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NEW COST BENEFIT ANALYSES: USEFUL AIDS IN DECISION MAKING OR CONFIDENCE TRICKS? AND ECONOMIC ANALYSIS AND SOIL CONSERVATION WORK

by

A.D. Meister

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Department of Agricultural Economics and Farm Management
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Foreword

The use of our natural resources has economic, social, environmental and cultural consequences. In the past much emphasis has been placed on the economic consequences or the efficient use of resources. A tool developed in the early 1930's to aid decision makers in evaluating the economic efficiency of resource development proposals is Cost-Benefit-Analysis (CBA). The criterion underlying this technique is that projects are economically desirable if the benefits to whomever they may accrue are in excess of the estimated costs.

With time dissatisfaction has arisen with this simple criterion and with the way CBA was used by decision makers. It was felt that stronger recognition should be given to consequences other than economic ones. This led to a broadening of the scope of CBA. On the one hand efforts were made to make it a multi-objective tool while on the other new techniques were developed to evaluate non-market consequences of projects. The fact that for some projects the benefits and cost occur far in the future has raised questions regarding the appropriateness of discounting. Thus with time CBA changed not only in scope but also in its role (or potential role) in the political decision making process. These changes were the subject matter of two recent

addresses by Dr Meister which are reproduced in this Discussion Paper.

The first paper was presented at the New Zealand Institute of Agricultural Science Conference, Lincoln College, September 1985. In this paper Dr Meister summarises the developments that have taken place in CBA and describes the state-of-art of CBA in New Zealand. In the final part of his paper he discusses what he sees to be the role of CBA, i.e. what it can or cannot do, and in what direction CBA in New Zealand should continue to develop. Throughout the paper he discusses the role of economic analysis (especially CBA) in the political arena especially with regard to the development of natural resources.

The second paper was given at a seminar at the National Water and Soil Conservation Authority's Science Centre, Aokautere, July 1985. In this paper Dr Meister looks at the role of economic analysis (and CBA) as applied to soil conservation works. He shows how a thorough analysis of the costs and benefits of soil conservation works requires inputs from many different disciplines. The role of the economist is one of organising information and of valuing impacts to place them on a commensurate basis. He shows how economists have developed new techniques to better evaluate project impacts. But also here he raises questions regarding multiple objectives and the place and relevance of economic analysis.

The aim of this Discussion Paper is to foster wider debate about the potential role of economic analysis, especially Cost Benefit Analysis, and its limitations in the Soil and Water field in New Zealand.

Robert Townsley
Head, Department of Agricultural Economics
and Farm Management

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"New" Cost Benefit Analyses; Useful Aids in Decision Making or Confidence Tricks?

Within any society there are forces that act to limit society's capability to achieve its many goals. They include excess claims on available funds: population growth: increasing levels of aspiration and scarcity of resources such as energy, land, air and water. The result often is political discomfort that generates a demand for more rational, pragmatic, economically justifiable decision making. Such decision making involves a balancing of costs and benefits and an evaluation of trade-offs ranging from those that can be expressed in tangible, economic terms to those that defy objective measurement. (Witness examples in New Zealand such as the Aramoana smelter, the Rakaia river, Pureora Forest, the Clutha Dam, further pine forest planting by the NZ Forest Service or the Maniototo irrigation scheme).

Cost-benefit analysis (CBA or BCA) has often played an important role in this process. Its purpose hardly requires explanation. It is self describing. As a technique it not only purports to measure the respective magnitudes of aggregate costs and aggregate benefits of a specific project,

but it also implies a criterion that aggregate benefits are to exceed aggregate costs.

One can hardly say that this is something controversial. Measurements of benefits and costs and their comparison are a fact of life. In personal decision making we routinely evaluate the costs and potential benefits from an action, consider the alternatives and reach a decision. Hence, when institutional or public projects are considered, CBA seems to be a logical extension of what we do at a personal level.

At first glance therefore it seems surprising that CBA excite such strong opinions among economists and non-economists alike. The fact that at this Conference time has been set aside for a separate paper on CBA is an indication of that. In what follows I hope to explain some of the reasons why this is so and as a good economist wanting to maximize well-being I hope that the benefits will outweigh the costs.

It was Robert Dorfman who once wrote:

> "Like the hero of a Greek tragedy, BCA from its very inception and nature contained the seeds of its own destruction and these seeds sprouted visibly some fifteen to twenty years ago. In one sentence: BCA suffered from being an economic approach to a political problem." (Dorfman, 1976)

Instead of CBA playing its essential role of providing information on the economic consequences of projects, it became entrenched into the political process and the results of cost benefit analyses were presumed to be determinative. That is, if a project's benefit cost ratio turned out to be

less than one it was assumed that that project was precluded no matter how desirable it might be for reasons not incorporated in the BCA calculation. This according to Dorfman "was an unfair burden and an unrealistic expectation" (Dorfman, 1976). A similar sentiment was expressed by Douglas M. Cottle - EPA Administrator when he said:

> "We cannot substitute the sophisticated but mechanical business of piling numbers on either side of a balance for the agonizing process of making a fallible, inescapable, human judgment. For such judgments are at one and the same time the dilemma and the glory of any society that aspires to be just" (Cottle, 1980).

It is the role of CBA within the political system that has made CBA such a controversial topic. It has led to strong opinions and to enormous intellectual effort to broaden the scope of CBA to make it 'hopefully' a more useful tool. 'New' CBA is the result. However, it is not a single entity or single direction as I will explain later. To discuss and critically examine new developments, however, I need to start with a brief introduction of what I call 'conventional' CBA. After having done so, I will discuss 'New' CBA, indicate why it was developed, ask what <u>it</u> can do and comment on how it has been accepted around the world. In the final part of my paper I want to relate these developments to New Zealand, and in particular, to CBA applications within the Soil and Water Budget.

Conventional CBA

CBA was developed as a procedure for quantifying the social advantages and disadvantages of a policy in terms of a common monetary unit (Pearce, 1971). The advantages (or benefits) and disadvantages (costs) are valued by using people's preferences for these goods and services as expressed in the market place. Within these markets countless individuals express their preferences for or against goods and services. They vote for them by buying them or against them by not buying them. The means that they use to express their votes is, of course, money. We could use shells or anything else, money has no particular value, it is simply a medium for exchange. In CBA we then aggregate individual's assessments of costs and benefit to them of a given action, policy, project or programme. Accepting this procedure involves two value judgments:

1. individual preference should count;
2. those preferences should be weighted by the existing distribution of income

(Pearce, 1983).

The first value judgment implies the principle of 'simple democracy' or consumer sovereignty. The second implies that we accept the existing income distribution as good. There is nothing sacrosanct about accepting value judgments 1 and 2. Instead of 1 we could take, for example, the preferences of experts; instead of 2 we could use some

variant implying different weightings for different groups in society.

Conventional CBA started out with the two value judgments as given above. New CBA is very much a reaction against those value judgments.

CBA therefore is a normative procedure and it is important that whatever variant we choose, that the underlying assumptions are made explicit and communicated.

Before leaving conventional CBA there are a few more more points I would briefly like to raise.

As I stated earlier, the first steps in a CBA are to identify benefits and costs and then to evaluate them. Although this sounds straight forward it isn't like that at all in practice. CBA is a partial equilibrium tool and project boundaries have to be drawn. All economic activity is linked and the effects of a project will work themselves through the whole economic system. Judgments have to be made as to which impacts are the most relevant and outside those impacts things are assumed to remain constant.

Primary or direct effects are often readily identified but secondary effects, including external costs and benefits, are more complicated. Here also the question arises as to which of these secondary effects should or should not be included. Technological externalities which affect production and consumption decisions by entering as arguments into the individual's production function or utility function should clearly be included (e.g. downstream pollution of upstream enterprises, pesticide drifts or the cutting down

of indigenous forest). However, whether to include other secondary effects (often represented by multiplier effects) is far from clear. In theory we know what to do, but in practice when we live in an economy with large unemployment, under-utilised capital etc. it is not all that easy.

Evaluation in turn also raises many questions. Again in theory, there is no problem. Market prices in a perfectly competitive economy are socially efficient prices reflecting people's marginal valuations for goods and services as well as reflecting marginal opportunity costs for inputs. However, if the economy does not reflect a perfectly competitive market system we have to apply judgment to market prices before we can use them. We need to ask, "are the observed prices really socially efficient prices or are they distorted"? Distortions can occur in many ways through taxes, subsidies, tariffs, imperfect competition (i.e. $P \neq MC$) government interventions etc. If this is true can we still use them? The answer is 'no'. CBA attempts to establish a set of pragmatic rules which will mimic the functions of the market so that public sector outputs can be allocated efficiently. Such an allocation refers to a situation which maximizes the value of goods and services from given resources and where no person can be made better off without making someone else worse off (a Pareto-efficient allocation). If CBA is going to be used as a means of moving the economy (through reallocation of resources) closer to its efficiency frontier, socially efficient prices need to

be used. Hence if prices are distorted they need to be adjusted. Such adjusted prices are called "shadow prices".

For some goods there are no markets at all and hence no prices, e.g. clean air and water, the last member of an endangered species, some types of recreation, health and education. Somehow values need to be obtained if we want to include these impacts in the calculus of CBA. In some cases techniques are available to do so (eg. recreation), in others proxy values are used (health and education), while in others no values can be calculated (and perhaps no attempts should be made to do so either).

Prices and cost also need to be projected many years ahead because the benefits and costs of projects occur over time.

Finally, after having identified and evaluated the effects, they now need to be made commensurate and to be aggregated. To make them commensurate we discount all costs and benefits back to the present. We then sum them and if the benefits are greater than the cost we dance for joy and say "we've done it" and if the converse applies we look glum and say "we had better start again and look for some more benefits", or, alternatively we turn to the project's design and the cost thereof and ask if all is well on this side of the equation (this, of course, only if the analyst is allowed to query the design!)

All this is not quite as simple as I have just made it out to be. Because of all steps in the CBA process, this last is one of the most controversial, and all because of the choice of a discount rate. Two major questions have occupied the minds of economists and non-economists alike. They are:

1. Why discount?
2. What discount rate to use?

It is beyond the scope of this paper to discuss either of these questions. It suffices to say that the first question deals with the ethical problem of how preferences of those living in the future are to be taken into account. The further in the future costs and benefits occur, the more relevant the question becomes because the discounting procedure reduces their influence on the result of the CBA to zero. Many have raised questions here about whether CBA should be used at all.

With regard to the second question, i.e. what discount rate to choose, no standard answer exists. The choice, however, is of utmost importance because it has a pronounced influence on the type of projects approved and on their economic desirability. In the words of Kenneth Boulding, "What was a clear case at two per cent ... may draw its fleeting breath at four and is certainly dead at five per cent". For a discussion on this in the New Zealand context see Forbes and Meister (1984) and for a discussion of the latest state-of-the art see Lind et al. (1982).

In summarising conventional CBA it was not my intention to give you a lecture on something you were quite probably familiar with. Rather it was aimed to dispel the notion that CBA is simply a mechanical technique, neutral in its application which somehow aggregates all cost and benefits resulting from a proposed project. It should be obvious that the technique is not neutral and not mechanical. Application of CBA requires much work, many judgments and much ingenuity. Economists have become very skilled in doing CBA's and some of the difficulties mentioned have been overcome. But it would be incorrect to state that we know how to deal with all of them and that no conceptual problems remain.

This then, is the basis from which 'New' CBA derived and it is to that development that I now will turn.

'New' CBA

Conventional CBA traditionally concentrated, as explained earlier, on the efficiency aspect of project choice. However, in its pursuit to achieve this and to come up with pragmatic rules which enabled CBA to mimic the efficient allocation of a competitive market system, the value judgment was made that the aggregation of cost and benefits could be done irrespective of who received or paid them. This would have been acceptable if government could deal with the relevant equity (or income distributional)

aspects by independent tax-subsidy measures. It has been argued, however, that government's fiscal powers to redistribute income intra-temporally and inter-temporally are likely to be limited, especially in developing countries, and hence equity considerations cannot be separated from those of efficiency in project choice (Little and Mirrlees, 1974). And it is just a small change to go one step further and decide that given the existing income inequalities in many countries, project choice can be used to affect this distribution by making CBA a tool in the hands of Government. Thus, instead of CBA being a technique or way to organise thought for comparing projects, under this new direction it becomes a tool to achieve planned investment and planned trade policies.

Some of the important aspects of this approach are that:

(i) productive efficiency for all traded goods is taken as determined independently of domestic consumption patterns;

(ii) interpersonal utility comparisons are firmly re-established via the principle of social valuation of consumption benefits to different groups;

(iii) the new method, by articulating crucial macro-planning variables in micro level selection criteria, lays claim to playing a central role in the overall planning process (Irvin, 1978).

In simple words what is being said is that because of market imperfections and because of income disparities, inputs and outputs should be valued at world prices and account should be taken of distributional impacts through giving weights to benefits and costs accruing to different societal groups (i.e. ethico-weights). Further, the discount rate is to become political datum and weights (politico-weights) are to be applied to goods having higher social value than other goods (e.g. investment versus consumption goods). This development was strongly supported by, among others, the OECD and the World Bank.

However, other directions of development also took place. 'New' Benefit cost analysts or the 'revisionists' as Mishan called them, "Do not form a tight school of thought. Rather they are a loose self-conscious federation having one or more proposals for departing from the conventional method" (Mishan, 1982).

Within western economies, what had begun to worry economists was the narrowness of CBA, especially with the entrenchment of CBA in the decision making process that Dorfman spoke about. With the rapid pace of economic development, the structural problems of balance of payment deficits, unemployment, regional development and environmental problems, came the realisation that CBA as practised was deficient in its ability to accurately value costs and benefits and thus deficient in the role it played in the political decision making process. This realization led to attempts to broaden the scope of CBA to incorporate the

valuation of project impacts on environmental, regional, and distributional objectives. In the USA this multi-objective framework for CBA became the standard (U.S. Government, 1979).

Dividing the 'new' approaches into two major groups is very arbitrary but there is a clear distinction between the two. While the first group of new methodologies is new in many aspects and is purposed to be a tool in the hand of governments, the second group is much more like conventional CBA with a broader scope.

In the first group the Little-Mirrlees-Squire-Van der Tak LMST approach of social cost benefit analysis (SBCA) has received most prominence (Squire and van der Tak, 1975). The methodology relies on the concept of valuing all input and outputs at accounting prices or border prices. Two types of accounting prices are distinguished: (1) efficiency accounting prices; and (2) social accounting prices. In the first type, no distributional effects are included, while in the second the numeraire of foreign exchange is redefined into uncommitted foreign exchange in the control of the government. All goods and services are classified in traded and non-traded goods and then evaluated. Non-traded goods may not be readily disaggregated (into traded/non-traded components) by project analysts and so a system of sectoral accounting price ratios needs to be devised based on input-output tables.

The system, to work, requires a central planning co-ordination to specify national parameters and modifications thereof over time as necessary. Once these national parameters are standardised, there seems little extra work involved for the project analyst to carry out the appraisals (Forbes, 1982).

The second group is not really represented by any major methodology. Rather it has branched out in all directions. To widen its scope in the evaluation of non-market effect such as environmental quality and recreational impacts many new techniques have been developed, to place values on these effects (Hufschmidt, 1983; Freeman III, 1979; Kneese, 1984). In the area of regional development, work has been done on the estimation of secondary benefits through the use of input-output models and multiplier analyses. Also in this group more emphasis has been placed on identifying distributional impacts through the identification of the incidence of costs and benefits and the use of financial analyses.

The work of the economists in this second group has received relatively less attention than that of the methodologies developed by the first group. The reasons for this are that the directions taken by the second group are basically extensions of conventional CBA, while the directions of the first represent a very significant departure away from conventional CBA and a departure strongly supported by the world's major lending organisations.

Given the above situation, it comes as a surprise then to find out that the work of the second group has found more acceptance worldwide than the work of the first group. Reading through the World Bank's textbook, "Economic Analysis of Agricultural Projects" by Gittinger, one finds the following statement:

> "Making allowances for income distribution and savings effects involves somewhat more complex adjustments than those necessary to estimate efficiency prices; it also unavoidably incorporates some element of subjective judgment. Although these systems have attracted widespread interest among economists, their application has been only partial or on a limited scale" (Gittinger, 1982).

So after all this impressive analytical development and institutional support, organisations like the World Bank do not utilise SBCA for its avowed purpose of ex ante investment choice in LDC's. Or to quote a recent article by Leff "the Bank does not make its important investment decisions using the procedures SCBA has developed to take account of marked distortions, externalities, income distributional conditions, and uncertainty. Further, this is not a case of the usual gap on a continuum between state-of-the-art theory and actual practice. The procedures that the Bank does use are not a rough approximation of SCBA. On the contrary, the Bank's major allocation decisions are generally made using a different conceptual framework and, indeed one that neglects some of the SCBA's fundamental priciples" (Leff, 1985).

What is said of the World Bank also seems to be true of other lending agencies and countries.

Why should this be so? Leff goes on to explain that what is being observed in the World Bank is a general phenomena in the relations between policy research and decision-making in the public sector. He felt that practicioners did not utilise SCBA because they had available an alternative approach that was better suited to their operational needs in investment choices of developing countries. The alternative is an intersectoral approach where sectors rather than projects are the basic unit of investment choices and sectoral priorities determine the major investment decisions. The sectoral decision making framework takes account of strategic considerations, spillover effects, both over time and across activities and income distribution. The new scope and abilities of SCBA were now superfluous. Basically all that was needed was conventional CBA to allocate the different sectoral budgets.

I find this development of great interest because I think it has parallels in New Zealand. To explain this further I would now like to turn to CBA and the state-of-the-art in New Zealand and see how it has been affected by the new development or alternatively in what way our approach to CBA can benefit from these developments.

CBA in New Zealand

The state-of-the-art of CBA in New Zealand is summarised in handbooks produced by the Ministry of Agriculture and Fisheries (1984) and Copeland (1980). It is especially the work of the Economics Division of MAF that has set the standard for CBA in New Zealand. Others have done CBA's besides MAF but many of these have been done on an ad hoc basis (e.g. Manapouri (Rae, 1977), Tiwai Point (McDonald and Ashley-Jones, 1980) and Aramoana (van Moeseke, 1980)). The work of the Economics Division however has had continuity over many years. Economic reports in the agricultural and soil and water field carried out by agencies other than the Economics Division are generally forwarded to the latter for comment.

The latest handbook, published in 1984, shows that CBA is still very much of the conventional type. However throughout the handbook the editors show awareness of the new developments in CBA that have taken place and make strong recommendations to see some of them included. For example under the heading of multiple objectives, it is noted that with regard to an environmental objective "the analyst should attempt to express the costs and benefits of the objective in either quantitative or qualitative terms (Ministry of Agriculture and Fisheries (1984, page 24). A complete chapter has been devoted to techniques for environmental benefit evaluation. The inclusion of this material is an acknowledgement of the rapidly increasing relevance of

this kind of work in New Zealand, taking examples such as the Rakaia and Waikato rivers (Leathers, 1985; Harris, 1983), Lake Tutira (Meister, 1981), Ohinewai, LDEL schemes, downstream benefits of erosion control etc.

Distributional impacts of projects are ignored, "since this objective is catered for in other fiscal policies." CBA therefore is still seen very much as a technique to provide information, not as a tool in the hands of Government to achieve income distribution policies. However, since the projects are used, also in New Zealand, to achieve distributional policies, there would nonetheless be a purpose in a procedure which would present to the decision makers information on the incidence of who pays and who receives. Also this is becoming more relevant in New Zealand with the Government trying to recoup the costs of its services and the New Zealand Treasury claiming that in the soil and water field "existing policy provides an uneven distribution of cost benefits....." and where"..... private landowners pay ... a disproportionately low sum in relation to the benefits they receive" (The New Zealand Treasury, 1984). It is important that objective evidence is obtained to either prove or disprove such sentiments. This is bound to have special interest to those faced with very high water charges for irrigation schemes.

With regard to regional development impacts or secondary benefits, these are not routinely calculated. But here, also, much research is going to improve the ability to provide this kind of information (Butcher, 1984). The impor-

tance of secondary impacts e.g. of irrigation schemes, has been a well publicised fact in New Zealand (Brown, 1978) and overseas (Powell, 1985).

In the area of identification and evaluation of costs and benefits much work has gone on to bring about consistency between analyses. Every year a book of agricultural and horticultural 'Product Price Assumptions' is produced to be used in CBA work. These assumptions are based on the best current available data, trend projections and expert opinions (Forbes, 1985). Risk is also routinely incorporated in the analyses. 'Shadow pricing' in a narrow (i.e. not the accounting prices of SCBA but rather prices adjusted for market distortions) is also applied.

Traded goods are valued at border prices. Adjustments are made for taxes and subsidies and where possible imputs are valued at their marginal opportunity costs. Labour is not shadow priced by MAF because of "the practical problems associated with measuring involuntary unemployment; the duration of unemployment over the project period; and the correct opportunity cost, keeping in mind the project's implicit alternatives (Ministry of Agriculture and Fisheries, 1984, page 15). However, in other analyses such as the Tiwai Point smelter, labour was shadow priced (McDonald and Ashley-Jones, 1980, page 32).

Foreign exchange has also been shadow priced by adding a 10% weighting (as recommended by Government) to foreign exchange components of projects. The relevance of this and the magnitude of the adjustment factor is not too obvious

today and several people have suggested that the magnitude of such adjustment can only be determined ex post (van Moeseke, 1985).

Overall then, CBA is well developed in New Zealand. In light of overseas developments and indigenous needs, its scope has widened over the years. In comparison to SCBA, CBA in New Zealand is still strongly in the conventional mould although border prices and exchange weightings are used. To go further than this and introduce the full LMST methodology would not present any major problem. This was demonstrated in an unpublished paper by Forbes (1982). Whether, however, it should be introduced is a question I want to leave until the concluding section.

CBA and political decision making in New Zealand

When one looks at the total Cost Benefit scene in New Zealand, one sees that cost benefit analysis appears to be rigidly applied in the Soil and Water field and less rigidly (on the surface at least) elsewhere. While in the Soil and Water field analysts seem to suffer from the 10 percent internal rate of return syndrome (the guideline specified by Government), this does not seem to be the case in other sectors where Government supplies goods and services, e.g. the energy sector. One immediately wonders why this is so. Is it because those other sector projects satisfy different objectives (besides efficiency in resource allocation) such

as regional development, strategic security, job creation or vote catching? Or is it because failures of these projects can be written off (quietly) across three million consumers while with, for instance, inefficient irrigation projects (which are funded differently and more transparently) the total burden of the mistakes fall on only a few (Easton, 1984).

Whatever the reason, there seems to exist an inconsistency in the across the board application of CBA. It is here that I see a parallel between the work of Leff and the New Zealand situation. It appears that we also have a macro-policy of intersectoral budget allocation with little comparability of economic rates of return between sectors. Within sectors, and especially so in the Soil and Water vote, the funds appear to be rationed using a 10 per cent discount rate.

I must emphasize that this is what appears to happen. What goes on in the Soil and Water vote is public knowledge, and for all to see. Economic reports are publicly available. What goes on in the other votes is not so clear and with regard to that, it has been very enlightening to read the latest Treasury reports on the low returns of the Think Big projects, the hydroschemes, and the latest Forestry plantings. One wonders why all these projects were approved. Were no economic analyses performed? Were there unlimited budgets? Perhaps we'll never know, but it still remains a puzzle why then soil and water projects need to pass the 10 percent hurdle. In terms of their total vote in relation to

other sector allocations, we are comparing peanuts with elephants (and some white ones at that)!

As a final query, why do we use a ten percent discount rate, this especially so when we deal with projects whose costs and benefits may lie far in the future? Does the Government decision making process allow for other objectives also in this area e.g. to preserve a minimum productivity level of our land resource; or to keep options open for future generations? Or is the total burden of decision placed on the CBA analyses? Perhaps in this area one could even question the use of CBA. Who knows, this question may be seriously considered in the new Ministry of the Environment.

Conclusion

It's been a long discussion and in many ways a very inadequate one. There are so many other aspects of CBA that should have been discussed before one can draw a conclusion about the usefulness of CBA and about its role in our political decision making framework.

In the first part of my paper I introduced conventional CBA, not only to show why the new developments were a logical consequence of the way in which CBA was used, but also to show that conventional CBA is an 'art' and not a science. Its application requires many judgements about which costs and benefits to include, about values, about intangibles

and about discounting. There are few precise rules, each analysis is almost a new piece of art. However, many years of applications and practice has to some extent standardised the approach and a certain amount of confidence was held by decision makers in the results of the analyses. At the same time analysts did acknowledge that the scope of conventional CBA was narrow, but as long as CBA did not become entrenched in the political decision process as a final decision tool, this narrowness wasn't critical. CBA added only one bit of information to the decision framework.

The new developments in CBA, especially SCBA, aimed at taking CBA much further. The new methodologies wanted to perform an analysis which was more complete by including more objectives and Government interaction. The incorporation of income distributional weights and/or politico-weights favouring investment benefits over consumption, and the use of the discount rate for political purposes increased the complexity of CBA greatly. It also introduced a much greater amount of subjectivity.

According to Mishan "It is a revealing comment on the myopia that comes with absorption in technicalities that the repeated attempts by economists to extend the reach and authority of their cost-benefit calculations by recourse to politico-weights will, should it succeed, render them impotent as economists" (Mishan, 1982).

In this I have to agree with Mishan that many of the new methodologies may take away from us our ability to be independent analysts. Also the new developments will lead to

the disappearance of any standardisation. Every analysis will be based on different assumptions, different values and different weights. The analyses will become much more subject to the discretion of the analyst to the extent that he can obtain any desired answer by manipulating the methodology. It is here that the 'confidence trick' of my paper's title comes in. Conventional CBA is conceptually simple. Its simplicity makes it visible, understandable and open for review. This is one of the reasons that it gets criticised so often - but at least decision makers and the public are able to get involved. As soon as we take away the visibility and simplicity, we can do what we like with our analyses by simply manipulating the assumptions, weights, data etc. There is a great danger here of creating confusion and mistrust and thereby discrediting CBA.

Especially in the light of my discussion on conventional CBA, it is my contention the CBA cannot and need not provide precise answers to policy questions. To ask this of the technique is in the words of Dorfman placing an 'unfair burden' on it. Rather CBA is a procedure that can provide a crude but highly useful picture of the relative merits of alternative policies. It provides a very good framework to identify impacts of projects and hence identify those investments that are either very good or very bad. The systematic way in which CBA organises data for policy decisions serves to educate decision makers and the public about the important elements of the project. In this way it provides a forum for public participation and discussion and

allows sensitivity analysis of the decisions to changes in those elements (for a good example see the work and the reaction from the public and Government to the CBA work done by van Moeseke (1985) on the Aramoana smelter).

To translate these opinions to the New Zealand scene, I would like to encourage further work on improving our ability to do conventional CBA and to standardise the procedure. Further, as indicated earlier, I also encourage the widening of the scope of CBA into the area of multiple objectives but this extra information should be kept separate from the results of the conventional analysis. For decision making purposes, regional benefits, environmental trade-offs and distributional consequences are important. Economists are skilled at providing this kind of information. But it should not clutter the results of the conventional analysis. This would serve no purpose. It would make the consideration of trade-offs between objectives more difficult, it would complicate the analysis (and hence the ability to comprehend the results) and also it may reduce CBA's credibility because of the greater subjectivity of the extra information.

All economic analyses are balancing acts between trying to do too much (and losing credibility) and not doing enough which may lead to poor decisions. How to walk this tightrope is again an art!

Finally with regard to the role of CBA in New Zealand, I wish for a more consistent application across the board, and for more transparent decision making in terms of approvals and disapprovals of projects.

In my opinion CBA can provide useful information and can be a very helpful tool in decision making. The state-of-the-art in New Zealand is well developed. It is in the political application of CBA that I still have questions. Perhaps in the new 'open book' environment some of these will be answered.

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Economic Analysis and Soil Conservation Work

Economic analysis, for better or worse, is a fact of life. Whether it is done implicitly, as is usually the case for personal decisions, or explicitly, as required increasingly by central government, by banks or international lending agencies, most decisions that involve spending money and time, are based to some extent on economic analysis.

Thus also in the area of erosion control or soil conservation, economics has played an important role. Most soil conservation programmes need government approval and such approvals in many cases are linked to the economic return of the project.

Some object to this as they see erosion control as something that should be done as of right since it deals with the preservation of one of our most precious resources and also because it deals with the welfare of future generations. Economic analyses, they say, cannot deal fairly with this latter issue. In many cases, soil conservation benefits will be more real for our children and grandchildren than for ourselves. These kinds of benefits are difficult to quantify in money terms and do not fit into the economic

calculus of discounting. That calculus is biased toward the present generation and towards short-term projects.

Others, however, say that this is not so and that economic analysis is a neutral tool that simply provides information to decision makers on economic costs and benefits. It is then up to the decision maker to take into account all aspects of the project and decide accordingly.

Between these two views lies a multitude of other opinions. The fact that I am here to talk about the economics of soil erosion indicates that my view lies also somewhere in between the two extremes. To me economic analysis and especially benefit-cost analysis is a useful tool (or procedure) to analyse the economics of soil conservation projects. But, at the same time I also preach great care in using it. To me benefit cost analysis is an art, not a science. It can easily be misused and too much emphasis can be placed on it. Also, it is far too easy to play around with figures and make them do what you want them to do. The title of a paper I have to give in September on CBA to the NZIAS reflects my feelings on CBA: "Is 'New' CBA a useful tool for decision makers or a confidence trick?"[1]

Further with respect to economic analysis - it is far from neutral - I tell my students this in the first lecture I give them. Economic analysis is as Ida Hoos once stated "about as neutral as asking a fox into a henhouse to observe the colour of the eggs" (New York Times, Feb. 14, 1982).

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[1] This paper is the first paper in this Discussion Paper.

Therefore in dealing with the question of distribution of benefits and costs between generations (which is what soil conservation is all about), it is important that we do recognise the value biases of economic techniques. To this I will return later.

At the same time, however, it is not good enough to take the benefits of soil conservation work for granted and only concentrate on cost sharing procedures. Soil conservation works require resources which have opportunity costs and hence these costs should be compared with benefits.

I'm not here, however, to convince you of the need for economic analysis, or alternatively to talk you out of it. I'll leave that task to say the Treasury or the Government. What I intend to do is to tell you something about how I think economic analysis can or cannot help you in your attempts to build a convincing case for soil conservation works (I hope that that at least is one of your aims, even if it is only to justify your existence here!)

The Benefit-Cost Analysis Process

When I refer to BCA I refer to it as a process and I prefer to do so. BCA is not, as many seem to believe, a discounting methodology that comes up with a single figure - IRR or NPV - which decides the sentence (dead or alive) of a project. Rather it is a process of evaluation requiring

inputs from many disciplines, one of which is economics.

To illustrate what I mean by this, take the schematic for estimating on-site and off-site effects of agricultural activities (Figure 1). This flow diagram represents the process of analysis I have in mind. The expertise of the economist revolves mainly around 5 and 7 but to do a complete analysis, he/she should understand all steps of the process. In the final analysis the economist is completely dependent on others to solve for him/her the questions relating to 1, 2, 3, 4 and 6. Without that information the economist is completely helpless.

Having thus acknowledged that economists basically are very helpless creatures (which makes it hard to understand why we are so maligned by government) - it follows that we depend on physical and social scientists for data and information. Let me go on to outline some of the information I require and what I, as an economist, can do with it.

First of all what are the impacts or costs we are talking about? In Table 1 I have made a list of possible impacts: this table is not exhaustive, but it does show the wide variety and range of possible impacts resulting from soil erosion.

The on-site costs of erosion (or the benefits of control) accrue to the private landowners. The off-site costs (or benefits) accrue to the region or nation.

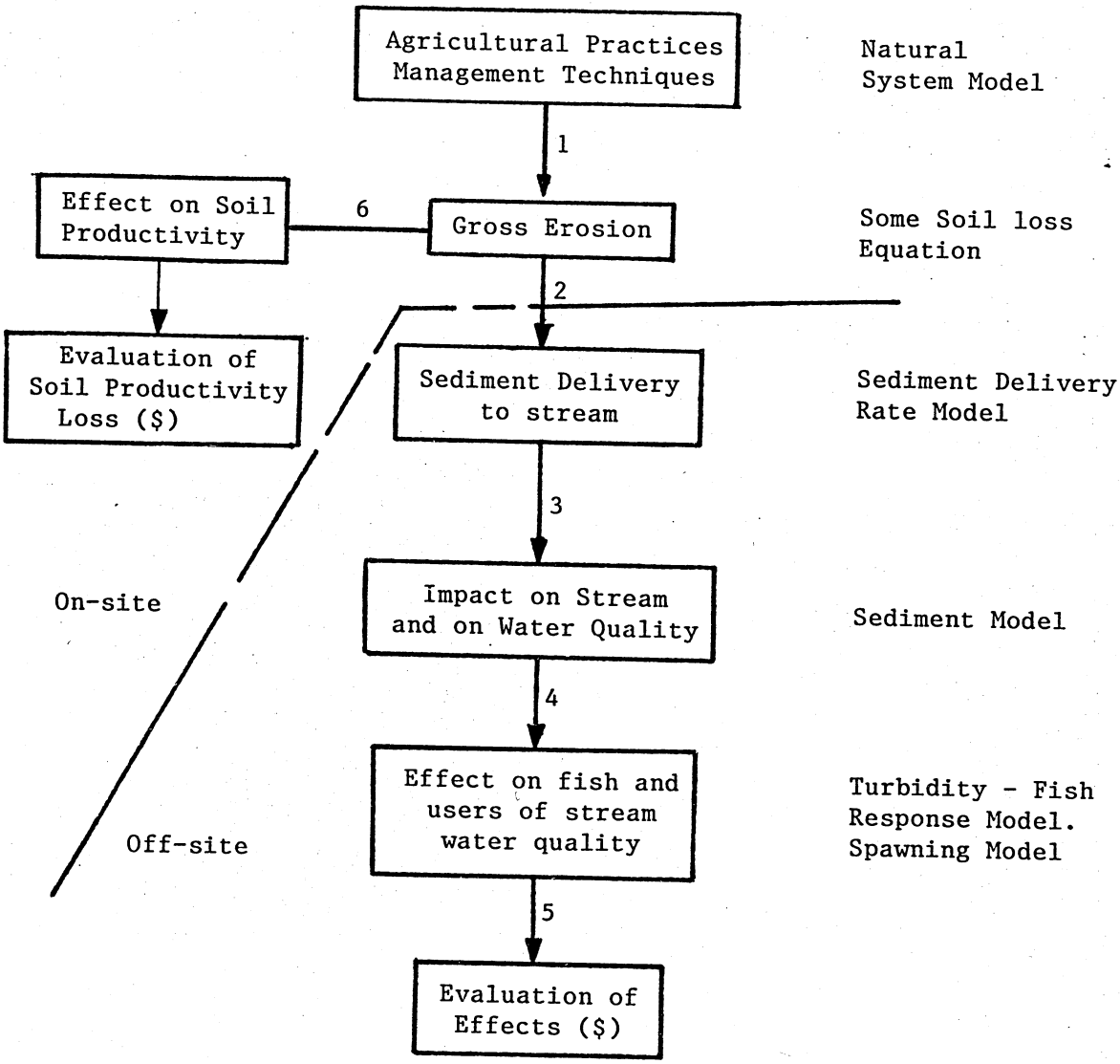


Figure 1: Sequence of analysis for estimating on-site and off-site effects of agricultural activities

Table 1: Possible Effects of Soil Erosion

ON-SITE COSTS

Loss of productive areas; either eroded away or buried
Decrease in productivity
Loss of fences; access or stock

OFF-SITE COSTS

In-stream Effects

Biological Impacts:- Loss of spawning areas, food sources, habitats
- Direct damage to aquatic life
- Pesticide poisoning
- Eutrophication

Recreational Impacts:- Aesthetic
- Fishing less successful
- recreational activities;
- swimming, boating

Water Storage Damages and Scouring:- Sedimentation
- Power loss potential

OFF-STREAM EFFECTS

Flood damage - increased frequency
- roading costs

Water treatment and other off-stream impacts
- Water supply
- Irrigation systems
- Public health risk

The existence of off-site costs is in my opinion one of the reasons for the grants and subsidies available for river control and soil conservation works. However, some of these may be in danger, reading the Treasury booklet on Economic Management and Land Use Issues' where we find:

> "In some cases benefits from catchment works accrue to the region in terms of saved maintenance to regional roading, reduction in flood inconvenience etc. Benefits classified as having value to the general taxpayer, such as the maintenance of the State Highway system, make up the smallest category. Clearly the existing policy provides an uneven distribution of costs and benefits. Generally private landowners pay, through the rating system, a disproportionately low sum in relation to the benefits they receive".

This statement appears to refer to soil erosion as well as flood control schemes and, if true, I can agree to some extent with the sentiment expressed. However, I wonder on what evidence this statement is based. I think we should be very careful making such broad generalisations. It is my contention that the taxpayer has often benefited much more from catchment control schemes than has been indicated in economic evaluations simply because many of the benefits as outlined in Table 1 are (or were) immeasurable. Further, for the farmer to benefit from soil conservation works (the benefits of which are often far in the future) we need an active land market where land prices reflect the benefits of soil conservation works. There may be reasons to suspect that the market fails to register these benefits because:

1. it may underestimate future demands on the land or overestimate the rate of development of technological substitutes for it;

and/or

2. farmers do not plan as far into the future as society does and long term effects of erosion on productivity don't affect them;

and/or

3. farmers are ignorant of the long term effects of erosion on productivity.

I am not saying that all this is happening in our land market. Perhaps our land market works much better than I expect. However, before we agree to statements such as the one made by the Treasury, and agree to changes in grants and subsidies, we need to carefully consider the evidence first. To get this evidence we have to measure the benefits and consider the distribution of them. It is to the first of these that I will now turn.

The Measurement of Benefits: the Concept of Economic Value

Just a little bit of economic theory and jargon (see Hufschmidt et al.) Our economic system emphasises the philosophy of individual consumer sovereignty. So economic welfare is a function of the self-expressed welfares of all individuals in a society. The degree of welfare or satisfac-

tion experienced by individuals can be measured in terms of the prices they are prepared to pay for consumption of goods and services. In many instances, individuals consume goods and services without actually paying for them, but prices that individuals would be willing to pay can, in principle, be imputed from observed behaviour, from survey data, or by other means.

This concept of people's willingness-to-pay for goods and services is the crux underlying all benefit estimation. The willingness-to-pay for a good X by people in an economy is represented by the demand curve for that good (Figure 2).

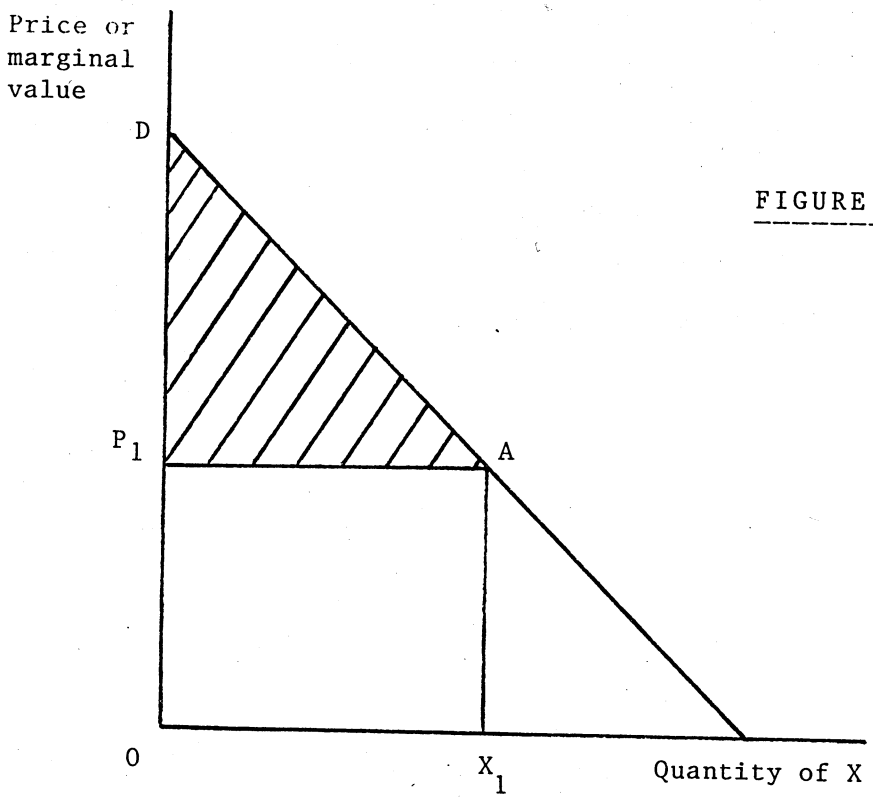


FIGURE 2

Suppose that our individuals were supplied the quantity OX_1 of good X. The marginal valuation of X would be OP_1. To buy OX_1 of X, the monetary outlay would be price multiplied by quantity consumed, or the rectangle OP_1AX_1. Total willingness to pay, however clearly exceeds this amount, for it comprises the sum of all the marginal valuations of X from O to X_1 - that is, the area of the region $ODAX_1$. This area is a representation of the total level of satisfaction (utility) and would appear as a gross or total benefit in a benefit-cost calculation. The area of the shaded region DAP_1, is known as consumer's surplus and measures the maximum willingness-to-pay over and above the actual cash cost of consumption. Consumer's surplus should always be added to the market value of goods and services consumed to obtain a proper estimate of total economic benefits.

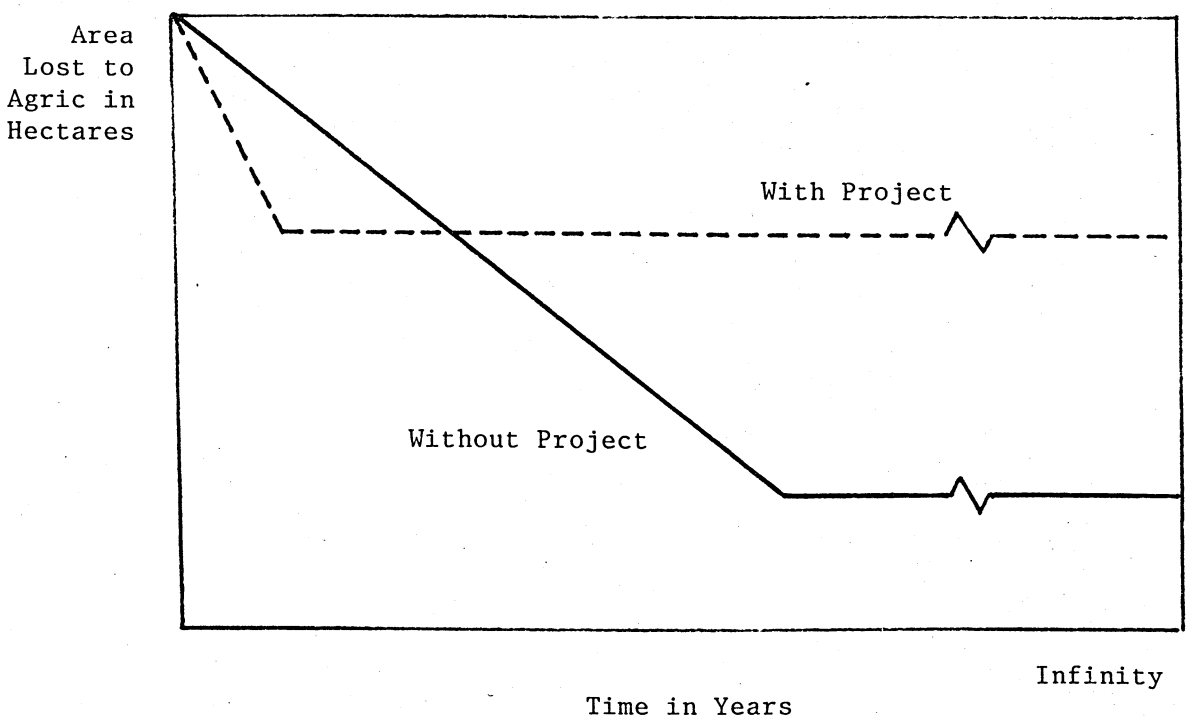
As a final note, if the good in question is supplied free of charge, then the whole area under the demand curve (up to the quantity supplied) is the consumer's surplus.

Well so much for economic theory.

The Measurement of Benefits: Techniques

Returning to Table 1, the first costs mentioned there are the on-site farm costs. These costs are losses in productivity, losses of land and other costs. Thus, if erosion control can prevent some of these losses, economists can place values on them. No major problems are encountered

here. The losses in productivity are translated into products (sheep, beef, lamb) which have market prices (or adjusted market prices to give truer reflections of social values). So in terms of Figure 1, step 7 is reasonably straight forward. I say 'reasonably' because there are of course the problems of predicting market prices for future time periods, and the problems of inflation (but the Government has promised us that they will soon have that under control). These are problems we can deal with. All we need is for you to complete step number 6. And, although I know you are working hard at it you haven't got very far as yet. We therefore have to use rough approximations such as linearly declining productivity (in the case of no soil erosion management). See for example page 75 in the Cost Benefit Handbook produced by MAF where we find the following graph:



Similarly some equally rough assumptions are made about dry matter production and productivity in both the with and without situation. This was pointed out in a paper I received back in 1981 entitled, "Some assumptions for evaluating benefits from soil conservation works for the East Cape Region". In the summary to this paper the authors wrote:

> "There appears to have been little work done in evaluating the effects of erosion or conservation techniques on production. Several broad assumptions were made in this paper but because of the lack of suitable information these were necessary .... the writers would urge that experimentation be done on determining the effects of erosion and conservation techniques on production because, as the economic squeeze gets greater, more accurate economic analyses of soil conservation works must be carried out."

Well there you've got it from the horse's (or soil conservators') mouths. You can't blame the economists here (you'll be able to do that later). More information about losses and recovery rates will be of great help to all of us.

As I said before, I know you are working on it and I read about the research findings in a 1983 issue of 'Soil and Water' in a paper by Trustrum, Lambert and Thomas. I hope all this will be translated into practical rules economists can use in their economic evaluations.

Thus, in the case of on-site benefits from soil conservation work, the ball is very much in your court. Economists await the outcomes of your research.

But before leaving these on-site benefits there would be an alternative way to value them. That way would be to use land prices, and this goes back to my earlier discussion on benefits of conservation to private land-owners.

If land prices do reflect soil conservation benefits we should be able to separate out the contribution (or the effect) of conservation works on the total price. This technique is called the hedonic price approach and is used in urban housing markets to measure the separate effects of different housing attributes (e.g. size, rooms, age, neighbourhood, air pollution level, nearness to school, etc.) on house prices. If sufficient data is available (and certain conditions are satisfied) a regression equation can be estimated showing the relationship between house prices and attributes. From this equation we can obtain an implicit price for a particular attribute. Thus, if we could apply this technique to land prices, an implicit price for different erosion levels could be obtained. This price would in turn indicate buyers' valuation of erosion control benefits.

This technique is not new to New Zealand. It has been applied to urban housing as well as to land with irrigation potential. In the latter application the objective was to establish a relationship between land prices and irrigable potential. However, to apply the techniques to hill country land to estimate the benefits of soil conservation works could run into serious data problems which would severely limit its feasibility.

Off-site costs and benefits

Here we find in Table 1 a wide variety of possible benefits from erosion control. In some cases we can identify the impacts and follow them through till they finally affect the consumer, in other cases we are still stuck in stages 2, 3 and 4 of Figure 1. Ultimately what we would like to have is a relationship between levels of erosion and impacts on consumers in terms of $'s. This in the economist's jargon is called a damage function. (Figure 3)

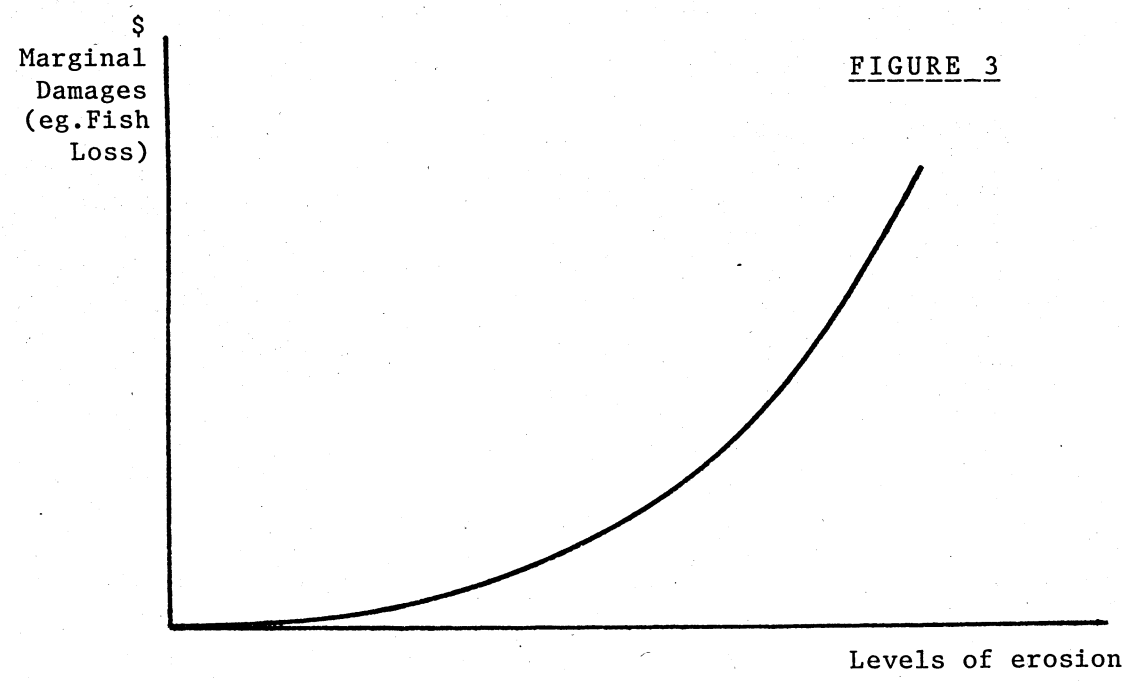


FIGURE 3

If we knew the damage function we then could simply read from the curve the extra costs imposed on society in terms of, say fish loss, as erosion levels increased. Or we could do the converse and see the benefits from reductions in erosion levels. However, to obtain such a damage function we need to understand the relationships between erosion and sediment, sediment delivery and stream pollution and fish kill, and between lower fish levels and peoples' satisfaction (or their perceptions).

Often all this is not known and we have to use alternative approaches. For example in the above case we may estimate the amount of fish stock needed to keep the fish population constant. The benefits of erosion control then become the reduced amount of restocking needed as sediment loads arriving in rivers, lakes or tributaries decrease. We can call this approach the cost avoidance' approach. This was used by MAF in their evaluation of the Lake Taupo Catchment Control scheme. And although this is not really a benefit measurement approach it is useful in that it provides us with a minimum estimate on the benefits from the control measures.

Recreation benefits need little introduction. We are all aware that water quality as well as aesthetics have an effect on recreation. The situation at Lake Tutira several years ago (and still today) presents a good example. Soil erosion and run-off from the surrounding catchment enriched the lake, caused eutrophication and decreased the recreational and aesthetic value of the lake. An economic analysis

of a Catchment Control scheme for the lake fell well short of the 10% Internal Rate of Return Criterion. This was to be expected as most of the benefits were off-site and 'intangible' or 'immeasurable'. A student and I set out to attempt to evaluate one of those intangibles i.e. the recreational value of the lake. To do this we used what is known as the Travel-Cost Method. This method uses information on people's travel cost, place of origin, plus other socio-economic data to derive a demand curve for the site. The area under the demand curve can be calculated and represents users' total willingness to pay or consumers' surplus for the lake (the lake is free).

The results of the analysis are site specific but can be used to estimate the benefits to society of recreational losses avoided if erosion control or catchment works are put into place. The technique is widely used overseas and also now in New Zealand but has as yet not been used often in erosion control situations.

Amenity, aesthetic and ecological effects: The general perceived levels of amenity and aesthetics can be affected by soil erosion itself or its impact on water quality. To measure this impact we can use for example land value approaches or survey techniques.

An example of the first approach was used in a soil conservation scheme in the Eppalock catchment in Australia. In this example, a with and without soil conservation project analysis was done of the value of production. The increased value per hectare from improved pasture

productivity was calculated. The difference in land prices between the improved and unimproved land was larger, however, than the value of the increased productivity. The extra value was attributed to environmental quality benefits.

This land value technique thus permits quantification of benefits and a division between productivity related and aesthetic benefits.

Survey techniques rely on direct surveys of consumer willingness to pay. Consumers are confronted with direct questions regarding their willingness to pay for particular changes in the environment, these could be changes in visual amenities, water quality levels or other environmental quality changes. The results from these interviews allow the analyst to construct a demand curve for things like water quality or visual amenities or recreation benefits.

Although interview techniques often suffer from survey bias, the techniques developed in this category of approaches are very suitable for benefit estimation. Barry Harris from the Waikato Valley Authority has used this technique to place a value on water quality levels of the Waikato River.

Aesthetic and amenity values cover a wide spectrum of benefits. New Zealand's environmental resources have cash value for tourism, for the film industry and for other aspects of communication media which allow people to experience situations which they will never visit. Measurement of

such benefits requires much ingenuity, but the least we can do is to identify these kinds of benefits.

Several of the other benefits of soil erosion control mentioned in Table 1 can only be approximated by cost avoidance techniques. For example flood control benefits are regularly calculated, but in most cases what is calculated are the costs avoided. Some of the real benefits such as peace of mind, lives saved etc. are very difficult to estimate. We may use some proxy techniques such as the human capital approach but these are based on theoretically very shaky grounds.

Water treatment and irrigation cost fall similarly in the cost avoided (or replacement cost) category.

Where does all of this leave us?

1. It is clear that although we can identify the effects of erosion and the impacts of soil conservation work, quantification and evaluation of the effects is still very difficult.
2. However, measurement of the costs and benefits of soil erosion controls are essential in the economic climate under which we live.
3. Most of the evaluation of soil erosion control work will be done in the form of benefit-cost analyses. It is of utmost importance that all costs and all benefits are included. If some benefits are not measurable in dollars, they should at least be identified and quantified.

4. I hope to have shown that techniques exist which enable us to place monetary values on some (previously thought intangible) benefits, but that other benefits are still immeasurable.

5. That in all this work both economists and scientists need to do a lot more work to estimate changes in physical parameters which finally can be translated in effects on consumers. Economists need to do a lot more work on identifying how people value changes in environmental quality and other parameters.

6. This extra effort to estimate costs and benefits is required to overcome the inbuilt bias in Benefit Cost Analysis towards short term projects. As long as the Government sticks to the 10% real discount rate, soil conservation schemes will find it difficult to get funding approval. In a recent paper titled "The Discount Rate Issue in the New Zealand Water and Soil Resource Field", Rod Forbes and I discussed the impact of the 10% discount rate and showed how alternative discounting procedures would treat catchment control schemes more favourably [Forbes, R.N. and A.D. Meister 1984]. However, I don't expect any major changes in the project evaluation and discounting procedures in the near future. Hence the only way open is to identify and evaluate much more carefully the benefits of soil conservation works and in this way convince society of their worth.

7. Soil conservation programmes should be evaluated not in a vacuum, but in an overall strategy of optimal resource allocation. This requires, among other things, that all projects, agricultural, manufacturing and conservation, should be evaluated using similar criteria. Comparing the 10% Internal Rate of Return guideline for soil conservation projects with the returns calculated for the Marsden Point Refinery Expansion or NZ Steel makes me doubt that this is happening at the moment. Of course reasons can be advanced why this may be so - such as other objectives beyond economic ones (strategic value, independence etc.). If that is the case however then soil conservation projects should also receive the benefits of being evaluated in the light of other objectives. I have in mind here e.g. the objectives of keeping our options open to the future by avoiding irreversible land use changes today or as J.A. Sinden once stated "Uncertainty of the future provides a case for conservation of the maintenance of minimum levels of resource productivity" [Sinden, 1971].

Finally, under current economic conditions there is little we can do about political decision making with regards to soil conservation schemes, except to continue research into the costs and benefits of erosion control and to improve our ability to show what can be achieved, and to show the value of this work to society.

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