

**SIGNPOSTS FOR AUSTRALIAN AGRICULTURE:
A FRAMEWORK FOR DEVELOPING
ECONOMIC AND SOCIAL INDICATORS**

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I. Introduction

Over recent decades business and industry have come under increasing pressure to demonstrate their contributions to ecologically sustainable development. The National Land and Water Resources Audit's project *Signposts for Australian Agriculture* is aimed at developing a framework for reporting on the contribution of agriculture to ecologically sustainable development in Australia.

A key strategy of the *Signposts* project has been to engage industry and government to identify relevant ecologically sustainable development outcomes to report on. In stage 1 of the project, the Bureau of Rural Sciences (Chesson et al 2005) (in consultation with six research and development corporations) developed a pilot framework and associated outcome statements and indicators. As part of stage 2, the National Land and Water Resources Audit commissioned ABARE to review the human systems component of the *Signposts* framework and provide recommendations on economic and social outcome statements and indicators that could be considered for inclusion. As part of the review, ABARE considered the key elements of sustainability in defining guidelines for identifying appropriate indicators.

Ecologically sustainable development involves the allocation of resources between alternative uses, including current and future use. The key principles underlying ecologically sustainable development include a) consideration of future generations and maintenance of ecological processes, and b) balancing economic, social and environmental outcomes to meet the needs of current and future generations (World Commission on Environment and Development 1987). Given the often conflicting nature of these outcomes, achieving this balance is likely to involve significant tradeoffs.

The role for government in ecologically sustainable development is to ensure future generations are treated fairly in resource allocation decisions, and to intervene to correct market failures where they exist and where the benefits outweigh the costs. Governments will also be interested in whether policies designed to address sustainability problems are having the desired impact. Given these principles, and the role of government in resource allocation, it is possible to identify some of the types of information that might be useful in considering agriculture's contribution to ecologically sustainable development.

The information needs of industry and government are likely to differ somewhat. Policy makers, for instance, will be interested in targeted information related to policy objectives, whereas industry is likely to be more concerned with communicating the contribution of their industry to the nation's well-being. In the context of *Signposts*, the aim is to provide a set of indicators that meets both needs. However, not all information is equally useful and there is a need for indicators to be prioritised to those related to identifiable policies or actions.

2. Framework for sustainability

Concern for the future

The development and use of Australia's natural resource base since European settlement has been a major contributor to national income and community well-being. However, in realising these benefits some undesired legacies, in the form of natural resource degradation, have been left for current and future generations. Depletion of the natural resource base is a concern because of the potential costs it imposes on present and future generations in terms of lost production and quality of life more generally. At the same time, increasing knowledge – human capital – offers the potential to better manage and mitigate these problems.

These concerns are reflected in the concept of ecologically sustainable development (ESD). Over recent decades there have been many interpretations of this concept, how society should go about achieving sustainable development, and how sustainability can be meaningfully measured – given that all systems evolve.

The concept of sustainability is based on the proposition that future generations and the longer term need to maintain ecological processes should be considered when making current decisions (World Commission on Environment and Development 1987). In 1992, the National Strategy for Ecologically Sustainable Development attempted to further refine the concept by providing the following definition: 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased' (Commonwealth of Australia 1992).

The principles of ESD an efficient allocation of resources through time such that each succeeding generation can expect to be at least as well off as the current generation. Natural resources represent a stock of wealth. This wealth can be used in a number of ways to provide a flow of services to the community. For example, resources could be consumed now or managed so as to produce benefits over time – the question is how to manage the resource so that society receives the greatest benefit whilst maintaining essential ecological functions. The fact that resources are scarce relative to competing demands requires that tradeoffs be made between alternative current uses and between current and future use. Another question is how society wishes to transfer wealth between generations. For example, for depletable natural resources the current generation has the option of using the resource now and consuming the proceeds, using it now and generating other kinds of wealth with the proceeds, or saving the resource in its natural state. In some cases, using the resources now in order to build up capital stock and technology may be a more effective way of passing on wealth to the next generation than leaving those resources intact (Rose and Cox 1991).

Balancing outcomes

As stated in the previous section, from the perspective of natural resource management, the objective is to maximise the net benefits society receives over time from the use of resources. Social welfare – the total well-being of a community – is maximised by ensuring that all resources are applied to their highest valued combination of end uses, both now and into the future. 'Value' in this context includes not only commercial values such as those derived from cropping or grazing activities, but also 'unpriced' values (box 1). Unpriced values include those that for some reason or other are not

valued in markets. Anything from which individuals gain satisfaction is deemed to be of value, and the highest valued end uses of a resource will, by definition, be those from which society derives the greatest satisfaction over time. Implicit in this assertion is that value is a human, as opposed to intrinsic, aspect of natural resources.

Box 1: Concepts for valuing society's resources

Natural resources represent existing or potential sources of net benefit to various groups within society. In addition to the economic values accruing from the direct use of natural resources, a number of other economic values exist which may also be important despite often being less easily quantified.

Use values: *Direct use values* are the net result of benefits and costs associated with using a resource for productive activities such as agriculture, mining or tourism. *Ecological function values*, on the other hand, relate to the capacity of a resource to contribute to the maintenance of an ecological system. *Option values* are derived from the potential stream of benefits that could be obtained from retaining a resource for use at some future date.

Non-use values: *Existence values* are derived from society's satisfaction in knowing a resource exists, independent of the consumption of the resource. *Bequest value* is derived from knowing a resource will remain in existence, apart from the potential stream of benefits that could be obtained from using that resource at a later date.

If it were possible to quantify the value individuals derive from the use of natural resources in some common unit, it might be possible to identify natural resource use decisions that either increase or decrease social welfare. However, it is not possible to quantify values derived from all uses of natural resources.

This would not be a problem if achieving ESD did not involve tradeoffs. The reality is, however, that many natural resource use decisions will involve a trade-off between environmental condition and wealth derived from productive activities. Under these circumstances it will not be possible to unambiguously determine whether a resource use decision has increased or decreased social welfare – some form of subjective evaluation will be required.

While a quantitative economic evaluation of the benefits of conserving a natural resource may not be possible, it may be possible to provide information on the costs of alternative policy options to allow informed political choice. Even without information on the economic benefits, this type of information is essential in the decision making process as it makes the tradeoffs between natural resource conservation and the costs to various sectors of the economy explicit. It will only be possible to unambiguously determine whether a natural resource use decision has increased social welfare if it has: increased the net benefits derived from the commercial use of the resource without any reduction in environmental condition; or improved environmental condition without any reduction in net commercial benefits.

3. Information needs of decision makers

There is an enormous array of information that could be collected and analysed for reporting the contribution of agriculture to Australia's economic, social and environmental well-being. However, developing and interpreting sets of information can be problematic. At the same time, not all information is useful and there is a need for indicators to be prioritised to those related to identifiable policies or actions. In 1998, the Standing Committee on Agriculture and Resource Management (SCARM 1998) recognised the difficulties in measuring sustainability when it made no attempt to provide a general statement on the sustainability of agriculture.

Measuring overall progress toward sustainability is difficult because of the complexity of the economic, social and environmental interactions associated with natural resource use, and the fact that there is no agreed method to trade off the positive and negative trends between indicators. Moreover, preferences can vary across regions and cultures, and may change over time. In addition, tracking changes may identify a trend but will generally not be sufficient to identify a point where environmental damage becomes irreversible. The scale and scope of an issue also needs to be considered because the boundaries of natural resource management problems – typically a catchment or bioregion – do not necessarily align with data collection frames or the jurisdiction of individuals, industries or governments. For example, water quality is best understood on a catchment basis rather than an industry basis, while many economic issues – such as employment – are best understood from state or national levels.

While there are many factors influencing ESD outcomes, and the set of possible indicators is extensive, it will be important to limit the number of indicators to a manageable level. This will involve identifying the information needs of the major users – in the case of *Signposts* these are likely to be industry and government. The information needs of industry and government are likely to differ to some extent. On the one hand, industry is likely to be more concerned with communicating its contribution to economic, social and environmental well-being. In this case, a broader set of information describing trends in the size and nature of an industry would be appropriate. Policy makers, on the other hand, will require targeted information that will help them in the first instance identify whether an ESD problem exists, and secondly, to identify whether policies introduced to address ESD problems are having desired outcomes. In the context of ESD, the case for government intervention primarily rests on the existence of market failures associated with resource use. Under these circumstances, market forces are unlikely to lead to socially optimal or economically efficient outcomes (Productivity Commission 1999). While an ESD indicator (eg declining productivity, profitability or resource condition) may flag a potential market failure, this alone is not sufficient to warrant government intervention. ESD indicators should be used as triggers for further analysis, and are no substitute for research into the causes of changes in ESD indicators (that is, is it due to market failure or not), or a detailed analysis of the costs and benefits of intervention. The fact that policy making frequently involves consideration of factors that are not easily measured does not negate the need to consider quantified costs and benefits, where data are available, in combination with supporting qualitative information. Should policies be designed without this type of information, the probability of policy failure – where policy intervention leads to a net loss in social welfare – is increased.

It should be noted that in the context of *Signposts*, the aim is to provide a set of indicators that meet the needs of both industry and government without becoming unwieldy. Consequently, applying some criteria for prioritising indicators will help avoid the set of indicators becoming too large.

Identifying desirable indicators

What are the characteristics of a good indicator? Essentially, a good indicator should be focused and unambiguous. The most useful indicators will be those related to identifiable policies or outcomes. A small number of indicators directly related to the impacts agriculture has on economic, social and environmental outcomes will help prevent ambiguous interpretation. For example, the number of farm accidents can be used as a direct measure of agriculture's contribution to a community's health, whereas the number of visits to a doctor – also a measure of a community's health – cannot be directly ascribed to agriculture.

Indicators should also be unambiguous in defining whether outcomes are desirable at different scales (that is, taking account of spatial and temporal dimensions). For example, a decline in local population may not be desirable at a regional level, but when viewed at a state or national level it might reflect a reallocation to employment opportunities elsewhere. This indicator therefore fails the ambiguity test. In contrast, an improvement in regional biodiversity is unambiguously good at both regional and national scales when judged in the context of an environmental indicator. Whether this improvement is good in terms of improving social welfare will require further analysis, however, as a substantial cost may have been incurred in realising this improvement.

Given the interrelated nature of economic, social and environmental outcomes, it is not feasible to produce a range of measures that do not overlap across outcomes. For example, economic and environmental indicators might both reflect the productive capacity of land and also provide useful information on specific issues – such as contribution to economic wealth versus contribution to land degradation. The primary focus should be on developing a set of indicators that can be used to effectively inform decision making processes.

Box 2 contains a set of criteria that can be used as a filter to identify desirable indicators. Even where indicators meet the majority of these criteria, however, some interpretation is likely to be required. For example, *farm land value* – a measure of the value of the natural resource base used in agricultural production – meets the first criteria in that it reflects the direct contribution of agriculture to wealth at national, state, industry and regional levels. The productive capacity of agricultural land is a major factor contributing to farm land values. However, there are likely to be other influences that would need to be considered – for example, increased demand for land for nonagricultural purposes (such as rural-urban subdivision) can contribute to higher land values.

Box 2: Criteria for identifying desirable indicators

1. Indicators should be related to identifiable policies or actions.
2. Indicators should be directly related to the impacts of agriculture on outcomes.
3. Influences of factors other than agriculture on the indicator should be minimal.
4. Indicators should be unambiguous, clearly indicating movement toward (or away) from desirable outcomes.
5. Indicators should be able to be interpreted in context of appropriate scales and coverage.
6. Indicators should not be difficult or costly to measure using data of appropriate quality, availability and reliability.

7. Indicators should be sensitive to measuring change across appropriate time dimensions and should be able to monitor change across locations and industries.
8. Indicators should be amenable to predicting outcomes.

Information on economic outcomes

The three main economic measures that provide some indication of the contribution of agriculture to sustainable development include wealth, income and productivity. A set of indicators for economic outcomes are outlined in box 3.

Productivity is the preferred measure as it captures the link between income and assets (including natural, physical, financial, human and social assets), and describes the relationship between the output of goods and services and the inputs of resources used to produce them. Productivity is usually measured as a ratio of changes in inputs to changes in outputs using index numbers. Total factor productivity (TFP) indexes have been produced by ABARE (Knopke et al 1995) to show growth in productivity in various agricultural industries.

TFP has an advantage over other economic measures in that it avoids the confounding impacts of changes in commodity prices. Declining TFP or low rates of TFP growth will warrant further investigation. In a heavily traded sector such as agriculture, ideally TFP data would be available for both domestic and international agricultural production. An increase in Australia's TFP relative to international producers would indicate an increase in Australia's international competitiveness, and hence economic sustainability. Given the differences in techniques used to measure TFP internationally, however, it is not always possible to directly compare TFP indicators.

Income is also a useful measure of the contribution of agriculture to sustainable development. For the purposes of defining an economic indicator, income is narrowly defined here as financial income and measures the net returns generated from a given mix of natural, physical, financial, human and social assets. In the context of agriculture, it is the income derived from agricultural activities that is of interest. *Farm business profit* is a measure of returns to farming activities, and takes into account the consumption of capital in the production process. This figure is net of unpaid family labour and paid farm labour (unfortunately the ABS does not produce data on the returns to farm labour.) In measuring agriculture's contribution to sustainability, income indicators should be net of government transfers such as subsidies and welfare payments. Since income measures – such as farm business profit – are sensitive to changes in commodity prices, it will be important for analysts to take this into account when interpreting changes. For example, changes in income due to short term fluctuations in commodity prices will not indicate a viability problem in the long term, whereas declining returns due to declining productivity may indicate a problem.

The final economic indicator considered in this analysis is wealth. Wealth is a dollar measure of the value of natural, physical, financial and human assets that yield or have the potential to yield income. As with income, wealth is narrowly defined here as financial wealth. Perhaps the best indicator of wealth in the context of agriculture is the value of farm land. Farm land value is a dollar measure of the natural resource base used for agriculture, and is a reflection of the capitalised returns to agricultural activities. Changes in land value may indicate a change in the productivity of the natural resource base, and hence expected future returns. As alluded to in the previous section,

however, changes in land values can be unrelated to expected returns from agricultural activities, and be influenced by factors such as proximity to towns or cities.

Box 3: Economic indicators

Productivity

Total factor productivity

Total factor productivity is a relative measure of total farm output to total input use, expressed using indexes.

Desirable outcome: An increase in total factor productivity reflects gains in farm incomes from adopting new technologies and better farming methods.

Level or reporting: National, state, industry, region.

Current availability: Total factor productivity estimates are available for the period 1989-90 to 2003-04 for the broadacre and dairy industries covered in ABARE's farm surveys (that is, wheat and other crops, mixed livestock-crops, sheep, beef, sheep-beef and dairy). Industries for which data are not available include cotton, sugar and horticulture.

Source: ABARE Farm Surveys.

Income

Farm business profit

Choosing an income indicator depends, in part, on the intended purpose of the indicator. Two related measures are net value of agricultural production (aggregate farm business gross revenue generated from the production of agricultural goods minus production costs) and farm business profit (an average per farm measure of farm business cash receipts minus cash costs, plus buildup in trading stocks, minus depreciation and unpaid family labour). Net value of production is an appropriate measure if the requirement is to measure the contribution of agriculture to national income, while farm business profit is a more appropriate measure for monitoring change over time using actual farm data. An advantage of farm business profit is the existence of a consistent dataset covering major broadacre and dairy industries since 1977-78. Net value of production is not available for individual industries.

Desirable outcome: Rising farm business profit.

Level of reporting: National, state, industry, region.

Current availability: Farm business profit estimates are available for the period 1977-78 to 2004-05 for the broadacre and dairy industries covered in ABARE's farm surveys (that is, wheat and other crops, mixed livestock-crops, sheep, beef, sheep-beef and dairy). Industries for which data are not available include cotton, sugar and horticulture.

Source: ABARE Farm Surveys.

Wealth

Farm land value

Farm land value provides a dollar measure of the natural resource base used in agricultural production.

Desirable outcome: Rising farm land value per ha.

Level of reporting: National, state, or industry.

Current availability: Farm land value estimates are available for the period 1977-78 to 2004-05 for the broadacre and dairy industries covered in ABARE's farm surveys (that is, wheat and other crops, mixed livestock-crops, sheep, beef, sheep-beef and

dairy). Industries for which data are not available include cotton, sugar and horticulture.

Source: ABARE Farm Surveys.

Information on social outcomes

Social outcomes are those arrangements for everyday life that are influenced by social structures and networks, as well as by economic and environmental factors. These outcomes may be described as contributing to 'quality of life'. Broadly, information on social outcomes can be captured by the concepts of human capital and social capital.

Information on human and social capital is harder to define and measure than economic and environmental information. Social capital does reduce transactions and enforcement costs of individual rights in a society. While these are measurable, to some extent, they are not unique to agriculture. The type of social information that is important and how to interpret that information will most likely differ among communities and individuals and the nature of information required will differ according to particular circumstances. Also, clearly identifying the contribution of agriculture to human and social capital is likely to be difficult because of the numerous influences at work. For example, employment is affected by developments in the whole economy, not just by changes in a region's agriculture.

Various published definitions of human capital refer to qualities embedded in individuals, such as knowledge, skills and health. Health reflects the ability of individuals to contribute to society, including contributions to social structures or economic activities. Participation in these activities may affect or may be affected by an individual's mental and physical health. Indicators such as 'number of farm accidents' can be a useful measure of agriculture's contribution to health in a community.

Education and training provide an individual with the capacity to participate in a wide range of social and economic activities. Education also equips people to better adapt to changes in the economic or biophysical environment. For example, the proportion of a given population – such as the farmers in a region or industry – that has attained certain levels of formal education provide an indication of the likelihood that education is contributing to a community's well-being. Participation in less formal training activities such as seminars and workshops may also provide an indication of education. However, such measures may be difficult to interpret because of potential inconsistencies in the quality of such activities.

In comparison, social capital is inclusive of a number of concepts such as the network of institutions, relationships, attitudes and norms that govern interactions among people. There is no internationally agreed framework of what constitutes social capital, how it accumulates in society, the impacts on communities and individuals, or how to measure the various elements and dimensions of social capital (ABS 2004). Consideration of social capital, then, is best interpreted in the context of a particular issue or desired outcome rather than as a set of indicators. In light of these concerns, agricultural employment data may provide some broad indication of the contribution of agriculture to social capital. However, this indicator is likely to be of little use to policy makers. Employment

fails the ambiguity test at different scales. For example, reduced employment within a region may be due to better employment prospects in other regions, or increased farm productivity.

Box 4: Social indicators

Human capital

Number of farm accidents

A measure of the number of reported OH&S incidents occurring on Australian farms.

Desirable outcome: Declining number of farm accidents.

Level of reporting: National, state, industry.

Current availability: Data are available by industry from 1994-95 to 2002-03.

Source: National Occupational Health and Safety Commission.

Level of education and training

A measure of the education level attained by people employed in a defined industry or geographic area.

Desirable outcome: Increasing proportion of participants with higher education levels.

Level of reporting: National, state, industry.

Current availability: ABARE survey data includes education level of survey cooperators for broadacre and dairy industries. Education levels of other farm workers are not included.

Source: ABARE Farm Surveys.

Social capital

Employment

A measure of the number of people that are employed in a defined industry or region.

Desirable outcome: Rising employment or Not applicable

Level of reporting: National, state, industry, region.

Current availability: Data are available by industry from 1985-86 to 2002-03.

Source: Australian Bureau of Statistics.

4. Conclusion

Over recent decades business and industry have come under increasing pressure to demonstrate their contributions to ecologically sustainable development. The National Land and Water Resources Audit's project *Signposts for Australian Agriculture* is aimed at developing and implementing a framework for reporting the contribution of agriculture to ecologically sustainable development in Australia.

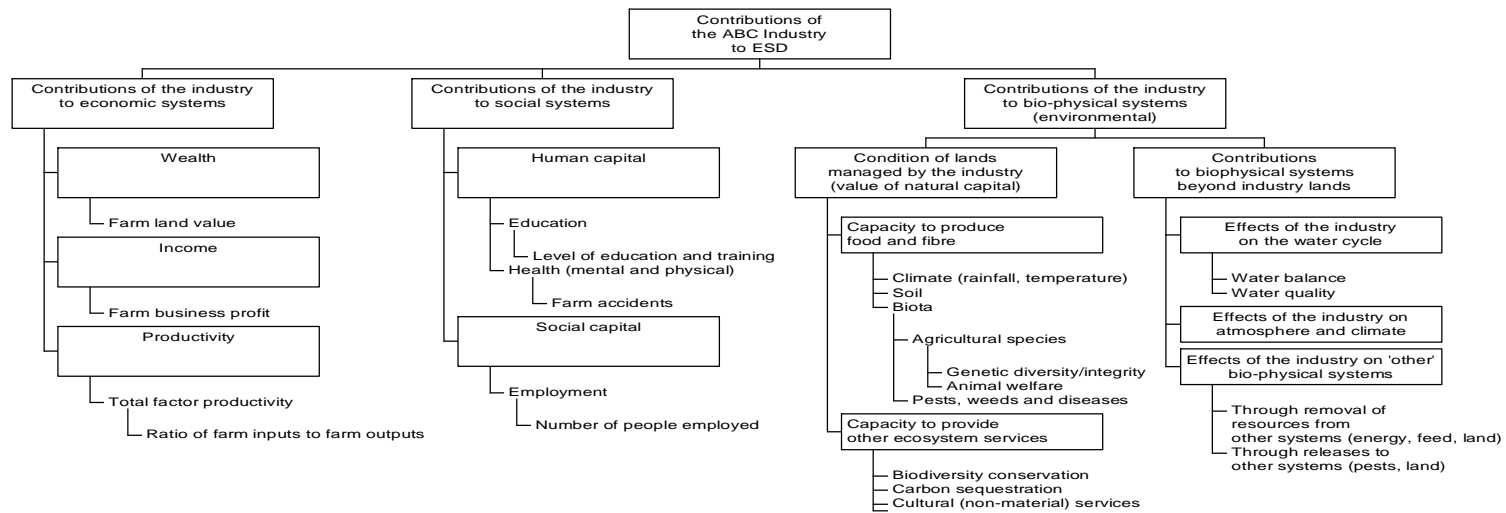
The key principles underlying ecologically sustainable development include a) consideration of future generations and maintenance of ecological processes, and b) balancing economic, social and environmental outcomes to meet the needs of current and future generations. Given the often conflicting nature of these outcomes, achieving this balance is likely to involve significant tradeoffs. Unfortunately, the mix of market and non market values being traded off are not amenable to aggregation, hence it is not possible to get a single measure of the impact of the contribution of agriculture to ESD. It may be possible, however, to identify agriculture's contribution to each component of ESD – that is, to the economic, social and biophysical systems that comprise ESD. For these individual indicators to be useful, however, they will need to be focused and unambiguous. This will mean confining these indicators to those related to identifiable policies or actions and allowing measurement of impacts directly related to agriculture. Applying these two filters significantly reduces the list of potentially useful indicators.

The direct contribution of agriculture to economic outcomes can be measured using indicators of wealth, income and productivity. These indicators also provide links between economic outcomes, social constructs and the physical environment. In defining information on environmental outcomes, consideration needs to be given to the way in which humans use and value natural resources and the impacts agricultural uses have on those resources.

Social outcomes are those arrangements for everyday life that are influenced by social structures and networks, as well as by economic and environmental factors. However, social capital does not easily lend itself to definition by a set of indicators and is best interpreted in the context of a particular issue or desired outcome. Social capital does reduce transactions and enforcement costs of individual rights in a society. While these are measurable, to some extent, they are not unique to agriculture. Some broad indicators that can be directly related to the impacts of agriculture on human and social capital include health and education.

Finally, indicators should not be considered in isolation. They are not a substitute for detailed analysis of the costs and benefits of specific policies, but can usefully provide a trigger for further research.

Appendix A Signposts for Australian agriculture



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