



Cooperative Research Centre for Sustainable Rice Production



SCOPING OUT A SOCIO-ECONOMIC RESEARCH AGENDA FOR THE COOPERATIVE RESEARCH CENTRE FOR SUSTAINABLE RICE PRODUCTION

Barbara Chambers, John Spriggs,
Tony Dunn

Rice CRC Final Report PR5202FR09-01



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SCOPING OUT A SOCIO-ECONOMIC RESEARCH AGENDA FOR THE CO-OPERATIVE RESEARCH CENTRE FOR SUSTAINABLE RICE PRODUCTION

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In May, 2000 the Co-operative Research Centre for Sustainable Rice Production (henceforth called the Rice CRC) commissioned Professor John Spriggs and Mr Tony Dunn from Charles Sturt University to write a paper called Scoping out a Socio-economic Research Agenda. By 'socio-economic' research, we mean the study of social and economic effects of policy decisions recognising that policy affects people's way of life, their cultural traditions, their community and their standard and quality of life. The project was based on at least two assumptions. The first was that existing programs do not embrace a systems view of the rice industry, a significant omission given that the CRC is concerned with economic and social sustainability of rice farming in the irrigation areas. The second was that existing programs do not adequately involve producers in the change process required to respond to socio-economic challenges, especially technical research projects

The methodology was to develop a research framework and then use this framework as a basis for constructing the research agenda. We approached the task of building a research framework in four stages. First of all, we built an initial tentative framework from an initial meeting of the Socio-economic Committee of the Rice CRC. Second, we conducted an extensive literature search, including existing research reports and web-based data. Third, we undertook a number of semi-structured interviews with key informants. Finally, we revisited the initial tentative framework and modified it as dictated by the results of the literature search and interviews. The modified framework was then to be used to determine a proposed research agenda for the Rice CRC.

The modified framework contained four components: (i) drivers for change; (ii) changes in technology and the institutional arrangements; (iii) socio-economic effects of changes on the irrigated rice system and the subsequent response; and (iv) flow-on socio-economic effects outside the irrigated rice system and the subsequent response. The four components were linked both linearly (from (i) to (iv)) and in a feedback loop [see Figure 2 of the Final Report]. Because of these links, any and all components could lead to socio-economic effects. Hence, a complete socio-economic research agenda should pay attention to all four components. Section 5 of the Final Report examines each of the four components of the research framework and discusses the nature of research, which may be undertaken under each one.

Final Report

Prepared by

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March, 2001

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PART 1: SCOPING OUT A SOCIO-ECONOMIC RESEARCH AGENDA

1 INTRODUCTION

In May, 2000 the Co-operative Research Centre for Sustainable Rice Production (henceforth called the Rice CRC) commissioned Professor John Spriggs and Mr Tony Dunn from Charles Sturt University to write a paper called Scoping out a Socio-economic Research Agenda. In June 2000, Associate Professor Barbara Chambers, Director of the Institute for Regional Community Development at the University of Canberra was selected as a Research Associate for the project. The project was based on at least two assumptions. The first was that existing programs do not embrace a systems view of the rice industry, a significant omission given that the CRC is concerned with economic and social sustainability of rice farming in the irrigation areas. The second was that existing programs do not adequately involve producers in the change process required to respond to socio-economic challenges, especially technical research projects (Committee on Socio-economic Issues in the Rice Industry, CSU, December 14, 1999). In a philosophical sense, the dominance of scientific research has meant that the human dimension has often been ignored. A myth is perpetuated that facts and logical thinking will lead to changes in behaviour. But it is people that make decisions about how they will act, how they will respond to change and it is often attitudes and values that affect practice, not information per se. Socio-economic research attempts to address these dimensions, where there is a recognition that the affective (feelings and emotions) is at least as important as the cognitive (thinking) domain when people make important life decisions, such as in producer responses to market forces, salination, water reform and land use.

In this context, 'socio-economic' research refers to the study of social and economic effects of policy decisions on people and communities. Changes in policy affect people's way of life, their cultural traditions, their community and their standard and quality of life. With this in mind, the aim of the current project is to focus on policy as it relates to irrigated agriculture in rice-growing areas of eastern Australia and hence to define a socio-economic research agenda for the Rice CRC.

Our methodology is to develop a research framework and then use this framework as a basis for constructing the research agenda. We approached the task of building a research framework in four stages. First of all, we built an initial tentative framework from an initial meeting of the Socio-economic Committee of the Rice CRC. Second, we conducted an extensive literature search, including existing research reports and web-based data. Third, we undertook a number of semi-structured interviews with key informants. Finally, we revisited the initial tentative framework and modified it as dictated by the results of the literature search and interviews. The modified framework was then to be used to determine a proposed research agenda for the Rice CRC.

2 INITIAL TENTATIVE FRAMEWORK

It is possible to envisage the rice industry as a socio-economic system (that is, a network of relations) consisting of a number of players including rice producers, their families, the Ricegrowers' Co-operative Limited, the Ricegrowers Association, the Co-operative Research

Centre for Sustainable Rice Production (Rice CRC), CSIRO and NSW Agriculture. The rice system includes farm production, storage, processing and marketing. The elements of this system interact with each other and the broader community (economic/political/physical/social) or what some people term the external environment. For example, the rice system interacts with the broader community to create other economic activity and jobs (think of towns like Griffith and Leeton in the Riverina), but at the same time has created environmental and political concerns in NSW and the Murray Darling Basin.

The interactions of the rice system with its environment lead to two types of socio-economic effects:

- (1) The socio-economic effects of the environment on the various elements of the rice system;
- (2) The socio-economic effects of the rice system on the external environment.

With respect to (1), the external environment poses a number of challenges (threats and opportunities) to producers and other participants of the rice industry. In particular, these include:

- growing public concern about the adverse environmental impacts of irrigation
- questions about the pricing of irrigation water
- questions about the single-desk selling of rice.

With respect to (2), the irrigated rice sector may affect the external environment through:

- economic multiplier effects on the surrounding communities and
- environmental impacts of irrigation including issues of sustainability.

A simple schematic of this might look like Figure 1 below.

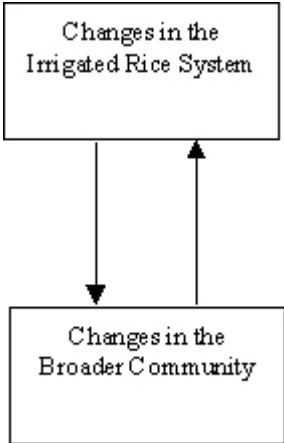


FIGURE 1: SCHEMATIC OF THE INITIAL TENTATIVE FRAMEWORK

We proposed this as our initial tentative framework. This framework suggests three types of socio-economic impacts are potentially important: (a) the impacts of the rice system on the broader community; (b) the impacts of the broader community on the rice system; and (c) the feedback effects of the impacts in (a) and (b). The long-term structure (and hence

sustainability) of the irrigated rice sector could be affected by any or all of these three types of impacts. Hence, our initial tentative framework would suggest a socio-economic research agenda that focused on these three types of impacts. However, we did not want to develop a research agenda at this stage. Rather, we undertook the literature search and then semi-structured interviews, which were used to help inform the appropriate research framework. In Section 3 below, we discuss the nature of the literature and the interviews. In Section 4 we analyse the results of the literature and the interviews. In this Section, we examine the literature and interviews in connection with the initial tentative framework and so developed a modified framework. In Section 5, the modified framework is used as the basis for developing the research agenda.

3. NATURE OF THE LITERATURE AND INTERVIEWS

The purpose of this stage of the project is to gather information relevant to the study. Key terms are contained in a Glossary in Appendix A. Gathering information involved a literature search as well as interviews with key informants in the industry (see Appendix B). The literature search focused on socio-economic research but within a context of irrigated agriculture. An annotated bibliography of key readings is contained in Part 2 of the report. This is intended not only as input into our framework for a socio-economic research agenda, but also to directly contribute to the knowledge base of decision makers in the Rice CRC. A synthesis of the literature appears in Section 3(a) below.

Key informants were initially identified through the literature. Key informants are knowledgeable and articulate people whose insights help the researcher with their observations and often an insider understanding of the research situation (Patton, 1990:263-4). A process of snowballing was used to select further informants for interview. Snowballing is a technique that requires each person interviewed to nominate significant others in the field who may be useful to the field of inquiry. People were either interviewed face-to-face or emailed for their comments. A list of respondents who were key informants is contained in Appendix B. From July to December 2000, each interviewee was asked four questions as part of a semi-structured interview. Prior to the interview, interviewees were asked if they agreed to their responses being attributed to them. For those who didn't, their perspectives have been incorporated into the analysis (Section 4) but without attribution.

Interview questions were formulated around four basic questions derived from the objectives set for the project:

- What is the most important research currently being undertaken or recently produced in the area of socio-economic change related to irrigated farming areas?
- What are the socio-economic research priorities for the future surrounding irrigated farming, especially rice? (Probe: If you had a wish list of the type of research that could be carried out immediately, what would it consist of?)
- Who else would you identify as key researchers that we ought to contact who are working in this area?
- Are there any other comments you wish to make about irrigated farming?

A synthesis of the responses to these four questions is presented in Section 3(b) below.

3.1 Synthesis of the Literature

3.1.1 The socio-economic effects of the environment on the various elements of the rice system

Changes to water regulations are undoubtedly the single biggest socio-economic effect on the various elements of the rice system (see Appendix C). There is a tension evident in the various reforms between efficient allocation of water for production and the need for environmental sustainability. NSW has the largest irrigation industry in Australia, and the challenge it faces is to create a legislative framework that allocates water efficiently while simultaneously recognising the legitimate claims of the environment to this precious resource (Crase, Dollery and O'Reilly, 2000). Cullen (1999) states that unsustainable land management practices are causing degradation of our land and waterways, and this leads to loss of biodiversity. As Beare, Bell and Fisher (1998) state, there are growing economic, social and environmental pressures for water reform, stemming from the perception that existing institutional and regulatory arrangements have led to inefficient allocation of resources to production and inadequate conservation of the environment. Cullen (1999) argues that the classification of water rights based on separation from land rights will accelerate this readjustment and provide a basis for water trading.

Bjornlund and McKay (1999) argue that water markets play a major role in the ongoing changes taking place in the irrigation industry. Some of the consequences of a water trade are that water has moved to more efficient and higher value properties, resulting in a more efficient use of this valuable resource. Trade in water appears to have divided the irrigation community into two groups: large family properties relying on outside labour and a group of smaller family farms relying on off farm income. There are also different effects on irrigated farming communities compared with dry land farming communities. In the former there appears to be a change in the composition of the rural population, with lifestyle farmers able to buy or sell small quantities of water to either maximise their lifestyle benefits or conversely to help finance the purchase of their property. In the latter, changes to water markets leads to a less productive and viable rural community. Bjornlund and McKay (1999) also caution that water markets can have other potential negative impacts, with some irrigators in the Murray-Goulburn Irrigation District in Victoria selling the water that their existing production is dependent on. This raises questions about the long-term viability of these properties. Crase, Dollery and O'Reilly (2000) also signal the possibility of negative impacts, such as excessive transaction and transfer costs, hoarding behaviour and speculation in the market, and cultural attitudes that limit market participation. From a wider perspective, Cummings (2000) states that in essence, the debate is apparently driven by state-based water reform and the development of 'integrated basin management', which crosses state boundaries. The two key issues appear to be water entitlements and institutional issues. Limiting farmers' rights to use water flowing across private land and to prevent the construction of irrigation dams in upper catchments, has been received negatively by many irrigation farmers (Hilton, 2000).

Another aspect of the socio-economic effects of the external environment on the rice industry is the impact of globalisation. Mergers, take-overs and strategic alliances have created giant agribusinesses with considerable purchasing power, as a result the buyer is now dictating the price to the seller as never before. World-wide farmer's debts are increasing while their incomes are decreasing. The disproportionately high rate of suicides in rural areas is one of the worrying indicators of the impact of social change in rural communities (Halweil, 2000). Some farmers believe that the rapid policy and regulatory changes meant that they had no time to

negotiate claims of compensation for giving up or transferring valuable water rights (Hodge and Saunders, 2000). The government instead put money into addressing salinity problems in the 20 most degraded water catchment regions, but the Australian Conservation Foundation and the National Farmers Federation believe the \$1.5 billion in funds over the next five years is not nearly enough. They put the cost at 65 billion over the next ten years (Hodge and Saunders, 2000).

3.1.2 The socio-economic effects of the rice system on the external environment

It has been proposed that the irrigated rice sector may affect the external environment through economic multiplier effects on the surrounding communities and through environmental impacts of irrigation, including issues of sustainability. Rising water tables and leaky soils are major threats to the sustainability of irrigated agriculture. Humphreys et al (1998) argue that future sustainability will depend on the ability of each farmer to choose paddock-crop irrigation management combinations that control the impacts on water tables on their farms.

There are very few thorough social and economic impact studies done. Bodington and Syme (1989) undertook a survey "aimed to establish the current significance of the role of social impact assessment within the water planning and decision making process and whether this significance was likely to change in the future" (p.vi). The authors concluded that there was a great deal of social evaluation being conducted, but little guidance provided on the conduct of social impact assessment and a blurring of the distinction between public participation and social impact assessment. This study was a forerunner to the Social Impact Guidelines for River, Groundwater and Water Management Committees, produced by the Independent Advisory Committee on Socio-economic Analysis (1998). The guidelines provided are clear, involving a ten step plan, on-going support, provision of updated information and 'skilling-up' committee members. However, key informants believe there are insufficient resources to provide such support and much of it goes into the hands of independent consultants rather than building social capital in communities. Some of the questions posed in assessing community well-being are extremely complex and perhaps beyond the capacity of individual committee members to research.

The studies most often quoted are Powell's et al.(1985) study on The Economic Impact of Irrigated Agriculture in NSW and Jayasuriya's and Crean's (2000) study of The on-farm impacts of environmental flow rules in the Murrumbidgee Valley. Powell's study is sixteen years old but it is viewed as a benchmark for estimation of multipliers arising from irrigation farming. Jayasuriya and Crean used a combination of linear programming and hydrology simulation modeling to assess the impacts of different flow scenarios as identified by the MRMC. The importance of irrigated agriculture in the Murrumbidgee Valley is underpinned by its total value in 1995-96 of \$414 million. "Irrigated agriculture represent around 30 per cent of the total value of production and is a significant contributor to the regional economy of the Murrumbidgee Valley. Powell et al.(1985:3) found that irrigated agriculture and its flow-on effects within these areas contributed approximately 25-30 per cent of regional output, income and employment." If the two studies were updated and incorporated the social dimensions of impacts, as well as the importance of context specific case-studies, we would have a much clearer picture of the socio-economic impacts of the rice system on the larger environment.

3.2 Synthesis of the Interviews

The responses to the four questions used as a basis for the interviews are discussed in turn in the next four sub-sections.

3.2.1 What is the most important research currently being undertaken or recently produced in the area of socio-economic change related to irrigated farming areas?

Dr Mark Fenton's (Director of EBC) response was this: "I don't want to sound narrow minded but I only know of our work in Queensland". His work in Queensland investigates social and economic impacts associated with water allocation and use in several water catchments over the last three years. This work is essentially based on the TRC-analysis framework and has been applied in the Barron, Condamine-Balonne, Burnett and Logan water catchments in Queensland. Much of the focus of this work has been on irrigated farming areas and specifically the impacts of changes in water allocation and use on farming properties themselves and dependent rural communities.

Laurie Lewin discussed the issue of ecological sustainability by describing the make-up and progress of the RGA Environmental Subcommittee, indicating that while a start has been made, further action is needed. He later returned to this theme by including an over-dependence on rice and associated salinity problems as threats to the industry. Others saw the RGA initiative as being a source of important research. However, the RGA was also seen as potentially being held back by its role as "the good advocate".

Matt Linnegar, who is leading the RGA initiative, referred to social ecology studies conducted by Hawkesbury Agricultural College (David Russell) and the Australian Rural Leadership Program (Mike Beckingridge) as worthwhile projects. The issue of sustainability and the environment were raised and often linked. He stated "Sustainability is okay at the macro level but how can it be researched at the micro level?"

Papers such as the Land and Water Management Plans were identified as sources of important research. However, these were seen as having some limitations: namely their emphasis on economic and gross margin modelling, but with little social emphasis.

Many of the comments on sustainability raised the issue of water usage in one form or another. Various projects were mentioned including the design of viable water trading arrangements, an investigation of the social and economic impacts associated with water allocation and use in several water catchments in Queensland, the socioeconomic impact of environmental flows, the high volume of water used in rice farming, the impact of water trading on rice farming, changes in water laws and the separation of water from land. One specific study cited was the "Socio-economic Impact of Environmental Flows," which was commissioned by the Murrumbidgee River Management Committee.

3.2.2 What are the research priorities for the future surrounding irrigated farming, especially rice? (If you had a wish-list of the type of research that could be carried out immediately, what would it consist of?)

Some respondents stated simply that more socio-economic research is required, with the emphasis on the social aspect. For instance Peter Cullen stated, "In the recent past the CRC's were 'forbidden' to do socio-economic research." More than one interviewee mentioned the importance of the 'triple bottom line'. Laurie Lewin stated, "People are at the centre of the equation." Matt Linnegar stated that often "the trouble with socio-economic is that it's only economic!" He cites studies by the DLWC and NSW Agriculture (for the Murrumbidgee Management Committee) as examples. According to Peter Cullen the best way to determine needs for future research is to get key industry leaders sitting around the table to identify areas of need, keeping in mind institutional arrangements and engaging in scenario building. He feels it is important for the information to come from industry not from literature.

Ongoing research into water issues was also a concern, ranging from general issues to more specific questions such as "Will rice remain viable in a water trading environment?" One interesting question was raised by Mark Fenton who asked "How do we quantify or define the social and economic dependence of rural communities on the water used by irrigated farms in rural areas?" Phil Eberbach would like there to be consideration of the socio-economic impact when water is not available for farming.

Farmer characteristics and farming styles were a third area of research discussed. In particular how these elements affect farmers' ability to adjust to change and adopt new farming practices. Frank Vanclay is doing significant work in this area. The rural drift to cities was another issue put forward for consideration, one that is apparently being investigated by the Murray Region of Councils. Connected with this, Dr Mark Fenton listed three research questions:

- What relationships exist between farm and farmer characteristics and current irrigation practices.
- Are we able to identify those characteristics of farms and farmers that are at least reasonable indicators or predictors of their capacity to change current farming/irrigation practices to more sustainable practices.
- How do we quantify or define the social and economic dependence of rural communities on the water used by irrigated farms in rural areas.

Matt Linnegar stated that a committee of rice leaders identified two major issues. These were "to understand the industry's ecological footprint" and "growing criticism of the industry". One response was to produce a "PR" booklet called "Rice for Life". However, in Linnegar's view, this was an inadequate "knee-jerk reaction" when what was required was a need to understand and improve the industry's image. Presumably this would involve research into these two issues. Mark Bramston also followed up the ecological issue by suggesting that more biodiversity work ("how rice is affecting land") needed to be done. Peter Cullen was also concerned with ecological issues in the generic form of 'natural resources' yet he acknowledged that salinity was the big ticket issue and hoped it could be used as a Trojan horse for the inclusion of natural resources in the national agenda. He echoed Matt Linnegar's statement by stating that one "must reduce the footprints of agriculture". He believes that these are largely downstream and due to either farming the wrong land or through poor farm management. He

also stated that farms that fix environmental issues get better production and that most farmers are not irresponsible or vandals, rather they want to know ways to go forward environmentally.

Peter Cullen also stressed the importance of assisting industry partners to develop knowledge strategies. One example mentioned was to facilitate the water authority in mapping the outcomes if a bug got into the system, as in the case of the cryptosporidiosis outbreak in Sydney. He believed researchers should assist farmers map out potential problems is a potential area for research. He identified a seven-step list for the development of knowledge strategies:

1. Knowledge is required.
2. Who needs it?
3. In what form?
4. Where can I get it?
5. What are the costs/risks of not having it?
6. Track emerging technologies.
7. Need to be able to pick up emerging issues

Peter Cullen also expressed his views on the way research is reported back to industry partners and the specific needs of such people. He found that they:

- Don't care for plain English reports of research.
- Want instant access to 1-2 page overview of all research
- Are very busy
- Are very distrustful
- Want a credible source with up-to-date information
- Can't articulate what they need. On the other hand researchers think they know what is needed.

To help meet these needs and bring together the various stakeholders in an appreciation of all viewpoints, Peter Cullen suggested that positions of knowledge brokers be created to work with researchers and industry partners to formulate research projects and implement results. This is in line with Senge's *The fifth discipline* (1993), whereby each player is encouraged to appreciate other viewpoints and see beyond their own mental models.

The issue of communities' perception of rice growing, particularly the view that rice growing uses too many resources, was raised by Phil Eberbach with the proviso that consumers should change their views because "city people also concentrate nutrients." He also stated his belief that socio-economic issues are driven by the environmental imperative.

Laurie Lewin discussed the area of threats to the rice industry. Many of his points relate to difficulties with the supply of water, including changes to water allocation and the uncertainty of how much of that allocation can be released in any one-year and the development of salinity. He also mentioned the difficulty some farmers have in finding an alternative crop. Finally, Warren Muirhead of Coleambally Irrigation Co-operative spoke of the general importance of industry funded research and the ethical considerations including copyright, intellectual capital and ownership of research.

3.2.3 Who else would you identify as key researchers that we ought to contact or read who are working in this area?

The interviewees also mentioned people whose work was cited in the literature review. The names listed below are those who had been mentioned more than once by interviewees:

Mark Fenton

Rapid Rural Appraisal by Tony Dunn and Liz Humphreys

Meredith Hope

Rice Growers' Co-operative Limited

Roy Powell

Warren Muirhead

Kath Bowmer

3.2.4 Are there any other comments you would like to make?

Often the politics of research were discussed either at this point or throughout the earlier questions. One respondent believed that government research money would be better spent in universities than on CSIRO. Similarly, Mark Bramston stated that industry priorities for research are often different to government priorities, yet much research is government funded hence industry needs to fund its own research in order to enter into dialogue with government findings. Yet another, Laurie Lewin, reported an instance where the Murrumbidgee River Management Committee found itself in conflict with the State Government over the setting of environmental flows and the government won the day. Others spoke of specific government bodies noting that COAG allowed water trade and MDBC developed a water cap. Phil Eberbach is of the view that the Government has absolved itself of the task of making policy by devolving this to the community level, for example Victoria has stipulated that each valley will run itself from community reference committees. He also noted that the Victorian government policy runs for ten years where farmers would prefer fifteen years which is the time-frame provided by the new NSW Water Management Bill. Peter Cullen views institutions as part of the problem in that they have let to the current mess, yet they also hold the key to the future and he would like to see the development of a Natural Resources Council that crosses over federal, state and local boundaries.

Finding an appropriate research process is an important aspect of any research project, industry representatives and researchers don't have a very good history of working well together, similar difficulties occur across disciplines. To address these concerns Peter Cullen turns to facilitators that he calls knowledge brokers, who have appropriate backgrounds and are situated close to industry partners and hence are respected by both researchers and industry partners.

Matt Linnegar gave a detailed account of the structure and activities of the RGA and RIRDC in relation to domestic and overseas rice growing issues. He mentioned the industry's strong desire to remain as chemical free and possible and to have no GMO's. He felt that the environment was becoming the biggest driver, displacing economics in importance. Consumers now demand evidence of environmental credentials. He also discussed industry dynamics in relation to issues of deregulation.

Eberbach saw rice growers being caught in a dilemma where they wish to diversify, yet this is very difficult for them to achieve as they are locked into flood irrigation. The greatest risk to the industry is low rice prices brought on in part by falling commodity prices.

4. ANALYSIS OF THE LITERATURE AND INTERVIEWS

An analysis of the literature and interviews revealed some significant deficiencies in our initial, tentative framework for socio-economic research. Firstly, the broader community is far from a single homogeneous entity. For example, one part of the broader community, the general public (through the political system), may have the most significant impact on the rice system, while another part of the broader community (e.g. rural communities adjacent to the irrigation area) may be most affected by changes to the irrigated rice system. To clarify this distinction, it is useful to replace "broader community" with factors leading to change in the rice system (i.e. external drivers of change and changes in technology and the institutional arrangements) and factors leading to external effects of changes in the rice system (i.e. off-farm effects). Thus, our initial tentative framework is modified to that represented in Figure 2.

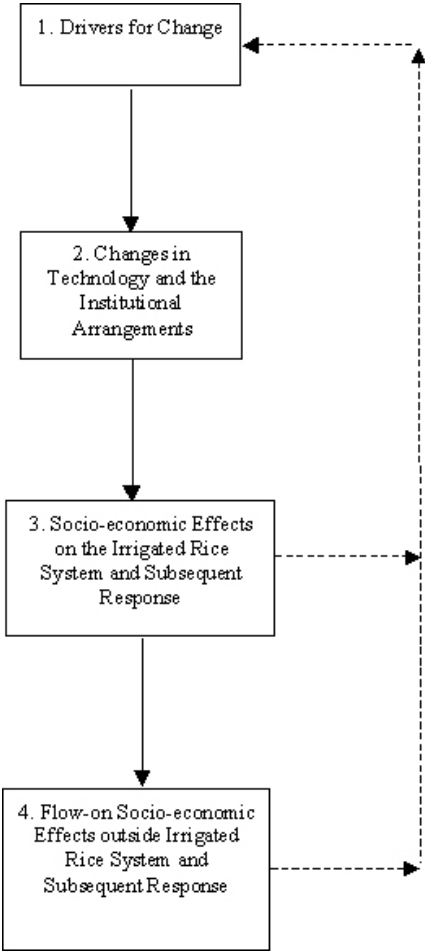


FIGURE 2: SCHEMATIC OF THE MODIFIED FRAMEWORK

This will be the modified framework, which we shall use as a basis for determining the research agenda. According to this schematic, the solid arrows indicate the main direction of effects and the broken arrows indicate the secondary (feedback) effects. To work through this schematic let us begin with box 3 (Socio-economic Effects on the Irrigated Rice System and Subsequent Response). The components of box 3 derive from Changes in Technology and the Institutional Arrangements (box 2), where institutional arrangements are the formal and informal rules under which the Irrigated Rice System operates. The formal rules include such things as legislative and contractual arrangements. The informal rules include handshake agreements, codes of practice, strategic alliances and partnerships. Changes in the Institutional Arrangements come about as a result of what we call Drivers for Change. These may arise either from outside or inside the Irrigated Rice System and could include such things as political pressures from environmentalists or policy economists, social pressures from local businesses or economic pressures from globalisation or from innovative farmers in the area. Changes in technology or the institutional arrangements will have effects not only on the Irrigated Rice System, but also will have flow-on effects outside the Irrigated Rice System (box 4). For example, if institutional changes discourage rice production, this could have a flow-on effect on people and businesses, which depend on the rice industry. Figure 2 also includes feedback effects from boxes 3 and 4 to box 1. Suppose a new institutional arrangement is introduced, say water trading (box 2). If this leads to permanent water rights being traded out of an irrigation area, the flow-on socio-economic effects on the local rural community may be devastating (box 4). This may encourage the local rural community to respond in such a way as to be a new driver for change (box 1), either resisting the initial institutional change or creating new technologies or institutional arrangements to enable the community to better adapt to the change.

The four boxes of Figure 2 provide the framework on which to hang the research agenda. A complete research agenda should include research related to each of the four boxes because they all impinge directly or indirectly on the socio-economic dimension of the irrigated rice system. The research relates to either: (a) factors which cause socio-economic effects (boxes 1 and 2); (b) measures of the socio-economic effects (boxes 3 and 4); or (c) responses to the socio-economic effects which may in turn have feedback effects on the drivers for change (boxes 3 and 4). However, before turning to the research agenda, let us first analyse the results of the literature and interviews in terms of this modified framework.

4.1 Drivers for change

From the literature and interviews, the drivers for change can be summarised in the stated imperative to achieve the triple bottom line (i.e. environmental, economic and social). With respect to the environmental dimension of the triple bottom line, interviewees and writers referred to the imperative of ecological sustainability. With regard to the economic dimension interviewees and writers referred to the imperative of globalisation and risk management. With regard to the social dimension interviewees and writers referred to the importance of saving rural and regional communities. Let's consider what was said about these drivers for change.

4.1.1 environmental driver (pressure for ecological sustainability)

In the interviews a number of individuals talked about the importance of ecological sustainability. Lewin, Linnegar, Bramston and Eberbach all discussed the issue of ecological

sustainability. Lewin referred to the work of the RGA Environmental Subcommittee as making a good start in considering such issues. Linnegar and Eberbach both saw the "environmental imperative" as the main driver of change, with Linnegar going on to say that this had replaced the "economic imperative" as consumers now demand evidence of environmental credentials. Linnegar, who is a member of the RGA Environmental Subcommittee saw a need "reduce the ecological footprint of agriculture" and suggested that research on ecological sustainability was being carried out at "the macro level" but more was needed "at the micro level." Bramston suggested a need for more research to be carried out on "how rice is affecting the land" and on the impact of biodiversity. From the literature, ecological sustainability was seen as an important driver for change by Cummings (2000) who referred to watershed events such as the 1992 Rio de Janeiro declarations and the Barwon-Darling blue-green algae outbreak of 1992. McLintock and Stern (1999) also referred to the "pressure for sustainability" and the need for farmers to use their resources efficiently and effectively. Robertson and Roshier (1999) argue that there are five major challenges to the sustainability of natural resources: greed, ignorance, institutional arrangements, fashions of governments and the attitudes and behaviours of scientists and farmers. Finally, Watts (1999) discusses the challenges of conserving biodiversity due to physical, chemical and biological degradation of freshwater environments. He argues the solution is to raise community awareness about the importance of maintaining diversity and to educate farmers on the link between conservation and profitable agriculture.

4.1.2 economic driver (pressures of globalisation and risk management)

In the interviews, Eberbach talked about falling rice prices as a driver for change, while Linnegar referred to the possible deregulation of the rice industry. From the literature, Cummings (2000) sees economic rationalism as being an important driver for water reform, while Halweil (2000) argues that globalisation is a challenge to farmers, rural economies and the environment on a worldwide scale. He says globalisation is shifting the balance of market power towards giant agribusinesses with incredible purchasing power, and is contributing to large scale changes in rural communities. Lowe (1998) said that globalisation was forcing the agricultural sector to diversify, value-add and form strategic alliances and that producers need to be convinced that co-operation rather than competition is needed for economic sustainability in the future. McLintock and Stern (1999) argue that globalisation (and the pressure for environmental sustainability) require farmers to use their resources more efficiently and effectively and they expect these pressures will lead to more corporate and less family farming in the future.

A separate but related issue to that of globalisation is the driver to manage economic risks due to variability in both seasonal conditions and commodity markets. The seasonal uncertainty of water in Australia affects both the availability and demand for water. This implies that calculating the value of water on the basis of agronomic gross margins may substantially understate the value of water and associated infrastructure. Moving away from an allocation scheme to a market for water in storages would, in principle, reduce the risks faced by irrigators and increase the efficiency of water utilisation. However, a market for water in storages still holds significant price risks that growers may wish to try and manage (Beare, Bell and Fisher 1998).

4.1.3 social driver (pressure to save and build rural and regional communities)

A number of interviewees acknowledged the importance of doing socio-economic research (e.g. Cullen and Linnegar). However, Linnegar argues that, in the past, the socioeconomic research has been heavy on the "economic" and light on the "social". Lewin argues "people are at the centre of the equation". Wolfendon refers to the problems of water reform as "wicked problems" because they have so many dimensions including the social one - these problems affect "many lives". In the literature, Bowmer (1999) argues that the values and expectations of the community are becoming increasingly important in policy development. But, she adds, while policy makers are increasingly acknowledging this, one area that has been underestimated by policy makers has been the importance of spiritual and cultural values. Cummings (2000) talks about the increasing pressure from communities to participate in issues like water reform that affect them.

4.2 Changes in Technology and the Institutional Arrangements

In recent years, there have been growing economic, social and environmental pressures for water reform, stemming from the perception that existing institutional and regulatory arrangements led to an inefficient allocation of resources to production and inadequate conservation of the environment (Beare, Bell and Fisher, 1998). Cullen agrees, arguing that past institutional arrangements have led to the current mess. However, he adds they also hold the key to the future. In recent years, the institutional arrangements governing water use have been undergoing change. The most important of these are the ones associated with water reform. They include:

- (a) A set of resource management plans established at different levels of aggregation. At the catchment level, they include Catchment Management Plans (covering four separate areas: groundwater management, river management, vegetation management and unregistered streams management), At the sub-catchment level they include the Land and Water Management Plans for Irrigation corporations. At the individual irrigator level they include whole-farm plans and property plans.
- (b) The water cap established by the Murray Darling Basin Commission.
- (c) Council of Australian Governments (COAG) guidelines for the reform of water policy. These aimed for consumption-based pricing of water, a system of water allocations separated from land titles and the trading of water entitlements.
- (d) State legislation implementing the COAG guidelines on water reform. In NSW, these were spelled out in the NSW Water Management Bill. The main stated objective of this Bill is to provide for the protection, conservation, and ecologically sustainable development of the water sources of the State. (A proposal for updated and consolidated water management legislation for NSW: a white paper, December 1999). This is probably the single most significant set of institutional arrangements governing water reform in NSW. Hence, an overview of this bill is contained in Appendix C. Among other things, it gives the NSW government the power to review water use approval every five years when the relevant resource management plan is reviewed.

The changing conditions and regulations related to water use, water entitlements, share entitlements and the nature of information required by government before approval is given for irrigation reflect a changing social philosophy about holistic, natural resource management planning. Significantly, there are now clearly defined rules and outcomes about water access

conditions, water is now separated from land, and it now can be traded at the discretion of the entitlement holder. Generally the entitlement holder is the irrigation co-operative or corporation, which imposes restrictions on individual use and trade through the LWMP. However, such restrictions that are perceived to involve a restraint on trade may be tested in court by the individual producer having water use approval.

While some significant institutional reforms are currently under way, Cullen still sees the need for more. A particular reform he would like to see is a national Natural Resources Council that crosses over federal, state and local boundaries. According to Hodge and Saunders (2000), the federal government also favours such a body which could be responsible for setting regional rehabilitation targets and developing a community awareness strategy.

More generally, Cullen sees the best approach to further institutional reform as making use of the techniques of scenario analysis and scenario building. This would involve key industry leaders sitting around the table as well as researchers (who can provide specialised information) and knowledge brokers (who can bridge the gap between industry leaders and researchers).

Bramston focuses on institutional reform through the LWMPs and argues it should be based on an adaptive management approach applying the principles of ecologically sustainable development. In this, he recognises the importance of ecological sustainability as an important driver for change in the institutional arrangements. He also recognises the importance of communities in playing a role in water management planning. However, Lewin argues that the LWMPs are based on economic and gross margin modelling rather than socio-economic planning.

Marshall argues the evolution of water management planning varies in effectiveness from region to region. In general he expressed concern about the process of consultation and strategic planning in the Department of Land and Water Conservation, which he said was driven by technologists who had an engineering culture. He thought the process of land and water management planning worked well in the Murray Region (because of the involvement of government personnel with sociological and educational experience) but not so well in the Murrumbidgee Region. He said, in the Murray Region, farm leaders and sociologists were well informed and more sympathetic to change than in the Murrumbidgee Region.

Marshall argued that the research agenda for the development of new technologies and institutional arrangements requires community participation. Questions such as 'why are we doing this? Is it do-able? Is the land capable of it? Are our expectations realistic?' were basic. Marshall says we need to go back to basics (especially as economists - revisiting the tragedy of the commons analogy and the 'free-rider' problem). "What is collectively rational is not necessarily individually rational" and our culture is evolving to bridge the gap between collective and individual rationality. "Transaction costs are getting beyond us - the more you intervene the more you undercut the informal capacity. We need to rekindle self-reliance, the democratic flame. The regulatory system (i.e. the set of formal institutional arrangements) depends on endogenous co-operation, not exogenous solutions." Marshall clearly favours institutional reform as a way to solve land and water resource problems - this institutional reform should facilitate collective rationality as opposed to individual rationality (i.e. to overcome the free rider problem) and should provide community ownership of the problem and the solution. He believes the research agenda for irrigated agricultural communities ought to

focus on structural adjustment with regard to price and competition for water, adding that rice will last longer than cotton (20:7 megalitres per hectare). Large-scale social change will have to happen and environmental concerns will force large structural adjustments. This will affect dry land farming as well and those farmers will have to shift to stewardship and tourism. "The more the conflict can be resolved voluntarily, the better". He argues that rather than relying on formal regulation to solve problems, it is preferable to look for solutions that exploit trust, assurance and credible commitment between communities. This will involve building social capital. However, he adds: "The glitch will be the arrogance of government. It tends to see capacity as a problem of community rather than seeing itself as a useful partner with capacity." It is worth noting that a counterexample from the UK is the learning cities project, where senior bureaucrats were instructed by Prime Minister Tony Blair to go out and talk to communities about and facilitate their capacity building. Part of this re-structuring of the bureaucratic-public interface was the creation of community resource positions to enable intra-government access and communication with respect to problem solving.

Watts (1999) argues that the way to build social capital is by raising community awareness through education and community partnerships (such as Landcare and Rivercare). Klein (2001:1) states that "In order for Social Capital to develop within a locality, there must be a sufficient amount of mutual recognition, acceptance, and sense of connectedness between its residents. Deliberate efforts are recommended to support the integrative infrastructure that create such social glue in order to bridge major inter-functional and inter-role gaps that are endemic to modern communities."

One of the other drivers for change has been globalisation. This has led to diversification and value adding and the formation of strategic alliances. In fact, Lowe (1998) argues that farmers should embrace co-operation rather than competition as a way to be more sustainable economically. This is an example of commercial institutional change. In addition this approach is supported by Powell (1999), who calls for an integrated future for rural regions where there is an increasing role for partnerships of all kinds. According to Powell, this signifies a significant shift from independence to interdependence and signifies the necessity of capacity building as a way of accessing downstream value adding opportunities.

4.3 Effects on the Irrigated Rice System

In Australia, water trade has always been regulated in some way (Bjornlund and McKay, 1999:555-572). According to these authors, water markets play a major role in the ongoing changes taking place in the irrigation industry. Some of the consequences of the establishment of a water trade are that water has moved to more efficient and higher value properties, resulting in a more efficient use of this valuable commodity. Bjornlund and McKay (1999) assert that trade in water also appears to have divided the irrigation community into two distinct groups: large family properties relying on outside labour and a group of smaller family farms relying on off-farm employment to supplement their farming income. Rather than causing a decline in the irrigated farming rural populations, the adjustment process to developing water markets seems to facilitate a change in the composition of the rural population. It suits the needs of lifestyle farmers who are able to buy or sell small quantities of water to either maximise their lifestyle benefits, or conversely to help finance the purchase of their property. Irrigation communities have been finding it easier to adjust to water markets than the more remote and drier agricultural regions. In remote dry areas, the research seems to indicate that a

more productive agriculture, due to changes to water markets leads to a less productive and viable rural community. There is also some evidence to suggest that water markets have other potential negative impacts. Some irrigators in the Goulburn-Murray Irrigation District in Victoria are selling the water on which their existing production depends. This action raises questions about the long-term viability of these properties and the local communities.

The effects of institutional change on the Irrigated Rice System have some feedback effects on drivers for change and future institutional arrangements. This is indicated in the schematic by the dotted line from box 3 to box 1. An example of this is seen in the recent attempts to address the salinity problems of rural Australia. The federal government has allocated \$750m in federal funds to desalinate the nation's rivers (The Canberra Times 2000, p.3). However, what is equally significant is the recent coming together of the Australian Conservation Foundation and the National Farmers Federation to launch a Repairing the Country Strategy, estimating that the financial commitment required over the next decade to address the problem of salinity is \$65 billion. It is not simply a case of external drivers for change impacting on what farmers do. Rather farmers (such as through the NFF) are helping to drive change that will improve the institutional arrangements and have positive effects on the irrigated rice system and beyond.

Research on the effects of change on the irrigated rice system may be of two types: (1) research on how to measure the effects of change; and (2) research on how to assist the participants in the system to respond effectively to the change.

Examples of the first type of research include two sub-types. The first is assessments of farmer characteristics. Vanclay is doing significant research in this area, exploring what he calls farming styles. Fenton is another researcher in this area and is concerned with: (a) what relationships exist between farmer characteristics and current irrigation practices; and (b) what farmer characteristics can be used as indicators of their capacity to change current irrigation practices to more sustainable practices. The second sub-type is exemplified by the work of Jayasuriya and Crean (2000). This study attempts to measure the on-farm effects of environmental flow rules in the Murrumbidgee Valley. It used a representative farm approach in which the biophysical effects of environmental flow rules are first estimated (using a biophysical simulation model) and then enterprise choice is determined on the basis of profit maximisation (using a linear programming methodology).

The second type of research includes research needs analysis of farmers (Humphreys, 1996) and Rapid Rural Appraisal (Dunn et al, 1996, Dunn et al, 1997, Reale, 1998 and Humphreys et al, 1998) and its variations. RRA is a team survey approach that enables all interested parties to participate in the researching of complex problems (called 'wicked problems' by Wolfenden) that threaten a sustainable and economically viable agriculture. RRA methodology defines problems from the bottom up enabling farmers to collaborate in research. Potentially adoption rates of technology are improved because the "right" research is done. Researchers also benefit from collaboration by having greater access to farmer's knowledge and skills, as well as seeing that their research is actually being used. Variations on the RRA process include Creative Problem Solving Methodology (Chambers, 2000) and Transparent Box Modelling (Wolfenden, 1998). However, these tend to be used more in researching responses in the broader community and so will be considered in more detail in the next section

4.4 Flow-on effects Outside the Irrigated Rice System

Changes in the institutional arrangements governing the irrigated rice system will have flow-on effects outside this system. These include socio-economic effects (on dependent rural communities and the more broadly defined regions) as well as environmental effects. According to Socio-economic Assessment Guidelines for River, Groundwater and Water Management Committees "Balanced decision making requires the integration and explicit recognition of social, economic and environmental impacts." (1998:2).

In the interviews we conducted, such effects were discussed by Fenton who was investigating the socio-economic effects of water allocations on dependent rural communities in a number of water catchments in Queensland. Fenton's work involves the development of social indicators (and social indicator analysis) as he attempted to answer the question "how do we quantify or define the social and economic dependence of rural communities on the water used by irrigated farms in rural areas?" Powell also was concerned about the flow-on socio-economic effects and, in this, advocated the use of regional input-output analysis. Thus, Powell et al (1985) involved a regional input-output analysis focusing on the economic spillover effects of irrigated agriculture. While this study is sixteen years old, it is widely viewed as a benchmark for the estimation of the flow-on effects of irrigation farming. One other type of flow-on effect discussed in the interviews was environmental externalities created by irrigation agriculture. This was mentioned by Linnegar in his comments about the downstream "footprints of agriculture".

The focus on triple bottom line (social, economic and environmental effects) has implications for integrated community development. One model used by Ife (1998) positions ecological social justice at the hub of community development, with social, economic, cultural, personal/spiritual, environmental and political factors at the interface. Implicit in how we achieve the triple bottom line are considerations of how one involves community. Pigram (Interview 22/9/00) in referring to Engineering and Water Reform stated that: "The technical and bio-physical dimensions need to be read and written in a way that socio-economic implications are realised. There needed to be a triple bottom line to water reforms: economic, social and environmental." Pigram cited a document written for the National Land and Water Resources Audit in January and re-released in June 2000 that used this approach (Large Water Resource Development: An Integrated Assessment Process). John Wolfenden (Interview 22/9/00) referred to 'wicked problems' (very difficult problems that require a lateral and usually trans-disciplinary approach) that affect major reforms affecting many lives. Wolfenden talked about the need for Organisational Systems Thinking (borrowed from MIT) and the concept of collective learning. Transparent Box Modelling (transparency in organisational relationships is a key feature of contemporary discourse) is used as a guide to decision-making and stakeholder groups are facilitated towards certain outcomes. Problem identification and possible solutions are arrived at by talking together - a consensual approach. Complex systems modelling is used because of the greater complexity further up the decision-tree. A risk-management strategy was employed along with an appeal to corporate good citizens (Stephen Covey's 'win-win' approach).

Research on the flow-on effects of change outside the irrigated rice system tends to be of two types, similar to those discussed in the previous section dealing with the effects of change

within the irrigated rice system. They include: (1) research on how to measure the effects of change; and (2) research on how to assist the stakeholders to respond effectively to the change.

The first type of research includes regional input-output analysis of the type conducted by Powell et al (1985). In this study, the authors set out to identify and measure the economic impact of irrigated agriculture on the regions and the state of NSW and to assemble a data base and modelling framework which could be used to assess the impact of changes in policies that affect irrigated farming. High flow-on effects were shown. In particular, irrigation agriculture provided an important stimulus to processing, marketing and transport in the region. Thus according to Powell et al (1985, p.96):

"At the state level it is possible to generalise that the impact multiplier was approximately five and at the regional level approximately three. This may be interpreted as indicating that for each unit of activity on irrigation farms, two were generated in the local region and a further two were generated in the rest of the state, mostly in the main metropolitan area."

Despite its considerable strengths, this type of input-output analysis is predominantly economic in nature and ignores environmental and social costs. Some people in the rice industry would like to see an update of Powell's work to estimate the regional flow-on benefits and costs of water reform. However, in doing such an analysis, it would be important to modify the analysis to include data on the social and environmental effects of water reform. In this, Fenton's work on social indicator analysis would be useful. Fenton's social indicator analysis using GIS was used to investigate the social and economic impacts associated with water allocation in 3 water catchments in Queensland over the past 3 years. Another useful methodology would be that of social benefit-cost analysis incorporating the effects of environmental externalities. By externality is meant ...One approach to measuring these environmental externalities is contingent valuation (and is currently being explored by the EPA.

Another approach to measuring the socio-economic effects of change is social impact assessment. Boddington and Syme (1989) conducted a survey of Australian water authorities to determine the extent of social impact assessment being done. Their work was followed up ten years later with Socio-economic Assessment Guidelines for River, Groundwater and Water Management Committees(Independent Advisory Committee on Socio-economic Analysis, 1998). This approach involves a multidimensional, multidisciplinary approach to constructing a community "water profile". The aim of the water profile is to assemble key socio-economic data that will enable Water Management Committees to obtain a general picture of their catchment in terms of its socio-demographic and economic structures. One problem with this approach (as expressed by DLWC Staff) is the limited capacity of community-based committees to undertake the water profile. Unless capacity building is a concomitant program, and/or resources are allocated to outsource such research, it is doubtful whether this laudable data collection will eventuate in the near future.

The second type of research concerns how to assist the stakeholders to respond effectively to the change. Research here needs to focus both on the creation and provision of knowledge and also on the change process. Powell (interview, 22/9/00) creates and provides knowledge in the form of feasibility studies, census data for a region (using a static and trend component) and regional impact multiplier analysis. He believes researchers have an important role as knowledge providers in the change process. Cullen (interview, 11/9/00) also believes in the contribution researchers can make to regional development and bases his Knowledge Brokers

on the learning organisation principles of Senge (1990). The researcher is therefore in equal partnership with community and industry, rather than merely an observer or process worker. Cullen further stressed a need for researchers to adopt a cross-disciplinary approach to creating or providing knowledge signalling a new way of researching 'wicked problems'. This approach is supported by Dunn et al (1997) and Chambers (2000). Bowmer's appeal to an understanding of and accounting for values and spirit underpins a holistic approach to research in the rural sector and most particularly in the areas of irrigated farming. We can no longer afford to specialise in a particular discipline or product given the complex interplay of socio-economic, environmental and ecological issues involved.

Both Powell and Cullen are interested in capacity measurement and the building of social capital. Interestingly, though, Powell does not believe that value-differences can be resolved in community consultative methods. Instead, Powell's approach to process change appears to require governments to thrash out agreements with different sectors and it is a government's role to make the hard decisions.

In contrast to Powell's approach to process change are those that involve community consultation. These include Value Management, Creative Problem Solving Methodology (Chambers, 2000) and Transparent Box Modelling (Wolfenden, 1998). The essential element of all these approaches is respectful partnership with key stakeholders in the relevant community. Issues and concerns are identified and stakeholders work together to come up with strategies and possible solutions as a way forward. The important point is that all players own the problem and agree to test out solutions, thus ensuring ownership of the process and outcomes. It is a slower but more effective method and a far cry from token consultation, whereby communities were informed via a public meeting of what local government intended to do about the problem. Building capacity and investing in social capital are the key words that refrain under the banner of Civics in contemporary social science research. RRA may also be included in this research type if the methodology includes wider community participation than just farmers. With this broader participation, RRA may be used to set the groundwork for future research projects and to increase the opportunities for community education in rural communities. A recently started research project by Spriggs, Chambers, Dunn and Fromholtz entitled *Beyond Economic Rationalism: A New Socio-economic Change Process for the Coleambally Irrigation Area* attempts to combine knowledge provision with a respectful community consultation process as a new approach to achieving socio-economic change in a rural community.

5 THE SOCIO-ECONOMIC RESEARCH AGENDA

5.1 Drivers for Change

The main objective of conducting research on the drivers for change is to ensure the drivers are based on an objective reality and not on a perception that differs from objective reality. This is particularly important where the drivers affect institutional arrangements through the political process, as is often the case with environmental drivers. Where the drivers are based in objective reality, the research will support change, but where the drivers are only based on perception, the research will not. The research methods will be the same as those discussed in sections 5.3 and 5.4 which involve measuring socio-economic effects. The difference is that here such methods are used to assess the effects of existing practices while in sections 5.3 and

5.4 they are used to assess the effects of changes in existing practices due to changes in institutional arrangements.

5.2 Changes in the Institutional Arrangements

Institutional arrangements are defined broadly as the rules, constraints or incentives governing individual behaviour. They may be formal (eg laws or explicit contracts) or informal (handshake arrangements, understandings, codes of behaviour). The main objective of conducting research on the institutional arrangements is to develop good institutional arrangements. These may include the following:

- investigation of alternative institutional arrangements for water use and water trading using New Institutional Economics (to improve governance structures and lower transaction costs) and traditional policy analysis (including the private and social benefits and costs of different water use and trading rules)
- investigation of institutional changes that would lead to more effective communication and decision-making (this might include a needs assessment of irrigation farmers as a basis for developing tailored education and communication programs)
- analysis of new marketing mechanisms to manage the effects of globalisation (e.g. new generation co-operatives and strategic alliances)
- analysis of the changing structure of irrigation communities

5.3 Effects on the Irrigated Rice System

The main objective of conducting research here is two-fold: (a) to measure the effects of changes on the irrigated rice system; and (b) to assist participants to respond effectively to the changes that are occurring. The research proposed under this title include

- assessment of farmer characteristics as indicators of their capacity to change (social indicator analysis)
- analysis of the on-farm effects of changes to the water use and trading rules (using representative farm analysis and regional aggregation) (as in Jayasuriya and Crean)
- participatory action research as a way assisting farmers to respond to the changes that are occurring (including the advent of new technologies). This may include:
 - research needs analysis (as in Humphreys, 1996)
 - Rapid Rural Appraisal and related techniques (as in Dunn et al 1997, Reale, 1998, Humphreys et al 1998)

5.4 Flow-on Effects Outside the Irrigated Rice System

The main objective of conducting research here is two-fold: (a) to measure the effects of changes which have taken place in the Irrigated Rice System; and (b) to assist stakeholders to respond effectively to these changes. The research proposed under this title include:

- regional input-output analysis (as in Powell, 1985) modified to include social and environmental effects using:
 - social indicator analysis (as by Fenton)
 - social impact assessment (as proposed by the Independent Advisory Committee on Socio-Economic Analysis) including social benefit-cost analysis (incorporating the effects of environmental externalities)

- contingent valuation as a way to measure the effects of environmental externalities (as in EPA's current work)
- transactional analysis - mapping attitudes and preferences of stakeholders (as in Syme, 1988)
- assessment of community capacity for change and building of social capital
- cross-disciplinary team approach to creating and providing knowledge to communities
- development of community-owned process of socio-economic change - e.g. using techniques of value management, creative problem-solving and transparent box modelling (as in Wolfenden, 1998 and Chambers, 2000)
- work with water management committees (using participatory action research techniques) to undertake community water profiles.

6. SUMMARY AND CONCLUSION

The purpose of this scoping paper was to develop a socio-economic research agenda for the Rice CRC. To help define a research agenda we thought it was essential to construct a framework for thinking about the research required. We began with an initial tentative framework (Figure 1), which emerged from an initial meeting of the Socio-economic committee of the Rice CRC. Using this as a basis, we carried out a number of key informant interviews and a literature search (Section 3). The interviews and literature led us to revise the framework to that represented in Figure 2. The modified framework consisted of four components:

- drivers for change
- changes in technology and the institutional arrangements
- socio-economic effects on the irrigated rice system and subsequent response
- flow-on socio-economic effects outside the irrigated rice system and subsequent response.

In Section 4, the interviews and literature were analysed in terms of these four components. In Section 5, and based on the analysis of Section 4, a research agenda was developed for each component of the framework.

The strongest message to emerge from the interviews and the literature was the importance of the triple bottom line (i.e. the social, economic and environmental effects of water reform). Many ecological and environmental challenges present as wicked problems, not able to be solved by simplistic formulas for change based on scientific evidence alone. But, neither is discipline-based research based only on economics, social change or environmental science sufficient. Multi-disciplinary teams (perhaps transdisciplinary in approach) of social, economic, environmental and biophysical researchers are needed to provide the data required to enable communities most affected by changes in technology and institutional arrangements to understand and respond appropriately. Social change through participatory action research and developing learning communities appear to be the key thus far. This research direction underlies the socio-economic research agenda spelled out in this paper.

MISCELLANEOUS RESEARCH TOPICS

Other research ideas to emerge from interviews include:

- An investigation into the socio-economic capacity of river, groundwater and water management committees in irrigated farming communities to undertake community water profiles in order to assemble key socio-economic data.

- Undertake case studies of participatory action research where researchers work with water management committees to undertake community water profiles.
- Undertake case studies to assess the socio-economic capacities of irrigated farming communities to adapt to change.
- Conduct analyses of the low adoption of technologies advanced by the Rice CRC.
- Investigate the distribution and processing requirements of the new crops through an analysis of the marketing chain.
- Undertake needs assessments of irrigation farming producers as a basis for developing tailored education programs.
- Undertake case studies of farmers interested in new co-operatives as a mechanism for accommodating and managing change in the market.
- Investigate institutional arrangements and possible changes required for effective communication and decision-making.
- Investigate the benefits and costs of alternative treatments and costs of salinity.
- Participatory action research on community building or building social capital and participation with respect to necessary change.
- Investigate the social impacts of different policies related to water reform.
- Undertake cases studies and analyses of values and expectations amongst the general public, farmers and irrigation communities in the context of water reform. This may include an investigation of the role of government and its interactions with industry in driving change.
- Investigate the interplay of socio-economic, environmental and ecological issues in irrigated farming communities.
- Investigate the constraints to water trading in terms of measuring the value of water, including the private and social benefits and costs of water.
- Analyse the changing structure of irrigation communities, perhaps through a comparative study of a rice and cotton growing area.
- Others e.g. NIE and transaction costs; structural adjustment, effects of globalisation on diversity, value adding, forming strategic alliances; impact multiplier analysis

PART 2: ANNOTATED BIBLIOGRAPHY

The following annotated bibliography has been developed with the intention that it forms part of a scoping paper requested by the Rice CRC of NSW. It is designed to give the reader an insight into recent research and other available hardcopy texts relating to the socio-economic impacts of rice growing, and New South Wales agriculture in the broader sense. This bibliography does not claim or intend to be exhaustive, rather it aims to convey to the reader the depth and breadth of the relevant research. Key issues to have emerged in this research include the need for long term ecological sustainability, the need to address the problems of salinity and rising water tables, and the emergence of water markets and their impact on irrigated agriculture. At a broader level the impact of technological advances and globalisation on rural communities are also explored, as are the opportunities to, and desirability of, farming communities to get involved in diversification and down stream value adding ventures. The way in which agricultural research is carried out has also emerged as an important issue in its own right. Many of the papers listed below address the desirability and consequences of a more participative approach towards agricultural research. There is a growing trend towards researchers consulting from the outset with the farming community most affected by the

research, and all parties working together to address the agricultural problems that lay before them.

- **Barlow, G. & Borchard, N. 2000, Fee switch: Water price reforms set to enrage northern Victorian irrigators. The Weekly Times. 16 Aug., pp.1-4.**

New pricing reforms are being proposed to change northern Victorian irrigator's rights to water. The package of reforms is called the Rural Entitlement Reform. In essence the renaming of old entitlement to water is being proposed with the introduction of new detailed tariffs and exit fees for those selling water out of the district.

- **Beare, S., Bell, R. & Fisher, B. 1998, Determining the value of water: The role of risk, infrastructure constraints and ownership. American Journal of Agricultural Economics. 80(5), pp.916-940.**

A common problem in resource management is water pricing and water allocation. There are growing economic, social and environmental pressures for water reform, stemming from the perception that existing institutional and regulatory arrangements have led to an inefficient allocation of resources to production and inadequate conservation of the environment. The Council of Australian Governments (COAG) has established guidelines for the reform of water policy. The COAG guidelines aim for consumption-based pricing and the recovery of the full water provision, the implementation of a system of water allocations separated from land titles, and the trading of water entitlements so that wherever possible water is transferred to the highest value end users. There are three aspects common to the management of most natural resources that add a considerable degree of complexity to a seemingly straightforward issue. Firstly, there are location specific, physical and infrastructure constraints. Secondly, institutional arrangements generate further constraints, as does the third and last aspect, variability in both seasonal conditions and commodity markets. The seasonal uncertainty of water in Australia effects both the availability and demand for water. This implies that calculating the value of water on the basis of agronomic gross margins may substantially understate the value of water and associated infrastructure. Moving away from an allocation scheme to a market for water in storages would, in principle, reduce the risks faced by irrigators and increase the efficiency of water utilization. However a market for water in storage still holds significant price risks that growers may wish to try and manage.

- **Bjornlund, H. & McKay, J. 1999, Do permanent water markets facilitate farm adjustment and structural change within irrigation communities? Rural Society. 9(3), pp.555-572.**

In Australia water trade has always been regulated in some way. The purpose of this regulation has been to ensure that water is used efficiently and without causing further degradation of the environment. Water markets play a major role in the ongoing changes taking place in the irrigation industry. Some of the consequences of the establishment of a water trade are that water has moved to more efficient and higher value properties, resulting in a more efficient use of this valuable resource. Trade in water also appears to have divided the irrigation community into two distinct groups- large family properties relying on outside labour, and a group of smaller family farms relying on off farm employment to supplement their farming income. Rather than causing a decline in the irrigated areas rural populations, the adjustment process to developing water markets seems to facilitate a change in the composition of the rural population. It suits the needs of lifestyle farmers who are able to buy or sell small quantities of

water to either maximise their lifestyle benefits, or conversely to help finance the purchase of their property. Irrigated communities have been finding it easier to adjust to water markets than the more remote and drier agricultural regions. In remote dry areas, the research seems to indicate that a more productive agriculture, due to changes to water markets leads to a less productive and viable rural community. There is also some evidence to suggest that water markets have other potential negative impacts. Some irrigators in the Goulburn-Murray Irrigation District in Victoria are selling the water that their existing production is dependent on. This action raises questions about the long-term viability of these properties.

- **Bodington, W. and Syme, G. 1989, The Use of Social Impact Assessment in Australian Water Authorities: A Survey by Planning Committee of the Australian Water Resources Council, Occasional Paper PC No.2, Water Authority of Western Australia, Perth.**

This study was the forerunner of the Social Impact Assessment Guidelines for River, Groundwater and Water Management Committees, produced by the Independent Advisory Committee on Socio-economic Analysis, 1998. The authors undertook a survey "aimed to establish the current significance of the role of social impact assessment within the water planning and decision making process and whether this significance was likely to change in the future." (p.vi). The survey was distributed to Australian water management and supply organisations. "Overall, 98% of respondents indicated that social impact evaluations are given some recognition in the decision making processes of their organisations...Social impact studies were strongly associated with environmental reviews and public participation processes and were less likely to occur as an activity planned in isolation. There was more support of the 'key issues' approach and a subjective type of social impact evaluation.

However, there was a lack of corporate policies or guidelines concerning the process and less than a fifth of respondents were fully satisfied with the processes in their organisations." (p.vi).

The authors conclude that there was a great deal of social evaluation being conducted, but little guidance provided on the conduct of social impact assessment and a blurring of the distinction between public participation and social impact assessment.

- **Bowmer, K. H. 1999, Water Landscapes: Perceptions and Expectations. In Preserving Rural Australia: Issues and Solutions, ed. A. Robertson & R. Watts. CSIRO, Collingwood, Vic.**

Myth, memory, art advertising and the media all shape our perceptions and expectations of the Australian landscape. In efforts to improve, conserve or rehabilitate our land and waterways; we inevitably confront these perceptions. Most scientists now value the concept of naturalness and recognise the dangers of moving too far from the natural state. However it seems that the general public is conditioned to the aesthetic changes brought about by land clearing, farming and river regulation. The values and expectations of the community are becoming increasingly important in policy development regarding natural resource management, yet the importance of spiritual and cultural issues, which underpin the value of a place have been underestimated by policy makers.

- **Canberra Times. 2000, \$750m in federal funds to desalinate nation's rivers, 11 Oct., p.3.**

The federal Government has announced a 7-year plan to clean up Australia's growing salinity problem. According to Prime Minister Howard 2.5 hectares in the country are now affected by salinity, leaving a third of the national river system in poor condition. The urgent need to address the problem is further highlighted by the claim that if no immediate action is taken to rectify the situation, Adelaide's water supply will be undrinkable in 20 years and the water in the Murray-Darling would be undrinkable in 50 years. It will take just over a decade of no action to allow the problem to spread and affect an estimated 12 million hectares. The package was criticised by the federal Opposition, Greens and the Australian Conservation Foundation for not going far enough. The Australian Conservation Foundation and the National Farmers Federation recently joined forces to launch a Repairing the Country Strategy, estimating that the financial commitment that is required over the next decade to address the problem of salinity is \$65billion. A total of \$37billion of this is required to come from the public purse. The states are yet to commit but Western Australia is already demanding compensation for landowners prevented from clearing land.

- **Collins, R. (n.d.). Developing Supply Chains in new agricultural industries: A Social Systems Approach. School of Natural and Rural Systems Management, The University of Queensland, Gatton, Qld.**

In successful new agricultural industries biological systems need to interact with social systems. A new species that successfully adapts to a new environment does not and cannot create a successful new industry. Rather successful new agricultural industries are created through the linking together of satisfied consumers and satisfied producers who are able to mutually benefit from each other. Supply Chain Management (SCM) is a way of understanding and managing the complex linkages between consumers and producers of agricultural products. SCM emphasises the need to develop strong trusting relationships, and the importance of having the right product attributes. There are three key elements in integrating a SCM framework to a new agricultural industry; they are strategic intervention, empowerment and action learning. The bulk of this paper details how these elements were successfully integrated in the development of a new agricultural industry in Australia, the persimmon industry.

- **Conway, G. R. 1994, Sustainability in agricultural development: Trade-offs between productivity, stability, and equitability. Journal of Farming Systems: Research and extension. 4(2), pp.1-14.**

Agroecosystem Analysis (AEA) provides both a theoretical and practical context for useful definitions of productivity, stability, sustainability and equitability. Productivity is defined in terms of inputs and outputs with the outputs being a valued agricultural product. It is natural for productivity to vary over time due to a number of factors such as changes in climate, labour, fertilisers, pesticides and the product itself. Stability is the term used to measure the constancy of productivity over time while sustainability measures the ability of productivity to withstand major disturbances. Equitability describes the pattern of distribution of productivity; it addresses such issues as who benefits from the productivity. Is the product and/ or profit evenly shared amongst the community, or does one person/ group benefit above others? The bulk of this paper compares a variety of agricultural systems against each other in order to demonstrate the inevitable trade-offs that take place in AAE.

- **Conway, G. R. 1990, Agroecosystems. In Systems theory applied to agriculture and the food chain, ed. J.G. W. Jones & P. R. Street. Elsevier Applied Science, London.**

Agroecosystem analysis is an example of a research approach known as Rapid Rural Appraisal (RRA). RRA is a relatively new process, developed over the last decade and involves the use of a multidisciplinary team carrying out field research to gather new data and hypotheses about rural life. Traditional studies of rural life concentrated on extensive data collections, involving many researchers and costing an enormous amount of time and money. Traditional research methods often ignored the locals, or if they did consult them it was through formal channels, using written questionnaires. The researchers, who were preoccupied with calculating 'averages', rarely examined the context in which the information was collected and significant variations were often overlooked. This traditional research method gave little opportunity for insights to be gained; more could have been accomplished by proper consultations with the locals. RRA attempts to rectify these shortcomings, therefore one of the most important RRA techniques is semi-structured interviewing, which allows the interview to take a shape of its own due to the interaction between farmer and researcher.

- **Conyers, M. & Quinn, P. 1999, Saline politics: An inland city case study. In Preserving Rural Australia: Issues and Solutions, ed. A. Robertson & R. Watts. CSIRO Publishing, Collingwood, Vic.**

The approach of local participation in addressing environmental problems is desirable economically, politically and socially. The participatory approach is cost effective because non-government resources are used; it is also democratic since a range of people are involved in the decision making including individuals who would not usually have the opportunity to be in a position to contribute in a political sense. According to this article large-scale rural environmental problems require a partnership approach to rehabilitation between government, industry and community groups. The Wagga Wagga City Case Study is used to illustrate this partnership approach between government and community groups to address the problem of urban salinity.

- **Cruse, L., Dollery, B. & O'Reilly, L. 2000, Water markets as a vehicle for water reform: The case of New South Wales. The Australian Journal of Agricultural and Resource Economics. 44(6), pp.299-321.**

NSW has the largest irrigation industry in Australia, and the challenge it faces is to create a legislative framework that allocates water efficiently while simultaneously recognising the legitimate claims of the environment to this precious resource. This article examines proposed water reforms, water administration and licensing in NSW, Tradable Water Entitlements and the Development of Water Markets in NSW. Obstacles to permanent water entitlements are also explored, as is the effect of the variability of supply, the possibility of excessive transaction and transfer costs, hoarding behaviour and speculation, and cultural attitudes that limit market participation.

- **Cullen, P. 1999, Water politics and power, can we integrate natural resource management in Australia? In Preserving Rural Australia: Issues and Solutions, ed. A. Robertson & R. Watts. CSIRO Publishing, Collingwood, Vic.**

Unsustainable land management practices are causing degradation of our land and waterways, and this leads to loss of biodiversity. The challenge for our political and economic systems in combating these problems needs to include a shifting of focus in decision making from the short-term gains to the long-term consequences. It is also vital that we adopt a whole systems

approach between state and federal governments as many of our waterways cross state boundaries. Irrigation is going through a revolution. The independent audit process has produced a new level of accountability and public exposure as to who gets what, and for what purposes. If full-cost pricing of water is accepted it will lead to a more efficient use of water and encourage water to be used on high value crops. The classification of water rights based on separation from land rights will accelerate this readjustment and provide a basis for water trading. In order to address the challenges confronting rural Australia it is essential that we share knowledge amongst researchers, farmers and the broader community.

- **Cummings, B. 2000. The water debate. Paper presented to the Tenth Australian Cotton Conference.**

The debate is seen to be driven by state-based water reform and the development of "integrated basin management" which crosses state boundaries. The development of these are contributed to several factors including economic rationalism, the 1992 Rio de Janeiro 21 declarations, the Barwon-Darling blue green algae outbreak of 1992, pressure groups, community participation and media reporting.

Cummings identifies two key issues in the debate. These are water entitlements and institutional issues.

Water entitlements encompass issues of:

- environmental flows which are variable in Australia when compared to other countries and not uniformly defined within Australia.
- the MDBC Cap which is in place to limit degradation of the Murray Darling basin. This cap through negotiation has come to vary with the climatic changes and is subject to wide review. The article considers cap issues for the cotton industry in some detail mainly concerned with the permanence of the cap, it is here to stay.
- a definition of rights which deals with unclear issues such as floodplain, runoff and unregulated stream water. There is concern that such a definition be uniform across states especially as basin areas cross state boundaries.
- security of supply
- equity with the observation that "the more users involved or the greater the total shares then everyone's share reduces."
- Institutional issues encompass "the tools (legislation, policy), processes and organisational structure of government agencies." This includes:
- MDBC which is very effective in addressing degradation. The author considers that any change to its structure may not be in best interest of the cotton industry and notes that decisions of the commission or Ministerial council "require unanimous agreement."
- new water legislation. The author identifies eleven issues that the cotton industry needs to consider. These deal with the powers and role of ministers, processes of appeal and issues of ambiguity such as floodplain waters and certain changes in licensing.
- the water resource departments. These are being restructured and the author outlines the changes in NSW and Queensland noting that the cotton industry "may be disadvantaged, as the regulator will be further away from the user."
- decision support tools such as "valley hydrologic models" which measure environmental flow. The author supports the continued use of these.
- pricing with different approaches in NSW and QLD and a call for any subsidising to be transparent by COAG.

The article goes on to consider the cotton industries participation in the water debate and compares Queensland's and NSW's experiences highlighting the differences and similarities in their approaches. The article extrapolates from this description a list of things that the cotton industry could do better some of which entails accepting sustainability and the "basin ethic". The article concludes with a list of future issues that relate mainly to possible developments within the MDBC and government bodies.

- **Dunn T., Humphreys L., Butterworth, J., Hope M. & Syme G. 1997, The Coleambally Rapid Rural Appraisal. Managing Change- Building Knowledge and Skills: Proceedings of the 2nd Australasia-Pacific Extension Conference. Albury, Australia November 18-21, Vol. II, pp.125-137.**

This conference paper introduces Rapid Rural Appraisal (RRA) methodology to the reader and then outlines how it was applied to the Coleambally Water Use Monitoring Project. RRA is a relatively new team survey approach that enables all interested parties to participate in the researching of complex problems that threaten a sustainable and economically viable agriculture. RRA methodology has the potential to advance the adoption rate of technology by farmers, as they are involved from the outset of the research project and able to influence the directions being taken. Researchers also benefit by having greater access to farmer's knowledge and skills, as well as seeing that their research is actually being used. Through wider community participation RRA is also able to set the groundwork for future research projects and increasing the opportunities for community education in rural communities.

- **Dunn, T., Humphreys, L., Muirhead, W., Plunkett, M., Croker, N. & Nickl, M. 1996, Changing paradigms for farmer-researcher-extensionist relationships: Exploring methods and theories of farmer participation in research. European Journal of Agricultural Education and Extension. 3(3), pp.167-181.**

This paper emphasises the benefit and desirability of adopting a collaborative approach between farmers and researchers in addressing agricultural and environmental problems. It is asserted that every effort needs to be made to forge closer links between farmers, researchers, extensionists and funding bodies to generate and share knowledge. The establishment of a multi disciplinary team to conduct Rapid Rural Appraisal (RRA) is beneficial as it brings the various stakeholders together. The probability that farmers will adopt new technology and research is increased when they themselves have been involved and consulted in its development, as it is then much more likely to reflect their needs and address the practical problems that they encounter.

- **Gray, I., Lawrence, G. and Dunn, T. 1993, Coping with change: Australian Farmers in the 1990's. Centre for Rural Social Research, Charles Sturt University. Wagga Wagga, NSW.**

This study addresses the recent restructuring in Australian agriculture and the worsening environmental and economic challenges facing Australian farmers. There is a real possibility that Australian farmers will fall into one of three increasingly segregated farming categories consisting of large, viable producers; small semi-viable producers, whose off-farm work subsidises farm activities; and a third group of economically vulnerable producers who are unable to diversify due to a lack of a variety of essential resources. This stratification of farming is likely to have far-reaching social and economic consequences for individual farmers, rural Australia and future government policy directions. At a broader social level education is a vital resource for farming families as it equips them with the strategies that will enable them to

successfully cope with the challenges they encounter. At an individual level morale and self-esteem are also extremely important. Many farming families face difficult challenges on a daily basis which cause despair and depression and more needs to be done to assist these families to cope with their situation, or to support them in the process of departing farming. The focus of policies has traditionally been on the economic aspects of either staying on or, of leaving behind the family farm. Yet farmers have very strong values and beliefs about the importance of agriculture and the family farm and they require emotional support in order to make this sort of life altering transition. Despite the challenges facing rural Australia most farmers are taking positive steps to stay in farming, and have the resources they require to do so, by supplementing their income with off-farm work. However diversification is a coping option many of the farmers ignore or dismiss without proper consideration. It is possible that off-farm work is limiting farmer's options to diversify, and that diversification is perceived by many as a socially and economically unattractive option. However it is also possible that many farmers do not have access to sufficient information, or possess the necessary skills to diversify. Government intervention in the form of education and the provision of resources may lead to better land use and production related decision making amongst those farmers that are reluctant to diversify.

- **Halweil, B. 2000, Where have all the farmers gone? World Watch, Sept-Oct., pp.12-28.**

The impact of globalisation on farmers, rural economies and the environment is devastating. It threatens the diversity of crops, ecosystems and cultures. Worldwide farmer's debts are increasing while their incomes are decreasing, and the number of people employed in agriculture is also shrinking. Mergers, takeovers and strategic alliances have created giant agribusinesses with incredible purchasing power, as a result the buyer is now dictating the price to the seller like never before. Even farmers who have substantially increased their outputs are finding they are making less rather than more profit. The disproportionately high rate of suicides in rural areas is one of the worrying indicators of the impact of social changes in rural communities, brought about by rapidly changing economic circumstances.

- **Hilton, V. 2000, State divided over water rights issues. Stock and Land, 90(32), pp.1-2.**

This article explores the issues and both sides of the debate surrounding the proposal to limit farmers rights to use water flowing across private land, and to prevent the construction of irrigation dams in upper catchments- unless a water right has been bought from existing water right holders.

- **Hodge, A. & Saunders, M. 2000, '\$1.5bn water rescue pool'. The Australian. 11 Oct., p.1,6.**

Australia's 20 most degraded water catchment regions will receive \$1.5billion in funding over the next 7 years, to address the nation's salinity problem if the state government agree to match the federal government's financial contribution. The bulk of the federal governments \$750m in funding is directed to the Murray-Darling basin catchments. It is anticipated that the salinity issue will be fiercely debated at the Council of Australian Governments meeting next month. The topic of compensation for landowners that give up or transfer valuable water rights is also expected to cause controversy. The federal Governments plan calls for the establishment of a national natural resources management body to set regional rehabilitation targets. It also aims to develop a community awareness strategy. The Australian Conservation Foundation and the

National Farmers Federation costed the job of repairing the nation's salinity problem at \$65 billion over the next 10 years. The Australian Conservation Foundation therefore was very critical of the amount of funding offered by the federal Government, commenting that it falls significantly short of the required funding.

- **Hope, M. & Humphreys, E. 1997, Paddock water use monitoring in the Coleambally Irrigation Area and the Murray Valley in 1996/97. CSIRO Land and Water, Griffith, NSW.**

According to the results published in this report the key to sustainable irrigated agriculture is the ability to limit recharge to safe amounts. To achieve this farmers will need to adjust their on-farm management to control recharge at the paddock scale. Therefore farmers need to have available to them information on irrigation efficiency and recharge of individual paddock/crop/management combinations. This type of data however is not currently readily available for the range of crop, paddock, management and seasonal conditions that occur in southern NSW. Preliminary results of this study outline meter performance, crop water use, and estimate recharge from both row crops and rice.

- **Hope, M., Humphreys, L. & Dunn, T. 1997, Using farmer skill and knowledge in agronomic research- A case study. In Managing Change- Building Knowledge and Skills: Proceedings of the 2nd Australasia-Pacific Extension Conference. Albury, Australia. November 18-21, Vol. 1, pp.727-736**

To ensure the long-term sustainability of agriculture in the Coleambally Irrigation Area major changes need to be implemented regarding irrigation management. Factors such as readily available water, low water costs, excessive risk aversion, poor water control, high water requiring crops and limited management skills result in excessive water use and drainage. This conference paper outlines how researchers adopted a non-traditional and participative research process, which involved farmers and researchers monitoring paddock water use efficiency. This type of participative research style succeeds if a project is relevant; client driven and well organised, and if there is trust established between researchers and farmers to enable collaboration to occur.

- **Humphreys, E. 1996, Sustainability of the Coleambally Irrigation Area: Research needs identified by the farming community to provide solutions to their problems. CSIRO Division of Water Resources, Griffith, NSW.**

This report presents the research needs identified by the farming community of the Coleambally Irrigation Area from a survey of 52 farm businesses, as well as outlining whether or not these research needs are currently being met. The major categories of concern for the farmers surveyed were water tables, salinity, chemicals and water policy.

- **Humphreys, E., Hope, M. A., Dunn, A., Butterworth, J. & Syme, G. 1998, Adopting improved use of current water monitoring technology to manage recharge. CSIRO Land and Water Consultancy Report No. 98-49.**

Rising water tables are major threats to the sustainability of irrigated agriculture. Future sustainability will depend on the ability of each farmer to choose paddock-crop irrigation management combinations that control the impacts on water tables on their farms. The challenge for both farmers and researchers is to develop technologies that suit farmers needs, and which move toward more sustainable farming practices. This report also highlights the benefits of involving the farming community in the research process. Increased contact between community members and researchers, and consulting with a large cross section of the

farming community increases community awareness. By raising community awareness and understanding of the issues associated with net recharge management, this particular project helped Coleambally Irrigation to successfully introduce a comprehensive water use monitoring system.

- **Humphreys, L. 1996. Coleambally Irrigation Area: What you told us about your concerns, opportunities and needs for a sustainable future: Summary of findings from a survey of Coleambally farm people. CSIRO Division of Water Resources, Griffith, NSW.**

The major concerns raised by the Coleambally farmers surveyed for this report were chemicals, water tables, salinity and water policy. Some of the other issues explored included soil acidity, NSW Agriculture cutbacks and the rising prices of fuel, fertilisers and possibly water, although the concern about high water prices was not unanimous. According to some of the farmers water was too cheap and raising the price of water would lead to more efficient use of this important resource. 80% of the people interviewed were concerned about chemical usage, and in particular pesticide resistance, spray drift, drainage, chemical effects on human and/or stock health, and the Environmental Protection Authority. Water tables were also a major concern for approximately 80% of the farmers. The most frequently mentioned signs of rising water tables were wet farm laneways and roads, dying off of large trees, water logged paddocks, rising or static water levels in gravel pits and drainage channels remaining wet throughout winter/spring. A number of the interviewees suggested that too much rice was a major on farm cause of high water tables. Growing rice on unsuitable soils was also seen as a major problem, due to inadequate rice water monitoring, and because rice soil suitability tests were inadequate. Most people said that salinity was a major problem in parts of the Coleambally Irrigation Area with increasingly visual signs of salt along roadways and laneways. Several farmers also reported losses in productivity due to salinity. Overall most farmers were optimistic about the future with opportunities for diversification, the opening up of rice and other winter cereal markets, the potential for local value adding ventures and the use of fewer but better chemicals.

- **Jayasuriya, R. and Crean, J. May 2000, The on-farm impacts of environmental flow rules in the Murrumbidgee Valley: Draft Report to the Murrumbidgee River Management Committee. Economic Services Unit, NSW Agriculture, Orange.**

The NSW Government introduced environmental flow policies through the 1997 Water Reform Package. These were aimed at "improving and maintaining a sustainable river system." (p.1).

"An important factor in the development and implementation of environmental objectives is the consideration of social and economic impacts. Under the water reform program, NSW Agriculture has responsibility for assessing economic impacts at the farm level, DLWC has responsibility for assessing social impacts and regional economic impacts on all sectors while the EPA is responsible for assessing environmental benefits and costs." (p.1). The importance of irrigated agriculture in the Murrumbidgee Valley is underpinned by its total value in 1995-6 as \$414 million. "Irrigated agriculture represents around 30per cent of the total value of production and is a significant contributor to the regional economy of the Murrumbidgee Valley. Powell et al. (1985) found that irrigated agriculture and its flow-on effects within these areas contributed approximately 25-30 per cent of regional output, income and employment. These high contributions are attributed to the fact that many of the dominant industries within the Murrumbidgee Valley (rice and horticulture) provide inputs into high value regional

processing industries. Hence any economic impact on irrigated agriculture is likely to have significant flow on impacts for regional income and employment." (p.3).

The authors used a combination of linear programming and hydrology simulation modelling to assess the impacts of different flow scenarios as identified by the MRMC. They conclude by arguing for further work taking into account the financial position of farms and to confirm the magnitude of the impacts, such as:

- Gross margin is not profit - changes in zonal gross margin is not an exact indicator of farm profit or financial viability.
- Flow on effects - the analysis excludes any flow on effects to the communities, thereby underestimating the impacts from the implementation of different flow scenarios evaluated...{need to do multiplier analysis}.
- Aggregation - modelling the impacts of changes in water allocation on a regional or zonal basis (effectively treating the region as one large farm) assumes that there are no impediments to the movement of water from lower value uses to higher value uses...
- Focus on short term impacts - the approach only looks at short-term impacts by changing enterprise mix on the farm. In the longer term some farm adjustment such as investment in water saving technologies would be expected to reduce these economic impacts.
- Distributional issues - despite the level of disaggregation (sic) achieved, the analysis likely to under estimate impacts on some farms and over state impacts on others within any zone...
- Marginal values - underlying linear programming is the principal assumption that the marginal value of water in alternative enterprises is the principal factor, which determines where and how water is utilised. However, the actions of irrigators in making management choices about enterprise mix will be influenced by a whole range of factors in addition to the marginal value of irrigated water. These include financial factors such as fixed costs, the need for specialised equipment and skills, as well as social factors such as personal objectives and history and culture of individual regions, which include strong links to particular enterprises." (pp 21 - 22)

It appears that this study ignored the social dimensions of impacts, as well as the importance of context specific case studies, which may well have given a more accurate picture of on-farm impacts of environmental flow rules.

- **Kilpatrick, S. 2000, How social capital facilitates learning outcomes for small family businesses. Centre for research and learning in regional Australia, University of Tasmania.**

Social capital may be defined as a by product of the interaction of a group of committed individuals who share a common purpose and their combined skills and knowledge with each other, to enable each individual member to better meet the challenges placed before them. Unfortunately social capital is an often unrecognised and undervalued resource. This paper details how a group of small agricultural business owners (Executive Link) came together to learn to better manage their businesses, and the social capital that was created by them through their interactions with each other. Members of Executive Link found that the social capital they created provided them with the support they required to take advantage of the opportunities open to them, and equally as important, to minimise the effects of the threats they encountered. According to this paper, to develop social capital it is essential that individual members of the network/ community acquire a high level of self-confidence and interpersonal skills. It is also important for the individual members to get to know each other as individuals, through sharing their personal histories and future aspirations, in order to develop a mutual trust and shared

values. Ideally this will lead to a confidence in fellow members as credible sources of support and advice. It is also vital that each member is committed to fellow members and willing to play their part in making the network successful. The ability of a community to adapt to changes and its resilience to 'shocks' varies according to the quality of the social capital available to them.

- **Lowe, T. 1998. Agribusiness alternative program begins to bear fruit. Regional First: NSW community economic development newsletter. 2(12), p.7**

Due to the effects of globalisation, the NSW agricultural industry is being forced to diversify, value-add and form strategic alliances to remain competitive. As a response to these changing circumstances the NSW government has set up twelve Agribusiness Development Officers (ADO's) to assist producers in identifying and developing alternative agribusiness options.

- **Lowe, I. 2000. Off the beaten track. New Scientist, October 21, p.75.**

Reports that a group of scientists posit a new approach to science, one that needs to be "re-oriented to provide the knowledge necessary for a transition to sustainability." The article calls for "interdisciplinary studies of complex systems" and emphasises the need to acknowledge the complexity and interdependence of ecosystems. The article relays the views of various scientists and results of various case studies that all reach the same conclusion concerning a need for further studies that consider natural and societal systems in concert

- **McClintock, I. C. & Stern, W. R. 1999, The farming environment. In Preserving rural Australia: Issues and solutions, ed. A. Robertson & R. Watts, CSIRO, Collingwood, Vic.**

Agriculture is closely integrated with society, therefore as society changes so does farming. In order to conserve the natural resources of rural Australia farmers need to adjust, as well as respond to the communities' environmental concerns and economic pressures. Globalisation and the pressure for sustainability stress the importance for our farmers to be efficient in their use of resources, and farmers resources can be categorised into three distinct categories; environmental, genetic and aggregate. To enable sustainability to occur the skill level of the farmer is important, as is not only the efficient, but also the effective use of these various resources. Categories of risk for farming are defined as production, environmental, financial, and marketing. The margin between success and failure in agriculture continues to narrow with the number of people participating in primary production declining significantly over the last 25 years. It is anticipated that the future will bring an increase in commercial farming and a decrease in family farming. This paper also explores the practical consequences of the shrinking financial and medical services in rural communities.

- **Milliken, P. 1999, Toward regional strategies for rural sustainability: A farmer's view. In Preserving rural Australia: Issues and solutions, ed. A. Robertson & R. Watts, CSIRO, Collingwood, Vic.**

This article describes the establishment, work and role of the Murrumbidgee Catchment Management Committee (MCMC) from the perspective of a farmer who was also one of the founding members of the MCMC. Farming is a complex business, which involves regular and active decision making based on social, economic and environmental factors. An experienced farmer can make these decisions intuitively when well supported by information transfer. The

method for achieving the goal of sustainability in agriculture is to invest in self-sustaining actions, to achieve cost-effective outcomes, to monitor outcomes and to analyse and plan.

- **Olfert, R. & Weinand, H. 1997, The role of rural communities in New South Wales: Part II. Office of Rural Communities, NSW Ministry of Agriculture.**

Rural communities play an important role, serving their own and surrounding populations as trade centres, from which consumer goods and services (including health and education) are provided. Rural communities therefore also provide employment and income earning opportunities for the local labour force as well as providing the opportunity for off-farm employment. This report defines and categorises the trade centre structure of NSW rural communities in the context of Central Place Theory. This framework allows researchers to systematically and simultaneously consider factors such as population size, business structure and public health and education infrastructure, in determining the position of each rural community within the trade centres of NSW. Communities are classified into levels representing a combination of higher order functions. This classification system aims both to provide information about the structure of the trade centre system at a given point in time, as well providing a benchmark against which to consider future changes in structure.

- **Powell, R.A., Jensen, R.C. and Gibson, A.L. 1985, The Economic Impact of Irrigated Agriculture in NSW: A Report to the NSW Irrigators' Council Limited. Department of Agricultural Economics and Business Management, University of New England, Armidale.**

While this study is sixteen years old, it is viewed in the industry as a benchmark for the estimation of multipliers arising from irrigation farming.

The authors set out to identify and measure the economic impact of irrigated agriculture on the regions and the state of NSW and to assemble a data base and modelling framework which could be used to assess the impact of changes in policies that affect irrigated farming (p.i). Input-output analysis (in the author's view, the most appropriate method of estimation of multipliers) was used to measure the flow-on effects of both irrigated agriculture and associated activities. Associated activities include marketing, transport, storage and processing of products; the provision of extension services; the activities of the Water Resources Commissions and the capital expenditure of irrigation farmers. "Irrigation farming was shown to produce output valued at \$645m. This represented 23 per cent of all agricultural production in NSW. These farming activities generated flow-on effects amounting to \$1414m which gave a total effect of \$2059m." (p. 96). High flow-on effects were shown: "At the state level it is possible to generalise that the impact multiplier was approximately five and at the regional level approximately three. This may be interpreted as indicating that for each unit of activity on irrigation farms, two were generated in the local region and a further two were generated in the rest of the state, mostly in the main metropolitan area." (p. 96). One important factor in the large flow-on effects was "the high proportion of the output from irrigated agriculture that was processed within the region in which it was produced. For some regions this was as high as 80-90 per cent." The authors conclude that changes that effect the level of production will have large and proportional flow-on effects to processing, marketing and transport.

The nature of this type of study is that it will tend to support the status quo. It will show that irrigated agriculture creates positive flow-on effects to the rest of the economy and will be used by those who wish to promote the existing state of affairs. In addition, the notion of a representational farm ignores the possible heterogeneity of farms in the region. This type of

input-output analysis, which is predominantly economic in character, ignores environmental and social costs that would be location specific. The authors also offer cautionary remarks that no attempt was made to make an assessment of the efficiency of the industry or to answer 'What if?' type questions such as positing what would happen if less water were available, although this study provides a basis for such research. "The results...will enable better judgements to be made about the effect of policy changes on both irrigation farmers and the rest of the economy and form the basis for better policy decisions." (p.97).

- **Powell, R. 1999, Revitalising Australian regions. Unpublished paper presented to the Regional Science Association Conference, Newcastle, September.**

The relationship between the farm sector and rural economies is changing. In the past the two were closely linked, however that is no longer the case. A continuing strong relationship between agriculture and the regional economy will now be the result of good policy and economic strategy rather than necessity. To build an integrated future for rural regions there is an increasing role for partnerships of all kinds, including a growth in various networks, alliances and clusters that are designed to provide a range of competitive advantages. This signifies a substantial shift from independence to interdependence. Capacity building is also necessary as most of the new development opportunities associated with agriculture now lie in the downstream value adding area. Rural regions have seen a substantial reduction in both public and private agribusinesses as technological advances have enabled most agribusinesses to operate from an urban environment, which suits these operations, as it is much cheaper to run a business in the cities. If agriculture is to reclaim its position as the key driver of regional economies then it needs to focus on the abundant downstream value adding opportunities that exist. It will also be necessary for rural areas to make a case for a larger share of the infrastructure funding to enable these downstream operations to be located in regions even though the underlying economic forces will favour city locations.

- **Reale, L. 1998, Rapid rural appraisal of the vegetable industry in the Murrumbidgee Irrigation Areas. Masters Dissertation, Faculty of Science and Agriculture, Charles Sturt University, Wagga Wagga, NSW.**

Generally speaking the vegetable farmers in the Murrumbidgee Irrigation Area admired the rice industries level of organisation and ability to form a powerful lobby group. However most of the vegetable farmers consulted for this report indicated that they believed that many of the environmental problems that affect the Murrumbidgee Irrigation Area are due to rice farming. Rising water tables in particular were seen to be as a result of rice farming. There were strong suggestions made to limit or decrease the level of rice farming to combat these problems. This study describes the conceptual and methodological bases for Rapid Rural Appraisal and uses RRA in three surveys in the Murrumbidgee Irrigation Area.

- **Regional First: NSW Community Economic Development Newsletter. 1998, Credit care helping to re-establish financial services in rural and remote areas'. 2(12), p.8.**

Credit Care is a national government project assisting rural and remote communities to re-establishing access to essential financial services that they may have lost.

- **Robertson, A. & Roshier, D. A. 1999, Scientific and social impediments to restoration ecology as applied to rural landscapes. In Preserving rural Australia: Issues and solutions, ed. A. Robertson & R. Watts, CSIRO, Collingwood, Vic.**

With a growing world population there is a growing demand for Australian agricultural products globally. Greater efficiency of Australian farmers based on better management; marketing, economy of scales and a shift towards corporate farms will allow Australian farmers to better penetrate global markets. The impact of the biotechnical revolution is also contributing to higher yields. These current trends are suited to short term profitability, however they pose challenges in the long term for sustainability of our already stressed agricultural ecosystems because there will be greater demand on water resources, more intensive use of soil and greater pressure on vegetation. According to this article the five major challenges to the sustainability of natural resources are; greed, ignorance, institutional arrangements, fashions of governments and the attitudes and behaviours of biophysical scientists and farmers.

- **Independent Advisory Committee on Socio-economic Analysis, 1998, Socio-economic Assessment Guidelines for River, Groundwater and Water Management Committees, Department of Land and Water Conservation, Sydney.**

This document represents an important step in involving community, through various water management committees, in the process of compiling information to assist them to consider the socio-economic effects of their water management decisions in the process of developing River, Groundwater and Water Management Plans. A ten step plan is detailed and the Independent Advisory Committee on Socio-economic Analysis is to provide on-going support, including the provision of updated information and 'skilling-up' of committee members. This is a laudable process, but various key informants believe that there are insufficient resources to provide such support and that whatever resources are available are being outsourced to consultants, rather than building social capital in communities. It is in any case, not clear just how the community would be involved in the process as no participatory methodology is suggested, other than through the committee.

- **Watts, R. J. 1999, Challenges for conserving biodiversity in Australian freshwater ecosystems. In Preserving rural Australia: Issues and solutions, ed. A. Robertson & R. Watts, CSIRO, Collingwood, Vic.**

There is an increasing pressure on freshwater resources worldwide. Loss of freshwater biodiversity is due to a number of factors. In Australia these include; alteration to the hydrological cycle, direct and indirect alteration of habitat, pollution, introduced species and commercial and recreational exploitation of species. Physical, chemical and biological degradation of freshwater environments is widely recognised as a major problem, however loss of biodiversity in freshwater systems has received relatively little attention, and desperately requires future research attention. Fish are good indicators of biodiversity and in Australia a third of all freshwater fish species are threatened or rare. A survey of NSW shows that more than 99% of the fish in the Murrumbidgee Catchment are carp, an introduced noxious fish. Reasons for conserving biodiversity are generally grouped into four categories, ecological, utilitarian, moral and recreational. Raising community awareness is one of the major social challenges for maintaining biodiversity, as is educating farmers on the link between conservation and profitable agriculture. Community partnerships such as Landcare and Rivercare are essential to this process.

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APPENDIX A: GLOSSARY OF TERMS

Capacity building. An approach to the development of sustainable skills, organisational structures and resources. It also implies a commitment to developing social capital.

Capacity measurement. A measurement of the ability of a given community to adapt or change. This includes an assessment of the resources that the community has to enable them to develop and change.

Collaborative problem-solving. The co-operation of several individuals or interest groups in the process of making decisions and addressing problems.

Community. A group of people with a sense of shared identity which can be based on various characteristics - for example race, class, geographic location, age or occupation.

Creative problem-solving methodology is a technique created for community and regional development projects, where collaborative and consultative methods of problem solving are desired, rather than conventional adversarial approaches. The technique is based on divergent and convergent thinking about problems or issues over a two-day workshop.

Economic viability. The degree to which a commercial undertaking is likely to produce a profit in the long term.

Ecosystem degradation and fragility. Describes the way that different aspects of life are interrelated. This includes how people, animals, plants, waterways and soil are linked together. Therefore, damage to one potentially entails damage to all.

Endogenous and exogenous solutions. Endogenous solutions are those that are generated by the individuals or community involved in the problem. Exogenous solutions are those that come from outside the concerned community and may in fact be imposed upon them.

Environmental sustainability. The degree to which commercial activity is compatible with the environment in which it takes place - for example industrial activity that adds to pollution of the waterways on which it relies is not environmentally sustainable.

Environmental externality. An externality is a cost or benefit resulting from an action by one party that falls on another party - thus it is 'external' to the first party. One of the most common ways of generating externalities is through action which affects the physical environment (i.e. an environmental externality). For example, air pollution may be created by a processing plant which imposes costs on those living downwind.

Farmer adoption rate. This describes how farmers take up new innovations - for example the farmer adoption rate for technology would be concerned with how many and how quickly farmers employed new technology in their farming practice.

Interdisciplinary research. Study that encompasses more than one academic discipline - for example research that crosses over between economics and sociology.

Issues and concerns to stakeholders. Stakeholders are those groups and individuals with an immediate interest in the issue or concern under consideration.

Natural resource management. The regulation of the ways that elements such as minerals, land and water are used by individuals and communities. Often this entails ensuring that the natural resources are not degraded through overuse.

Owning the problem. The degree to which a community or individual accepts a difficulty and views the solution to that difficulty as being their responsibility. When the community or individual does not own the problem, the expectation is that others will do the solving.

Partnership. In this context, partnership means a formal and equal collaboration of relevant key stakeholders on a specific project. It also implies joint responsibility for a project.

Participation. Participation can be defined as taking part, or having a part or share in decision making.

Policy. Defines goals and strategies for action. Policy is often determined by government agencies and industry organisations.

RRA methodology. RRA stands for Rapid Rural Appraisal which is a team survey approach to problem-solving - refer to Dunn et al. (1996, 1997) in the annotated bibliography.

Rationality. In neo-classical economics, the rational person always reaches the decision that is objectively best in terms of the given utility function. In psychological terms, rationality refers to reasonable decision-making based on available knowledge and means of computation.

Regulation. In its simplest sense, regulation refers to rules governing institutional arrangements, including social and economic conduct.

Social capital (sometimes called social knowledge). The non-monetary value of social skills and knowledge possessed by any given population.

Social change. A standard sociological definition refers to the alteration in basic structures of social groups or society.

Stewardship. Describes the relationship of people to the land and its natural resources with the implication that people should take care of the land.

System. It is a network of functions, relations or activities within an industry or organisation that work together for the aim of that industry.

Sustainability. "The principle of sustainability means that systems must be able to be maintained in the long term, that resources would be used only at the rate at which they can be replenished, that renewable energy sources should be utilised, {and} that output to the environment should be limited to the level at which it can be absorbed." (Ife, 1999:45)

Systems thinking. An approach to social analysis that emphasises interaction. This approach seeks to identify all of the aspects of a situation and describe how they interact with each other.

Tourism. The industry of recreation.

Tragedy of the commons. The term was first coined in 1968 by Garrett Hardin and refers to the damage that is done to the environment when a large number of people make use of a scarce but publicly available natural resource - refer to Ostrom (1990: 3) in the reference list. Transaction costs. This concept refers to costs other than the money price that are incurred in trading goods or services. All of these activities involve opportunity costs in terms of time, energy and money. For example, if the terms of the trade are to be more complicated than simple "cash on the barrel-head", then negotiations for such a detailed contract may itself be prolonged and very costly in terms of time, travel expenses, lawyers' fees and so on.

Transparent box modelling: A style of interaction that builds trust between and amongst participants in a problem solving situation by making processes and expectations visible.

Value management. An organised approach to locate, identify and remove unnecessary costs in products, processes or systems, to improve efficiency, productivity, performance, quality and value, and to also develop the skills and maturity of the people involved. Value means the lowest cost to reliably perform a function.

Wicked problem. An undesirable set of circumstances that is particularly difficult to rectify. There is little agreement about the nature of the problem and therefore there is no clear solution. In addition, the context is changeable - refer to Roberts (2000:1) in the reference list.

APPENDIX B: KEY INFORMANTS

Bramston, Mark (CEO, Coleambally Irrigation Co-operative Ltd.)

Cullen, Peter (CEO of CRC for Freshwater Ecology, University of Canberra)

Davis, Jeff (General Manager, Research, RIRDC, Canberra)

Eberbach, Phillip (Senior Lecturer, Head of Program 5, Rice CRC, School of Agriculture, CSU)

Eyres, Tony (Manager, Birchchip Cropping)

Fenton, Mark (Director, EBC, GIS Systems, Queensland)

Fishburn, Geoff (Manager, Murrumbidgee Region, Dept. Land and Water Conservation, Wagga Wagga)

Gray, Ian (Associate Professor in Rural Sociology, School of Humanities and Social Sciences, CSU)

Lewin, Laurie (Director, Sustainable Rice CRC, Yanco)

Linnegar, Matt (Rice Growers Association)

Marshall, Graham (PhD student in Economics at UNE)

Muirhead, Warren (Coleambally Irrigation Co-operative Board)

Powell, Roy (Centre for Agricultural and Regional Economics - CARE)

Pigram, John (Director, Centre for Water Policy Research, UNE)

Stayner, Richard (UNE - difficulty in contacting him)

Vanclay, Frank (Associate Professor in Rural Sociology, Deputy Director, Centre for Rural Social Research, CSU)

Wolfenden, John (Researcher, Centre for Water Policy Research, UNE)

Young, Mike (CSIRO, Environment, Land and Water, Adelaide)

Other researchers/practitioners/policy makers identified by informants and covered in the literature review.

Bowmer, Kath (Chair, Murrumbidgee River Catchment Management Committee)

Collins, Ray (Action research, Brisbane)

Crase, Lyn (Economist, La Trobe University)
Hope, Meredith (NSW Agriculture, Dubbo)
Rice Growers' Co-operative Ltd.

APPENDIX C: WATER REFORM LEGISLATION

A proposal for updated and consolidated water management legislation for New South Wales: a white paper, December 1999.

The single most significant information in this regard is the Water Management Bill 2000. It is the guiding imperative for the socio-economic research agenda and therefore the salient features of the reform bill need to be outlined first. It should be noted that there are several amendments to the bill at the present moment. An overview of the bill follows.

The main object of this Bill is:

- to provide for the protection, conservation, and ecologically sustainable development of the water sources of the State, and

Legislative Framework

Water management planning based on an adaptive management approach, applying the principle of "ecologically sustainable development" (ESD). These principles include:

- Precautionary principles
- Inter-generational equity
- Conservation of biological diversity and ecological integrity
- Improved environmental valuation.

The legislation and framework for the implementation of the water management Bill in NSW can be described as an attempt by Government at holistic management processes, incorporating other related water Bills into one single document and set of procedural structures. Therefore, the Bill either repeals or amends other Acts, incorporating provisions within the new Act.

The Bill forms part of the broader natural resources planning framework.

Essentially, the proposed legislation gives the Minister control of water in NSW.

Main Elements In The Proposed Water Legislation

1. Protection of the water environment
2. Water management planning and the community
3. Clarification of water rights and ecosystem activity approvals
4. Water trading and transfers

5. Compliance

In managing our water resources we (Government) are seeking to achieve three interlocking outcomes:

1. Innovative and competitive industries that make use of water resources, within their capability, to generate wealth for social and economic wellbeing.
2. Ecosystem Integrity - maintenance and enhancement of rivers, lakes, wetlands and aquifers and their dependent ecosystems.
3. Regional communities that are committed to the ecologically sustainable development of water resources in their regions.

True sustainable management can only be achieved by policies and decisions that explicitly consider how these outcomes can be integrated.

Problems With The Current Legislation (outlined in the White Paper - the government's perspective)

- No explicit head of power for environmental needs
- No explicit mechanisms for broad community involvement
- No community based planning provisions
- Licenses tie water entitlements to land
- Water access entitlements need definition

- Licenses tie water entitlements to works and specified land
- Access to water is not secure
- Water use approvals need streamlining
- Special entitlements are loosely or poorly specified
- Difficult to integrate water management across the water ecosystem

Note: there are two references to community involvement that have implications for the Scoping project.

What Is Needed

The white paper states what is needed for reform, including:

- Provision for ensuring ecologically sustainable development outcomes - (meeting aquatic ecosystem requirements)
- Provisions for community/government partnerships in water management - (a fundamental feature of this Government's natural resource management policy).
- Clearly defined rules and outcomes- (Water access conditions)
- Security for entitlement holders - (specifications and tenure of water entitlements)
- Harvestable and domestic stock rights - (statutory water access provisions clearly specified and should be confined to limited and justifiable needs.) Government's accountability balances and checks of land uses.

- Specification tailored to each resource - (access water specified by way of a number of access or use components relevant to the specific water resource, regulated, unregulated and groundwater. Specified differently in terms of its tenure, its unit value, its adjustability, tradeability, geographic extent etc.)
- Separation from land - (non-landholders and landholders alike should be able to own water entitlements). The Government will also be able to own water entitlements under the new legislation, as Irrigation Corporations now do.
- Tradeability - (valuable components of the water access entitlements should be able to be traded at the discretion of the entitlement holder) Therefore, if the Government can own water entitlements, it can also trade.
- Obligations - (responsibilities of water entitlement)
- Consistent, generic framework - (all types of water supply and use managements should be accommodated under the new system)
- Administrative efficiency - (water users who obtain supply from a regulated river or a water distribution service only need to deal with their most immediate provider)
- Register - (all water entitlements and approvals will be registered)

Issues - New Water Approvals System

The proposed Water Management Act will incorporate requirements similar to elements of the current land and water management plans and include measures to ensure consistency with relevant resource management plans and State policies.

The Minister may require applicants for a new or revised water use approval to supply information relating to one or more of the following matters:

- Volumes of water to be used or applied
- Nature of the crops (i.e. permanent planting or pasture)
- Irrigation method proposed and the area to be irrigated
- Works for storage or distribution of water on the property
- Drainage, recycling, and return flows and any measures to reduce impacts or restore environmental features
- Soil compatibility salinity, groundwater quality and levels
- Social and economic benefits of the enterprise
- Cumulative environmental impacts including existing and emerging major degradation and impacts on biodiversity
- Proposed removal of native vegetation and measures for native vegetation retention or re-establishment
- Buffer zones
- Water conservation strategies and best practice principles including total water cycle management
- Potential off site impacts on other water users
- Heritage and cultural aspects of the site
- Generic matters specified in the Administration of the White Paper.

The Minister may require the applicant to present the information required in the form of a property - based plan.

The New System For Irrigation Corporations And Individual Irrigators

Individual irrigators, irrigation corporations, industry companies, mining companies, water utilities and others will be required to obtain a water use approval in order to use water.

Approval for individual irrigators will be issued for a **ten-year term**; irrigation corporations, industry companies, mining companies and local water facilities will be **15-20 years**.

Water use approval will be reviewed **every FIVE years**, when the relevant resource management plan is reviewed.

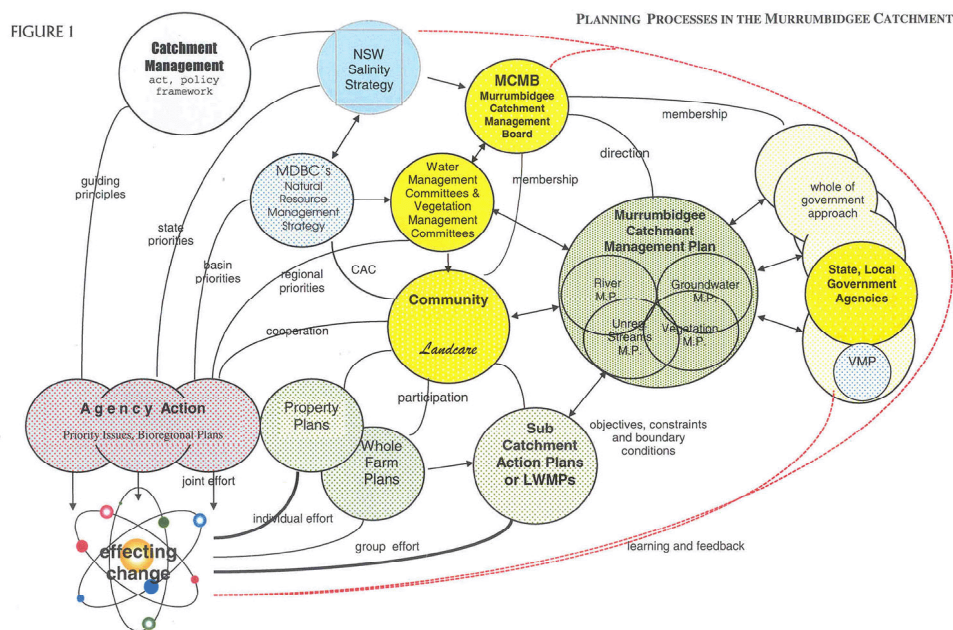
The water use approval sets limits on the volume that can be used and determines the conditions of use i.e. irrigation method, drainage management and recycling and return flow.

Individual irrigators, irrigation corporations, industry companies, mining companies and others will require a:

- Share entitlement,
- Extraction entitlement and
- Water use approval in order to operate.

Water use approval for irrigators may include a condition a condition requiring a property-based plan. The water use approval for irrigation corporations will include provisions equivalent to the relevant current requirements for regional land and water management plans.

Appendix D: Water Management Structure In The Murrumbidgee Catchment (Source: Department of Land and Water Conservation)



aimmaraj tcmlan2.doc 04/07/2000

Rice CRC ... of growing importance

About the Rice CRC

The Rice CRC is strengthening the rice industry's research and development (R&D) effort through its focus on sustainability.

Its mission is to increase the environmental, economic and social sustainability of the Australian Rice Industry and enhance its international competitiveness through both strategic and tactical research and the implementation of practical, cost-effective programs.

The Centre uses the intellectual resources of some of Australia's peak R&D organisations to target five main program areas:

1. Sustainability of Natural Resources in Rice-Based Cropping Systems
2. Sustainable Production Systems
3. Genetic Improvement for Sustainable Production
4. Product and Process Development
5. Education, Skills Development and Technology Transfer

Rice CRC core participants are Charles Sturt University, NSW Agriculture, CSIRO, Department of Land and Water Conservation, University of Sydney, Ricegrowers' Co-operative Ltd and the Rural Industries Research and Development Corporation.



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