(e) the effect on profit and net worth of implementing the suggested farm programme;

(f) the amount of soil loss given the farm programme.

Importantly, it should be realised that excess profits will not be reinvested in soil conservation programmes, unless they will return a predetermined rate of interest (usually the rate which is being offered for alternative investments off-farm). In order to demonstrate the economic impact on the landholders of implementing soil conservation programmes, I will highlight the variation in a couple of major parameters while operating under two potential farm programmes. The farm programmes considered are designated as follows:-

'SC': a farm programme which incorporates appropriate structural soil conservation works;

'Nil SC': a farm programme which is void of recommended structural soil conservation works.

For the purpose of demonstrating the impact on an individual farmer, only soil conservation programmes incorporating

structural works are considered. The parameters to be considered are total soil loss, farm profit and landholder net worth.

3.1 Total Soil Loss

Figure 1 indicates the soil loss of both farm programmes.

The programme 'Nil SC' settles on management practices which incur significantly higher annual soil loss averaging out at 11.8 t/ha/yr, compared to 4.2 t/ha/yr for the programme which incorporates appropriate soil conservation programmes. 'Nil SC' is embarked upon in the short term belief that there is no future productivity penalty associated with soil loss. I will now consider the financial implications of undertaking the 'Nil SC' farm programme.

3.2 Landholder Profit

In the following figures, only the first eight years results of implementing either programme are considered, because in the later years of the model, more profitable but more soil degrading enterprises are undertaken because the time dependent effects of soil loss in those enterprises are not considered after year ten.

Figure 2 indicates the effect on landholders' profit of undertaking either farm programmes.

FIGURE 1: SOIL LOSS UNDER DIFFERENT MANAGEMENT PROGRAMMES

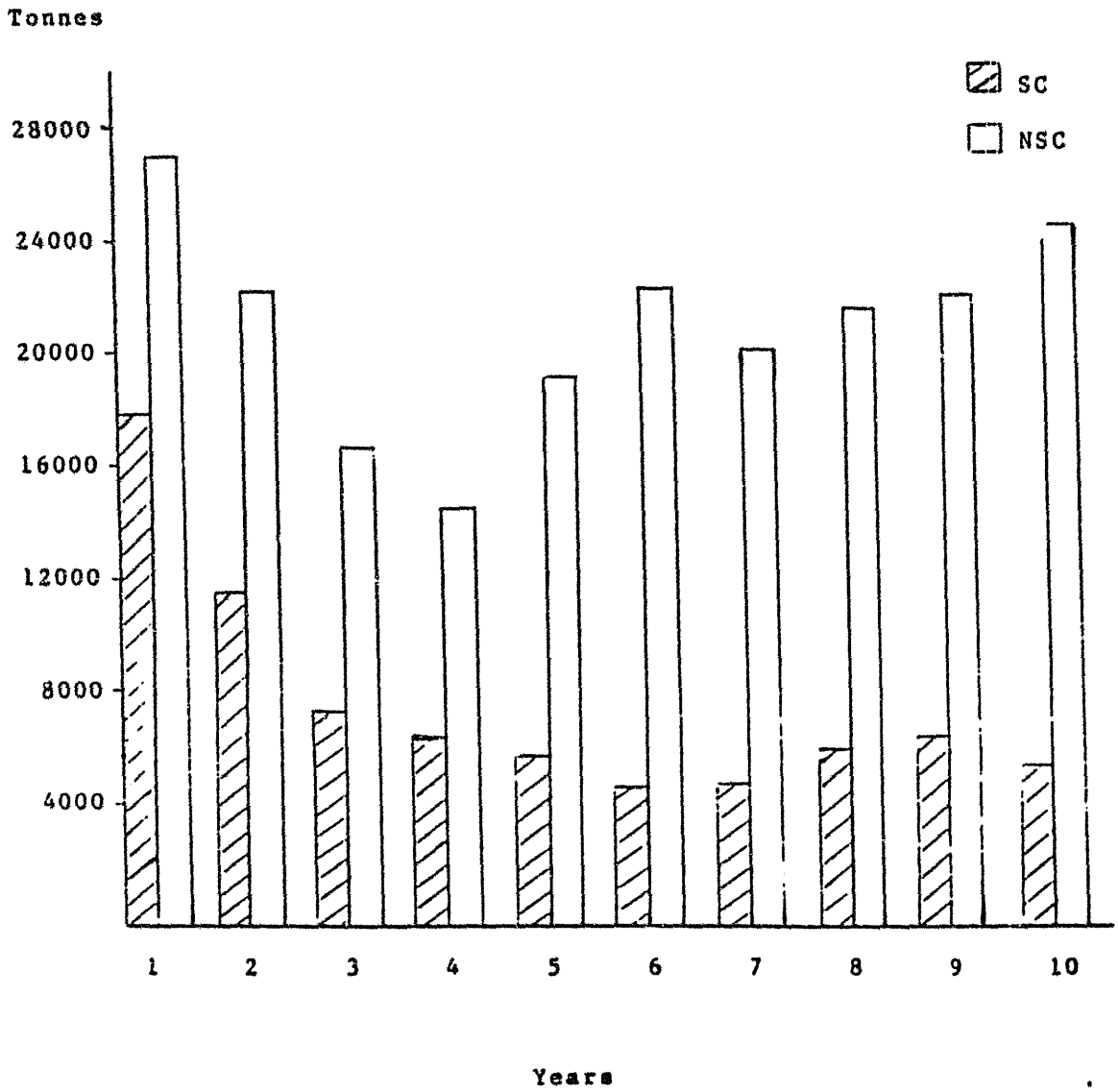
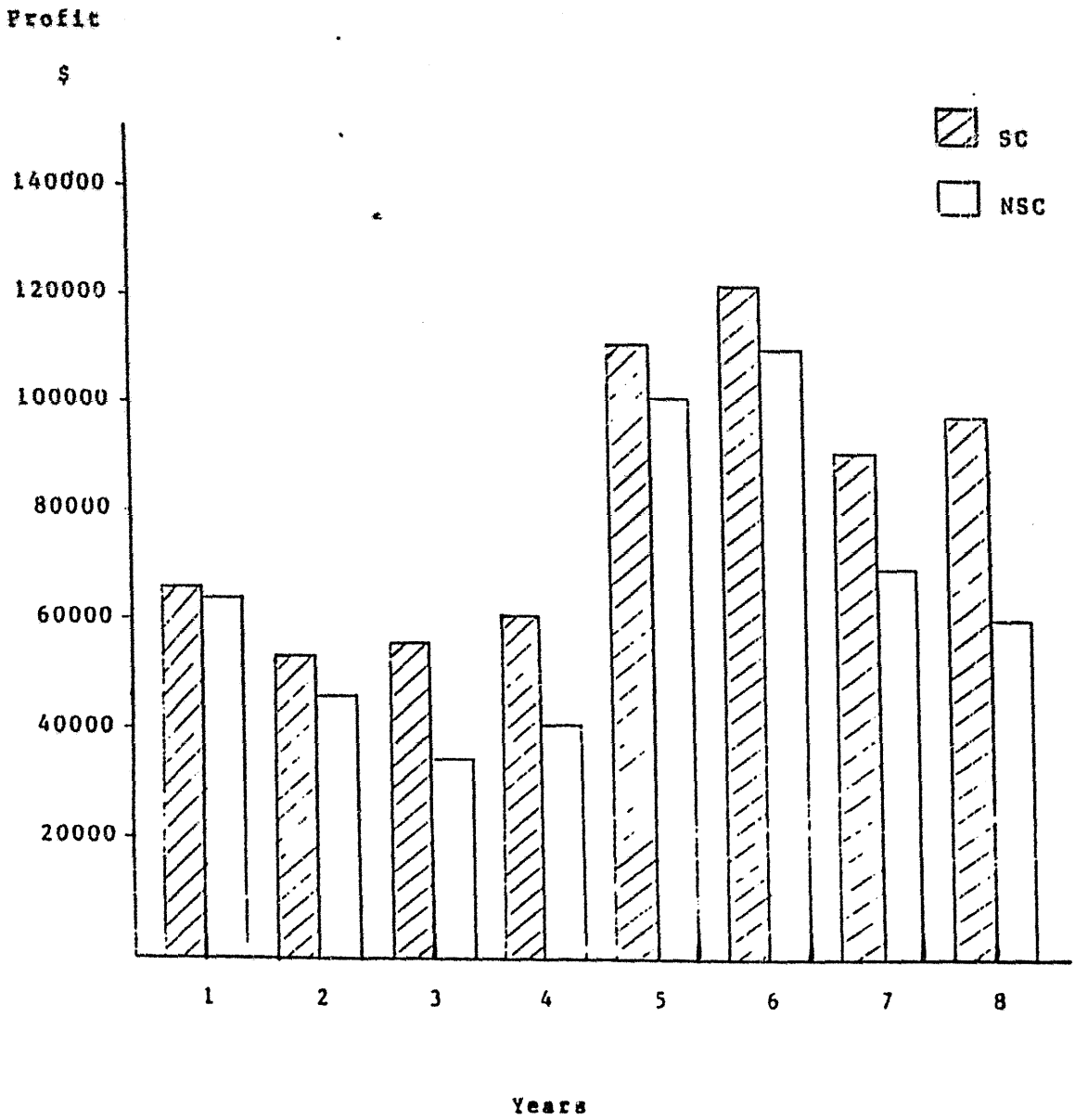


FIGURE 2: PROFIT LEVELS UNDER DIFFERENT MANAGEMENT PROGRAMMES



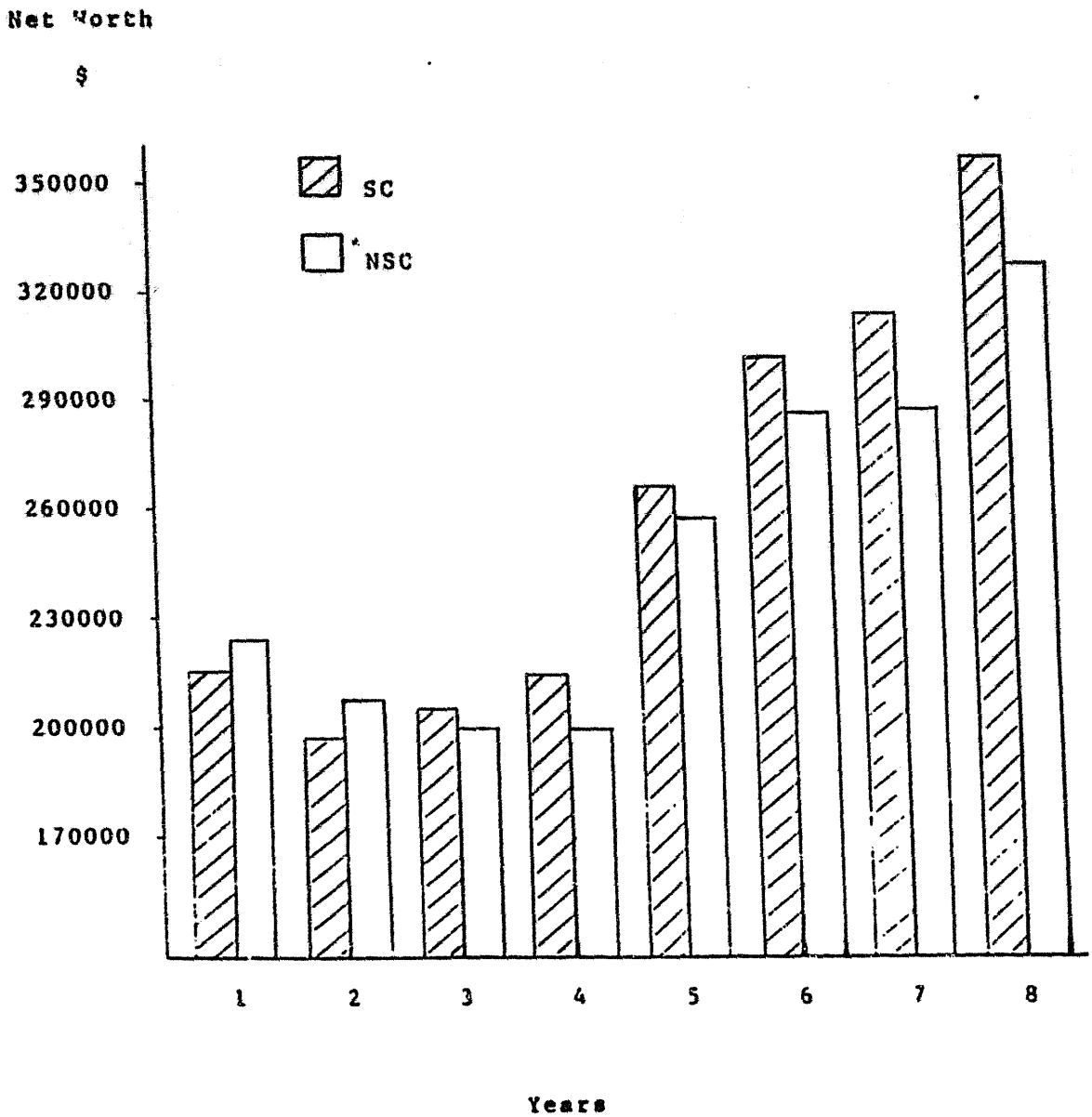
The adoption of recommended soil conservation programmes in programme 'SC' allows for the maintenance and later enhancement of profit levels throughout the duration of the programme. The 'Nil SC' programme has to undertake less profitable activities with lower soil loss occurrences in order to maintain viability. In practice, however, many producers will not (or cannot) afford to settle on the less profitable activites, and opt for the more profitable activities risking the occurrence of major soil loss. However, is it sound economic planning to opt for the more profitable, more soil degrading activities at the risk of suffering significant financial loss in the longer term?

For the two programmes considered, 'SC' derived an average profit level of $82765 per annum while 'Nil SC' derived $61488 per annum. On a per hectare basis over the 1780 hectares of the property, this represented an $11.94 difference in the two programmes.

3.3 Landholder Net Worth

The adoption of soil conservation programmes [illegible] have some effect on property values, and subsequently the landholders' net worth. Figure 3 graphically depicts the changes in the net worth of the landholder operating under the two different programmes. The base net worth for the commencement of the programmes was $200,000.

FIGURE 3: NET WORTH UNDER DIFFERENT MANAGEMENT PROGRAMMES



The assumption was used that $1.00 invested in soil conservation on the case study property will return $0.80, proportionally declining over the life of the works (King 1986). Although the net worth is lower in the first two years while the soil conservation programmes are being implemented, the net worth under 'SC' outstrips that of 'Nil SC' from year 3 onwards.

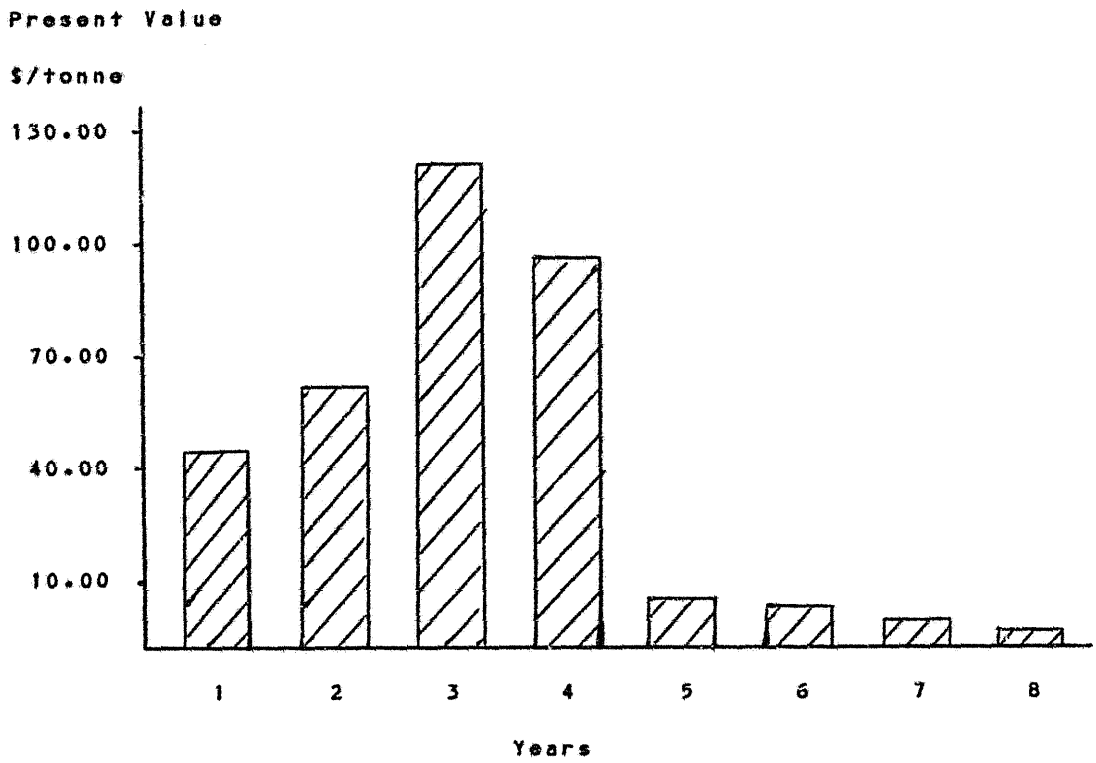
Figure 2 and Figure 3 highlight the time dimension aspect of soil conservation in that the economic importance clearly to the landholder, is a long term investment. Short term returns may fall behind relative to landholders who choose not to adopt such practices, but from the information provided here, it is obvious the importance of such programmes in economic terms is in the longer term.

4. Present Value of Soil Loss

Additional information generated from the model is the cost, in terms of lost income, of a further one tonne soil loss.

That is, if a management practice was undertaken this year that would cause a further one tonne of soil loss over the property, what cost would that mean to the landholder? Figure 4 graphically depicts this value for the case study property. The interpretation is to consider the effect of adopting a practice now, that will result in a further one tonne of soil loss in year 1, or year 2, or year 3, etc.

FIGURE 4: PRESENT VALUE OF SOIL LOSS FOR OPTIMUM PROGRAMME



The significance here is that landholders value more highly potential soil loss in the short term than in later years. The landholder realises that soil loss in the short term will cost him money, but potential soil loss at a later date has little economic bearing on his decision making process. If a landholder knew when a major soil loss event would occur, he would clearly protect himself against it, but while he considers it a matter of probabilities, he is less economically sensitive to practices which may incur a soil loss in the longer term. Clearly, the

dilemma to be faced is one of equating the landholders' economic decision process over the short term, with the long term effect of soil degradation.

6. Ranking of Soil Conservation Programmes

There is little doubt that soil conservation programmes are economic and must be implemented to ensure sustainable agricultural systems in the future. However, this assessment is based on annual average soil loss, whereas in practice, soil loss occurs from random, isolated events. Nonetheless, while this remains the best available means of estimating soil loss, we are faced with the dilemma equating the landholders' economic decision process over the short-term, with the long-term effect of soil degradation.

Where the option of changes in land management practices were incorporated for a North Star property, they generated greater economic benefit to the landholder in the short-term than the implementation of structural earthworks. The implementation of conservative land management practices is emphasised by the fact that they can control the major proportion of soil loss with only marginal increases in landholder expenditure. It is the larger monetory outlays on soil conservation earthworks that landholders will tend to baulk at until the time comes where they can see the reality of major soil loss.

Undoubtedly, control of soil erosion requires a balanced approach between land management practices and appropriate structural earthworks. Earthworks are consequently often seen as an insurance against erosion, in the event of reduced surface cover through poor management or unfavourable seasonal conditions.

The essence of ranking soil conservation programmes comes down to the 'preventative soil loss' programmes which require conservative land management practices, and the 'remedial soil loss' programmes which requires structural earthworks.

Clearly, it is the responsibility of the landholder to adopt those land management practices that minimise potential soil loss. Structural earthworks, while of equal importance and economically viable in controlling erosion, require a significant financial commitment by landholders. It is this commitment without the certainty of a realistic return in the short-term that is of major concern to landholders. Given the current public comment being made about the longevity of our soils it is up to the community to decide the importance of soil loss prevention, and to what level they should contribute to ensure sustainable agriculture.

7. Conclusion

It is the uncertainty of predicting soil loss events that often puts soil conservation in an unattractive light. Average annual soil loss allows for the economic assessment of soil conservation programmes, although in reality, any capital outlay may not generate an acceptable level of return for many years depending on the frequency of erosion events.

Clearly, soil conservation is an economic proposition for landholders, although its importance is difficult to stress given the uncertainty of major erosion events. Conservative land management practices adopted by landholders will allow for the major proportion of soil loss to be controlled, while structural earthworks provide an insurance against a major soil loss event.

A balanced approach between different forms of soil conservation programmes, and the relative contributions of different sections of the community is required to ensure long-term sustainable agriculture.

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