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IMPACT OF ADOPTION OF SUSTAINABLE PRODUCTION SYSTEMS ON FARM PROFITABILITY

by

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PAPER TO 41ST ANNUAL CONFERENCE OF THE AUSTRALIAN AGRICULTURAL AND RESOURCE ECONOMICS SOCIETY
JANUARY 1997

ACKNOWLEDGMENTS

This paper provides an overview report of the work of the following agricultural economists employed by the Queensland Department of Primary Industries (QDPI):

James Gaffney (Toowoomba) - Broadacre Grain, Darling Downs
Peter Donaghy and James Gaffney (Emerald)- Broadacre Grain and Beef, Central Highlands
Ian Gibbons (Mackay) - Sugar Cane, Mackay District
George Antony (Brisbane) - Green Beans, Gympie District
Peter Hardman (Brisbane) Beef/Agroforestry, S.E. Queensland
Bill Holmes (Townsville) - Beef, Northern Savannah
George Millear (Longreach) - Wool, Mitchell Grass (CWQ)
Paul Clark (Charleville) - Wool, Mulga Lands (SWQ)

The work of Rod Strahan and Parthasarathy Kalpana - (Masters students at the University of Queensland) supervised by Mal Wegener is also acknowledged in analysing agroforestry and sugar production systems respectively.

George Passmore (Department of Natural Resources) made a major contribution to the formulation of the methodology used in the project.

Appreciation is also expressed to several other colleagues who assisted at various stages in this project. These include Ross Berndt, Noel Dawson, Trevor Wilson, John Mullins, Greg McKeon, David Freebairn and Bob Reilly.

IMPACT OF ADOPTION OF SUSTAINABLE PRODUCTION SYSTEMS ON FARM PROFITABILITY

I.B. Robinson

Preliminary results from the analysis of nine major agricultural production systems by QDPI economists are presented in this report. These systems include grain, sugar, beef and wool and are distributed throughout Queensland.

Comparisons of discounted cash flows were made over a thirty year period in assessing profitability of traditional and sustainable systems. The adequacy of information used in modelling these systems is discussed. Given the limited time and resources available for the project a not surprising conclusion is that further analysis is required to extend the generality of the results.

Comment is also made on the implications of the results for the issue of whether additional government initiatives might be required to stimulate adoption of more sustainable systems.

INTRODUCTION

Background

The endorsement in 1992 by all States and the Commonwealth, of the National Strategy for Ecologically Sustainable Development acted as a catalyst for the Queensland Department of Primary Industries (QDPI) in the preparation of new Natural Resource Management (NRM) legislation.

The objective of the new Act was to bring together eight existing Acts dealing separately with specific natural resources such as soil, water, fisheries and forests and in doing so to establish a common approach to protect the sustainable productive capacity of natural resources in Queensland.

In 1994 a major discussion paper "The Sustainable Use and Management of Queensland's Natural Resources" was issued by the QDPI. This was followed by a period of intensive consultation with interested parties to elicit comment on the proposals in the discussion paper.

As part of this consultative process some fifty workshops were held in all regions of the State to facilitate the flow of comment from a wide range of primary industry, conservation and other community groups.

The single most commonly identified issue at these workshops was that of how the adoption of sustainable production systems would affect the profitability and viability of rural enterprises. In response to this concern it was agreed that the QDPI should initiate a project designed to throw some light on this issue and in doing so possibly remove one of the impediments to more widespread adoption of enhanced natural resource management by primary producers.

The Project

A detailed project proposal was endorsed by a steering committee established to overview its implementation. This committee comprised industry representatives together with representatives of the Australian Bankers' Association and the Queensland Landcare Council. The objectives of the project were to:

a) Prepare representative models (case studies) for major farming and grazing systems which assess the impact, both short and long term, on profitability and viability of adoption of sustainable management practices.

b) Identify on a case study basis the localised indicators of sustainability which may be used to influence market behaviour in a positive way so as to reward good managers for their efforts.

c) Disseminate the results of these studies to key target audiences, including industry, finance and community groups. This will include the linkage between long-term profitability and land values. This information will be conveyed to producers together with other relevant information.

d) Assess what further information or policy initiatives may be required to facilitate the adoption of sustainable management practices.

Regional agricultural economists were seen as key resource people in coordinating the project at regional level and in conducting the required economic analysis. A workshop was held in February 1996 to facilitate interaction between specialist modellers and regional agricultural economists.

This paper reports the work done on selected farming and grazing systems by project teams coordinated by regional economists. For two of the production systems (sugar at Bundaberg and agroforestry in SEQ) the analysis was conducted by masters students in agricultural economics at the University of Queensland.

Due to limitations of both time and resources it has not been possible to address all of the objectives outlined above. Objective (a) most directly addresses the concerns expressed by landholders and for this reason effort was focused on this objective.

Farming Systems Analysed

Whilst an attempt was made to include most major agricultural systems in the State, this proved to be somewhat ambitious given limitations due to the availability of skilled staff to work on the project, the availability and quality of information required in making comparisons between conventional and sustainable systems and general constraints of time and limited funding. Nevertheless a fairly comprehensive range of systems was studied as follows.

Cropping

Broadacre Grain - Darling Downs
Broadacre Grain and Beef - Central Highlands
Sugar Cane - Mackay District
Sugar Cane - Bundaberg District
Green Beans - Gympie District

Grazing
Wool Growing - Mulga Lands, SWQ
Wool Growing - Mitchell Grass, CWQ
Beef Production - Northern Savannah
Beef/Forestry - South East Queensland

The following map provides a broad indication of the location of the farming systems studied

METHODOLOGY

For each of the agricultural systems selected for analysis, project teams agreed on the selection of a typical property which was broadly representative of the system in terms of bio-physical attributes, enterprise pattern, productivity and profitability

For the representative properties, two management systems were then defined - conventional or traditional and sustainable. Whilst there has been a lot of general discussion of sustainability of agricultural systems in recent years, project team members commonly had difficulty in defining just what was meant for the production system being focused upon.

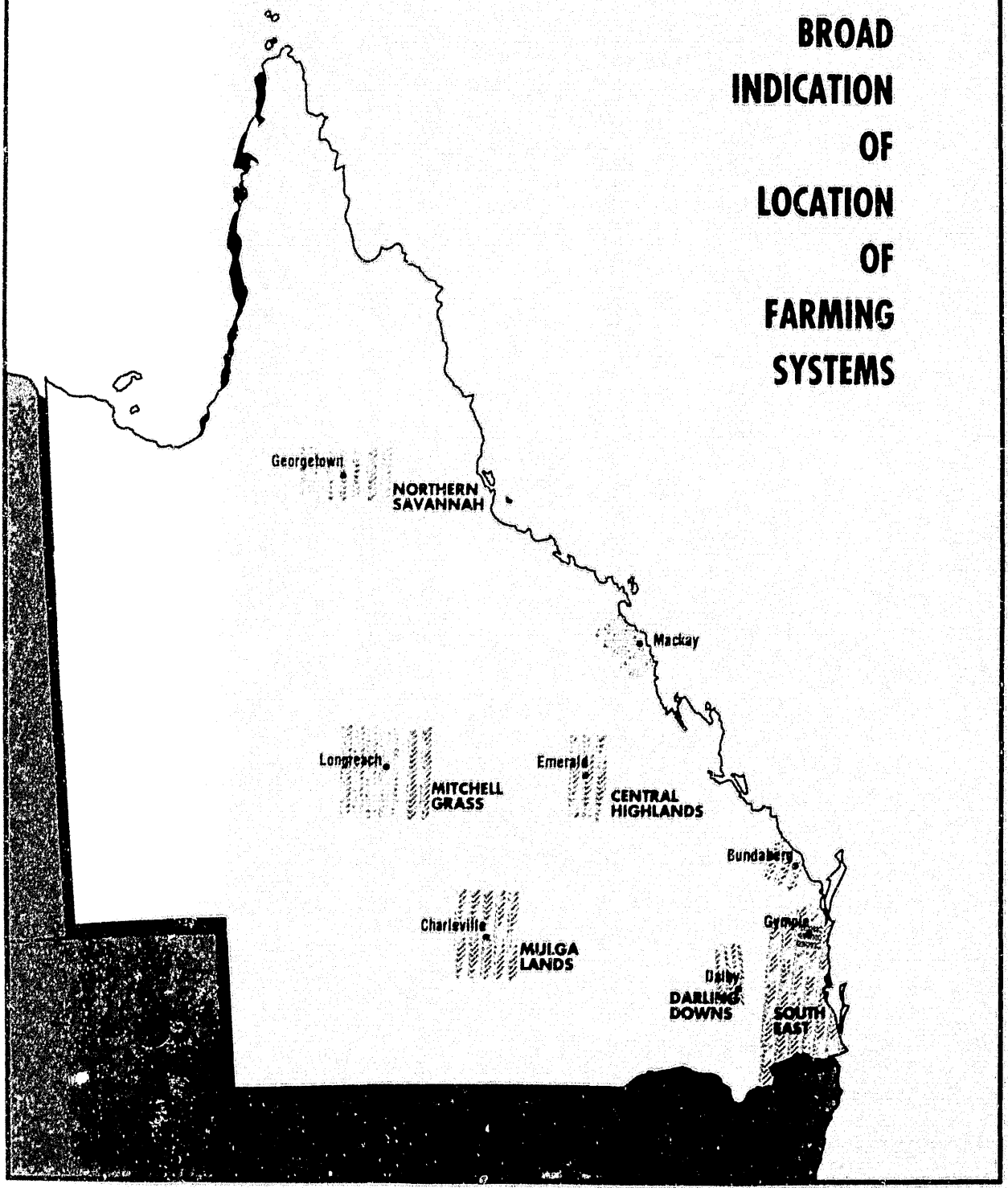
The next step was to specify physical performance for both the conventional and sustainable systems being compared in terms of crop yields over time, stock turnoff, wool cuts etc. Application of price data and costs of inputs then generate cash flows of annual returns and costs which were discounted over the period selected.

As the adverse effects of natural resource degradation can take many years to become evident it was necessary to conduct the analysis over a long period. For this project 30 years was proposed to project teams. From a discounting point of view cash flows beyond that period are of little significance. Where the differences in cash flows between the conventional and sustainable systems are substantial, it was proposed that residual values at the end of the 30 year period be used although this was not generally done in the individual analyses.

For this project it was proposed that project analysts adopt discount rates in the range used by the Land and Water Resources Research and Development Corporation (LWRRDC) viz. 4%, 7% and 10%.

In modelling the performance of conventional and sustainable systems, the single most powerful determinant of performance will be seasonal climatic influences especially

MAP SHOWING BROAD INDICATION OF LOCATION OF FARMING SYSTEMS



rainfall. Droughts in particular will have a profound effect on cattle and sheep numbers and output and on crop yields. They will often also give rise to episodes of serious resource degradation.

Several of the studies incorporated a range of seasons in modelling performance over the 30 year period. Others did not due mainly to the absence of productivity information related to climatic variations.

Other factors which will influence profitability and viability are the mix of enterprises adopted (where a choice exists) and the size of the enterprise. Where relevant, alternative combinations of crops have been tested. The effect of size has not been addressed at this stage but could easily be incorporated in further work.

Commodity Prices

As with the discount rate and period, project analysts were asked to adopt common commodity prices for their production systems in order to enhance the capacity to draw conclusions for the project as a whole.

A number of options were available for determining prices used. These include current prices, average real prices over a recent period (1988 to 1994), application of a trend derived from earlier year values or an average of ABARE's long-term forecast prices. The second of these was recommended i.e. an average of prices over the period (1988-89 to 1994-95) in real terms. These are shown in Table 1.

Table 1: Average Prices 1988-9 to 1994-5

	Unit	Average	Low	High
Sugar	$/tsugar	350	250	420
Wheat	$/t	165	150	250
Barley	$/t	145	125	200
Sorghum	$/t	175	150	250
Wool (Eastern Market Indicator)	c/kg clean	730	520	1000
Beef	c/kg	220	200	300

Sources of Data

All project teams sought to use the best available data. Sources included research work conducted in the region both on research stations and on properties, surveys of farm performance by ABARE or by QDPI personnel, case studies of individual properties and local consensus data (LCD) agreed upon by QDPI personnel in conjunction with primary producers.

There was a great variation in the quality of data available for particular systems. This impacts on the confidence that can be placed in the results of the analysis and the conclusions drawn. Special attention is paid to this issue in subsequent discussion.

Off-Farm Effects

Because the primary objective of this project is to estimate the impact of more sustainable production systems on farm profitability, off-farm effects, such as siltation and damage to infrastructure and excessive nutrients leading to water degradation, are not considered.

These off-farm or off-site effects often have adverse effects on other resource users and would be evaluated in broad economic studies of resource use - such as those conducted on a whole catchment basis.

RESULTS

For each production system analysed a report has been prepared. These reports are unpublished at this stage and are available from individual authors as listed in the acknowledgments and references. A very brief summary of each study follows:

Broadacre Grain-Darling Downs

The current cropping system is considered to be highly sustainable and includes several components which contribute to this sustainability including strip cropping and stubble mulching. The 'more' sustainable system incorporates zero tillage and tactical applications of nitrogen as well.

It is concluded that the more sustainable system is equally profitable if no extra land is farmed. If 20 % more land is cultivated as a result of savings on labour and machinery use, profitability increases by $10 000 p.a. Assessed over a 30 year period this latter option generates an additional NPV of $ 132 000. However the superiority of this system is not unqualified as profits appear to be less in poor years and subject to greater variability.

Broadacre Grain and Beef - Central Highlands

Practices analysed in the sustainable system are minimum tillage and use of fertiliser nitrogen in the cropping enterprise and lower stocking rates for the beef enterprise.

It is concluded that in the short term the sustainable system will generate and extra profit of $10 000 p.a. High profitability for cropping offsets losses from livestock in the early years. In the long-term over a 30 year period an additional NPV of $145 000 is generated.

Sugar Cane - Mackay District

Management practices assessed in the sustainable system in this study are minimum tillage and green cane trash blanketing.

The conservation system is estimated to generate additional profit of about $17 000 p.a. consisting largely of reduced labour and capital costs. Over a 30 year period it generates an additional NPV of some $235 000. It is suggested that a farmer could cultivate up to 50% more land with this system due to reductions in labour inputs.

Sugar Cane - Bundaberg District

In this study green cane trash blanketing (getb) and drip irrigation are analysed as the main components of the sustainable system. It is acknowledged that other practices such as minimum tillage, controlled traffic and on farm water storage would further contribute to sustainability.

Results indicate superior profitability for the sustainable system. Over a 30 year period and additional NPV of $ 146 000 is estimated for the getb and an extra $237 000 for the drip irrigation. Reductions in yield for the conventional system would enhance the superiority of the sustainable system.

Green Beans - Gympie District

Three production systems incorporating varying degrees of reduced or minimum tillage are examined in this analysis.

Gross margins are used to assess differences in profitability for the conventional and more sustainable systems (referred to as Best Practice 1,2 and 3). Discounted cash flows are not used as information was not available on long term effects. It is concluded that profitability of the more sustainable systems is equivalent to the conventional system.

Wool Growing - Mulga Lands, SWQ

This analysis, which is incomplete at this stage, compares lighter stocking rates for the sustainable grazing system compared with the conventional system.

Using data from a trial conducted in the region it is estimated that the lighter stocking system increases profitability by about $12 000 p.a.. A partly completed simulation model run over a 22 year period shows higher returns for heavier stocking but does not incorporate changes in numbers and values of stock resulting from seasonal changes such as droughts.

Wool Growing - Mitchell Grass, CWQ

This study compares higher and lower stocking rates with dry sheep equivalents fluctuating between 9000 and 19500 for the conventional system and between 7500 and 12000 for the sustainable system according to the type of season encountered.

Assessed over the 30 year period (1963 to 1992) the low stocking, sustainable system is estimated to generate an additional NPV of $216 000

Beef Production - Northern Savannah

Given an almost complete lack of information on productivity responses to reduced stocking rates, this analysis assumes a reduction of 30% and then estimates the productivity improvement required to break even with the conventional higher stocking rate system. This improvement comprised a reduction in breeder mortalities, increased branding rate and an increase in steer prices. The author indicates that the estimated productivity improvement would seem to be achievable and invites comment form other expert personnel.

Beef / Forestry - SEQ

This analysis compares a beef only enterprise with one also incorporating an area of timber producing eucalyptus saw logs after 25years.

It is concluded that the mixed enterprise would have only a marginal impact on profitability if current prices for timber are maintained. Additional NPV over the 25 years would be only $18 000. However real prices for this type of timber are expected to increase at a rate of 1.1% p.a.. This would increase the additional NPV to $84 000.

Summary of Impact on Profitability

The following table summarises these estimated impacts on profitability.

Table 2 Estimated Impacts on Profitability

System	Change in Profitability (Additional NPV)
Broadacre Grain - Darling Downs	nil if no extra land NPV of $132000 if extra land
Broadacre Grain and Beef - Central Highlands	NPV of $145000
Sugar Cane - Mackay	NPV of$235000
Sugar Cane - Bundaberg	NPV of $383000
Green Beans - Gympie	nil
Wool Growing - SWQ	results incomplete
Wool Growing - CWQ	NPV of $216000
Beef - Northern Savannah	not estimated
Beef/Forestry -SEQ	NPV of $18000 at current prices NPV of $84000 at forecast prices

CONCLUSIONS

From this information it appears that for five of the nine systems, profitability is enhanced by the adoption of sustainable systems; for two of the systems profitability is roughly equivalent and for the remaining two, the impact on profitability is unknown until more work is done.

Reliability of Results

The degree of confidence which can be placed in the results of the nine studies is determined principally by two factors - the availability and quality of information upon which the analyses were conducted and the adequacy of the methodology used in evaluating the conventional and sustainable production systems. The critical issue in

assessing the adequacy of the methodology used is whether a sufficiently broad range of outcomes has been tested.

Each of the studies has been subjectively rated on a scale of high, medium or low for these two factors. In doing this it is emphasised that this rating is not an assessment of the work and effort of the analysts. All participants committed as much to these projects as the limited timeframe and restricted resources permitted. It will also be obvious that where a study is rated low so far as the availability and quality of information is concerned, this is largely a reflection of past research activity and nothing to do with the application of study teams.

Table 3: Rating of Factors Determining Reliability of Results

	Avail. & Quality of Information Used	Adequacy of Methodology
1 Broadacre Grain - Darling Downs	High	Medium
2 Broadacre Grain & Beef - Central Highlands	Low	Medium
3 Sugar Cane - Mackay	Medium	Medium
4 Sugar Cane - Bundaberg	Medium	Medium
5 Green Beans - Gympie	Medium	Low
6 Wool - Mulga Lands	High	Medium
7 Wool - Mitchell Grass	Low	Medium
8 Beef - Northern Savannah	Low	Low
9 Beef/Forest - SEQ	Medium	Medium

The degree of confidence that can be placed in the results is an amalgam of the factors shown above. Thus projects rating high and medium indicate reasonably robust results and those with low ratings indicate results in which only limited confidence can be placed at this stage.

It can accordingly be tentatively concluded that four of the systems studied (2, 5, 7 & 8) will require more analysis before the results can be considered robust. System 6 although rated high/medium will also require more work as it was not completed within the timeframe of this project. The other four systems have delivered results which appear to

be reasonably robust at this stage. Nevertheless none of the studies have generated sufficiently general results to conclude that there is no need for further work.

Need for Specialist Skills

Whilst this project has managed to address a key issue facing landholders, it is emphasised that the work done to date represents only a first step. Much work remains to be done to extend the generality of the conclusions, to analyse other major production systems and to encompass aspects and issues which have not been touched upon so far.

For example, the analyses reported upon have not looked at restoration of degraded areas through strategies such as removing stock, pasture establishment and so on. Another aspect which has not been addressed is that of conserving special areas of ecological significance on properties. A related aspect is that of strategic planting of trees to stabilise rural landscapes.

Taking stock of the availability of professional resources in Queensland there is a distinct gap in the bio-economic modelling area which will impede progress in doing further work on the systems reported upon and in addressing the areas which have been ignored to date. The Queensland Departments of Primary Industries and Natural Resources have established professional modelling units which focus on bio-physical aspects of agricultural systems. There is a priority requirement to complement the skills in these units with a small core group (perhaps 3 or 4) of bio-economic modellers to ensure that progress is made in analysing sustainability issues.

Models constructed in analysing the sustainability of agricultural systems will have a general utility in examining many other issues confronting landholders and State and Federal Governments. Issues such as structural adjustment , the impact of new technologies, the effects of climatic variability and climate change and the impacts of changes in the terms of trade are examples.

Although the situation in other states is not known, it is perhaps not unlikely that there is a need for these skills in Departments elsewhere in Australia. Because of the fundamental importance of this work to the rural sector there appears to be a case for the

Research and Development Corporations to provide some financial support in addressing this deficiency

Interaction with Research Personnel

Modelling agricultural systems is highly integrative and calls upon the skills of many disciplines. One of the beneficial outcomes of this project has been the advance made in defining what sustainability means for the systems analysed and in integrating piecemeal research results.

In integrating the components of the sustainable systems examined it is not surprising that gaps were identified in the information available. This highlights the need for a closer dialogue between modellers and R&D personnel particularly when priorities are being established for funding.

COMMENTS ON POLICY MEASURES

Notwithstanding the tentative conclusion that the adoption of sustainable systems may enhance profitability there is a need to assess whether new Government initiatives might be required to accelerate the rate of adoption of these systems thereby reducing the rate of natural resource degradation.

Current Natural Resource Situation

Whilst community attitudes towards sustainability have changed markedly in recent years the continuing decline in the quality of natural resources used in agriculture remains.
In Alexander's (1996) assessment, " it would be difficult to claim that we were well down the road towards an ecological, economic and socially sustainable agricultural sector". She goes on to state that the condition of Australia's natural resources is still declining and that adjustment pressures are profound.

A similar assessment has been made by Douglas (1995) who indicates that whilst the establishment of some 2200 Landcare Groups has profoundly changed attitudes towards

better natural resource management, the implementation of on-ground works, practices and systems is just beginning and it will take several decades to turn around the damage which has occurred inn the past

Ickersley (1989) has estimated the costs of land degradation at $2 billion per annum with 52 % of land used for agriculture in need of rehabilitation

Economic Situation

It is just as easy to compile information which demonstrates that the current economic and financial situation of the rural sector is parlous - notwithstanding the first good wheat crop for several years

A striking historical perspective on the decline in the rural sectors economic sustainability has been provided by Chisholm (1992) who has shown that the real Net Value of Farm output has declined by close to 60 % between the 1950's and the 1980's. This has been accompanied by a decline in the real value of total farm capital

A current assessment has been provided by the Federal minister for Primary Industries when opening the recent Rural Finance Summit He indicated that as many as two thirds of Australia's 150 000 commercial farms are at risk due to low cash incomes. Cash incomes of less than $50 000 p.a. is the benchmark used in making this assessment.

The impact of this poor economic situation on the capacity and willingness of primary producers to undertake better natural resource management has been summarised by Alexander

" Emotionally, physically and economically stressed people do not manage resources well. "

Similarly in a survey of graziers attitudes towards adoption of sustainable systems, Lawrence (1992) found that landholders' conservation and ecological ideals were clearly over-ruled by the economic necessity of making as much money as possible to meet short term economic needs to recover from high interest rates, inflation, recession and continuing drought periods.

Possible Initiatives

Given the continuing decline in the condition of the natural resources used in agriculture and the low capacity of landholders to invest in and implement more sustainable systems, it is important to canvass new initiatives which might assist in improving natural resource management

(i) Research and Extension

A suggestion has already been made for this area of activity viz. the establishment of small bio-economic modelling units in State Departments of Agriculture or Natural Resources.

Over time as these modelling units provide reliable information on the impacts of adoption of more sustainable systems, this information can be included in extension and information programs. The existing Property Management Panning (PMP) program provides a good vehicle for the provision of this information and for integrating the many diverse parts of sustainability packages.

The relationship between sustainability, profitability and land values is especially important in rewarding good NRM and this type of information should be placed in the public domain once the information is considered to be reliable.

Parts of sustainability packages such as integrated pest management and drip irrigation have been referred to as precision technologies by Zilberman (1996). They are characterised by their ability to respond to varying environmental conditions in a way which reduces waste levels of inputs. Another characteristic is that they require better knowledge and understanding of systems and substitute knowledge for excess inputs. Developing skills amongst landholders to use such technologies along with risk and business management skills should be a priority for extension and information programs.

(ii) Rural Adjustment Schemes

It is generally accepted that there is a better chance of achieving good NRM if rural holdings are larger. There has been a lot of debate over many years as to whether the rate of structural adjustment has been adequate and the urgency of achieving a higher rate of adoption of more sustainable systems adds weight to the call for an increase in the rate of adjustment in the rural sector.

The Rural Adjustment Scheme (RAS) was given something of a sustainability emphasis when it was reviewed in 1992 and there is now a case to further reinforce this emphasis. Such a focus could provide a rationale for continuing RAS with an emphasis on achieving property amalgamations and adoption of sustainable production systems.

When the components of sustainable systems are better defined and accepted there may be a case for RAS authorities to assist landholders to finance those parts of these systems which are important in achieving sustainability but which are not attractive as short term investments to landholders or to the commercial providers of finance.

Another component part of RAS which should be continued and even expanded is the regional approach where specific regions and agricultural systems are targeted to achieve structural adjustment and better NRM through the provision of additional inducements to landholders leave small properties and to amalgamate and consolidate larger holdings. An example of this in Queensland is the South West Strategy which is seeking to redress the wide scale degradation of the Mulga lands.

(iii) Stewardship Payments

There is a growing consensus amongst some commentators (Alexander, Douglas, Roberts, et.al.) that primary producers as custodians of natural resources should be able to negotiate with Governments for a contribution to be made for their services in maintaining these resources in good condition for other resource users both now and in the future.

Morton and Stafford-Smith (1994) express support for the concept of landholders as stewards receiving support in exchange for managing special areas in an ecologically

sustainable way. The provision of 'stewardship salaries' would partly relieve landholders of the economic imperative to make a profit out of such areas.

Alexander considers that it is beyond the capacity of producers to invest in nature conservation, stabilise water tables and manage weeds and pests on the scale necessary. A national debate on this issue should lead to cost sharing arrangements which would achieve the aggregate level of investment necessary to arrest current levels of deterioration. It is also recognised that the international trend is for direct income support for farmers in delivering public goods such as environmental management.

Commenting on the merits of different types of economic instruments, Peterson (1995) has concluded that to the extent that externalities justify landcare measures, subsidies would be better targeted if provided directly rather than through the tax system. Davenport (1995) has provided a thorough critique of the use of tax concessions in assisting implementation of landcare measures

Douglas has concluded that implementation of good NRM practices is proving difficult and that government investment is small and poorly targeted. He proposes several broad strategies to stimulate action one of which is the provision of targeted incentives at landholder level it has been estimated that a 3 % level on sales of food and beverages at the wholesale levy would provide $300 million p.a. to finance additional initiatives.

To progress this idea of stewardship payments or grants a little further it is suggested that an effective first step in targeting such payments would be to identify for major farming and grazing system those particular practices, works or measures which will not be attractive to landholders but which are very important in achieving sustainable production through the reduction of degradation processes and the restoration of damaged areas.

Examination of the detailed costs of these residual components of sustainability packages would provide a guide to cost sharing arrangements and to the level of direct financial support that governments might agree to.

Accountability for such arrangements could be secured through linking stewardship grants to a PMP type process using accredited practitioners.

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