Social Benchmarking for Interdisciplinary Ecosystems Management

Case Study:
Agriculture and Diffuse Source Pollution from Acid Sulfate Soils, NSW, Australia

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SOCIAL BENCHMARKING
THE PRINCIPAL RESEARCH QUESTION:
How can benchmarking most effectively be used to involve multiple stakeholders in learning and action to deal with a complex environmental issue such as acid sulfate soils in eastern Australia?

ABSTRACT

To incorporate concepts of sustainable agriculture into policy formulation, and decision making for ecosystem management there is a need to integrate social, environmental and economic objectives. This thesis explores a Social Benchmarking model for achieving this integration. The social benchmarking methodology has been designed to respond to complex ecosystem problems that are caused by diffuse source pollution. It is a multi-methodology approach that develops qualitative and quantitative data for measurement of change over time, combined with participative processes for identifying best practices and developing tools for providing information to decision makers. The philosophy behind the process is to actively acknowledge that each stakeholder has a vested interest in their own future and that they need credible information to enable them to reach agreement on future ecosystem issues.

The research was conducted in seven coastal catchments in New South Wales, Australia between 1998 and 2003. The case study explores the issues raised by problems from acid sulfate soils. Oxidation of these soils causes acidification of soils and diffuse source pollution of water. It is relatively simple to treat at source, but there are multiple sources and entry points from private and public land. The impacts can be a lowering pH to less than 3, affecting water quality, biodiversity and downstream industries. This has resulted in conflict between the multiple stakeholders. Such environmental problems are challenging much of the orthodox thinking and effectiveness of policies. To achieve sustainable development, government agencies need to change their operational ideas away from purely efficient use
to include environmentally and socially acceptable use of resources by multiple stakeholders.

The key themes of this thesis are using a benchmarking system to provide feedback to industry groups and the role and relationship between human and social capital for participatory and evidence based policy development. How to align education and regulatory policies with best practice standards and incentives so that institutions support building adult skills and community capacity to change. Thus, this thesis develops social indicators of human and social capital for stakeholders associated with acid sulfate soils, along with environmental and economic indicators.

The benchmarking system provided feedback to the industry groups (beef, cane, dairy and tea tree landholders) about where their industry was positioned relative to others in the industry, identified best practices and provided the mechanism for triple bottom line reporting. There are three reports within the scope this thesis. The first report “Farming community ideas about the way forward’ in 1998 described the industry, provided baseline data and introduces major issues, such as how there is considerable concern about developing a balance between education and regulation within stakeholder groups. Using participatory research to validate the survey results, the best management practices were identified. One industry, the sugar cane industry, was tackling managing acid sulfate soils and felt they were in control. This was due to their emphasis on building human and social capital. They had developed a soil sampling program and aligned their best practice standards and regulatory policies. The soil sampling program was investigated and guidelines developed to enable sharing of this knowledge in other industries. “Keys to Success” is best practices guidelines about how to sample for acid sulfate soils. The last report in the series “Four years on: What Changed?” looks at these same four industries and the changes that have occurred, while also exploring in more detail the policy implications including:

- Investing in adult education policies to increase adult skills over 4 years resulted in 25% increase in knowledge and behavioural change (sustainability performance indicators).
- Access to strong social capital, increases likelihood of life long learning and accounts for variation in human capital and behavioural change.
- Number of information resources accessed was highly correlated with positive attitude to behavioural change.
- Lack of equity between institutional and civil stakeholders undermines belief system and social capitals by causing conflict and loss of trust in institutions.
These books form the basis of a social/sustainability reporting system, they also provided the basis of the communication strategy to build human capital within the stakeholder groups. One final contribution to the communication facet of this thesis is the proceedings from an OECD funded workshop, Agriculture and Ecosystems Management. These proceedings were aimed at policy and academic stakeholders and attempt to investigate the relationship between the divergent viewpoints held by social, environmental and economic researchers.

Building human capital and thereby capacity of individuals and groups to move beyond agricultural production and to become natural resource managers requires alignment of policies and ongoing support and change in institutional thinking. Building strong social capital is the key to facilitating change particularly where collective action is required, but contradictory information and policies can rapidly undermine social capital. Within the context of the acid sulfate soils case study, results from this research indicate that communication of information about change in society through reporting mechanisms is an important facet of facilitating sustainable development that requires more attention in policy and institutional frameworks.
LIST OF PUBLISHED PAPERS AND OTHER RELEVANT MATERIAL BY THE AUTHOR

**Journal Article**


**Editor**


**Refereed Conference papers**


**Conference papers**


Reports


Extension Books


# TABLE OF CONTENTS

List of Published Papers and other relevant material by the author............................................... 5

Glossary13

Acknowledgements................................................................ .............................................................. 15

1. THE INTRODUCTION............................................................................................................... 16
   1.1 Background to the Research .............................................................................................. 16
   1.2 Research Problem and Assumptions............................................................................... 16
   1.3 The Biophysical Problem................................................................................................. 18
   1.4 Justification for the Research.......................................................................................... 19
   1.5 Outline of the Thesis......................................................................................................... 21

2. THE SETTING .......................................................................................................................... 26
   2.1 About the Author............................................................................................................. 26
   2.2 Background to the Research.......................................................................................... 26
   2.3 Geography and Climate................................................................................................. 28

   3.1 Sustainable Development and Agriculture................................................................. 34
   3.2 Integrated Catchment Management of Coastal Wetlands............................................. 39
   3.3 Acid Sulfate Soils, Setting the Scene............................................................................. 40
      3.3.1 The Bio-physical Problem .................................................................................... 41
      3.3.2 NSW Policy and Institutional Background......................................................... 44
      3.3.3 Historical Perspective......................................................................................... 46
      3.3.4 Stakeholders and Economics.............................................................................. 48
   3.4 Multiple Stakeholders................................................................................................. 51
      3.4.1 Adaptive Participatory Research and Community Participation ....................... 56
   3.5 Participatory Environmental Education ...................................................................... 59
      3.5.1 Agricultural Extension ......................................................................................... 59
      3.5.2 Environmental Education .................................................................................. 65
      3.5.3 Adult Learning and Changing Social Norms...................................................... 67
   3.6 Sustainability Indicators............................................................................................... 70
   3.7 Benchmarking and other Systemic Models................................................................. 74
      3.7.1 Models .................................................................................................................. 76
      3.7.2 Benchmarking, a Change Agent and a Device for Measuring Change ......... 78
   3.8 Reflections and Conclusions......................................................................................... 81

4. THE METHODOLOGY: SOCIAL BENCHMARKING ................................................................. 83
   4.1 Introduction..................................................................................................................... 84
4.2 Social Benchmarking ........................................................................................................... 85
  4.2.1 Developing Indicators for Benchmarks ........................................................................... 86
  4.2.2 Investigating Processes ................................................................................................. 94
  4.2.3 Communicate Information to Wider Audiences .......................................................... 98

4.3 Reflections and Concluding Remarks .................................................................................. 100

5. THE 1998 BENCHMARKING SURVEYS .................................................................................. 103
  5.1 Introduction .......................................................................................................................... 104
  5.2 Farmer Survey ..................................................................................................................... 107
    5.2.1 Sampling Strategy ........................................................................................................ 107
    5.2.2 Socio Demographic Profile of Survey Population ..................................................... 110
    5.2.3 Farm Management ....................................................................................................... 111
    5.2.4 Knowledge and Awareness of Acid Sulfate Soils ....................................................... 114
    5.2.5 Attitudes to the Management of Acid Sulfate Soils .................................................... 121
    5.2.6 Drains, Flood Gates and Unions .................................................................................. 127
    5.2.7 Catchment Management Committees ......................................................................... 136
    5.2.8 Information Sources ................................................................................................... 139
    5.2.9 Attitude to Acid Sulfate Soils Issues in the Wider Community .................................... 140
    5.2.10 Conclusions from Farmer Survey ........................................................................... 147
  5.3 Government Survey ............................................................................................................ 148
    5.3.1 Sampling Strategy ........................................................................................................ 148
    5.3.2 Knowledge about Planning and Management ............................................................... 149
    5.3.3 Local Environment Plans ............................................................................................. 150
    5.3.4 Catchment Management Committees ......................................................................... 151
    5.3.5 Information Sources ................................................................................................... 153
    5.3.6 Training ......................................................................................................................... 154
    5.3.7 Government Survey Conclusions .............................................................................. 156
  5.4 Oyster Survey Summary ..................................................................................................... 157
  5.5 Reflections and Concluding Remarks .................................................................................. 158

6. THE FOCUS GROUPS ............................................................................................................... 160
  6.1 Introduction .......................................................................................................................... 161
  6.2 Sampling Strategy and Focus Group Formats .................................................................... 162
    6.2.1 Sampling Strategy ........................................................................................................ 162
    6.2.2 Focus Group Formats ................................................................................................... 165
  6.3 Main Results: Landholders and Government Employees ................................................ 167
  6.4 Analysis of Key Issues ........................................................................................................ 171
    6.4.1 Research and Education ............................................................................................... 172
    6.4.2 Community Groups and Communication ................................................................... 173
    6.4.3 Regulation and legislation .......................................................................................... 174
6.5 Reflections and Concluding Remarks ................................................................. 175

7. THE STAKEHOLDERS, CONFLICT AND CONTROL .............................................. 180
   7.1 Introduction ........................................................................................................ 181
   7.2 Stakeholder Dialogue and Change .................................................................... 186
   7.3 Reducing Conflict ............................................................................................... 188
   7.4 Building Human and Social Capital ................................................................... 192
   7.5 Regaining Control ............................................................................................... 196
   7.6 Reflections and Concluding Remarks .................................................................. 199

8. DEVELOPING TOOLS FOR BEST PRACTICE ENVIRONMENTAL MANAGEMENT ........... 202
   8.1 Introduction ........................................................................................................ 203
   8.2 Implementation of a Best Practice Environmental Management (BPEM) Tool ........ 208
      8.2.1 Case Study: The Sugar Cane Sampling Program ....................................... 208
   8.3 Information Dissemination and BPEM ............................................................... 211
   8.4 Developing “Keys to success” BPEM Guidelines .............................................. 215
   8.5 Communication Strategy for ‘Keys to Success’ .................................................. 218
   8.6 Beyond BPEM to Best Practice Environmental Regulation ................................ 222
   8.7 Reflections and Concluding Remarks .................................................................. 224

9. WHAT CHANGED? INTERDISCIPLINARITY AND EVIDENCE FOR POLICY DEVELOPMENT .......................................................... 228
   9.1 Introduction ........................................................................................................ 230
   9.2 Policy Overview ................................................................................................ 234
   9.3 the Second Benchmarking Survey of Landholders .............................................. 239
   9.4 The OECD Interdisciplinary Workshop ............................................................ 251
   9.5 Reflections and Concluding Remarks .................................................................. 254

10. THE MAIN FINDINGS AND CONCLUDING REMARKS ........................................... 259
    10.1 Conclusions about each Research Question ................................................... 259
    10.2 Conclusions about the Research Problem ....................................................... 264
    10.3 Implications for Policy and Practice ................................................................. 268

REFERENCES .............................................................................................................. 271

LIST OF TABLES, FIGURES

Figures
Figure 1 Social Benchmarking and the Sustainability Model ....................................... 21
Figure 2 Study catchments in NSW Australia .............................................................. 28
Figure 3 Mean rainfall for Alstonville, Richmond Catchment ..................................... 29
Figure 4 Map of the Tuckean Swamp ......................................................................... 31
Figure 5 Map of the Tuckean Swamp in the Richmond Catchment ................................ ...... 31
Figure 6. Social, Economic and Environmental Linkages ..................................................... 36
Figure 7 Water table movement and acid sulfate soils ......................................................... 43
Figure 8 NSW EPA Causal Model of Environmental Behaviour ........................................ 66
Figure 9 Farm Management Model ........................................................................... .......... 72
Figure 10 The Social Benchmarking Model ...................................................................... .... 86
Figure 11 Hierarchical tree for developing social indicators ............................................. 93
Figure 12 Potential survey respondents by industry and catchment ................................... 109
Figure 13 Distribution of actual responses by catchment and industry ................................ 109
Figure 14 Phone call responses .............................................................................. ........... 109
Figure 15 Status of production from principle farming industry ....................................... 111
Figure 16 Distribution of landholders ages ...................................................................... 111
Figure 17 Lime and soils and water tests ...................................................................... ..... 113
Figure 18 Identification of acid sulfate soils (Q6.2 and Q6.3) ................................ ............. 116
Figure 19 Qualitative analysis of farmer awareness of acid sulfate soils ............................ 119
Figure 20 Importance of acid sulfate soils issues to farm planning and management ....... 121
Figure 21 Attitude to acid sulfate soils in the community (Q13) .......................................... 141
Figure 22 Qualitative analysis of farming industry attitude to community groups ............ 142
Figure 23 Qualitative analysis of farmer's negative attitudes towards community groups ... 143
Figure 24 Importance of acid sulfate soils issues in organisation ....................................... 150
Figure 25 Time spent on acid sulfate soils by government employees ............................. 150
Figure 26 Qualitative analysis of farmer attitudes to acid sulfate soil management sorted by industry ........................................................................................ ......... 198
Figure 27 A deep narrow drain on the right is reshaped to a wide shallow drain on the left that does not enter the acid sulfate layer of soil ........................................ 210
Figure 28 Communication Flow......................................................................................... 218
Figure 29 Cumulative proportion showing attitude to importance of farm planning by industry .................................................................................................................. 219
Figure 30 Cumulate proportion showing attitude to the perceived importance of acid sulfate soils to the community ............................................................. 219
Figure 31 Sustainability Performance Indicators used in the acid sulfate soils study for showing the capacity to change to BPEM ...................................................... 241
Figure 32 Adjusted Social Benchmarking Model to emphasis communication ............ 266

Tables
Table 1 Benchmarking Activities by year, chapter and appendix.......................................... 23
Table 2 Risk of ASS land area in the Richmond Catchment ............................................... 42
Table 4 Characteristics and elements of environmental conflicts ........................................ 53
Table 5  Characteristics of those who tend to adopt early over those who adopt later ........................................ 64
Table 6  SCARM farm management indicators ........................................................................................................ 71
Table 7  Principal stakeholders and the issues that cause concern that were identified during the acid sulfate soils study ................................................................. 89
Table 8  Types of data collected in telephone surveys ............................................................................................... 90
Table 9  Industry by catchment stratified responses from ASS landholder survey, showing node name and associated responses classified in the attitude nodes ..... 94
Table 10  Results of comparisons of industries socio-economic data .................................................................. 110
Table 11  Land use by catchment from survey respondent ......................................................................................... 112
Table 12  % Awareness of risk maps by catchment .................................................................................................... 117
Table 13  % Awareness of risk maps by industry ........................................................................................................ 117
Table 14  Qualitative analysis on awareness levels by catchment ............................................................................... 120
Table 15  Qualitative analysis of farmer sense of ‘in control’ to acid sulfate soils planning and management by % in catchment ......................................................................................... 123
Table 16  % by catchment of density of flood gates in catchments based on survey responses .......................................................... 131
Table 17  Interest to be involved in community groups by numbers in each catchment ....................................... 137
Table 18  How landholders gain information on acid sulfate soils ........................................................................ 139
Table 19  Number of cane farm who had been tested for acid sulfate soils in May 1998 ........................................ 140
Table 20  % of sightings of acid sulfate soils pamphlet by industry ......................................................................... 140
Table 21  Government organisations attending focus groups ................................................................................... 149
Table 22  Time until acid sulfate soils LEP in council? ........................................................................................ 150
Table 23  How information was gained on acid sulfate soils by government personnel ........................................ 153
Table 24  Training requirements for government employees ..................................................................................... 154
Table 25  Roles of government and other agencies in focus groups on acid sulfate soils ........................................ 164
Table 26  Questions developed for focus groups with landholders ........................................................................... 165
Table 27  Priorities by individual priority and classification. ......................................................................................... 170
Table 28  Agreed priorities by region / focus group ................................................................................................. 171
Table 29  Recent history, The sugar cane industry in northern NSW .......................................................................... 183
Table 30  Human and Social capital differences between the beef and cane industries ........................................ 185
Table 31  Summary of Government and Farmer issues and needs ............................................................................. 191
Table 32  Sugar cane industry BPEM ....................................................................................................................... 209
Table 33  Review of Cane Extension Programme .................................................................................................... 209
Table 34  Using empowering language in communication material .......................................................................... 217
Table 35  Characteristics of Best Practices Environmental Management ................................................................... 223
Table 36  NSW EPA Tools for environmental protection ........................................................................................... 235
Table 37  Total farms surveyed in each industry in each year ...................................................................................... 243
Table 38  % of landholders within industries using drain management practices .................................................. 248
Table 39  Percentage of landholders by industry. Level of confidence for BPEM indicating each level of confidence and mean score for each group ........................................ 248
Table 40 Percentage of landholders by industry. River acidity not caused by acid sulfate soils. ................................................................. 248

Table 41 Percentage of landholders by industry. Believe farm management had no effect on catchment water quality ................................................................. 249

Table 42 Corporate philanthropy struggles in the face of public vilification ...................... 264
## GLOSSARY

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Acid sulfate soils</td>
<td>These soils contain iron sulfides and occur on coastal floodplains. If these sulfides are exposed to the air, they oxidise to form sulfuric acid, hence the name acid sulfate soils. The soil itself can neutralise some of the sulfuric acid. The rest of the acid moves through the soil, acidifying soil, ground water and eventually surface water.</td>
</tr>
<tr>
<td>ASSMAC</td>
<td>Acid Sulfate Soils Management Advisory Committee a multi agency committee formed by NSW government to manage acid sulfate soils.</td>
</tr>
<tr>
<td>AKS</td>
<td>Agricultural Knowledge System. Knowledge in agriculture comprise three broad areas under the title AKS: science and research in agriculture; agricultural extension services and agricultural education</td>
</tr>
<tr>
<td>Best Practices</td>
<td>Management practices that are agreed to by industry and government groups</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>The variety of all life forms: the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form.</td>
</tr>
<tr>
<td>BPM</td>
<td>Best practice management</td>
</tr>
<tr>
<td>BPEM</td>
<td>Best practice environmental management</td>
</tr>
<tr>
<td>BPER</td>
<td>Best practice environmental regulation</td>
</tr>
<tr>
<td>Capacity-building</td>
<td>Programs or initiatives aimed at enhancing the effectiveness of individuals, organisations and systems to achieve or define outcomes, by strengthening their knowledge-base, competence, resources, networks, infrastructure and other forms of support.</td>
</tr>
<tr>
<td>Community</td>
<td>Includes all spheres of government, industry, special interest groups and the general public. The term is also used in a more specific sense to refer to those affected by particular issues under consideration or who are interested in some way.</td>
</tr>
<tr>
<td>Diffuse source pollution</td>
<td>Pollution comes from many sources, such as acid from acid sulfate soils. It is hard to trace back to source and it is difficult to treat the contamination due to the extensive scale.</td>
</tr>
<tr>
<td>Ecologically Sustainable Development (ESD)</td>
<td>Development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations. This term has been used throughout this document to refer to the path or framework for achieving sustainability.</td>
</tr>
<tr>
<td>Ecosystem</td>
<td>A unit composed of associated communities of organisms and their physical/chemical environment.</td>
</tr>
<tr>
<td>Education</td>
<td>A process in which society aims to build knowledge, skills and attitudes among its citizens. This can be a formal process achieved through the teaching and learning of established curriculums in schools, vocational education and training institutions, and universities. It may also be achieved through self-learning or a range of other less formal activities delivered by government agencies, non-government organisations and industry at a community and individual level.</td>
</tr>
<tr>
<td>Environmental Education</td>
<td>Programs and activities which facilitate the development of environmental awareness, knowledge, skills and attitudes leading to environmentally responsible practices and behaviour. The term ‘education for sustainability’ links environmental education more closely with the goal of sustainability.</td>
</tr>
<tr>
<td>Evidence based policy</td>
<td>Policy that is developed or the impacts of polices are measured using indicators</td>
</tr>
<tr>
<td>Human capital</td>
<td>The knowledge, skills and attitudes of an individual that enable that individual to function in society and respond to change.</td>
</tr>
<tr>
<td>Indicator</td>
<td>a) Indicators are key statistics. Indicators are statistics or parameters that, tracked over time, provide information on trends in the condition of a</td>
</tr>
</tbody>
</table>
phenomenon and have significance extending beyond that associated with the properties of the statistics themselves (Walker and Reuter 1996). Environmental and social indicators are selected key statistics, which represent or summarise a significant aspect of the state of the environment, natural resource sustainability and related human activities. They focus on trends in environmental changes, stresses causing them, how the ecosystem and its components are responding to these changes, and societal responses to prevent, reduce or ameliorate these stresses. Indicators are visual sightings of a phenomenon that have meaning to an individual; such as liming the water when the cattle looked ‘pinched up’.

<table>
<thead>
<tr>
<th><strong>Interdisciplinary dialogues</strong></th>
<th>Where participants from different disciplines, social, economic and environmental meet to discuss an issue</th>
</tr>
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<tbody>
<tr>
<td><strong>Landholders</strong></td>
<td>A person who is managing land for agricultural or other purposes, ie lifestyle</td>
</tr>
<tr>
<td><strong>Social Benchmarking</strong></td>
<td>Where different stakeholder groups are compared and analysed using human and social indicators</td>
</tr>
<tr>
<td><strong>NRM</strong></td>
<td>Natural Resource Management</td>
</tr>
<tr>
<td><strong>OECD</strong></td>
<td>Organisation for Economic Co-operation and Development, Paris, France</td>
</tr>
<tr>
<td><strong>Participatory research</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Potential acid sulfate soils</strong></td>
<td>Potential acid sulfate soils can become acid sulfate soils if they are oxidised and the water logged iron sulfide becomes oxidised and changes to sulfuric acid. See Appendix V for details.</td>
</tr>
<tr>
<td><strong>Performance indicator</strong></td>
<td>A measurable item or unit used to monitor and report changes in the management of resources.</td>
</tr>
<tr>
<td><strong>Social Benchmarking</strong></td>
<td>A benchmarking system for measuring changes in communities.</td>
</tr>
<tr>
<td><strong>Social capital</strong></td>
<td>The capacity of groups and institutions to function effectively and manage change. Measured by the levels of trust, reciprocity and cohesion.</td>
</tr>
<tr>
<td><strong>Stakeholder</strong></td>
<td>Any individual or group that has an interest in the management of a natural resource issues or is affected by that issue</td>
</tr>
<tr>
<td><strong>Strategy</strong></td>
<td>A broad statement of the method for achieving an outcome.</td>
</tr>
<tr>
<td><strong>Sustainability</strong></td>
<td>The goal to be achieved through Ecologically Sustainable Development. It refers to the ability to continue an activity into the future or maintain a state or condition undiminished (or enhanced) over time. Sustainability involves integrated ecological, social and economic goals.</td>
</tr>
<tr>
<td><strong>Sustainability Performance Indicator</strong></td>
<td>A measure of behavioural change based BPEM that provides environmental benefits to the environment.</td>
</tr>
</tbody>
</table>
ACKNOWLEDGEMENTS

Many people have contributed to the benchmarking project over the 5 years since the idea to apply for funding was developed in 1997. In particular I would like to acknowledge the assistance my supervisors:

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Also of particular note are:

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**Richmond River County Council**: Michael Wood

**NSW EPA**: Graeme Budd

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Lastly, but not least, I would like to thank my family for their ongoing support and constant enquires about ‘where its at’. The ongoing conversations about the farming industry with my family have provided a depth to this work which could not have been attained from other sources.
1. THE INTRODUCTION

1.1 BACKGROUND TO THE RESEARCH

Stakeholders have many competing needs and environmental pollution can take substantial time and resources to remediate. Management solutions for environmental problems on the farm that involve both on and off farm pollution frequently require collective action and a change of attitude, knowledge and behaviour from the stakeholders (Woodhead and Hughes 2000). Over the last 20 years, environmental issues have been given high priority in policy, and government agencies are required to define measurable targets towards sustainable development (Legg 2003, Parris 2003). Yet frequently the methodologies being used define targets for sustainable development, if any, do not adequately account for the complexity of the situation or provide policy developers with adequate information (Moffat 1995) or evidence of change. Nor are they aiding policies to translate to action on the ground (Jiggins 2003). This is most evident when considering diffuse source pollution of water from agricultural land. Water quality is continuing to deteriorate in Organisation for Economic Co-operation and Development (OECD) countries due to increased diffuse source pollution from agricultural land (eg. nitrogen, phosphorus, sediment) whereas point source pollution of water from industry has decreased (OECD 2001b, Ribauldo et al. 1999). There is extensive literature that suggests the lack of action on the ground is due to social issues, not a lack of bio-physical science on how to solve the problem (see chapter 3).

1.2 RESEARCH PROBLEM AND ASSUMPTIONS

The research problem this thesis examines is that current methodologies fail to combine measuring change with actively creating change by informing decision makers at all levels. Thus resulting in policies and actions being poorly aligned. Participatory methods while creating change generally do not produce measurable outcomes, information that policy makers prefer. Conversely, methodologies that measure things do not create action. Benchmarking in Australia and elsewhere has tended towards measuring changes in agricultural and other production systems but has failed to effectively inform stakeholders with meaningful information about best management practices or provide evidence for policy development.
This thesis therefore explores the concept of using benchmarking to both measure and inform the change process on ecosystems level problems that involve multiple stakeholders from the public and private sectors. Thus, dual approaches, the hard (positivist), that treat the organizational world as objective, vs. the soft (interpretivist), treating human organizations as fundamentally different based on subjective meaning and interpretation, are acknowledged in the Social Benchmarking model. The assumptions are twofold.

At an individual level:
- That each stakeholder has a vested interest in their own future and that they need credible information to enable them to reach agreement and take action on future ecosystem issues.

And at a society level:
- That sustainable development requires both stakeholder participation and credible sustainability indicators that measure change and progress towards targets.

The capacity to change at an individual and group level is sometimes called human and social capital respectively. To explore these assumptions the main questions that this thesis examines (discussed in Chapters 7, 8, 9 and 10) are:

1. Does benchmarking have greater potential than has been currently utilised by the agricultural sector?
2. Can benchmarking contribute to sustainable development by providing a methodology for participatory research that also measures change?
3. Can this information be used, with stakeholder participation, to develop best management practices for transfer to a wider audience?
4. Can these best management practices inform policy development so that these approaches are reinforced by local, national and international policies?

An important embedded problem that this thesis discusses is that social indicators have not been developed to the same level as economic and environmental ones (OECD 2000a). Therefore credible indicators of sustainability, which requires economic, environmental and social indicators are not available to inform decision makers. Building on the hypothesis just stated, it follows that social indicators need to reflect both human and social capital. It is difficult to measure social change because attitude and knowledge are highly influenced by situational factors such as age, income, property size and political persuasion. Robust social indicators that measure factors contributing to change require a deeper understanding of the
environment and constraints within which individuals and groups operate. This deeper understanding also helps define indicator use, likely effectiveness and appropriateness for different stakeholders requirements, such as policy development or management of the land.

1.3 THE BIOPHYSICAL PROBLEM

Acid sulfate soils on NSW coastal catchments are an excellent example of a complex ecosystem problem. Acid sulfate soils contain iron sulfides. They occur on coastal floodplains. If these sulfides are exposed to the air, they oxidise to form sulfurous acid, hence the name acid sulfate soils. The soil itself can neutralise some of the sulfurous acid. The rest of the acid moves through the soil, acidifying soil, ground water and eventually surface water. This process is generally accepted as being diffuse source pollution because the pollution comes from numerous sources. It is hard to trace back to source and it's hard to treat the contamination due to the extensive scale and highly variable climatic conditions (Ribauldo et al., 1999, Acid Sulfate Soils, Keys to Success, 2000 - Appendix III).

Since the late 1980’s when their impacts on the ecosystem were publicised after major fish kills, they have become an emotive and polarising issue for the many stakeholders involved. Conflict over acid sulfate soils is therefore newsworthy, and the broader community is introduced to different stakeholders from these polarising viewpoints. Consequently, cane and cattle producers, who benefit from the draining of acid sulfate soils, are portrayed as perpetrators. Oyster farmers and fishers, who incur the cost of acidified water, are portrayed as victims, while local and state government agencies, who have responsibility for regulation, are variously portrayed as either heavy-handed bureaucrats or toothless tigers. Thus, developing an understanding of a major environmental issue with multiple stakeholders is complex. Each stakeholder has a different perspective, level of knowledge and institutional focus.
1.4 JUSTIFICATION FOR THE RESEARCH

One of the problems confronting government agencies is the way in which environmental problems such as acid sulfate soils are challenging much of the orthodox thinking about how to create social change. To achieve sustainable development government agencies need to change their operational ideas away from purely efficient use, with goals of increased production and profit, to include environmentally and socially acceptable use of resources (Moffatt 1995). This change in thinking needs to occur both within and external to the government if sustainable development in our ecosystems is to be achieved.

Wilfrid Legg, pers. com (2001), who is the Head of Environment and Policy for the OECD Agricultural Directorate, suggests that there are four ways used in varying degrees by different countries, to create change that will lead to landholders improving environmental quality. The first is to provide financial incentives from increased market returns, which may be supplemented by subsidies. The second is by regulation, imposing penalties on landholders who fail to comply with statutory requirements, standards and conditions. The third is by public pressure, for example, about the way food is produced. Finally, the fourth way to stimulate change, is to educate by building agricultural knowledge systems (AKS) thereby creating stronger human and social capital. Indeed, a variety of stimuli and measures are required to change behaviour and to provide environmental benefits. This is especially so when there is no economic gain, no assessable indicators of compliance, and the cost of compliance is both time consuming and expensive for landholders.

Measuring the effectiveness of policies, known as evidence based policy (Young and Deng 1999), is somewhat reliant on having meaningful indicators to answer questions such as: Is there appropriate biophysical knowledge about diffuse source pollution within stakeholder groups? Do stakeholders have the capacity to comply with environmental regulations? or Are the regulations appropriate? Yet, confounding the development of meaningful indicators for agricultural and ecosystems policy development are the complex relationships between society, agricultural production and the ecosystem, particularly when dealing with diffuse source pollution. The relationships are complex because:

- diffuse source pollutants usually require collective action, i.e. numerous individuals and groups need to be involved in solutions;
- effects are often spatially and temporally separated from the source of contamination;
- it is often difficult to attribute off-site impacts to the multiple land sources;
climate and nature can confound the results of monitoring actions taken;
available knowledge for solutions is constantly developing;
governments frequently lack resources to measure and quantify effects; and
the
time to resolve environmental problems is frequently inter-generational;
social indicators are very limited (education levels and age)
scale and cost of solving environmental problems is often substantial.

As previously mentioned, extensive literature indicates that there is considerable technical knowledge about how to solve problems of diffuse source. Whereas governments have the tools, the knowledge and the means to effectively regulate for point source pollutants achieving actual reductions in diffuse source pollution has provided major challenges (Brezonik et al. 2000, Morris et al. 2003, Ribaudo et al. 1999). This is reflected in the lack of action on the ground over the last 20 years, even though water quality pollution by agriculture has been highlighted as a critical problem, according to Environmental Agencies worldwide.

Clearly a new methodology is needed that can both measure change and inform all stakeholders and decision makers about evidence of increased action, improved water quality and reduced diffuse source pollution from agricultural land. Benchmarking is one possible methodology because its basis is both to measure and inform the change processes. That is benchmarking is the process of using benchmarks to compare groups, and against which change can be measured. Further, ‘true’ benchmarking is not only about comparison, but also about ‘betterment’ (Irving and Murphy 1996). However, the Rural Industries Research and Development Corporation produced a report in March 2000 called “Rural Benchmarking Programs – A review” that stated:

“As well as revealing a common theme that data from benchmarking was not being adequately used by landholders in decision-making, the review highlighted:

- failure by extension personnel and benchmark providers to provide adequate support and guidance so landholders could use benchmark data fully to improve profitability and sustainability;
- a need to develop clear criteria for what constitutes a benchmarking activity and what distinguishes it from the range of activities currently operating under this umbrella; and
• the need to standardise benchmarks and benchmark terminology for greater ‘meaning’ behind figures across programs and regions. “

This thesis explores using benchmarking in its true definition, to both measure and inform the change process. Because ecosystem management involves multiple stakeholders, it was originally called multi-stakeholder benchmarking (Woodhead et al. 2000). However, as the process developed, and the relevance of the methodology to the sustainability model evolved, the name also evolved. The process has become known as Social Benchmarking because the emphasis of the information gathering and process analysis is on the social dimension and the relationship of these social traits to environmental and economic issues. Therefore the benchmarks and processes provide fundamental information for sustainability reporting systems such as Sustainability Performance Indicators (SPI) (see Figure 1).

![Figure 1 Social Benchmarking and the Sustainability Model](image_url)

**Figure 1 Social Benchmarking and the Sustainability Model**

**1.5 OUTLINE OF THE THESIS**

Using multiple methodologies and explicitly working in both the interpretivist and the positivist worlds seemed to me to be the best way to adequately tackle this type of complex
problem. However, this also raised academic issues that have taken me all of this research time to begin to understand. Indeed only in the last 6 months have I begun to fully appreciate the implications of the different paradigms, that most researchers have a very strong preference for one or the other paradigm and will disparage the other paradigm. Even those that believe they work in both paradigms appear to have an intrinsic bias.

The majority of this thesis is written objectively, in third person. At the conclusion of relevant chapters, (methodology, results and discussion chapters) there is a reflection section, which forms the meta-analysis. This is written in first person because the reflections are personal. These sections discuss what I learnt, how I would do the process differently and why I took the next step.

To help guide you through this thesis, Table 1 shows the main benchmarking activities that occurred between 1998 and 2002 and what chapter these activities are discussed in. Part I (Chapters 2,3 and 4) provides the background context for this work, the research problem and the methodology. Chapter 2 introduces the setting within which this research has developed. Chapter 3 discusses the theoretical background to this work. Further literature is reviewed throughout the thesis as areas of literature are identified from the research findings. The methodology for Social Benchmarking is outlined in Chapter 4.

Part II consists of two results chapters. Chapter 5 discusses the 1998 benchmarking surveys. Landholders and government staff frequently stated that they provided information but they didn’t get any results back. In response to this, a series of focus groups were organised in the catchments to provide an opportunity for survey respondents to view and discuss the results prior to their publication and to look at ways forward, Chapter 6 discusses the findings.

Parts III and IV address the research questions and that build knowledge to address the assumptions stated earlier. Part III contains three discussion chapters. Chapter 7 expands on the analysis of the surveys and focus groups by drawing on new literature and asks ‘Can this benchmarking data with explanations effectively engage landholders and government in better understanding the situation and participating in solutions?’ Chapter 8 investigates a project that was funded as a result of stakeholders identifying acid sulfate soils sampling in the sugar cane industry as a best practice. It explores developing best environmental management practices (BEMP) for other industries and asks how this information can be broadcast to landholders who have different industry structures. Chapter 9 considers policy implications and BEMP for ecosystems management. It draws on two sets of data, the 2002
A re-survey of stakeholders and the international interdisciplinary workshop funded by the OECD.

<table>
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<tr>
<th>SOCIAL BENCHMARKING ACTIVITY</th>
<th>YEAR</th>
<th>CHAPTER</th>
<th>APPENDIX</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Historical Background</strong></td>
<td></td>
<td></td>
<td>Appendix I</td>
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<tr>
<td>Newspaper articles</td>
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<td><strong>Surveys</strong></td>
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<td>Farmer, Land based (Cane, Beef, Dairy, Tea Tree)</td>
<td>1998</td>
<td>5</td>
<td>Appendix III</td>
</tr>
<tr>
<td>Government</td>
<td>1999</td>
<td>5</td>
<td></td>
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<tr>
<td>Farmer, Oyster</td>
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<td><strong>Focus Groups</strong></td>
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<tr>
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<td>6</td>
<td>Appendix V</td>
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<tr>
<td><strong>Workshop</strong></td>
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<td>International, local and state agencies</td>
<td>1999</td>
<td>9</td>
<td>Appendix V</td>
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<td><strong>Best Practices</strong></td>
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<td>2000</td>
<td>8</td>
<td>Appendix III</td>
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<tr>
<td>Policy</td>
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<td>9</td>
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<td>2002</td>
<td>7</td>
<td>Appendix III</td>
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<td>2000</td>
<td>8</td>
<td>Appendix III</td>
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<td>Four Years On: What Changed?</td>
<td>2001</td>
<td>9</td>
<td>Appendix III</td>
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<tr>
<td>Agriculture and Ecosystems Management</td>
<td>2002</td>
<td>9</td>
<td>Appendix III</td>
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<tr>
<td><strong>Presentations</strong></td>
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<td>1998</td>
<td>6</td>
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<td>Local and state government</td>
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<td>Funding body</td>
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Table 1: Benchmarking Activities by year, chapter and appendix
Part IV is the conclusion. Chapter 10 draws together some of the main points as a
discussion of what *Social Benchmarking* has achieved and where further effort needs to be
directed. Chapter 10 also revisits the initial assumptions
   a) That each stakeholder has a vested interest in their own future and that they need
      credible information to enable them to reach agreement and take action on future
      ecosystem issues
   b) That sustainable development requires both stakeholder participation and credible
      sustainability indicators that measure change and progress towards targets
and draws together the main findings.

Thus far I have discussed in very broad terms the issues that underpins this research. The
next chapter discusses my personal motivations and background to this research along with
the geographical setting.
PART I

BACKGROUND, RESEARCH PROBLEM AND METHODOLOGY
2. THE SETTING

2.1 ABOUT THE AUTHOR

My professional career in agriculture commenced in late 1992 with NSW Agriculture. Prior to this through most of the 1980’s I worked in London in film and photography combined with consulting on systems analysis primarily for a law firm. It was the eve of the information technology boom and I wanted to develop formal qualifications with skills to take me into the 21st Century. In 1989 I returned to Australia and commenced a Bachelor of Applied Science: Information Systems at the University of New England, completing in 1991. During the first half of 1992 I took some ‘time out’ to design and project manage the building of my house.

My childhood was spent on a sheep and grain farm in Wales. In 1973 when I was 13 years old my family immigrated to sub-tropical Australia. My parents retired from farming but my brother still farms peaches and nectarines. Official reasons for my parents emigrating included mid life crisis, fed up with the rain and the common market is going to ruin farming in the UK. Australia represented sunshine, un-regulated production and considerably cheaper land with plentiful resources.

2.2 BACKGROUND TO THE RESEARCH

During the mid 1990’s water was emerging as the international issue that would cause wars and death. Locally, acid sulfate soil was creating a media furore and conflict between landholders and catchments residents. Diffuse source pollution from acid sulfate soils was causing water quality deterioration and consequently affecting fish habitat, biodiversity and stakeholders lifestyle and incomes. Funding was available under the newly formed Acid Sulfate Soil Management Committee (ASSMAC) to investigate this apparently new phenomenon. Nearly all funding was directed at biophysical research, however, after many discussions Mike Hughes, a sugar cane researcher at GARAS and I agreed that it would be highly relevant to develop a project that surveyed stakeholders attitudes and established benchmarks for monitoring changes in awareness and attitude. We wanted to tap into the issue at the start, before government intervention, and work from the bottom up to develop relevant information.
We invited two other colleagues to join us, Dr. Peter Slavich, a soil scientist and the new director at Wollongbar Agricultural Institute, in the Richmond catchment, where I had moved to in 1994, and the newly appointed acid sulfate soils information officer, Jon Woodworth. This was a tactical move, to give the funding body confidence in our project. We called ourselves the benchmarking team, and I was the project leader and had the principal amount of time allocated.

The research for this thesis is based on three funded projects, a fellowship and an international workshop. The first project was called “Bench Marking of attitudes and management practices of acid sulfate soils” and commenced in July 1997 and ran for three years. It included the surveys, the focus groups and the first information book. The second project “Acid sulfate soils Identifying Best Practices” was funded in 2000 for 1 year and produced guidelines about sampling acid sulfate soils. The third project, the second benchmarking survey of stakeholders, 4 years on, is current, and funding commenced in July 2002.

In February 2001, I was awarded an OECD fellowship to visit the Policies and Environment division in the Agricultural Directorate at the OECD in Paris for 10 weeks. The proposal was to discuss with them the issues around diffuse source pollution and stakeholders in NSW Australia, and to review it in light of international policies. This I did and I wrote and presented a report for them (Woodhead 2001). I was invited back to present the findings to the OECD working party committee on Agriculture and the Environment in July, that same year. This resulted in the OECD funding a workshop where international experts came to Ballina, Richmond Catchment, NSW, during November 2002 to discuss diffuse source pollution, society and policies. All of these events since 1997 form the research basis for this thesis.

As previously mentioned, funding was available from ASSMAC, outlined below is a synopsis of the original benchmarking funding proposal to ASSMAC in late 1997:

> The project seeks to benchmark current attitudes and practices of stakeholders within catchments *. The project provides benchmarking information to aid evaluation of the performance of the ASSPRO funded programs, enables management to make strategic decisions on the effectiveness of the programs, map trends and identify catchment characteristics. The project will identify and benchmark strategic environmental indicators of change, such as farm management practices, stakeholder's awareness levels and penetration of ASSPRO projects into the catchment community. It will achieve this through surveys, interviews and
collation of data from other agencies and NSW Agriculture. Further it will provide information to the education program to facilitate targeting of issues within catchments and will have relevance to policy and management needs within ASSPRO.

* Catchments are those with currently active projects or those identified as having high acid sulfate soils on the NSW coastal floodplains.

### 2.3 GEOGRAPHY AND CLIMATE

The catchments (Figure 2) that were chosen for this study have considerable agricultural activity and high levels of acid sulfate soils related problems. The red line around the coast of Australia shows where acid sulfate soils can be found. These catchments have extensive rivers with many tributaries that have produced fertile floodplains over the centuries. Climate in the catchments surveyed varies from humid sub-tropical in the north to warm temperate in the south. In the most northern three catchments, Tweed, Richmond and the Clarence, rainfall varies in intensity and frequent flooding occurs with occasional severe flooding. Indeed, rainfall averages in these catchments is greater than in any other region of the state, particularly in summer. The southern catchments are also prone to occasional severe flooding.

![Figure 2 Study catchments in NSW Australia](image)

While this study looks at seven catchments in NSW over a 1500km distance, the Tuckean sub-catchment of the Richmond catchment is one of the worst affected areas with acid sulfate soils runoff and has been frequently studied by scientists. Therefore I present here a brief synopsis of this catchment which is somewhat representational of the geographic characteristics of many other catchments in coastal NSW.
The Richmond catchment has an area of 6,940 square kilometres (Source: Richmond Catchment Management Committee). The Richmond is part of the Clarence - Moreton Basin, an off-shoot of the Great Artesian Basin. The Richmond catchment lies between latitudes 28° 10'N and 29° 20'S and longitudes 152° 22'E and 153° 38'W and is in the north-eastern region of New South Wales.

The population is over 132,000, with the major centres being Lismore, Ballina, Casino, Kyogle, and Bangalow. The river system comprises two major tributaries, and rises in the Nightcap, Macpherson and Richmond Ranges, which have an elevation of around 1200 m ASL. The Richmond River enters the sea at Ballina, which is a major tourist destination. Indeed the whole area is a popular tourist and lifestyle destination. It has a number of lifestyle farms in addition to the commercial farming ventures that include cane, beef, tea tree and dairy on the coastal floodplains, oysters and fishing in the river estuary and horticulture, macadamias and other orchard crops on the higher Alstonville Plateau.

Average annual rainfall ranges from 1650mm or more along the coast, (see Figure 3) for Alstonville, to less than 1025mm at Casino and other inland areas. The ranges and slopes tend to receive more rain than the lower, protected valleys. Spring is usually the dry period, with rainfall at its maximum during summer and autumn. The average yearly discharge of the Richmond River is 1,920,000 Megalitres. Runoff as a percentage of rainfall is 18%, which is just above the average for coastal rivers. Streamflow in the Richmond varies between 15 and 233% of average yearly discharge.

![Maximum monthly rain for Alstonville 1970/1997](image)

*Figure 3 Mean rainfall for Alstonville, Richmond Catchment*

Source Bureau of Meteorology, Australia
Summer tends to be warm and humid, while the winter is quite mild. Mean summer temperatures range from 20°C in the higher altitudes, to 27°C in the inland valleys. In winter, temperatures very rarely fall below 7°C, although some inland areas do experience minor frosts during July/August.

The air in summer is moisture-laden as it comes off the warm sea but in winter it is dry after flowing over cold seas or land. The moist maritime air produces the summer rainfall pattern but the amount of rain that falls is influenced each year by the position of the equatorial trough and subtropical ridge. The equatorial trough usually extends into northern Australia from Broome through to Cairns, while the subtropical ridge lies at the latitude of Tasmania. As a result the prevailing winds in summer are from the east and north-east. By July the trough has migrated to the northern hemisphere and the subtropical ridge usually extends across South Australia. The prevailing winds are then more southerly - from the south-west flowing over the dry continent or from the south-east off a cold ocean. How much rain falls and how intense it is depends on how strongly the south-east trades and the north-west monsoon flow, how long they last and how they are modified as they pass over land or water.

The Southern Oscillation Index (SOI) is used as an index of the difference in air pressure between the central pacific at Tahiti, and Northern Australia at Darwin. When the SOI is strongly positive, trade winds blow strongly across the pacific picking up plenty of moisture. When SOI is negative trade winds are weak and rainfall can be below average. This is referred to as the El Nino event (Patridge 1993). I have not used the SOI in this study, I merely refer to it to provide a general overview of the climate in NSW. However, rainfall patterns are important because the amount and frequency of rain determines when and how much acid is released from the acid sulfate soils into the river system (this process is explained in the next chapter).

The Tuckean catchment, has five tributaries flowing from the Alstonville plateau and the upper Richmond catchment. They are the Tucki Tucki Creek, Marom Creek, Youngmans Creek, Gum Creek and Yellow Creek and this encompasses a catchment area of 215 km sq, which is a relatively small part of the Richmond River catchment. It is linked to the lower Richmond River by Tuckean Broadwater, some 20 km above the estuary at Ballina. The Tuckean swamp is less than 4 m above sea level and is bordered by the Tuckurimba ridge to the west, the Blackwall Range to the east and Alstonville plateau to the north, see Figure 4.
Figure 4 Map of the Tuckean Swamp

Figure 5 Map of the Tuckean Swamp in the Richmond Catchment

Soil on the plateau comprise mostly deep well-drained krasnozems with low available water holding capacity. The Tuckean swamp comprises poorly drained humic gleys, gleyed podzolic soils and dense clays. Most drainage is by subsurface flow, with the watertable being <100cm kilometres (Source: Richmond Catchment Management Committee).

The Tuckean swamp is tidal but since 1971 tidal intrusion into the swamp has been restricted by a levee and culvert arrangement known as Bagotville Barrage (see Picture, Page 3, Farming Community Ideas About the Way Forward, Appendix III) which is located...
about 3.7 kms upstream from its confluence with the Richmond River. Rapid runoff from rainfall across the steep sides of the Alstonville plateau combined with the flat topography of the floodplain causes significant local flooding of the swamp. Flooding within the swamp can also occur as a result of mainstream flooding of the Richmond river or as a combination of mainstream flooding and local flooding (White et al. 1996).

This chapter has provided the personal, institutional and biophysical setting for the benchmarking research work that has developed over the years 1997 to 2002. A broad overview of the research timing would be that 1998 was an analysis of the current situation in NSW. 1999 introduced taking the results back to the regions that participated in the study. 2000 was when I explored the relevance of these results for the Australian government. 2001, was when I went to the OECD and looked at international policies. 2002 was when the OECD and international experts came to Ballina for an interdisciplinary dialogue.

Part 1 of this thesis follows and includes two chapters. The first chapter discusses the theoretical background for this area of research, agricultural production, sustainable development, ecosystems and diffuse source pollution. It discusses participatory research and benchmarking as a methodology that can be used to both measure change and understand processes. The second chapter discusses the Social Benchmarking methodology.
This chapter looks at the theoretical background that underpins the subject of this thesis, a methodology for working with multi-stakeholder agri-environmental problems. The flow chart above shows the major areas of literature discussed. The first section, 3.1 is a discussion of the global background to sustainable development and agriculture and draws on research conducted at the OECD (Woodhead 2001). The OECD is a principal agency in developing environmental indicators and agricultural policy. It briefly explores the history of sustainable development. This develops into a discussion on sustainable agriculture, looking more explicitly at the social issues and environmental pollution. The biophysical context of the thesis is introduced with a discussion about integrated catchment management of coastal wetlands and relevant policy in 3.2. The case study, acid sulfate soils, is introduced in 3.3 both from a bio-physical and socio-economic perspective. 3.4 discusses multiple stakeholders, conflict and concepts of participatory research. This section is a preamble to chapter 7, where these issues are expanded upon in light of the results in chapters 4 and 5. Similarly section 3.5 is a preamble to Chapter 8 and looks at concepts and tools for achieving change through adult learning, extension, communication, and environmental
education along with changing social norms. Indicators of change are discussed in 3.6. It focuses on discussions about potential indicators of human and social capital. The final section, 3.7 explores possible research methods and models including a review of benchmarking.

3.1 SUSTAINABLE DEVELOPMENT AND AGRICULTURE

The United Nations Conference on the Human Environment in 1972, colloquially known as the Stockholm Conference, considered the need for a common outlook and for common principles to inspire and guide the peoples of the world in the preservation and enhancement of the human environment. They attempted to link ecological conservation to economic development. The conference produced a declaration that human environmentalism was an aspiration with twenty-six environmental principles. The Bucharest conference two years later went further and suggested that there was a need for “an integrated approach that accounted for inter-relationships between population, resources, environment and economic development” (Moffat 1999).

Moffat discusses theories of human environmentalism and the later theme of eco-development that arose in the 70’s and 80’s, and how sustainable development emerged and became considered as “alternative ways of organising socio-economic development in ways which would, as far as possible, result in less harmful environmental practices”. The Brundtland Commission, established in 1983, produced a blue print for putting sustainable development firmly on the political agenda (WCED 1987). At the heart of the debate Moffat says, there is an acknowledgment that “current patterns of economic growth and development are seriously damaging the ecology of the planet”.

Sustainable development has many definitions (Pearce et al. 1999), but all strive to acknowledge the problems that unsustainable development has had on the planet, the finite nature of resources and the need to provide for the future. An important finding from both the Brundtland report and Agenda 21 is the importance of not destroying the diversity of natural and cultural life on earth, and that future generations have equal right to be use of resources as previous generations. But the complexity of defining the way forward can be seen in the 27 principles of Agenda 21 that emerged from the Rio Earth Summit 1992 (Pearce 1999). In some cases it provided more questions than answers on such issues as equity, ethics and international economic and political power which are still being fiercely debated without agreement to date. However, Moffat (1999) states it is “a major achievement for identifying
the links between economic development and environmental conservation”. This debate continued at Rio +10 in South Africa in 2002 where society and individuals were a focus but Moffat (1999) offers this advice for future debates:

“without subjecting these principles to a careful critique they run the risk of offering little real guidance to individuals and groups who wish to make the concept of sustainable development operational and put into practice in their everyday lives”.

**Sustainable Agriculture** is an important part of the sustainable development issue. Sustainable agriculture needs to maintain options for future generations. Sustainable agriculture can be considered as a process in which the demands for its outputs – food, fibre and other services – are met from farming practices that are economically efficient, environmentally friendly, and socially acceptable (Legg 1999). The definition of sustainable agriculture adopted by the American Society of Agronomy is

‘one that, over the long-term, enhances environmental quality and the resource base on which agriculture depends, provides for basic human food and fibre needs, is economically viable, and enhances the quality of life for farmers and society as a whole’ (Schaller 1990 cited in Neher 1992)”.

Neher (1992) discusses how sustainable agriculture is a perplexing problem because there is “no precise, set formula that applies to all situations”. There is a need for increased knowledge about and management of ecological processes (Neher 1992, Pretty 1994). Indeed Pretty (1994) describes sustainable agriculture as

“a series of steps rather than a sudden and one-off shift in practices and values...The first thing to note is that sustainable agriculture should not prescribe a concretely defined set of technologies, practices or policies. This would only serve to restrict the future options of farmers...Sustainable agriculture is, therefore, not a simple model or package to be imposed. It is more a process for learning”.

Nationally and in most Australian States, Environmental Sustainable Development (ESD) is expressed as five principles guiding human relationships with their environment:

- equity between generations (allow our grandchildren their own choices);
- equity within generations (give this generation freedom to choose);
- the precautionary principle (ensure no risk of serious harm);
- protect environmental integrity (protect biodiversity and intact ecosystems); and
- monitor progress (towards a sustainable human/environment relationship)”. 
Figure 6 shows the key interactions of the three dimensions of sustainable development. While these interactions are defined for the whole community and not just agriculture, they clearly reflect many issues of commonality.

Of key interest to this thesis are the interactions between the environmental and social dimensions. Many, governments are seeking to better understand the social and environmental dimensions of sustainable agriculture, acknowledging that considerable effort has been put into developing an understanding of the economic and environmental issues.

Agricultural policies in OECD countries can very broadly be described (Woodhead 2001) during the last half century as going through three stages:

(i) The 1950s to 1970s were primarily concerned with increasing agricultural production through raising productivity to feed a growing and richer population, and to raise the relative standard of living of landholders. Actions were taken within and for the intended benefit of the agricultural sector, while attempting to supply food at reasonable prices to consumers.
(ii) During the 1980s to 1990s policies were extended to take into account the environmental effects of agricultural production. Actions were taken within the agricultural sector for the intended benefit of the agricultural sector and for the environment.

(iii) Since the latter part of the 1990s more attention is being paid to viewing agriculture as an activity integrated into the rest of the economy and society, and ethical issues (eg. inter-generational equity) have become more significant. Actions are now taken from both within and outside the agricultural sector for the intended benefit of the agricultural sector, the environment and society.

The social dimension is increasingly being acknowledged as highly significant to the success of economies and is gaining a higher profile as a key issue for consideration when developing policy. The social dimension includes human capital and the broader concept of social capital (the individual and group capacity to change in response societal and other pressures), which are discussed in more detail in Chapter 7. There are increasing pressure across OECD governments for more open and transparent decision making processes, which are compatible with greater decentralisation of decision making and the search for partners to work with governments for environmental protection (OECD 2001b). There is also an increasing trend for greater public and stakeholder participation. This entails widening of stakeholder circles to include the public at large. Governments, the private sector and non-government organisations (NGOs) all need to find more effective ways of communicating environmental information to citizens.

From the agricultural perspective, it is necessary to determine how farm people adapt to these environmental and economic policy developments. Changes in the management of farms will be increasingly influenced by external developments. Given that human and social capital are essential to economic growth and explain the variation in growth among countries (OECD 2001c), three questions become of fundamental interest to OECD countries:

1) How can the adaptation best be undertaken with existing human and social capital?
2) How can agricultural knowledge systems be best developed to develop human capital to enable sustainable agriculture?
3) How will we know if we are achieving sustainable development - what are the measures of progress?
These issues are explored throughout this thesis, using the *Social Benchmarking* model to develop indicators and best management practices, and formed around the questions identified in Chapter 1.
3.2 INTEGRATED CATCHMENT MANAGEMENT OF COASTAL WETLANDS

Acid sulfate soils are discussed in detail in the next section. This section discusses them in the context of soils that constitute elements of coastal wetlands in Australia. As such, although the key issue of this thesis is acid sulfate soils, they come under the Ramsar Convention on Wetlands (Ramsar 1971) because they are intrinsically linked with wetlands, lying between 1m and 3 m below the soil surface. The Ramsar convention defines wetlands as

“areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters”.

As of 1 March 2000, 119 states were contracting parties to the Ramsar convention. It is the only global environmental treaty dealing with a particular ecosystem. It stipulates the following principles for future wetland policy:

- Wetlands have fundamental ecological functions, as regulators of water regimes and as habitats supporting a rich biodiversity.
- Wetlands constitute a resource of great economic, cultural, scientific and recreational value that must be maintained.
- Progressive encroachment on, and loss of, wetlands constitute serious and sometimes irreparable environmental damage that must be avoided.
- Wetlands should be restored and rehabilitated, whenever possible.
- Wetlands should be conserved by ensuring their wise use. Wise use is defined as ‘sustainable utilisation for the benefit of mankind in a way compatible with the maintenance of the natural properties of the ecosystem’ - sustainable utilisation is understood as ‘human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations’. ‘Wise use’ may also require strict protection.

(Ramsar 1971)

Wetlands provide many functions and values. Functions include cleansing of polluted waters, floodwater detention and storage, shoreline stabilisation, and groundwater recharge. Functions contrast with values (e.g. production of marketable timber). Functions occur regardless of whether they have human value and, unlike values, are not subject to change. “A central irony thus surrounds wetland restoration: We are attempting to “restore” something which we are unable to define completely. It is around this point that much of the
discussion of wetland mitigation orbits. Many wetland scientists are not enthusiastic about mitigation because of this uncertainty” (White et al. 1992).

There are many challenges to implementing effective watershed management. Scientists and catchment managers have limited experience in dealing with issues at this 'scale' of complexity and integration. “Difficulties also arise from differences in the typically small physical scales and short time frames at which measurements are made or scientific information is obtained and the larger spatial and temporal scales to which this information must be applied to understand or model the behaviour of watersheds ecosystems” Brezonik et al. 1999. Watersheds require an interdisciplinary approach of both biophysical and socio-economic disciplines. Brezonik et al. (1999) argue that “the science that drives our understanding of how watersheds function has shifted from point- and population-specific questions to ecosystem-level and cumulative-effects questions”. However, while watersheds might make bio-physical sense as measurement units they do not necessarily make logical units for land management.

“As they increase in size, they increase in complexity, not only regarding land cover and use but also regarding basic geological and physiographic features that affect the potential for runoff problems and the appropriateness of various management practices to control such problems...Watershed management in large agricultural basins can be complicated by unclear goals, differing stakeholder perceptions, and overlapping government jurisdictions “ (Brezonik et al. 1999).

Further complicating the ‘integrated catchment’ vision is that much agriculture pollution is diffuse and therefore highly variable across the catchment. Montada and Kals (2003) discuss how this affects members of society in different ways and ‘those who gain advantage by polluting the natural environment are not the ones who are affected most by pollution’. Therefore to be effective, changes must be realised at the collective level within communities, nations, and the whole globe.

### 3.3 ACID SULFATE SOILS, SETTING THE SCENE

This section looks at the context of the acid sulfate soils debate. Understanding the history of acid sulfate soils is important to later understanding because this thesis is concerned among other issues, with attitudes and beliefs. The discussion begins with an introduction to the biophysical problem and then introduces the major stakeholders and discusses their
perspective using anecdotal historical knowledge of the industries, government reports and media articles.

3.3.1 The Bio-physical Problem

Acid sulfate soils is the common name given to soils containing iron sulfides. They occur on the low parts of the coastal floodplains. While the layers of iron sulfides are waterlogged, oxygen in the air is not able to react with the iron sulfide in the soil. Acidification occurs in two stages, first when sulfide is exposed to the air and second through the release of soluble aluminium and iron into the waterways. The soil itself can neutralise some of the acidity. Remaining acidic products can move through the soil, acidifying soil, ground water and eventually surface waters. When rains occur, iron rich acid drainage water is released rapidly into estuarine streams. Acid sulfate soils can have a detrimental impact on plant growth, cause corrosion of infrastructures such as bridges, lead to fish diseases and fish kills and disturb stream ecology in coastal catchments (White et al. 1997).

Acid sulfate soils are in many coastal areas of the world, notably in Vietnam, Thailand, The Netherlands and Australia. When left undisturbed they are benign, but disturbance by excavation or drainage exposes sulfidic compounds in the soil to air, producing large quantities of sulfuric acid. This has been the case in much of the east coast of Australia where agriculture and housing development, and where canals developed for recreational purposes, have disturbed these soils. Studies on the Richmond River in northern New South Wales estimated over 1,000 tonnes of sulfuric acid, 450 tonnes of aluminium and 300 tonnes of iron were released from a 4,000 ha catchment following a major flood in 1994. This acidified a 90 km reach of the river for seven weeks with pH falling to as low as 2.6. Nationally there is an estimated 40,000 km² of coastal acid sulfate soils containing over one billion tonnes of sulfidic compounds i.e. iron sulfide minerals (pyrite). When fully oxidised, each ton of pyrite produces 1.6 tonnes of sulfuric acid, (Working Party on Acid Sulfate Soils 2000). Table 2 shows the number of hectares in the Richmond Catchment that are at risk of changing from potential acid sulfate soils to actual acid sulfate soils, or have already acidified.
Richmond River Catchment  Latitude 29°, Longitude 154°

<table>
<thead>
<tr>
<th>AREA (HECTARES)</th>
<th>GROUND SURFACE ELEVATION (METRES)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-1</td>
</tr>
<tr>
<td>HIGH RISK ASS LAND AREA</td>
<td>1157</td>
</tr>
<tr>
<td>LOW RISK ASS LAND AREA</td>
<td>125</td>
</tr>
</tbody>
</table>

Table 2 Risk of ASS land area in the Richmond Catchment
Source (NSW Department of Land and Water)

**Oxidation and acid flow.** Drainage and excavation of potential acid sulfate soils expose the iron sulfides to the air. In NSW 200,000 hectares of a total of 600,000 hectares of acid sulfate soils has been drained during the 20th century. Much wetland conversion was actively encouraged and subsidised by governmental programs at a time when other beneficial functions of wetlands were unknown or under appreciated. Many coastal floodplains in eastern Australia have been drained with adverse impacts on estuarine ecosystems from loss of wetlands (White et al. 1997). Now the individual landholder relies on the farm drains to maintain agricultural production all year round. Indeed, drainage has changed much of the coastal lowlands from saline and freshwater wetlands to productive agricultural land.

**Drain water acidification** depends on the surface of the water table relative to drain height and the interaction of the floodplain and upland sources of water. Tidal exchange would normally dilute this water but because of floodgates and barrages this event does not occur in many catchments. Therefore the rainfall events are the primary driver of the discharge of acid from the drains (Sammut et al. 1996). Further, in wet periods, when the inputs into the watertable exceed the outputs, water storage in soil and groundwater increases, watertables rise and discharge to surface streams may occur. Conversely, in dry periods, when outputs exceed inputs, shallow watertable fall may expose sulfidic layers to oxidation. Precipitation, evapo-transpiration and drainage, which determine watertable dynamics, are therefore the key factors influencing oxidation and acid outflows.

**Acidification of the tidal reach** has been found to be dependent on both the reserve of acid within the drainage system and the operation of the barrage. Figure 7 shows how in the dry season the water table falls below the acid sulfate soil layer and in the wet season how the water table rises through the acid layer creating acid discharge.
The barrage actively dams acid water on a high tide allowing it’s bulk release on a low tide. With less tidal water available for neutralisation on a low tide, acid water may persist until the next high tide. However, high rainfall or cumulative rainfall can cause acidic conditions in the tidal reach for several days or longer. Sammut et al. (1996) study showed how acid conditions in the Tuckean, which is part of the Richmond catchment, persisted for more than 8 weeks following moderate flooding. This was because acid discharges were higher and tidal waters remained fresh and were unable to neutralise the acid. Acid events may affect the entire tidal reach of 4.5 km and extend downstream into the Richmond River another 0.8 to 1.0 km. Sammut calculates over 40 tonnes of acid can be exported in a single day during moderate flooding, 950 tonnes in an 8 week period and more than 16 tonnes of acid can be present in the tidal reach under static conditions.

Remediation strategies. The major problem in controlling acidic discharges in eastern Australia arises from broadacre agriculture in already drained coastal floodplains. Management strategies need site specific solutions, and these are continuously developing.
to account for the different soil types and different hydrology between sub-catchments and catchments. The challenge is whether acidic outflows can be reduced by better drain management (White et al. 1992) and on-farm management, or whether the entire drainage systems needs to be redesigned. There are three broad remediation strategies for managing acid sulfate soils in problem areas. These are:

- **Containment** – where acid is not allowed to escape into the environment. This often means contain the acid in the soil by maintaining high water table levels.
- **Dilution** – Allowing acid to escape into the environment at an acceptable rate. This can sometimes be achieved by drain management which relies on dilution exchange of saline water through floodgate structures.
- **Neutralisation** – involves the reaction of acid with a neutralising agent, either lime or bicarbonate in seawater. Neutralisation with lime is a high cost option which has application where development returns justify high levels of expenditure on those areas where other strategies will be ineffective.

### 3.3.2 NSW Policy and Institutional Background

Until recently a major focus of New South Wales (NSW) Agriculture’s research was concerned with increasing yields of animals and crops. The general attitude of the department, industries and landholders, was that agriculture production or production efficiency was of little interest to the community at large. They believed that other departments dealt with environmental issues e.g. Environmental Protection Authority (EPA) and the Department of Land and Water (DLWC). However, problems such as acid sulfate soils have challenged NSW Agriculture to move beyond production and into ecosystem management. The wider community is concerned about agriculture as demonstrated in the frequent press articles (see Appendix I and next section on history for examples) condemning agricultural practices, both because of the effects they are having on the ecosystem and the quality and safety of the produce. Public pressure is therefore ensuring that it is no longer possible for a state agricultural agency to be solely concerned with yield. NSW Agriculture is increasingly working with other industries and developing new directions in environmental management. They are appreciating that farms cannot be managed in isolation from the ecosystem within which they function, not least because in the tidal reaches of these catchments that are polluted by acid water from agriculture, oysters are grown, prawns are harvested and recreational and professional fishing is undertaken. Fish live and breed in creeks and wetlands, but where flood gates have limited fish passage, or drains have reduced water coverage, their habitat has been considerably reduced. Fishers,
oyster farmers and tourists all rely on good quality water and fish breeding habitat to ensure their economic survival.

When, in the early 1990’s, acid sulfate soils became a major public issue in coastal catchments, the NSW government formed a committee, the Acid Sulfate Soils Management Advisory Committee (ASSMAC) to look at management solutions. The number of government agencies (agriculture, land and water, urban affairs and planning, fisheries, environmental protection agency, local government), industry bodies and non government agencies in ASSMAC reflects the complexity of environmental problems that have diffuse effects on water quality.

There are two government policies that are highly relevant to the current management of acid sulfate soils. One is the Drainage Act 1939 and the other is the Wetland Management Policy 1996.

The Drainage Act. Government policy in the 20th Century had encouraged extensive drainage to enable the development of agricultural and urban developments. These drains, see Appendix III, Keys to Success, p.7 and Farming community ideas about the way forward, p.9, can either be defined as:

1. **On farm.** The maintenance of on-farm drains is the responsibility of the landholder.
2. **Drainage Union.** They operate in accordance with the Drainage Act 1939. This act makes better provision for the drainage of land and the mitigation of the effect of floods and the control of flood waters within certain areas, and facilitates the administration of drainage unions and of drainage trusts. Drainage unions may comprise affected landholders only or they may include a local government representative. Drainage unions could be set up wherever a tract of land was affected by permanent or occasional accumulation of water either from floods or tidal influences. Drainage unions have constructed the majority of drains in all catchments, which were not constructed as part of flood mitigation. Approximately 75 to 80 drainage unions have been constituted under the act since it was enacted.
3. **Flood mitigation.** These drains are designed to dissipate large floods rapidly to protect towns and rural dwellings. They tend to be the largest and therefore, deepest drains.

Floodgates have been constructed on all the above mentioned to control the passage of water and fish in both upstream and downstream directions. Local government maintains
most floodgates and drains, but individual landholders, groups of landholders, or combinations of all of these, maintain many other drains.

The New South Wales Government Wetland Management Policy (1996) aims to ensure that coastal wetlands are preserved and protected, and for best management practices are used for wetlands. Locations of wetlands were listed under the State Environmental Planning Policy No 14 (SEPP 14), gazetted in 1985. This policy has not been popular with landholders because it requires consent from the local councils and the concurrence of the Director of Planning to clear land, construct levees, create or maintain drains and requires an environmental impact statement to be lodged with development applications. The practical implications for landholders are that if they wish to clean drains, which is often done annually, they need to apply for a development application.

3.3.3 Historical Perspective.

Material for the following has been developed from government reports, such as ASSMAC reports, newspaper articles and newsletters as well as personal observations. It is important to note that these newspaper summaries represent a small sample of the numerous articles that have been published on acid sulfate soils, see Appendix I for examples of articles.

European settlers arriving in Australia were attracted to the better rainfall and warmer temperature regimes of the vast floodplains of the north coast rivers. Clearance of the trees from the floodplains led to agricultural use. Extensive flooding in the 1870’s resulted in serious losses for agricultural enterprises on floodplains and prompted landholders to take actions to drain the land. Over the next 100 years, drains were constructed through low-lying areas to accelerate drainage and reduce flooding. Natural meandering channels were straightened and cleared to improve flow. These drainage networks, during the 1940s and 1950s were often extended and augmented as part of flood mitigation schemes along most of the NSW coast. Flood mitigation schemes were still being completed up until the 1970’s. These schemes were built with the support of successive governments but operational responsibility now rests with the local flood mitigation authority or council. This progressive drainage of land has resulted in deeper drains, an associated further lowering of the water table, consequent oxidation of acid sulfate soils subsoil layers and the drying out of top layers of soil.

The media has played a significant role in bringing acid sulfate soils pollution to public attention. Dead fish and the bad landowner versus the victims, the oyster farmers have made good press. Over time the media has reported more positive farming stories. A
summarised selection of titles and some brief captions follows (see Appendix I for more examples):

1986  Fish deaths a mystery – Potsville residents want creek checked for chemicals.
1991  Major fish kills from acid water predicted
1992  Farmers blast govt on policy. Wetlands ruling stops anyone doing anything: A NSW environment policy which prevents Tweed Coast farmers from using their wetlands for agricultural use has come under fire from NSW Farmers Association. Daily News 17.3.1992
      Land clearing gets blame for fish kills.
      Fishermen want flood mitigation reviewed.
1993  North Creek acidity hits oyster growing. Last year $60,000 worth of oysters were lost by Mr Knudson’s company, Richmond oysters because of problems with acid water. North Coast Advocate 28.4.93
1994  Farmers reject acidity claims.
      Acid sulfate advisory group formed. A committee to assess and resolve local acid sulfate soil problems would put an end to ‘name-calling’ between professional fishermen and farmers, the Minister for Agriculture, Ian Causley, said yesterday.
1995  Outcry follows mass river fish kill.
1996  Major fish kill.
      Court win sends ‘clear message on drains’. Farmers will need council approval for any new drain that was not dug by hand. Northern Star 14.3.1996
1997  Oysters in crisis. EPA attacked over soil runoff. Failure by EPA to act is threatening oyster industry. Port Macquarie News 2.9.97
      All NSW cane farms tested for acid sulfate soils as part of an industry program to improve north coast waterways.
1998  Farmers making inroads into beating acid soil. Farmers in the tweed have developed a water management systems involving laser levelling of paddocks and liming drains to improve the water quality in their paddocks. Northern Star 20.3.1998
1999  Amery launches drain management project.
2000  Cane industry exemptions.
      The NSW sugar cane industry is close to finalising acid sulfate soils best practice guidelines to have all cane farms operating under an approved self regulation procedure for acid sulfate soils earth works and drain cleaning. ASSAY May 2000
      Sampling kit and guidelines for landholders.
      NSW Agriculture is developing a simple soil kit to help landholders estimate the distribution and depth of acid sulfate soils materials on their property. ASSAY May 2000
2000  Acid sulfate soil audit a success.
The New South Wales Sugar Milling Co-operative has just finished its first acid sulfate soils management compliance audit.

Early in 2002 there were catastrophic fish kills in the Richmond catchment caused by a long drought that was broken by heavy rainfall, which soaked through the newly exposed layers of potential acid sulfate soils that had oxidised to create acid sulfate soils. This acid was swept down the river several days after the rotting matter from dead vegetation had been swept down by flood waters causing de-oxygenation. Fish and oysters were either killed due to de-oxygenation of the water or by the next onslaught of acid water. The river was closed to all fishing for 3 months, because there were no fish. The smell from rotting organic matter was atrocious for nearly 3 weeks, impacting on prime real estate as well as the tourism and commercial industries. Economic costs have not been estimated for this instance, but models are being developed to estimate potential impacts (Pretty et al. 2003). Community impacts were extensive. There were numerous volatile public meetings in Ballina, a major tourism town at the mouth of the river. Drastic steps were proposed to alleviate the problem. However, as was explained to the catchment community, getting rid of agriculture is not a solution, not just because its not socially acceptable but because it won’t solve the problem. In fact without the help of the farmers, the government cannot afford to fix the problems they caused. This is explicitly demonstrated by the lack of capacity of government to manage existing land that has been betrothed to them as national parks by the state (Woodhead 2003). Much of this coastal public land is highly acid, yet farmers frequently complained in the survey (see Chapter 5) that no maintenance was undertaken on fences and drains. National Parks attest this is due to too much land and a lack of funds (see Chapter 6).

3.3.4 Stakeholders and Economics

There are many stakeholders involved in managing acid sulfate soils, and each has different levels of interest. Landholders, as mentioned previously play a crucial role because they farm the drained coastal floodplains. Excavator contractors are responsible for constructing and maintaining many of the drains, and along with landholders they have a legal responsibility to minimise, and if necessary ameliorate, disturbance of acid sulfate soils. Oyster farmers and commercial fishers need good water quality for consistent production. Urban communities at the estuary rely heavily on tourism and river based recreation. Government agencies play many roles. Some government agencies, such as local government and National Parks and Wildlife, are natural resource managers, while others, such as the Environmental Protection Agency are responsible for protecting the environment through regulation. Natural resource managing agencies face similar dilemmas to other landholders. They have limited staff with many conflicting environmental issues to prioritise.
Landholders own most of the 600,000 hectares of land in NSW with acid sulfate soils. The management of acid sulfate soils is about finding and developing a balance between the economic needs of the landholders, the health of the environment and the wishes of society. Whereas the economic losses of acid sulfate soils to individual landholders are relatively minor, the off farm losses are substantial. The strategy for the management of coastal acid sulfate soils outlined in the National Working Party on Acid Sulfate Soils (NWP) (2000) states that:

“Millions of (Australian) dollars worth of infrastructure corroded by acid water has had to be replaced. Millions of dollars of oysters, prawns and fish have been destroyed, nursery areas have been decimated and vast areas of land has been degraded by poor acid sulfate soils management. Acid drainage and poor water quality also pose considerable threats to coastal tourism and several communities reliant on good quality water”.

An economic study for ASSMAC by Mullen (1999) identified that the predominant occupier in coastal NSW, the beef cattle industry, was yielding the poorest gross margins ($75 per hectare) and had no significant capacity to invest in property improvements which might reduce acid discharges. The other major industries are sugar cane and tea tree. They are returning gross margins of about $850 per hectare and $3,000 per hectare, respectively and are considered to have the capacity to invest in improvements. While gross margins are significantly higher for the tea tree industry than the cane industry, there is no opportunity for retrofitting improved drainage by laser levelling once a plantation has been established as the land is in production for up to fifteen years. In addition the industry lacks the organisational structure to enforce compliance with best management practice. The cane industry has both the industry structure and a shorter-term crop.

Complete data about on site and off site costs are needed, but are not currently available. Acid sulfate soils do impose costs on the community (Mullen 1999) in the form of:

- lower agricultural production;
- lower fish and oyster production;
- less tourism, at least at a regional level;
- damage to public and private infrastructure;
- loss of environmental services such as biodiversity and aesthetic values;
- costs to public and private sectors of managing acid sulfate soils.
ASSMAC recognises that rehabilitation of sites cannot be achieved without the co-operation of the landholders. They recognise that acid sulfate soils have caused social conflicts between the needs of the landholders and coastal fisheries that have generated critical comment in the media and complaints to local authorities. Coastal fishers want action to address the water pollution, which is causing them substantial economic losses. Landholders are well aware of previous government policy on drainage and do not see why they should undertake expensive remediation work, for which they will receive no economic benefit. Therefore, it is recognised by ASSMAC that government response needs to be sensitive to these issues and this is reflected in the National Working Party strategy (NWP 2000) which is based on the ASSMAC strategy. The strategy is to support projects and initiatives that address the social conflicts as well as economic and environmental issues, including:

- raising awareness about the impacts of acid sulfate soils to all stakeholders;
- education of landowners and development of industry best practice; and
- planning controls to manage risk of disturbing acid sulfate soils.

These strategies have been incorporated into the national strategy for acid sulfate soils (NWP 2000). New South Wales, through ASSMAC has become the leading state in the management and development of policy on acid sulfate soils. National level policy has developed from NSW policy, both groups being chaired by John Williams, the Regional Director of Agriculture for Northern NSW. There are four sequential strategies, which have been defined from the NSW experience and included in the national strategy:

- Identify and measure coastal acid sulfate soils in Australia.
- Avoid disturbance of coastal acid sulfate soils.
- Mitigate impacts when acid sulfate soils disturbance is unavoidable.
- Rehabilitate disturbed acid sulfate soils and acid drainage.

Within New South Wales, the first, second and third strategies have been achieved in terms of legislation and regulatory controls and incorporated into local councils and state department policy (John Williams pers. com). It is the last point, which includes raising awareness and education and development of industry best management practices, which is now the major challenge.

Clearly, the acid sulfate soils case involves many stakeholders who have at times been in conflict (Chapter 5). With the water-based industries frequently portrayed as the victims,
landholders portrayed as negligent and ignorant managers and the government as toothless tigers, the press have had a ‘field day’. The water-based industries have driven the issue, and persuaded the government agencies and landholders to take action, using the press and NGO groups such as Ocean Watch. However, the interactions between the stakeholders are substantially more complex than is frequently alluded to in the press. In the next section current stakeholder knowledge is introduced by first looking at the layers of stakeholders involved in natural resource management.

This next section also discusses the reasons for involving stakeholders. I argue that mistakes of the past could have been avoided if stakeholders had been more actively involved in decisions about natural resource management. This requires developing consensus decisions by using participatory research methods and community participation. Finally the philosophies of environmental responsibility and altruism are explored with particular reference to diffuse source pollution.

### 3.4 MULTIPLE STAKEHOLDERS

There are many stakeholders involved or who have an interest in managing natural resources (Sinclair 2001), and communities need to become actively involved in managing natural resources (Abdalla 1996). Communities need to be involved because they are the cause of the problems. Röling (1994) discusses how it is remarkable that “NRM problems are commonly seen as belonging to the area of expertise of ecologists, climatologists, hydrologists, limnologists, biologists, and so forth…, because NRM problems are perceived and caused by people”. This raises two issues that are central to this thesis. Firstly, who are the stakeholders and what are their interests in natural resource management. Secondly can they all be effectively involved in the processes of managing natural resources and if so, how? The second point will be discussed in the next section under participative research. This section looks at the stakeholders.

Stakeholders in natural resource management cannot afford to be defined narrowly (Aslin 1998). Stakeholders have many roles and definitions. However, generally speaking stakeholders can be defined as any individual or group that has an interest in the management of a natural resource issues or is affected by that issue. This therefore includes federal and state government agencies, local government, landholders, resource users, non-government groups such as Ocean Watch and Landcare and the general public.
Table 3 shows the roles of agencies and groups in coastal NSW that are involved in Catchment Management Boards. The Governor of NSW under the Catchment Management Act 1989 set up these boards. They are responsible for producing a management plan that sets out natural resource objectives, targets and actions along with community education and consultation and strategic investment advice on an ongoing basis. The table of stakeholders highlights the diversity of interests that government agencies have. Whereas NSW Agriculture is concerned with building profitable and environmentally sustainable food and fibre industries, the EPA has a focus on regulation and environmental reporting. Stakeholders are inter-dependent on each other (Röling 1994), but they also have their own objectives. Indeed every stakeholder in a natural resource management issue has not only a particular objective that they are trying to achieve but also constraints within which the individual and / or organisation operate.

<table>
<thead>
<tr>
<th>Department of Land and Water (DLWC)</th>
<th>the primary agency responsible for the oversight and support of the board. It has a responsibility to advise the Minister on policy governing the board and on its operations”.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW Agriculture</td>
<td>the premier provider of information and services to build profitable and environmentally sustainable food and fibre industries in New South Wales”.</td>
</tr>
<tr>
<td>Environment Protection Authority (EPA)</td>
<td>leading organisation responsible for environment protection. In addition to its regulatory functions the EPA is active in environmental education, environmental economics, environmental monitoring, and regular reporting on the state of the environment in NSW”.</td>
</tr>
<tr>
<td>NSW Fisheries</td>
<td>responsible for managing the fisheries resources of New South Wales and provides management, scientific research, advisory and compliance services. It advises the government on the use and conservation of fisheries resources”.</td>
</tr>
<tr>
<td>Department of Urban Affairs and Planning (DUAP)</td>
<td>comprises a range of agencies that deal with planning, policy and regulation of our natural and built environment, rural and urban management (including urban growth, renewal and consolidation) and the development of housing policies”.</td>
</tr>
<tr>
<td>Water Advisory Council</td>
<td>appointed by Minister provide advice on the implementation of the Water Reforms.</td>
</tr>
<tr>
<td>Native Vegetation Advisory Council</td>
<td>appointed by Minister provide advice on native vegetation management.</td>
</tr>
<tr>
<td>Estuary management committees</td>
<td>not appointed by Minister, but are established by local councils. Provide estuary management committees (EMC) undertake a range of functions relating to .the management of estuarine resources.</td>
</tr>
<tr>
<td>Floodplain management committees</td>
<td>not appointed by Minister, undertake a range of functions relating to the management of floodplains.</td>
</tr>
<tr>
<td>Landcare</td>
<td>consists of people working towards more sustainable natural resource management on the ground. Landcare frequently operates as landcare groups working in partnership with a range of other players, including business and government at Commonwealth, State and local levels. In this context ‘landcare’ includes rivercare, bushcare, dunecare and coastcare”. Landcare groups are independent and autonomous</td>
</tr>
</tbody>
</table>

Stakeholders need to find innovative ways of working together because of the complexity and far reaching effects of natural resource management problems such as acid sulfate soils. Ways that cross disciplinary and organisational boundaries to work with experts to develop innovative solutions and ways of assisting local stakeholders (Abdalla 1996). However, the more stakeholders there are, and the more that are involved in the decision making process, the more opportunity for conflicts arise (Korsching et al. 2001).

Indeed natural resource management can be viewed as a conflict management environment where 'outcomes are decided by bargaining between holders of different viewpoints' (Cullen 1998). Conflict is defined in the Collins English Dictionary as ‘a struggle or clash between opposing forces and a state of opposition between ideas, interests etc’. The definition continues that conflict can lead to emotional tension and is thought to be responsible for neuroses. These disputes can provide barrier to the equitable resolution of natural resource issues. Cullen (1998) defines several characteristics of environmental conflicts, see Table 4:

<table>
<thead>
<tr>
<th>Seven characteristics of environmental conflict:</th>
<th>Five elements are common in environmental conflict:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. they have several different parties involved</td>
<td>1. interest or distributional elements... self interests of the people</td>
</tr>
<tr>
<td>2. they have several different issues of interest to different players</td>
<td>2. value elements... fundamental belief systems about the importance of things like our cultural responsibility for land</td>
</tr>
<tr>
<td>3. there is uncertainty about how the ecosystem will respond to various operations and possible accidents</td>
<td>3. data elements... people lack the information to make wise decisions</td>
</tr>
<tr>
<td>4. environmental information, especially predictive models, is often poor and not available to all players</td>
<td>4. labelling elements... players label other players with negative labels that may introduce misconceptions and stereotypes</td>
</tr>
<tr>
<td>5. there is uncertainty about how the various political players will act</td>
<td>5. structural elements... are introduced by the organisational structure we erect to manage the resource... between state and federal interests.</td>
</tr>
<tr>
<td>6. there are high emotions since all participants believe strongly in the virtue of their own position and the self interest of all opposing positions</td>
<td></td>
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<tr>
<td>7. the conflicts are very public, being played out for the evening TV news so it is easy for participants to get locked into extreme positions and find it hard to back down.</td>
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Table 4 Characteristics and elements of environmental conflicts
Source: Cullen 1998

Pressure on natural resources and therefore conflict will continue to happen and increase as the world population expands. Given the complexity of multiple stakeholders, multiple realities and therefore multiple conflicts, it is important to look at ways to involve stakeholders in the management of natural resources, while also looking at ways to reduce conflict. Röling (1994) describes the social actor perspective. He suggests that ‘people are
intentional sense makers, who hold diverse and conflicting objectives, socially construct their realities and negotiate for advantage, accommodate interests and sometimes reach consensus’. Therefore an individual’s perception of reality will vary from another individual’s based on life experiences, beliefs and myths, hence multiple realities.

To provide information and to participate with stakeholders to socially construct their realities requires developing knowledge about stakeholder’s perspectives. Each stakeholder brings their own personal and groups knowledge and attitudes to the issue. Landholders have often got historical knowledge about their land and local knowledge about their community. Scientists have expert knowledge about their particular discipline. However, whereas at the farm level sustainable management has one meaning for the farmer, the scientist may have a different perspective, a different reality about sustainable management, such as from a whole-of-ecosystem perspective.

Turning information into action requires certain decision making skills which is often said to underline the importance of education and learning for achieving environmentally sustainable development (OECD 2001d). Gaining knowledge is a precursor to attitude and behavioural change, but does not necessarily guarantee change. Changed behaviour involves a complex decision making process where the attitudes and beliefs are as important as the new technology itself (Chamala 1987). Locus of control is an indicator of an individual’s perception of their ability to change a situation (McNairn 1992). Understanding attitude is highly important for predicting the way an individual will respond to a given situation. However, the strength of the relationship between attitude and behaviour is influenced by many situational factors (Kaiser et al. 1999). Situational factors include categories such as level of financial resources, industry type, age, size of property and education levels.

Myths and beliefs are defined by human ecologists such as Machlis et al. (1997). Myths are “narrative accounts of the scared in a society; they legitimate social arrangements (Malinowski 1948) and explain collective experiences (Burch 1971). Hence, myths are an important supply variable because they provide reasons and purposes for human action. Beliefs are statements about reality that are accepted by an individual as true. Beliefs arise from many sources: personal observation, mass media, tradition, ideologies, testimony of others, faith, logic, and science”. Lundvall and Johnson (1994) discuss knowledge in a multi-faceted context:

- Know what: refers to knowledge about facts (i.e. ability to assess which varieties are the best for crop production).
• Know why: refers to knowledge about principles and laws in nature, human kind and society (i.e. the source of ground water and its source of recharge).

• Know how: refers to skills (i.e. ability to operate a tractor).

• Know who: involves the social ability to co-operate and communicate (i.e. working in groups for a mutual agreed outcome).

Formal learning has not been a requirement for entry and continuation in most agricultural activities. Knowledge and skills in agriculture have traditionally been both passed down from the previous generation and acquired during informal interactions with neighbours, such as "over the fence" or at the local market. This knowledge has centred on production and marketing of produce. Climatic events are frequently discussed but the larger concept of environmental and ecosystem knowledge is newer. Learning about the relevance of environmental issues, the ‘know why’, is going to come from outside the farm, from scientists as well as on the farm. It needs to be combined with ‘local’ knowledge if landholders are to increase their knowledge about ‘know how’ to manage their land. Landholders are going to need training in ‘know what’ skills, if they are going to be able to commence making sense of this information. For example fish kills down stream are a result of acid water, yet because the pollution is diffuse, show few signs at source, it is difficult to identify the numerous small problem areas on the land. Therefore some new knowledge is required to ascertain how to identify the source, to monitor pH water quality and to gain an understanding of the cumulative nature of the problem.

According to Brown (2000) there are four knowledge groupings, local community knowledge; specialised knowledge; strategic knowledge; holist knowledge. Stakeholders have different but equally valid ways of constructing knowledge and the four constructions of knowledge are nested, in that each builds on the other in this way. They are also networked, in that all human beings use all four in different situations and under different hats.

Horwitz (1998) discusses how science can bring a form of credibility to the decision making process 'due to the high esteem held for science in the public sphere.' However, science tends to not use the four knowledge groupings, science tends to use specialised knowledge and fails at the ‘know how’ and ‘know who’ phases. The esteemed scientific credibility is fragile and even an illusion, science has frequently undermined its own credibility. There are numerous adverse credibility examples in Australia such as the Cane Toad, a species introduced for the biological deterrent of the cane beetle. The toad is now, itself, a major environmental problem, along with Paramatta Grass and numerous other introduced species. Röling (1994) argues that social actors are ‘bent on pursuing their own ‘projects’ to
satisfy their own interests, misuse the available resources’. He also suggests that natural resource problems ‘always translate into social problems, involving conflict, power, and struggle’.

There are many imbalances in the use of resources such as between the rich, the poor and inter-generational. These inequalities are further complicated when environmental and historical perspective’s are considered. Syme et al. (2000) suggest that “members of the same society do not have equal ratios of the total use of ecological resources or the enjoyment of ecological benefits, and they do not bear equal ecological risks”. It is important to understand these imbalances if conflict is to be minimised and compliance to regulations is going to be increased. Syme further discusses the importance that stakeholders perceive decisions as being fair and that ‘the more people judge a decision as fair the more they are likely to comply.’ “Unless people are satisfied that, in their situations, a ‘fair enough’ decision process occurred in determining their allocations, conflict will persist between government and the community, and be exacerbated between the different stakeholder groups (Syme 2000). Therefore, initial steps towards resolving ecosystem dilemmas would be a recognition of the various interests and knowledge and acceptance of those as legitimate by all stakeholders (Axlerod 1994). But ‘rural people often see decisions coming from distant state, national or international arenas as failing to take their interests into account’ (Aslin 1998). In Australia stakeholders want to participate in the decision making process, and it has been encouraged through policy initiatives such as Landcare and the National Heritage Trust.

3.4.1 Adaptive Participatory Research and Community Participation

A popular concept running through recent discussion on natural resource management, is that stakeholders ‘need to initiate and sustain a more collaborative process to resolve disputes and advance shared vision of the future’ (Selin et al. 2000). Participatory research and learning focuses on the interactive involvement of many people in differing institution contexts. Rhoades (2000) defines participation as the full involvement of local populations in the identification of problems and solutions. The United Nations Food and Agricultural Organisation (FAO) expands on this with participation as ‘a process that empowers people and communities through acquiring skills, knowledge and experience, leading to greater self-reliance and self-management.’ Pretty (1994) discusses how participative practices have many different terms for describing the methods of participation but they all have important common features that include:

- A focus on cumulative learning by all participants
- A search for diversity rather than reducing complexity to average values
Group learning and flexibility to allow multiple variants

A facilitation process that is concerned with the transformation of existing activities to create changes that stakeholders regards as improvements.

That this learning process leads to debate about change and to sustained action.

 Participatory research has therefore got a strong focus on bottom up policy development and empowerment of stakeholders. While this has many benefits, such as stakeholder ownership of the problems, mutually agreed outcomes and a focus on a sustainable future for the whole community rather than for the benefit of a few, there are problems. Focussing on the local can tend to underplay the importance of inequalities and political forces. Mohan and Stokke (2000) argue that “the radical notion of empowerment focuses on ‘bottom-up’ social mobilisation in society as a challenge to hegemonic interests within the state and the market”. This challenges the hierarchical nature of organisation especially when participation is taken to the level of policy and planning designed and couched in terms of stakeholder’s needs and wants. “Practitioners of participatory research and development assume that local knowledge will reverse the previously damaging interventions which treated locals as passive recipients. However, the reversal has been almost complete. The corollary is that, by valorising the local in this way and being self-critical of our colonising knowledge, ‘we’ behave as if we do not have anything to offer. Another effect of ‘going local’ is that the state is downgraded in importance” (Brezonik et al. 1999).

Further challenging the institutions is how to define whether this new decision making process is actually making better decisions than the present status quo. While some argue that participatory research is a necessity for improving policy making (Martin 1991) and it is the policies that should be measured, another view is that an ongoing process of empowerment where local communities take over their own development is the ultimate measure of success (Pretty 1997). This is not to say that these views are mutually exclusive. However, this thesis argues that some accountability of participative processes at local, institutional and policy levels are essential. This is especially important when the critics of participative processes such as government organisations with ‘expert knowledge’ see the community as the outsiders in the decision process, who lack the skills and knowledge to make valuable contributions. Martin (1991) states that ‘this one-way street reflects past agricultural extension methods and is an exemplar of a hierarchical view of environmental management’. Indeed, participation to many is merely a necessity for obtaining funding, rather than a principle that they uphold (Rhoades 2000, Mohan and Stokke 2000). This presents a challenge because the “success of a participatory mechanism in a given policy domain depends not only on its internal resources, but also on external political support from...
CHAPTER 3 LITERATURE REVIEW AND RESEARCH ISSUES

other groups with authority (or influence) within that policy domain’ (Busenberg 2000). Indeed ‘many collaborative initiatives lack any systematic approach to evaluating whether important outcomes are being achieved’ (Selin 2000) and as to whether the relationships between the state and society are becoming stronger or operating in increasingly separate spheres (Mohan and Stokke 2000). The danger is that participative processes will be considered to have no value in one of the spheres. Therefore some measure of success is essential if it is to remain part of Australia’s policy approach to NRM and if an understanding of what does and doesn’t work is to be further developed.

There have been failures with past NRM policies. This is partly because of complexities of NRM and because the issues are ill structured (Bardwell 1991). That is the problem is too remote, too big, and too complicated and therefore it is difficult to define because each individual has a different perception of the problem based on their reality. The challenges of natural resource management, multiple stakeholders and many components with interdependencies, have resulted in ‘piecemeal approaches to river basin development and management that have often failed to lead to an optimal outcome, resulting in inefficient resource use, economic losses and environmental degradation’ (Lee and Dinar 1996). They argue that river basins are large and cross private, regional and international boundaries, and that this provides a setting for ‘private agendas, contradictory objectives, and histories of non-cooperation’. Because biophysical and socio-cultural boundaries rarely coincide, this has caused many of the environmental problems such as land and water degradation that we are currently dealing with (Blackburn and Holland 1998).

There has been a lack of local ownership partly due to the complex social and physical boundary issues and due to centrally controlled projects. These projects are generally run by biological scientists who argue that if ‘watershed management is seen as purely a socioeconomic matter, then the powerful forces of nature are ignored. Conversely, the social scientists argue that if viewed as merely hydrology or natural processes, the powerful roles of institutions, culture, and economics are minimised’ (Rhoades 2000). The FAO (1996) report suggests that user participation can be critical in pre-adaptive stages of certain research and that participatory research may reduce the costs of applied research. Rhoades argues that you need participation to get local ownership. Beyond local ownership, to get compliance, there needs to be a sense of a fair decision in the view of the community (Syme et al.2000). The conundrum is that without community participation in, at the very least, discussion about he issues, it is difficult to estimate the response of the community.
3.5 PARTICIPATORY ENVIRONMENTAL EDUCATION

Landholders, as local stakeholders in the catchment, are discovering an increasingly complex and sometimes hostile set of public pressures within which they strive to produce agricultural products and maintain their rural businesses and lifestyle. This complexity has sometimes created conflict between the landholders, the government and the general public.

Landholders concern include the view that agricultural policy will be driven by the environmental concerns of society. Some fear that this will imply higher costs that will have a negative impact on the economic viability of their farms. Increasingly landholders are becoming natural resource managers, responsible for far more than just commodity production. They need new skills in public relations, ecosystem management, economics, environmental awareness and pollution to name a few. Yet as their role is being re-defined by governments and society, for many, their skills remain the same and they are frequently ill equipped to deal with this complex new situation (Woodhead 2001). The quote below discusses the importance of acknowledging education and the role of education in sustainable development.

*Education can be seen as a critical complement to social and economic policies, as a means for engaging public and corporate understanding and for improving dissemination and implementation of new ideas and practices OECD (1999a). More generally, education for sustainability is concerned with the development of individual and collective competencies so that all citizens and institutions might play a role in the transition to a sustainable future. This embraces respect for individual and social rights and responsibilities, concern for natural and social well being, critical thinking and skills for civic participation. One powerful argument for focusing on education is because the "hard" policy instruments based on enforcement may be approaching their limits of effectiveness: "[As] the relation between public administration and society is becoming more dialogue-based...communication and education are increasingly important policy tools. This tendency can be recognised in the philosophy of the present environmental education management program where it focuses on the quality of educational processes rather than on the implementation of pre-set goals" (Pieters 1998).*

3.5.1 Agricultural Extension

*Extension* has been the traditional method used in agricultural departments to impart new knowledge and change social norms. The traditional models of extension, however, have
been criticised over the last two decades because of its hierarchical nature, and the assumption that the organisation knows what’s best for the farmer.

Röling (1988) has identified “five common elements of definitions of extension. They are:

- extension is an intervention,
- extension uses communication as its instrument of change,
- extension can only be effective through voluntary change,
- extension focusses on a number of different target processes and outcomes which distinguish it from other communication interventions, and
- extension is deployed by an institution”.

According to Röling, the earliest research question in extension science, one which is still being asked, is ‘How do I get them where I want them?’ And the subsequent research question of extension science as being ‘Why don’t they do what I want them to do?’

There are several extension models, but they can be broadly summarised into two categories the one way transfer of information, the research transfer model, and the systemic approach, a many to many co-learning, soft systems approach. The concepts behind these two approaches are introduced here.

The ‘research transfer model’ “adopts a predominantly one way transfer of knowledge from researcher via extension officer to farmer. The farmer is a passive recipient. This model has sustained considerable criticism. Extension according to Francis (2000) has lost legitimacy and credibility “because many agricultural scientists fail to appreciate the social basis of agriculture and the social context in which farm management occurs. Extension has been based on the notion that knowledge transfer was uni-directional, that science was the only originator of new ideas, and that farmers were passive receivers of new technology. Therefore it was believed that all new ideas, if successfully extended, would be adopted. Farmers have become sceptical of extension with their simple message that all that has to be done to solve all the problems is ‘such and such’. Farmers know that farming is more complex”.

Indeed a comment sometimes stated by government extension officers is that they (the landholders) don’t know what’s good for them. Cary (2000) defines the conundrum. “The most important element of the human process of new technology adoption is the human ability to assess the appropriateness of the new technology from the point of view of their own (self) interest”. If the farmer does not adequately understand what is being promoted or why, then they will not perceive the issue to be relevant to them. Also frequently discussed
among extension staff and academics are the ‘barriers to adoption’. Lawrence (1996) suggests understanding “why it might not be ‘rational’ for producers to accept new ideas and to introduce new practices” is a more fruitful approach. Further, Lawrence argues that “improvements to existing systems, are ‘Based on whose judgement?’ and that other problems with the model are that the impacts of technological change have been poorly considered; local knowledge is often subordinated and trivialised in the face of ‘technology’”.

That ‘innovation would trickle down over time’ is another popular top down concept. Target the lead landholders and the rest will follow. However, this is based on the economic rationalist model that landholders will make a profit from this innovation change. This assumption has several problems that will be discussed in the next section. However, it is important at this point to note that the farming population is not homogeneous, there are corporate landholders, lifestyle landholders, wealthy landholders and landholders who are under considerable strain from other external events such as deregulation of their industry. They are not all trying to make money from the land nor are they all actively participating in managing the land. Nevertheless, for mainstream landholders, economic imperatives are strong drivers.

The extension model according to Collinson (2001) needs to account for operational constraints and the farm level operational expertise should drive applied research rather than research driving farm operations. The research transfer model is a model that is less likely to cause changes in behaviour Murray (1997) and does not appear to have applicability to the uptake of conservation innovations (Lawrence et al.1996). Failure to respond to extension strategies has also been blamed on psychological factors leading to a ‘resistance to change’ such as ‘conservatism and fatalism’. Röling (1988) states that the ‘diffusion of innovations’ paradigm has been criticised for legitimising the circularity of ‘a form of extension which follows the path of least resistance: benefiting those who know best how to look after themselves and neglecting those who need assistance but are hard to reach’.

The soft systems approach proposed by Checkland (1990), whereby there are many realities with many alternative solutions, has gained increasing popularity. This challenges the vertical diffusion of innovation and invites a more horizontal approach, such as participative research, where the farmer is not the receiver of information but is part of a co-learning process. The ‘systemic model’ adopts a many views of the world approach (eg. Chamala 1991, Campbell and Junor 1992). A systemic approach attempts to respond to the increased complexity of agriculture. Knowledge in agriculture therefore comprises three broad areas under the title Agricultural Knowledge Systems (AKS): science and research in agriculture;
agricultural extension services and agricultural education (OECD 2000c). Extension is referred to as a subsystem within agricultural information systems and AKS. This approach acknowledges that agriculture is complex and there are many forms of knowledge.

Under this model education and training are no longer seen simply as processes of transferring knowledge or information. Rather as means to empower people to become critical thinkers and problem solvers. This approach is partly a reaction to the top down, research transfer model. That is, for example, where governments in Europe have provided subsidies and related extension to encourage greater use of fertilisers and pesticides, that are now causing environmental problems such as pollution of ground water (OECD 2001b). The systemic approach embodies the participatory paradigm whereby information is developed from many sources and is combined with teaching and interaction. The landholder therefore become a participant in the decision making process.

Further challenging the agricultural extension model is the advent of environmental problems which have not fitted snugly into the extension model because the ‘win win’ scenario, (that is production gains for changed management practices) are not immediately evident when dealing with catchment or water table scale environmental pollution issues, notable diffuse source pollution (Ribauldo et al. 1999, Brezonik et al. 1999). Agricultural extension has been less than successful for complex environmental problems that rely on farmer’s voluntary participation (Napier and Johnson 1998). It is difficult to convince landholders in the upper region that their practices are the cause of stream degradation problems that are evident only many kilometres downstream (Brezonik et al. 1999). Landholders will not take on new practices unless they are convinced that the new practice does not present a risk to their farms (Napier et al.1986) although a perceived threat to family health on the farm is a significant motivator (Napier and Brown,1993). Many environmental problems such as acid sulfate soils do not present an immediate perceived threat to human health or the farm.

Why would landholders not adopt conservation practices? The Ecologically Sustainable Development Working Group on Agriculture defined three key ingredients for the development of sustainable agriculture practices (Prevett, Murphy and Smithyman 1995):

- Farmers must want to change.
- Farmers must know how to change.
- They must have the necessary material resources to bring change about.
Age is important older producers tend to have fixed ideas about what constitutes appropriate farming methods (Lawrence et al. 1996). While they may have years of experience with producing agricultural produce their experience of diffuse source pollution concepts is usually limited. With environmental issues that cause diffuse source pollution benefits of new technologies and remediation are captured by others (Jacobsen et al. 1996) and landholders may not be convinced that it is their own farming practices which are causing off-farm environmental degradation. Landholders may have children who may not be interested in taking over the farm, and yet feel that they do not want to retire. There is evidence that landholders who have successors willing to take over the farm are more likely to adopt conservation practices (Gray and Phillips 1996 cited in Lawrence et al. 1996). They may also be somewhat suspicious about government-supported environmental programs, because the credibility of extension staff has been damaged in the past. Many extension staff believe non-adoption of the practices they promote is the main barrier to sustainable agriculture. Yet Francis (2000) notes it was “adoption (not non-adoption) of the practices that were promoted in the past - that are largely responsible for the environmental problems of today”. This is most emphatically the case with the government funded drainage systems and consequential problems with acid sulfate soils.

Lynne et al. (1988) found that landholders with a stronger conservation ethic or with stronger beliefs about farm related pollution exerted greater conservation effort, as measured by the number of different conservation practices adopted, and landholders were more likely to adopt conservation practices if they believed that the practices would improve water quality. Perceived threat to family health is a significant motivator (Napier and Brown 1993) for land operators to become concerned about groundwater pollution problems, however, respondents will not change production practices if adoption of new farming systems threatens the economic well-being of the farm enterprise. There is also some evidence to support the assumption that improved education is related to the capacity to adapt farming systems (OECD 2001d). Yet, current adjustment patterns are likely to result in a decreasing number of agriculture graduates in the broadacre industries (Barr and Cary 2000). This is likely to lead to a stratified farming community where increasing levels of education will be evident in those industries with sounder financial prospects. This is reinforced by findings by Rogers (1983) that the socio-economic and personality characteristics of those who tend to adopt early (see Table 5) than do later adopters or non-adopter favour higher levels of education among other traits. This raises a significant issue, landholders that most need to adopt conservation practices are not necessarily the innovators nor reliant on keeping their farms productive. The United States Department of Agriculture (USDA) (pers. com Dr. Margriet Caswell, Economic Research Service, USDA) discussed how lifestyle landholders...
own most of the highly degraded land, because profitable agriculture cannot produce enough on this land. This group also needs to learn about conservation practices yet they are not regarded as professional landholders. The USDA perceives this to be a major challenge given the lack of defined groupings, industry alignment or production incentives.

<table>
<thead>
<tr>
<th>socio-economic</th>
<th>personality</th>
</tr>
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<tbody>
<tr>
<td>• more years of education</td>
<td>• greater empathy, less dogmatism, greater rationality</td>
</tr>
<tr>
<td>• higher rates of literacy</td>
<td>• greater ability to deal with abstractions,</td>
</tr>
<tr>
<td>• a greater degree of upward social mobility</td>
<td>• higher scores on measures of intelligence</td>
</tr>
<tr>
<td>• larger-sized farms</td>
<td>• a more favourable attitude toward change</td>
</tr>
<tr>
<td>• a commercial (rather than a subsistence) economic orientation</td>
<td>• greater ability to cope with uncertainty and risk</td>
</tr>
<tr>
<td>• a more favourable attitude toward borrowing money and</td>
<td>• a more favourable attitude toward education and</td>
</tr>
<tr>
<td>• more specialised operations</td>
<td>• toward science</td>
</tr>
<tr>
<td></td>
<td>• less fatalism</td>
</tr>
<tr>
<td></td>
<td>• higher levels of achievement motivation and higher aspirations for education, occupation</td>
</tr>
</tbody>
</table>

Table 5 Characteristics of those who tend to adopt early over those who adopt later

Environmental concern is positively associated with conservation behaviours (Ebreo et al. 1999). Conservation behaviour can be rewarding to the participant because the action is satisfying on a personal level. They reviewed several studies and found that “intrinsic rewards play a major role in facilitating conservation behaviours. In contrast to external rewards such as financial incentives and behavioural prompts, intrinsic rewards are those that are derived from the satisfactions people receive through their participation in an activity; they include psychological benefits such as increased self-esteem, feelings of altruism, and enhanced connection with one’s community”. The earliest studies of these consumers, conducted in the 1970s, generally revealed that concern for the environment was greater in environmentally responsible respondents who were found to be young, well-educated, of high socioeconomic status, and who resided in urban, rather than rural, areas (Ebreo et al. 1999).

Syme et al. (2000) found that people are likely to judge pro-environmental decisions as just, and to contribute to environmental protection, the more:

- they regard universal as well as contextual lay philosophies of environmental protection as just (eg. equity principles, basic environmental rights);
- they regard universal as well as contextual lay philosophies which compete with environmental protection as unjust (eg. basic right to economic welfare);
- they accept private as well as government responsibility in environmental protection and management;
• they are aware of the extent of the relevant ecological problem;
• they perceive efficient means to reduce it;
• they deny arguments against the transference of ecological responsibility to individuals, and
• they trusted government.

Due to increasing complexity of these interactions between agriculture and society, and the failure of traditional agricultural extension networks to accommodate the broader stakeholder groups, I have observed that concepts of sustainable consumption and environmental education starting to gain interest among government agencies working in agriculture. Indeed recent extension gatherings such as at the Australia-Pacific Extension Network (APEN) annual conference in Melbourne 2000 saw many agricultural extension practitioners discussing the role of extension. The general view expressed was that extension needs to change its role and join forces with other community education groups and that agricultural extension can no longer be viewed in isolation from the rest of the community.

3.5.2 Environmental Education

Environmental education has many definitions but the most widely accepted is the 1970 International Union of the Conservation of Nature definition, which states:

‘Environmental education can be described as the process of recognising values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among people, their culture and their biophysical surroundings. Environmental education also entails practice in decision making and self formulating of a code of behaviour about issues concerning environmental quality (IUCN 1970).

It is the concepts of inter-relatedness among people and their biophysical surroundings that differentiates environmental education from the traditional extension practices that have been more geared to farm productivity. While the community appreciates some of the roles of agriculture, they do not appreciate some of the off-site effect, especially when negative economic impacts for the broader community result, causing disagreements in how the problem should be solved and who should pay (Korschning et al. 2001). Abdalla (2000) suggests that “knowing why events are occurring helps the community understand what may happen in their community in the long run, the type(s) of control they may be able to exercise over those future impacts, and what they cannot control. This understanding must include economic, demographic, and policy forces affecting change”. Information about agricultural practices needs to be communicated to the community and landholders need to understand more about the community’s concerns.
A Causal Model of Environmental Behaviour*

<table>
<thead>
<tr>
<th>Variables Affecting Behaviour &amp; Environmental Quality</th>
<th>Examples of Environmental Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>➔ Social values &amp; cultural norms</td>
<td>Peer education, role modelling, mass mediated public education campaigns, the arts</td>
</tr>
<tr>
<td>➔ Sociodemographic variables</td>
<td>Programs for young people, people from non-English speaking backgrounds, workplaces</td>
</tr>
<tr>
<td>➔ Structural factors</td>
<td>Education about environmental legislation, regulation and enforcement, policy development, economic mechanisms</td>
</tr>
<tr>
<td>➔ Institutional factors</td>
<td>Education and training to support strategic plans, codes of practice, environmental management systems, environmental audits and reviews</td>
</tr>
<tr>
<td>➔ Recent events</td>
<td>Public communication, including media liaison, press releases and publicity events</td>
</tr>
<tr>
<td>➔ The individual's level of awareness</td>
<td>Comprehensive school, community and workplace environmental education programs and targeted, issue specific programs</td>
</tr>
<tr>
<td>➔ Behavioural commitment &amp; intention</td>
<td>Developing infrastructure for environmentally friendly choices and expressing environmental concern</td>
</tr>
<tr>
<td>➔ Observable behaviour &amp; its effects</td>
<td>Promoting exemplars/lighthouse programs, best practice</td>
</tr>
<tr>
<td>➔ The state of the environment</td>
<td>State of the environment reporting, social research, epidemiology</td>
</tr>
</tbody>
</table>

Figure 8 NSW EPA Causal Model of Environmental Behaviour
Source Young (2000)

The New South Wales Environmental Protection Authority (NSW EPA) (Young 2000) developed a causal model of environmental behaviour, Figure 8. This model illustrates the decision process that facilitates information dissemination by the NSW EPA. The EPA's 2000 *Who cares about the Environment Survey* found that the public believe the
environmental situation in NSW is improving overall. Improvement has been noted in water quality, particularly cleanliness of beaches and ocean and the handling of household waste. However, water and air issues are still mentioned as key concerns. But many more people now see land degradation as a priority issue. The report further notes that community concern about the environment appears to have a longer term focus, with more people identifying the environment as an issue for government attention in 10 years time. Most people noted as the emerging issues of 2000, concern for future generations and the sustainability of the ecosystem. The report found that there was strong support from the general public for stricter or harsher laws to protect the environment. Yet others believe that education is the most important initiative the Government can contribute, particularly in relation to activities for protecting the environment at the individual or household level (Cavaye 2000). To facilitate this process of participatory research and environmental education the principles of adult learning are essential. The next section introduces the theory of adult learning.

3.5.3 Adult Learning and Changing Social Norms
Adult learning principles promote self directed learning, which inherently relates to needs (Murray 1997). The stakeholder, determines his/her needs, then seeks information and technology to satisfy those needs. Scientists make the linkages between those needs or problems and their underlying causes, and develop alternative solutions (Jacobsen et al. 1996). Malcolm Knowles (1980) is the theorist who brought the concept of adult learning (andragogy) as different from the learning of children (pedagogy) to the fore. He believed that adulthood had arrived when people behaved in adult ways and believed themselves to be adults. Then they should be treated as adults. He thought that adult learning was special in a number of ways, for example:

- adult learning brings a great deal of experience; this should be used as a resource.
- adults expect to have a high degree of influence on what they are to be trained in and how they are to be trained
- adults need to be able to see applications for new learning
- they expect a high degree of influence on how learning will be evaluated
- adults expect their responses to be acted upon when asked for feedback on progress of the program

‘By adulthood people are self-directing. This is the concept that lies at the heart of andragogy. Andragogy is therefore student-centred, experience-based, problem-oriented
and collaborative very much in the spirit of the humanist approach to learning and education ... the whole educational activity turns on the student’ (Burns 1995, p.233). Pogson and Tennant (1995) provide a perspective of adulthood as a social construction. They say that the concept of a life’s course varies for different individuals and in different cultures. They acknowledge the research which has shown that “one’s personality or identity changes and/or develops during the adult years ... Each (of a group of theories of learning) takes the stance that cognitive development continues apace in adulthood.” Further there is according to research quoted by Pogson and Tennant (1995, p28) ‘tremendous variation in adult experience’. Researchers such as Knowles believe that adults learn by experience and use the term ‘experiential learning’. The work of Kolb and Fry (1975) refers to the ‘circular nature of the various processes that are thought to occur in an experiential learning model’.

There are other learning theories such as sensory stimulation theory. Traditional sensory theory has as its basic premise that effective learning occurs when the senses are stimulated (Laird 1985). Laird quotes research which found that the vast majority of knowledge held by adults (75%) is learned through seeing; hearing is the next most effective (about 13%) and the other sense - touch, smell and taste account for 12% of what we know. By stimulating the senses, especially the visual sense, learning can be enhanced.

Cognitive-Gestalt approaches emphasise the importance of experience, meaning, problem solving and the development of insights (Burns,1995 112). Burns goes on to note that this theory has developed the concept that individuals have different needs and concerns at different contexts. The term life space is used to convey this special way of interpreting one’s environment.

Carl Rogers developed facilitation theory (the humanist approach). The basic premise of this theory is that learning will occur by the educator or trainer acting as a facilitator, that is by establishing an atmosphere in which learners feel comfortable to consider new ideas and are not threatened by external factors (Laird 1985).

The idea that people learn in different ways has been explored by Kolb who built his theory of experiential learning from the fields of psychology, educational theory, social psychology, psychoanalysis and Buddhism (Foley 1995, p.39). Kolb believes that an individual’s first way of adapting to situations is by learning and that learning involves two basic processes: Grasping (prehension), and transformation. His research found that people learn in four ways with the likelihood of developing one mode of learning more than another, they are:

- through concrete experience
- through observation and reflection
- through abstract conceptualisation
- through active experimentation

Gaining knowledge is a precursor to attitude and behavioural change, but does not necessarily guarantee change. Achieving **behavioural change** is a complex process and almost all studies related to the “motivational elements of behaviour have stressed that the decision to act in a certain way is affected by a ‘balancing’ or weighing of a number of influences’ (Beedell and Rehan 1999). These include environmental, physical and commercial factors, policy environment, advisory structures and the personality of the farmer. Indeed, changed behaviour involves a complex decision making process where the attitudes and beliefs are as important as the new technology itself (Chamala 1987). Locus of control is an indicator of an individual’s perception of their ability to change a situation (McNairn 1992). Understanding attitude is highly important for predicting the way an individual will respond to a given situation. However, the strength of the relationship between attitude and behaviour is influenced by many situational factors (Kaiser et al. 1999). Situational factors for agriculture include categories such as level of financial resources, industry type, age, size of property and education levels.

Changing social behaviour is imperative if there is to be an impact on the threats facing humanity and the environment, yet this is a complex process. To enable more effective management of resources, “policymakers need to become more sensitive to psychological and social processes” (Stern and Oskamp 1991) and they need methods to understand and make sense of these issues. One such model is the sustainability model with its three dimensions, social, economic and environmental. The broad concepts of sustainability has been discussed earlier in this chapter, this section looks at indicators for the sustainability model.
3.6 SUSTAINABILITY INDICATORS

Indicators have developed as the medium that policy makers use to understand and measure issues. The Gross Domestic Product (GDP) for instance measures the economic growth, and is one indicator of whether a country is experiencing a vigorous or a weak economy. Likewise environmental indicators have been developed that are used to show air pollution levels in cities and drought affected regions. Other environmental indicators have been developed for resources such as water quality and soil erosion with varying degrees of success. There are many problems associated with accurately recording environmental data; these include cost, variability, scale, and time span. However, environmental data is increasingly becoming available and used to measure progress and set targets.

Because indicators are so varied and complex, a process is required that combines scientific and social knowledge to develop meaningful indicators for particular issues. This section briefly discusses indicators that governments currently use to guide policy development and then discusses social and process indicators.

Indicators that are used by international, national and state agencies involved in natural resource management are included in the State of the Environment reports (State of the Environment, Australia 1998). These reports determine the state of the environment by measuring environmental indicators. They aim to ask ‘What is the state of the environment and what are the pressures?’ Physical, chemical, biological or socio-economic indicators that represent the key elements of a complex ecosystem or environmental issue are reported on. The type of social indicators measured are change in human population and density, utilisation of resources such as electricity, water and fuel and waste disposal by individuals and corporations.

<table>
<thead>
<tr>
<th>Group</th>
<th>Indicators</th>
</tr>
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<tbody>
<tr>
<td>long-term real net farm income (economic)</td>
<td>• real net farm income</td>
</tr>
<tr>
<td></td>
<td>• total factor productivity</td>
</tr>
<tr>
<td></td>
<td>• landholders’ terms of trade</td>
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<tr>
<td></td>
<td>• average real net farm income</td>
</tr>
<tr>
<td></td>
<td>• debt servicing ratio</td>
</tr>
<tr>
<td>natural resource condition (environmental and biophysical)</td>
<td>• nutrient balance: P and K</td>
</tr>
<tr>
<td></td>
<td>• soil condition: acidity and sodicity</td>
</tr>
<tr>
<td></td>
<td>• rangeland condition and trend</td>
</tr>
<tr>
<td></td>
<td>• agricultural plant species diversity</td>
</tr>
<tr>
<td></td>
<td>• water utilisation by vegetation</td>
</tr>
</tbody>
</table>
Within the agricultural sector, the current focus is on production indicators, but trends, particularly in Europe, suggest that increasing emphasis needs to be placed on the natural resource base and on ethical and social considerations. The OECD has developed a framework for comparing indicators at a country level (OECD 2001e) for agri-environmental indicators that explore the relationship between agriculture and the environment, but the social dimensions remains undeveloped (OECD 2001b).

The current OECD indicators include the viability of rural areas, biophysical processes, land use changes, farm management resources, farming practices, farm inputs and environmental impacts. Somewhat aligning themselves within this framework and also contributing data to the OECD is the Standing Committee on Agricultural Resource Management (SCARM). SCARM has developed its own set of indicators for national policy development in Australia. The indicators aim at answering the question ‘How viable is Australian agriculture?’ at a national and regional level. The five key indicators for sustainable agriculture as defined by SCARM (1998), were aligned to the key parts of the farm system: people, off-site environment, financial and farm physical. The sustainability model can be overlayed (for example see (economic) after farm income in Table 6). The social indicators, however, were very limited and they do not account for off-farm interactions, which were essential for issues such as acid sulfate soils because landholders represent one of several stakeholders with a vested interest (see Chapter 3 and 4). But, the SCARM indicators do attempt to provide a broad set of farm indicators and have been used by the OECD in their guidelines for agri-environmental indicators (OECD 2001e).

There are different approaches to measuring rural viability, such as assessing demographic characteristics, income changes and distribution, the number of people entering or leaving rural industries, the level of education and support structures in rural areas. Figure 9 shows

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicators</th>
</tr>
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</table>
| off-site environmental impacts (environmental and biophysical) | • chemical residues in products  
• salinity in streams  
• dust storm index  
• impact of agriculture on native vegetation |
| managerial skills (social)                         | • level of farmer education  
• extent of participation in training and Landcare  
• implementation of sustainable practices |
| socio-economic impacts (social)                    | • age structure of agricultural workforce  
• access to key services |

Table 6 SCARM farm management indicators
Source SCARM (1998)
the farm management model used by the OECD to define rural viability (OECD 2001e). It breaks down farm management capacity (covering the institutional aspects of agriculture), on-farm management practices (covering the environmental dimension of sustainable agriculture) and farm financial resources are related to the economic dimension. This model is somewhat restrictive because it does not relate to sustainable development. But it does place the farm in the larger context of the rural community.

The OECD report states that “farm management indicators can provide an early indication of likely changes in the direction of environmental impacts. Measuring farming practices is often more practical and cheaper than measuring changes in the environment. Monitoring the trends in management practice indicators alongside appropriate “state” indicators, such as water quality, can also help policy makers to evaluate directly the success of policies aimed at environmental improvement”.

Source: OECD (2001e).

**Figure 9 Farm Management Model.**

**Social indicators** have not been developed to the same extent, especially in the agricultural sector. The OECD and other international agencies measure landholder’s age and education levels in countries. Within countries attitude and awareness are measured both by researchers and by government agencies such as the NSW Environment Protection Authority, usually to develop a better understanding of stakeholders for the purpose of education or to establish impacts of policies. Questions have included behavioural traits such as waste disposal “Do you pick up rubbish from the road side?”, attitudes such as “Do you believe landholders are good environmental managers?”. Likert ranking scales of 1:5. are frequently used because it is considered a good way to assess the distribution of responses, 1 may represent not important through to 5 representing very important.
Indicators are also important for measuring progress towards targets. They can help define what are realistic expectations that can be achieved within a certain time span. Setting targets has become the standard mode or operation for government and community groups in Australia. The Catchment Management Boards set targets such as increase the pH of water in the Richmond Catchment from pH5 to pH6 by 2015 as a target to be achieved from better management of acid sulfate soils. From regional to international levels individuals and groups have tried to determine realistic targets for the future and measures of these targets. Pearce (1999) states "we need to understand the path we are heading towards or away from. Therefore we need to understand what sustainable development means – and indicators to tell us whether we are on or off the path". Pearce continues “What is missing from data sets is the dose-response functions – the link between emissions or environmental insults and damage – and any measure of just how important these impacts are. For now we have environmental not sustainability indicators”. What we need in sustainability indicators are the social indicators because, while environmental indicators are not well developed, social indicators are even less developed.

**Human and social capital** is associated with a wide range of non-economic benefits (OECD 2001c). Human capital is the knowledge, skills and competence that individuals develop during their life. Human capital is widely recognised by economists as a key factor for stimulating economic growth. Social capital incorporates the broader concept of social relationships. A well functioning community can be considered as having strong social capital. It represents the role of institutions and social relationships of communication and co-ordination and the more non-specific role of good governance within which all development takes place (Stattz 1998; Schmid 2000; OECD 2000b and 2001d). Putnam (1993) defines social capital as the oil that keeps society together, “those features of social organisation — networks, norms of reciprocity and trust — which facilitate co-operation for mutual benefit”. Low social capital implies low trust, community disagreements and difficulties in solving problems or achieving goals. Conversely groups with strong social capital have many networks that are active and have high levels of trust and low levels of conflict between members. These networks are able to debate future options and reach consensus for action.

Measuring human and social capital, along with economic and environmental indicators, can point to how landholders will manage change and growth in the future. Human capital contributes to social capital because there appears to be a strong inter-relationship between the level of initial education, continuing education and learning and levels of civic
participation and trust, pointing towards an ongoing cycle of reflective learning (OECD 2001d).

In March 1998, OECD Agriculture Ministers highlighted the increasing interest in assessing the role of social capital in the context of sustainable development concerns (Atkinson, et al. 1998). Three areas where social indicators could be applied to the agricultural sector are:

- **Social state** or conditions in agriculture implies identifying those issues and related indicators that can reflect current state and recent current trends of social conditions in agriculture, such as the spatial distribution of farm employment.
- **Social potential** of agriculture implies identifying those issues and related indicators that can clarify social conditions in agricultural and rural communities, such as education levels and development of institutions to raise environmental awareness.
- **Social consequences** for the agricultural sector of changes in the potential and state of social conditions in agriculture, such as age structure of people entering agriculture.

The social dimension and more specifically the social indicators that are discussed in this thesis are concerned primarily with social potential, but social state and social consequences to a lesser extent are also covered. Within the framework of social potential, this thesis will develop or further define the concepts of the two levels of capital: individual, or human capital, and group, or social capital. Both represent a component of social wealth and indicate the ability of individuals and groups to effectively manage change (OECD 2000b).

### 3.7 Benchmarking and Other Systemic Models

There is a need for a methodology to deal with gaining a better understanding of the social situation. Methodologies are based, implicitly or explicitly, on ‘particular philosophical assumptions concerning the nature of the organisational world and the appropriateness of various forms of action’ (Mingers and Gill 1997). They describe three different paradigms:

- **hard** (positivist), treating the organizational world as objective, essentially the same as the natural world;
- **soft** (interpretivist), treating human organizations as fundamentally different, based on subjective meaning and interpretation/ and
- **critical**, accepting the place of both hard and soft but emphasizing the oppressing and inequitable nature of social systems.
These paradigms, are frequently considered to be ‘mutually exclusive and the methodologies that embody them, are often said to be incommensurable because their underlying assumptions are believed to be irreconcilable’ (Mingers and Gill 1997). However, multi-methodology, to utilize more than one methodology, has gained increasing interest over the past decade. There is a realisation that no one methodology can adequately explain the complex interactions embodied in natural resource management. Mingers and Gill (1997) provide two important arguments for the use of multi-methodology: “First, that real-world problem situations are inevitably highly complex and multidimensional. Different paradigms each focus attention on different aspects of the situation and so multimethodology is necessary to deal effectively with the full richness of the real world. Second, that an intervention is not usually a single, discrete event but is a process that typically proceeds through a number of phases. These phases pose different tasks and problems for the agent”. They also suggest that many researchers are using multimethodology already and that it is important that these methods are further developed.

Neher (1992) argues that “Ecosystem-level concepts require ‘systems-level’ thinking and research” and that systems have multiple interactions and are ‘inherently complex’. A systems approach to an agroecosystem is interdisciplinary and includes biological, chemical, physical, and social scientists. Researchers such as Checkland have conducted considerable development of these concepts.

Checkland’s Soft Systems Methodology (SSM) (Checkland and Scholes 1990), as discussed earlier in this chapter, focuses on ‘whole systems and taking a set of actors through a process of shared problem appreciation, learning about the problem and taking collective action to improve it.’ Cause and effect, or hard systems data may be used to inform the process. There is an underlying appreciation, by soft systems proponents, that there are many realities and that ecosystems are ill-structured problems as previously discussed. Not only does each stakeholder have their own concept of what they believe the problem is, but also every stakeholder has their own vested interest in the solution and consequently a concept of what the solution should be. Soft systems methodology is an approach to inquiry which ‘builds upon differing perceptions of problematic aspects, to describe a number of conceptual models of potential management activity’ (Hamilton and Attwater 1996, Attwater 1999) and the methodology supports stakeholders’ capacity for collaborative problem-solving. Röling (1994) describes the soft systems approach as helping to structure a dialogue aimed at defining desirable changes, suggesting new ideas, and changing perceptions, and Pretty (1994) as a system of inquiry that encourages action.
The major problem that is facing integrated catchment management and ecosystem management is ‘no clear, or uniformly accepted, model of how to translate the concepts into practice’ (Wolfenden 1998). There needs to be models that ‘include the forces driving infinite human desires, along with the more limited possibilities of satisfying those desires with increased natural resource productivity’ (Machlis et al. 1997). They suggest that we should view ‘human variables as both the cause and consequence of system change’. The next section looks at possible models for ecosystem management.

3.7.1 Models

Models are ‘applied to reveal strategies for managing and allocating scarce resources to their highest and best use’ (Lee and Dinar 1996). However, models have been most effectively developed to deal with quantifiable data. Decisions are made using both quantifiable data and qualitative data, therefore, Lee and Dinar argue ‘the primary function of models is as an information tool in the overall decision-making process’.

3.7.1.1 Models that advise policy

Models such as Social Impact Assessments (SIA) (Vanclay and Bronstein 1995) and the Ecological Footprint (Rees 2000) explicitly fit this definition. Their aim is to advise policy. The SIA model is a comparative model and is somewhat a companion to the Environmental Impact Assessments (EIS) which have become an essential part of all development applications. SIA attempts to acknowledge the social aspects of the decision making process. They are based on ‘studying the course of events in communities where planned environmental change has occurred, and extrapolating from that analysis to predict what is likely to happen in another community where a similar developmental event or policy change is planned’ (Vanclay and Bronstein 1995). Similarly, stakeholder analysis (SA) is another methodology aimed at policy analysis and formulation. It is an approach to understanding a system, and changes in it, that identifies key actors or stakeholders, and assesses their respective interests in that system. Stakeholders are categorised according to their relative influence and importance. The model develops a picture of the differential consequences for stakeholders arising from a particular course of action (or non-action), and indicating winners, losers and ‘payoffs’. Compatibility problems between objectives and stakeholders are defined (Grimble and Wellard 1997).

Another model with somewhat similar goals is the Ecological Footprint model. This footprint of a human population is calculated through the determination of consumption in a given area, divided into relevant categories (food, housing, transportation, consumer goods and services) which are then multiplied by the calculated land use for each consumption category
(Roth et al. 2000). Both these models can contribute valuable information for policy development. But static measurements do not explain the reasons for non-compliance or for non-sustainable development, nor will they give any ‘indication of the most appropriate development path for human activities’ (Roth et al. 2000). Social analysis generally analyses the effects of policies, after the event rather than before. Therefore the analysis does not ‘reflect the principles of community involvement in developing policies to achieve environmental sustainability’ or the ‘moral basis of evaluation, such as fairness’ (Syme et al. 2003). These models fail to create the environment for social change and improved management of the natural resources, partly because they do not attempt to include the stakeholders in the process, so the information is circulated within a limited group of stakeholders. Tracey et al. (1996) argues that Social Impact Assessment is seen as an activity that ‘highlights the negative effects of social change and is limited to mitigating these effects’.

3.7.1.2 Models that create change without measuring the impacts numerically

There has been a growth of models that try to include a more participative ‘soft’ approach to management. These models are actively trying to create change rather than measure the impacts of change. Warner and Jones (1998) describe a methodology called Conflict Management Assessment (CMA) that is not dedicated to informing the project design, but to ‘paving the way for stakeholder negotiations’. The goals are to ‘generate agreement and outcomes which are acceptable to the conflicting parties with the minimum of compromise or trade-off.’

Participative models such as Rapid Rural Assessment (e.g. Pretty 1999) have become very popular with organisations such as the United Nations Food and Agriculture Organisation. Rapid Rural Assessment, like CMA, embodies the concept that change occurs best when negotiated by the stakeholders and that a participatory approach enable this process. However, Rhoades (2000) argues that “if the participatory approach is the answer, then its proponents in a few years will have to prove beyond mere rhetoric that it actually works,” and that the ongoing projects have often yielded more rhetoric than effective output. There has been both a failure to evaluate participative models with quantitative data when they are employed and to assess the impacts over time. This is partly because participation is a qualitative process and conventional monitoring and evaluation methodologies are inadequate to evaluate participation due to the lack of agreed social indicators, but also because soft systems proponents have not considered quantitative measurements a priority.
A critical paradigm that accepts both hard and soft paradigms is needed. A system that has the potential to address the complex needs of ecosystems management and also provides evidence to argue the success or failure of policy approaches is benchmarking.

3.7.2 Benchmarking, a Change Agent and a Device for Measuring Change.

The fundamental concepts behind benchmarking are that it is about understanding and working with processes as well as measuring change. Therefore it intrinsically embodies both the hard and the soft methodologies discussed above. “Benchmarks are the most appropriate measure for addressing issues surrounding the framework approach to sustainable agriculture since they are designed to influence processes rather than to measure outcomes” (Williams and Walcott 1998). The power of benchmarking lies in the fact that the process as a whole is

“designed by the organisation itself, is customised to its own circumstances, and that the change strategy is developed by the benchmarking teams on the basis of indisputable achievements discovered by those teams. This helps to ensure commitment to the process and ownership of the strategy for change, thereby maximising the likelihood of successful implementation. Because benchmarking is interactive, organisations must maintain and review their benchmarking process to continually search for and endeavour to meet the standards of best practice environmental regulation”. (Australian Manufacturing Council 1993)

The goal of benchmarking does not necessarily have to be best practice environmental regulation. It can be education or agricultural practices, or the effectiveness of extension programs. However, the important point is that benchmarking is a process, the first measurement providing a benchmark to compare groups, and against which change can be measured. True benchmarking is not only about comparison, but is also about ‘betterment’ (Irving and Murphy 1996). There are three main types of benchmarking:

1) internal where one department is compared against another;
2) functional which involves finding and studying the best external practitioners;
3) competitive which involves collecting information about direct competitors (Thompson 1993).

Xerox Corporation first developed the process of benchmarking in the late 1970’s. It has since been further developed within commercial companies wanting to obtain or maintain a competitive edge (Thompson 1993; Ronan and Cleary 2000). Benchmarking has also been
used to determine the success of educational programs (Mckenna 1992) and quality in service and products (Hyden 1991).

Advantages of benchmarking include building teams and building skills of individuals within these teams. Important benefits seen by Camp (1989) include, determining measures of productivity (change); setting goals with a view to external conditions and building awareness of, and desire for, knowledge of best management practices. Benchmarking is a goal setting process. It is a method by which the practices needed to reach new goals are discovered and understood (Thompson 1993). Indeed benchmarking is much more than ‘an investigation of the quantitative measurements of the best practices’ since it must include ‘what practices are employed to achieve these measures, how they work, and how they differ from ours’ (Tyndall 1990). It is about developing an understanding of process (Ronan and Cleary 2000; Camp 1989, O’Keefe 1995).

In a comparison of government and private benchmarking projects in Australia, Shaw (1997) identified the following key deficiencies of government benchmarking projects:

- lack of clear definition of the terms benchmark and benchmarking
- poor use of ‘farmer as learner’ methodology (adult learning principles)
- very little use of environmental and people indicators for sustainability
- lack of use of evaluation to practical change or outcome level
- the benchmarking of performance indicators only

and these key elements of private benchmarking:

- predominate use of adult learning methodology
- use of the terms benchmarking and benchmark to mean the process for adoption and the measure (tool) used for monitoring respectively
- poor use of evaluation to practice change or outcome level
- some use of environmental and social indicators
- the benchmarking of performance indicators in Agriculture, and the recommendation to benchmark processes in Industry.

Murray concludes that ‘both public and private benchmarking have traditionally benchmarked performance indicators, not the how (processes)’. Ronan and Cleary (2000) discuss how benchmarking is promoted in Australia as a farm business tool with ‘expectations that it will help landholders in the pursuit of better practices and profits’. They criticise the process based on the fact that benchmarking is not looking at the ‘underlying enterprise process and drivers of competitiveness’ and is therefore having limited success. Benchmarking in Australia has been primarily focused at achieving better productivity and financial outcomes.
Where best practices have been identified it has been on the basis of assessing the unit cost of the practice. Ronan and Cleary propose that best practice benchmarking should ‘systematically link process and performance’ and provide a more balanced set of information including production, financial, environmental and social indicators, this information is known as “sustainability performance indicators”. This information should be presented in a form that ‘enables easy, unambiguous interpretation by landholders’. A key part of the process which will need special attention is the degree of communication backwards and forwards between the various spheres of decision-makers, and the extent to which this is reflected in the various plans” (Williams and Walcott 1998). Intrinsic to the success of many commercial benchmarking projects has been the Chief Executive Officer (CEO). The Ausindustry report (1995) states that CEO’s have a ‘pivotal role’ in successful projects and that their commitment is essential.

While the focus in Australian agriculture has remained more on the production bottom line, there is a need to focus on the environmental bottom line. Irving (2000) argues that ‘benchmarking is one way to improve these environmental management practices. It has shown itself to be an effective tool to assist organisations to move towards best practice environmental management.’ This is particularly so when the environmental problem has the capacity to terminate production on the farm, either due to public pressure or due to degradation of the land. Changing from a ‘production orientation is the single biggest challenge facing most agricultural industries’ (O’Keefe 1995). Lockie (1998) goes further and states that best-practice needs to

‘limit the extent to which negative impacts, or externalities, are generated that place at risk: the health and safety of communities living in close proximity to sites of agricultural production; the safety of end-consumers of agricultural produce; and the environmental sustainability of agricultural production”.

Social benchmarking is a new benchmarking process (Woodhead et al. 2000). This process uses triangulation, in which different methods, such as surveys and focus groups, are linked to address the deficiencies of the other and provide information on a single phenomenon (DePoy and Gitlin 1994). Quantitative and qualitative methods are used to describe the multiple realities (each individual’s independent perspective) of the stakeholders and the ambiguities of their views. Using triangulation of methods specifically addresses the need with complex environmental problems to benchmark multiple indicators including practices, attitudes, values and beliefs. The principals of Social Benchmarking are: a) comparison to find and define best management practices, within or between groups; b) goal setting to identify which best practice is applicable to transfer to other groups; and c) transferring best
practice to target groups by investigation and adaptation of other groups’ best management practices. Levels of achievement of these goals are measured against the first benchmark during subsequent investigations of the groups. The methodology is expanded on in the next chapter (4).

3.8 REFLECTIONS AND CONCLUSIONS

To conclude this chapter there is a pertinent opinion article written by Tony Gleeson, an Australian farmer and researcher, called “Have the environmental scientists got it right this time” Online Opinion, 3 January 2003. Gleeson was commenting on the Wentworth Groups, “Blueprint for a living continent” which was commissioned by the Prime Minister to explore whether Australia could be ‘drought-proofed’. The Wentworth Group decided it couldn’t and came up with several recommendations that are discussed in Chapter 9. However, the comments below are highly pertinent to the discussion in this chapter.

“Scientific reductionism is alive and well
The Wentworth scientists, like moths to a light, promote a fatal reductionism. They advocate a water policy isolated from considerations of the economic, social, spiritual and biophysical realities of our ecosystems. The lessons of history - even our recent history - are forgotten, not learned. We struggle with the narrowly conceived national program on salinity. We forget the lack of impact of the equally narrowly conceived tree programs of the 1980s. Most astoundingly, we forget that we are now wrestling with the aftermath of the father of all reductionist programs, the Snowy scheme. Surely the lesson is that there are grave risks in dealing in isolation with one part of the ecosystem. There is no recovery from such a reductionist position. The total ecological jigsaw is greater than the sum of the bits. Once the elements become packaged separately - into their own administrative and policy boxes as is proposed - wild horses will not pull them back together”. (Gleeson 2003)

The comments by Tony Gleeson imply that even though we have the information and knowledge now (in 2003) about why a systemic approach is necessary, still, scientists prefer to take the reductionist stance. I believe this is partly due to the structure of these decision-making groups. Groups form with people that have similar views because they feel comfortable with each others points of view, knowing that the findings will reinforce their perspective and protect their own survival. The Wentworth Group is another example of this inward looking process. If the sustainability debate is to truly challenge the status quo it has to involve individuals that, at first glance, probably have nothing in common except an
interest in the commodity, eg. water. The literature concerning constraints to sustainable
development frequently cites the lack of social processes in bio-physical and economic
decision making forums, the challenge is how to include it, how to bring different
perspectives to the same table and share knowledge so that new knowledge can begin to be
created.

The following chapters describe a personal journey and a research journey, that I undertook
to develop techniques to involve people with different viewpoints in the Social Benchmarking
process. The journey includes working for NSW Agriculture, a fellowship with the OECD in
Paris researching the social dimension organising an international workshop on this topic
with the OECD and the University of Western Sydney. During this journey, covering nearly 5
years, I’ve met many that cite participatory research and participatory learning as beliefs, but
I’ve noted that the actions of some do not reinforce their stated beliefs. I believe that
participative, systemic thinking involves challenging your beliefs and working through
conflict, and accepting others beliefs as having credibility. Therefore, I have tried to do as I
‘preach’ and throughout this process challenge my beliefs and myself, to become an actor
and absorb the world views of others, to learn from and acknowledge the reductionist
scientist or the soft systems sociologists. I have called this process, combining naivety with
experience. Naivety because I learn from others beliefs and experience because it
becomes part of my learning. I believe this has enabled me to produce better
communication material, to more effectively listen and involve diverse stakeholders in
discussion and to recognise and appreciate individuals whose participatory beliefs are
reinforced by their actions.

The aim of this chapter was to provide some historical perspectives; to build understanding
about the three pillars of sustainability, social, economic and environmental issues as they
relate to ecosystem management of diffuse source pollution and to look at possible models
to use. The research undertaken on acid sulfate soils has been based on the premise that
there was no model currently available that adequately applied the theories of sustainability
with systemic multi-methodology models to agri-environment problems. The next chapter,
Chapter 4, introduces the Social Benchmarking methodology with reference to the acid
sulfate soils study.
Social benchmarking developed over two years from 1998-1999. The methodology was published by Woodhead et al. (2000) under the title Multi-Stakeholder Benchmarking. The original aim was to simplify the complexity and ambiguities in agri-environmental situations by establishing indicators for documenting and measuring change in stakeholder attitude and behaviour. It grew to include more soft systems approaches, partly as a response to stakeholder’s interest in the information gathered and partly because the author was learning more about participatory research. The aim therefore expanded to empowering individuals and groups while supporting processes of change and informing policy. This evolving knowledge has informed the process considerably since publishing and the Social Benchmarking model will be revisited in Chapter 10. This chapter describes the methodology and the application of it to a complex agri-environmental problem, acid sulfate soils and diffuse source pollution.
4.1 INTRODUCTION

Both governments and rural industries invest in programs designed to effect change in the behaviour of landholders. With respect to the adoption of more sustainable agricultural practices, changed behaviour involves a complex decision making process in which underlying attitudes, values and beliefs are as important as the new technology itself (Chamala 1987). Therefore effective education programs will involve attempts to change attitudes as much as to communicate new technology. The importance of attitudinal change is especially powerful when dealing with complex environmental issues such as acid sulfate soils, where the economic circumstances, attitudes and beliefs vary widely between stakeholders from industry, government and the wider community.

Sustained pressure on rural communities to respond to acid sulfate soils issues is complicated by the number of physical and biological factors and the range of stakeholders involved. As discussed in Chapter 3, the effects of acid sulfate soils are often temporally and spatially separated from the management practices required to address the cause. Furthermore, the social, economic and environmental consequences of change are largely unknown. Diverse indicators of social and economic conditions at the community level that measure trends spatially and temporally are needed to provide credible information back to all stakeholders on issues affecting short and long term sustainability of their catchment.

The effectiveness of programs can be gauged from ‘before’ and ‘after’ measurements using appropriate indicators. This process is often called “benchmarking”, the first measurement providing a benchmark to compare groups and against which change can be measured. The extent to which landholders use clearly defined practices can be quantified fairly simply through instruments such as quantitative surveys. Quantitative surveys may be less reliable where the practices are complex (Parkins 1999) and the underlying behaviour is exceedingly difficult to quantify (Pretty and Vodouhe 1997). Quantitative surveys can work best when they complement qualitative sources of information (McComas and Scherer 1999). This qualitative information adds reliability and validity to the statistical results (Parkins 1999). For researchers to understand the more complex technology issues and underlying social factors, the use of qualitative research methods are required, such as open-ended questions in surveys and focus groups. Focus groups are a medium to test the validity of the survey results on groups of survey respondents and to further explore attitudes to some of the complex technology and social issues raised during the survey process. However, as discussed in the previous chapter, “true benchmarking is not only about comparison, but is also about ‘betterment’” (Irving and Murphy 1996). This chapter discusses how the focus
groups became a forum to identify best management practices in an industry and look at how it could be developed in other industries.

In this chapter, to assist in explaining some of the processes, each step is illustrated with examples drawn from selected segments of data from the survey (Chapter 5) and focus groups (Chapter 6) of acid sulfate soils stakeholders in NSW.

4.2 SOCIAL BENCHMARKING

The process of Social Benchmarking developed from a benchmarking survey of acid sulfate soils landholder attitudes. While the survey provided interesting qualitative and quantitative information, it became clear that the information required further investigation. Considerable criticism has been directed at benchmarking in Australia because the investigation of the processes, identification of best management practices and communication of results are neglected (Tyndall 1990, Williams and Walcott 1998, Murray 1997, Ronan and Cleary 2000).

In response to this criticism this Social Benchmarking model uses triangulation, in which different methods, are used including:

- surveys to provide quantitative benchmarks and qualitative information from the open questions, and
- focus groups to validate the data and define best management practices

These are linked to counteract the weakness of each on its own and to provide information and feedback on a single phenomenon (DePoy and Gitlin 1994). These quantitative and qualitative methods are used to describe the multiple realities (each individual’s independent perspective) of the stakeholders and the ambiguities of their views. Using triangulation of methods specifically addresses the need with complex environmental problems to benchmark multiple indicators including practices, attitudes, values and beliefs.

The following sections in this chapter describe the methodologies used to establish the survey and the focus groups, followed by a discussion of how Social Benchmarking was applied to acid sulfate soils and a brief look at the results to illustrate why certain methods were used. The first section looks at developing the benchmarks, the indicators, and the second section discusses process, where information is relayed back to the stakeholders. This research occurred from 1998 to 2002, and Table 1 (Chapter 1, page 18) gives details of the events. Details of the sampling strategies for each event is provided in the relevant chapters where the results of that event are discussed. Levels of achievement of these goals
are measured against the first benchmark during subsequent investigations of the groups. The Social Benchmarking process is shown in Figure 10. Each step of Social Benchmarking, except the last, re-surveying (discussed in Chapter 9), is discussed by first introducing the theory and then the application to the case study.

4.2.1 Developing Indicators for Benchmarks

4.2.1.1 Identifying stakeholder groups, quantitative indicators and questions

To identify groups and indicators, Social Benchmarking first establishes a reference group, which defines stakeholders and geography, and then identifies potential indicators and helps develop questions for the surveys. Environmental issues are usually complex and have many stakeholders. Understanding the interactions between stakeholders, their attitudes and management options, requires a range of skills and perspectives. "When one is living through change, it is often difficult to perceive the nature of the changes that are taking place" (Price 1999). Therefore, forming a cross-disciplinary group to discuss the social and physical information requirements helps to set goals and objectives within a broader context, reducing the bias which emanates when persons from the same discipline make strategic decisions across many disciplines.

Indicators are statistics or parameters that, tracked over time, provide information on trends. Indicators can be classified into groups depending on the parameters measured. Environmental, social, and economic indicators are selected key statistics, which represent...
or summarise a significant aspect of the natural resource and related human activities. They focus on trends in environmental changes and societal responses to prevent, reduce or ameliorate these stresses. Whereas environmental indicators summarise the physical aspects of the environment, social indicators are concerned with measuring “quality of life” or “social well-being” (Pomeroy 1997). Within the context of this thesis, social indicators refer to knowledge, attitude and beliefs. Economic indicators assess the impacts of factors such as off-farm income on the future productivity of the farm. Social and economic indicators, collected over time, can provide valuable information for policy and management of natural resources. Indeed, the OECD has concentrated on developing a conceptual understanding of the links between agriculture and the environment to help identify which indicators might be developed to improve policy analysis and monitoring (Parris 1997).

To establish informative measures and indicators of change, rigorous question design is imperative. Closed questions such as ‘Do you use lime? Yes or No’, are quick to tabulate and compare between stratifications (sub-groups of the survey population). Open questions, which do not require a structured response, are more open to interpretation. Kish (1962) explored the hypothesis that attitudinal or opinion questions were more likely to be influenced by interviews than questions about factual material. Questions about facts can be verified, whereas questions about attitudes and opinions cannot be verified or observed by anyone but the respondent (Fowler and Mangione 1990), which is why focus groups are an important component of Social Benchmarking. Open-ended questions offer more potential for interviewer effect because of the possible ambiguity of what kind of answer will suffice and the recording task is more complex. Questions are sources of error if:

- they are misunderstood
- they require information that respondents do not have or cannot recall accurately and
- when respondents are not willing to answer accurately.

In the acid sulfate soils case study, the benchmarking team was set up as a cross-disciplinary reference group of four people, with skills in statistics, social science, soils, agronomy and communications. Team members were also chosen for their interest and involvement in acid sulfate soils, their commitment to developing social information and their geographical accessibility. Time allocated to the projects over 3 years, was 50% by the team leader (the author), and other member were asked to commit 5% of their time. It was anticipated that by becoming a part of the benchmarking team, members would develop a sense of commitment to the project and become important conduits for flows of information to and from other committees. An initial meeting was convened to review the application for funding and to endorse the aims and goals of the project. Having such a team approach also
assisted the funding application by providing a depth of experience and prestige that one member could not have achieved alone. The benchmarking team initially further defined major stakeholders, principle gaps in knowledge and resources available to investigate the issues. At subsequent meetings, throughout the life of the project, the group discussed results, information requirements and future courses of action.

Identification of stakeholder groups occurred during semi-structured interviews with government agency staff, industry groups and catchment management committees. A stakeholder, defined by the benchmarking team, was a person or an organisation with an interest and/or a necessary involvement in acid sulfate soils management. The principal stakeholders in NSW, (see Table 4) were landholders, excavator operators, oyster farmers, fishers, government agencies and primary producer organisations.

<table>
<thead>
<tr>
<th>Stakeholders in NSW</th>
<th>Issues concerning stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land holders and fishers</strong></td>
<td></td>
</tr>
<tr>
<td>Land based: Beef, Dairy, Sugar cane and Tea tree.</td>
<td>Productivity based on flood-gated land.</td>
</tr>
<tr>
<td></td>
<td>Cost and risk of drain re-design.</td>
</tr>
<tr>
<td></td>
<td>Individual versus sub-catchment needs.</td>
</tr>
<tr>
<td></td>
<td>Government ownership of past drainage - who will pay for changes?</td>
</tr>
<tr>
<td></td>
<td>Active water management (for water quality) requires much greater landholders input</td>
</tr>
<tr>
<td></td>
<td>Regulations may affect farm operations.</td>
</tr>
<tr>
<td>Property Developers</td>
<td>Cost of compliance and need for streamlined approvals.</td>
</tr>
<tr>
<td>Water based: Oyster, Commercial fishers and Aquaculture</td>
<td>Acid fish kills, oyster mortality and damage to aquatic systems.</td>
</tr>
<tr>
<td></td>
<td>Floodgates stop fish passage.</td>
</tr>
<tr>
<td><strong>Government Agencies</strong></td>
<td></td>
</tr>
<tr>
<td>NSW Agriculture, NSW Fisheries, Dept. of Land and Water, Dept. Urban Affairs and Planning, Environmental Protection Agency, State Forests, Environment Australia, Local and County Councils, Total Catchment Management and Estuarine Management Committees, Drainage Unions, Universities, consultants and laboratories.</td>
<td>Regulate to avoid disturbance of acid sulfate soils</td>
</tr>
<tr>
<td></td>
<td>Identify and repair priority 'hot spots'</td>
</tr>
<tr>
<td></td>
<td>Planning and regulation</td>
</tr>
<tr>
<td></td>
<td>Targeted research</td>
</tr>
<tr>
<td></td>
<td>Develop best management and advisory information</td>
</tr>
<tr>
<td></td>
<td>Prioritise funding and involve key stakeholders in decision process</td>
</tr>
<tr>
<td></td>
<td>Loss of wetland and fish passage, water quality</td>
</tr>
<tr>
<td></td>
<td>Streamline approval process for maintenance works</td>
</tr>
<tr>
<td><strong>Community</strong></td>
<td></td>
</tr>
<tr>
<td>Coastal residents, Recreational fishers, Environmental groups, Media, Schools and Tourism.</td>
<td>Ecological sustainability of coastal land and water activities.</td>
</tr>
<tr>
<td></td>
<td>Efficient use of government resources</td>
</tr>
<tr>
<td></td>
<td>Quality estuarine water to attract visitors</td>
</tr>
<tr>
<td></td>
<td>Adequate fish stocks</td>
</tr>
<tr>
<td></td>
<td>Regional employment in new developments, aquatic and agricultural industries</td>
</tr>
</tbody>
</table>
Geographic locations within catchments were defined by using the Acid Sulfate Soils Risk Maps prepared by the NSW Department of Land and Water Conservation in 1998 (see Keys to Success, page 8, Appendix III). The floodplains of the Shoalhaven, Hunter, Manning, Macleay, Clarence, Richmond and Tweed catchments were chosen because they had large areas of agriculture on potential acid sulfate soils (see map and catchment descriptions, Farming Community Ideas about the Way Forward, page 12 Appendix III). The principal agricultural industries in these catchments are sugar cane, beef, dairy and tea tree.

Indicators of acid sulfate soils, were identified during semi-structured interviews with industry representatives, government departments and primary producers. Questions to ascertain data about these indicators developed iteratively by testing within the benchmark team. Once the benchmark team had agreed on the draft questions, local landholders and government personnel outside of the group provided further feedback. Survey questions, such as attitude to the management of acid sulfate soils in the catchment, were replicated across all stakeholders surveys whenever possible. Questions on attitude, knowledge and behaviour focused at two levels, catchment and farm. Whereas the catchment level was most relevant for the government agencies, excavator contractors and oyster farmers, the farm level was most relevant to landholders. Types of data collected across all stakeholder groups are listed in Table 8. Economic issues such as percentage of off-farm income and production on-farm of primary crop (increasing or decreasing) were established for the primary producers. All surveys established point of sources of information on acid sulfate soils and attitude to the management of it in the catchment.

<table>
<thead>
<tr>
<th>Who surveyed:</th>
<th>Data collected on:</th>
</tr>
</thead>
<tbody>
<tr>
<td>All stakeholders</td>
<td>Attitude to management of ASS in catchments</td>
</tr>
<tr>
<td></td>
<td>Knowledge of ASS indicators</td>
</tr>
<tr>
<td></td>
<td>Sources of information about ASS</td>
</tr>
<tr>
<td></td>
<td>Requirements, attitude, knowledge, and involvement in:</td>
</tr>
<tr>
<td></td>
<td>• drain and floodgate management;</td>
</tr>
<tr>
<td></td>
<td>• catchment groups and</td>
</tr>
<tr>
<td></td>
<td>• water quality</td>
</tr>
<tr>
<td>Landholders and Fishers</td>
<td>Property location, size and ownership status</td>
</tr>
<tr>
<td></td>
<td>Years in industry and age of respondent</td>
</tr>
<tr>
<td></td>
<td>Production status (increasing, decreasing)</td>
</tr>
<tr>
<td></td>
<td>% of other income</td>
</tr>
<tr>
<td>Landholders</td>
<td>Attitude to ASS management on the farm</td>
</tr>
<tr>
<td></td>
<td>Knowledge of ASS on property</td>
</tr>
<tr>
<td></td>
<td>Soil testing for pH, use of lime</td>
</tr>
<tr>
<td></td>
<td>Number of scalded areas on property</td>
</tr>
</tbody>
</table>
Table 8 Types of data collected in telephone surveys

Data gathering in the survey was by quantitative and qualitative question. Quantitative questions used binary, scale or multiple choice responses. Qualitative data developed from 2 sources: first when a respondent replied to a quantitative questions, the respondent frequently clarified the response, these comments being noted; and second, using data from open questions such as “What do you think of the local communities attitude to acid sulfate soils and water quality?”

4.2.1.2 Survey techniques to establish measurable points

Social Benchmarking uses three steps to establish measurable points, define the survey boundaries, execute the survey and analyse the results. Surveys provide comparable and measurable data. Conducted by telephone, letter or personal interview, surveys can be private and confidential. Respondents can express their views, without group pressure. McComas and Scherer (1999) discuss the role of surveys in communicating scientific information to the public and notes that advantages are:

1. input of a wide representation of views relatively systematically;
2. the data can yield both general and specific results.

Milbrath (1981) believes information can be obtained from citizens who are affected by an environmental problem but are otherwise unable to participate in the policy making. The levels of agreement and disagreement and the various attitudes of these citizens can be quantified by surveys (Johnson and Meiller 1987). This puts community groups in a position of being informed and able to take a pro-active rather than a reactive position for understanding individual’s and group’s particular positions.

Managing a survey can be complex and challenging. It requires a good deal of planning and coordination. It is important to have reliable data. Parkins (1999) refers to reliability as the extent to which a measurement yields the same results when repeated under the same conditions. Stakeholders need to have confidence that the data are reliable, and credible information is especially important when the issue has become emotional and clouded by tangential views. Producing reliable information depends on reducing bias and error. Bias is reduced by good survey design, interviewer training and quality control. Stratification, proportional representation of the respondents, reduces the sampling error of the experimental design, and is important for statistical analysis and developing comparisons between stakeholders. Significant error can also arise in the design of the questions, during the interview and during data input and reduction (Fowler and Mangione 1990). Determining
a sampling strategy, designing questions, training surveyors, entering, verifying and analysing data are time consuming and require a number of skills. Surveys require high level skills such as statistical training to accurately interpret the data (Heberlein 1976). There can be a lack of interaction in community surveys between respondent and surveyor, resulting in loss of potentially valuable information Johnson and Meiller 1987). Surveys work best when they complement other forms of citizen participation, such as semi-structured interviews, focus groups and workshops (McComas and Scherer 1999).

_In the acid sulfate soils case study_, the benchmarking team anticipated two main sources of variability in survey responses from landholders. These were their geographic location and their major farming enterprise. Accordingly, to reduce variability, the survey population was stratified according to the catchment where they farm, and the rural industry they supply. Four principal agricultural industries and seven catchments were used to stratify the landholders. Apart from defining natural geographical boundaries, this stratification enabled the measurement of variability in responses between cropping and grazing industries. Government, excavator operators and oyster farmers were industries with greater homogeneity and so were stratified by catchment. Colleagues, as adjuncts to their main research, conducted the government agencies, excavator contractor and oyster farmer surveys, whereas, the survey of landholders was identified and conducted as a principal research aim of the benchmark project.

_The landholder survey_. Potential lists of landholders for sampling were developed using a multiple frame consisting of list frames (address lists provided by industry, government agencies and local catchment communities) and area frames (from acid risk maps overlayed by local council cadastre maps). Telephone was chosen as the survey medium because it enabled coverage of the large geographical spread of the coastal farms, over 1000 km from south of Sydney to the Queensland border. There is a low response rate to postal surveys and it is difficult to get landholders to express the same breadth of qualitative data in writing that they will verbally. Personal interviews were another option, however, telephone surveys can cover more respondents for less cost and time. The estimated time for the survey completion was 20 minutes, however, the mean conversation time was 40 minutes. Surveyors were paid an hourly rate and advised that the telephone conversation was an important public relations exercise, as well as a data gathering exercise. Although no information was provided, landholders stated that answering the questions had raised their awareness of factors related to acid sulfate soils management.
Four women and one man were interviewed and chosen as telephone surveyors based on their communication skills and understanding of agriculture. The surveys were conducted during the evenings in their homes. The surveyors were made familiar with the principal issues of acid sulfate soils and the sensitivity of the issue and trained in phone manner, developing a good relationship with the respondent and neutral communication skills. Special emphasis was given to unbiased recording of what the respondent said, using their words. Final alterations to the survey were made during these training periods. This training period was important to establish a sense of membership and bond between the telephone surveyors. Telephone numbers for catchments and industries were randomly allocated to the five surveyors. The surveyor first established that the respondent was a primary producer and was on a coastal floodplain before commencing the survey (see Appendix II for copies of Landholder survey and other surveys). Surveyors met each week to discuss findings and difficulties. At completion of the survey, the benchmark team discussed the whole process with the survey team, who provided initial feedback on characteristics of the catchments and industries.

The government agencies and excavator contractors surveys were conducted prior to workshops, which were organised by another government group to inform respondents about acid sulfate soils. Workshops were advertised and personal invitations were sent to target groups. A post workshop appraisal was filled in to monitor effectiveness of the workshops and to help determine future extension requirements.

Surveys of oyster farmers were conducted prior to respondents participating in semi-structured interviews. Most oyster farmers are affiliated to one of two organisations, who provided address lists, and local farmers further assisted by identifying oyster farmers within catchments.

All surveys were conducted between May 1998 and May 1999. The landholder survey was during one month, May 1998 with 287 respondents. The government and excavator surveys were conducted during the latter half of 1998, with 44 government and 84 excavator contractors responding. The oyster farmer survey, during the month of May 1999, with 39 respondents.

4.2.1.3 Developing qualitative social indicators

Open questions provide the data for the development of further social indicators. Responses to open questions are classifiable by the same stratifications that are determined for the quantitative responses during the survey development. Qualitative data can be analysed using Non-numerical Unstructured Data Indexing Search and Theorising (NUD*IST) software.
(Qualitative Solutions and Research Pty Ltd 1997). The package enables the management of text based information by sorting statement responses into categories, or 'nodes', designated and defined by the researcher.

There are three principal stages to NUD*IST analysis. During the first stage, using a reference group, names and descriptions of nodes are developed which describe the responses. Each of these nodes has a unique description, which provides guidelines for subsequent classification of all the responses from the survey. An example, (see Figure 11) is attitude node, the 'negative / industry not cohesive' node describes industry as not being supportive, organised or effective at communicating information about issues or practices. Whereas the 'positive / management in control' node describes stakeholders who have an attitude of confidence about their ability to manage the problem. Respondents with responses in this node state that the environmental problem is either:

- within their control;
- not an issues that effects them; or
- the industry body is attending to the problem adequately.

Figure 11 Hierarchical tree for developing social indicators

A response can be placed in more than one node. Each node has a count associated with it that shows the number of responses within that node. The second stage is to develop a hierarchical tree, that simplifies viewing the many contrasting statements that emerge during qualitative research. While building the tree some nodes may have their descriptions broadened and be combined with other nodes once the overall structure of the tree becomes clearer. The final stage is to analyse the hierarchical tree. In addition to a count of total response in a node, each response within a node has a stratification and question
identification. This enables extensive comparative descriptive statistics and analysis using more complex statistical methods, such as principal components.

**In the acid sulfate soils study**, some social indicators such as attitude to the management of acid sulfate soils in the catchment, were sampled quantitatively. Then 104 nodes were developed to sort and analyse the qualitative responses in the landholder survey. Table 9 shows examples of the stratifications, nodes and qualitative responses.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Attitude nodes</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richmond catchment tea tree farmer</td>
<td>Positive / in control</td>
<td>Having ASS is not a death sentence, learn to live with it …responsible management with proper guidance.</td>
</tr>
<tr>
<td>Manning catchment beef farmer</td>
<td>Negative / not in control</td>
<td>It has scared the drainage unions, they want to do a good job, look after land properly but there is much uncertainty in community. Neighbour lost a lot of income due to red tape getting approval for drainage union to clear drains, so even going through the correct channel hurts the farmer.</td>
</tr>
<tr>
<td>Macleay catchment dairy farmer</td>
<td>Negative / industry not cohesive</td>
<td>I’d like to know a bit more - [I] would like someone to come out and have a look and discuss issues with me to see if I have a problem. I don’t think I have a problem because I have good pasture.</td>
</tr>
<tr>
<td>Richmond catchment Cane farmer</td>
<td>Positive / industry cohesive</td>
<td>Farmers are saying to each other 'you need to lime there'… you wouldn’t have heard that 6 years ago. The cane community in particular are really on top of it.</td>
</tr>
</tbody>
</table>

Table 9 Industry by catchment stratified responses from ASS landholder survey, showing node name and associated responses classified in the attitude nodes

### 4.2.2 Investigating Processes

#### 4.2.2.1 Establish focus group to validate and explore survey results

Focus groups are the next step in the investigating processes and actively facilitate change by presenting findings back to a sub-sampled group of the survey respondents to explore their views on the results. Surveys have been criticised (Pretty and Vodouhe 1997) for their lack of ability to establish information on issues that are important for local people because, put simply, questions have to be determined prior to the survey and cannot take into account many unforeseen issues. In earlier sections of this chapter rigorous question design, interview training and open questions were discussed, to reduce error in the survey process. The focus groups provide a medium to further reduce error, by validation of the survey results by the survey respondents. Validity refers to the degree of success in measuring what is intended to be measured (Parkins 1999). Results from the survey are presented to the focus groups and discussed using a set of pre-determined questions. This enables the

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1 The term focus group is used here to encompass meetings and workshops as well as focus groups. The theory and principles of the process remain the same.
respondents to agree or disagree with the findings and to contribute to the discussion, while comparing their position in relation to other groups surveyed.

The aim of an interdisciplinary dialogue is to build a collective understanding, with diverse stakeholders (culturally and in disciplinary terms) and create a collective focus. While achieving consensus is an optimistic goal, aiming for an accommodation between different interests so that purposeful actions can be undertaken, is realistic. From a management perspective, groups coming together for particular purposes need to be interdisciplinary rather than uni-disciplinary because same discipline groups tend to become too competitive, homogeneous and inward looking.

The questions for the focus group were developed during discussion by the reference team. Questions aimed to clarify and further define issues raised by the respondents during the survey. Issues may have evolved because: a) there was a wide range of disparate views; b) more information was required to make informed decisions; and c) when it becomes known that information was needed on an issue and none was previously requested.

The advantages of focus groups are that they are conducted with specific groups. They are simple to set up, especially when using groups sub-sampled from the initial survey. Sub-sampling of the survey respondents can be determined by attributes identified during the survey, such as knowledge levels or attitude. Focus groups are also relatively inexpensive, requiring only a meeting room, facilitator and some sandwiches. They provide a forum for discussion and learning about other stakeholders’ ideas and management techniques, which is flexible.

The disadvantages are that focus group participants can be overwhelmed by peer pressure, and consequently, withhold their opinions. Results can be analysed by defining and grouping themes and the strength of opinion. However, this analysis is limited, and provides no statistically measurable outcomes. Other problems with focus group are: a) stakeholders may not be inclined to contribute their time; b) the findings rely heavily on the quality of the facilitator; and c) groups may find the issue too complex, confidential, sensitive or incriminating.

In the acid sulfate soils example, the ‘benchmark team’ conducted a workshop to develop questions for the focus groups based on findings from the survey, and these are discussed in Chapter 5 along with the results of the workshops. Geographic stratification, using the major acid sulfate soils catchments used in the survey, defined the locations of the focus
groups. The seven landowner groups, based on catchment stratification, were sub-sampled from the original survey respondents and each consisted of up to 12 participants. When possible, an equal representation of the industries producing in the catchment was sought along with varying levels of acid sulfate soils awareness, (high, medium or low) as identified in the survey. Refusal to participate was high among those with identifiable low levels of acid sulfate soils awareness, therefore the focus groups were skewed towards higher awareness levels. Government groups, with representatives from each government agency, that had an impact on the management of acid sulfate soils, were invited to three meetings that were conducted, in the north, mid and south coast of NSW. These meetings were attended by up to sixteen representatives.

Results from the survey were presented to focus group participants at the commencement of the meeting. Unique characteristics of and differences between catchments and industry approaches to the management of acid sulfate soils were highlighted verbally and visually using bar charts. Information content differed slightly for the two groups. Landholders had more information about acid sulfate soils, and the range of land-management problems resulting from acid sulfate soils than government personnel. The landholders meetings were conducted between 1900 and 2200 hours, whereas the government meetings were a whole day, between 0930 and 1600 hours. Landholder groups were divided into two sections with two questions in each. Both sections commenced with the presentation of results from the survey. Standard focus group procedure was modified for the government groups. In addition to the presentation of results and questions, the government groups included: a) a brief session where individuals introduced themselves and defined their role and area of expertise in managing acid sulfate soils; b) a role playing exercise; and c) a strategic planning session. In the role playing exercise, participants annotated their feelings, beliefs and arguments to descriptions of their designated role (as either landholder, oyster farmer, regulator or facilitator) before playing-out a debate about the allocation of funds for acid sulfate soils management. The strategic planning session was foreshadowed at the end of the morning session with a written exercise to establish: a) the organisation they represented; and b) to ‘Write down in order of priority three issues that you believe are important for the future management of acid sulfate soils.’ This information was used to prioritise and count frequency of issues cited, and as the basis of the strategic planning session in the afternoon.

Different material was used with the international interdisciplinary meeting in November 2002, however, the essential approach was the same and is discussed in Chapter 9, that is, to provide material and discuss the information in small groups.
4.2.2.2 Refine comparisons and identify the best management practices

Identifying ‘best management practices’, that is practices which are of the highest quality, the most advantageous, suitable or desirable for a given circumstance, is a natural evolution from the comparison stage of the benchmark process. Most agricultural benchmarking programs in Australia have as their primary stated aim to identify what farming practices lead to better productivity and financial outcomes (Ronan and Cleary 2000). Social benchmarking defines best management practices are those practices which stakeholders perceive as best helping with managing the environmental issue. For example, a landholder may require assistance with identification of the environmental problem on their land, whereas the government agency needs guidelines to assist with development applications by landholders for land use changes. Certain best management practices will become evident during the survey. The focus groups provide a forum to view different stakeholder groups approaches and to discuss these best management practices and rank them in order of priority.

In the acid sulfate soils study, comparisons of the four major land industries were presented to the landholder and government focus groups. Details of these comparisons are discussed in Chapter 5, Survey and 6, Focus Groups, however, briefly, the typical of information presented was:

“The beef farmers are more reliant on off-farm income, dairy farmers are most reliant on on-farm income. The tea tree industry is young, with an average enterprise age of 6 years, and it is rapidly expanding. Cane farmers and dairy farmers are static in their production levels, while beef farms are in decline”.

To further illustrate the development of the comparisons to the participants, a brief profile of each industry was developed. For example, the beef industry is an industry characterised by a lack of cohesion, low commodity prices and geographic dispersion. Thirty percent of beef farmers feel management of acid sulfate soils in not under control on their property, and have observed scalded land on their properties. Beef farmers are frustrated with their catchment and on-farm drainage regimes. They are concerned about government policies in declaring wetland areas and rumours about catchments being re-inundated with sea water. In comparison, the sugar cane industry has made acid sulfate soils a focus, establishing an active extension program and is ahead of other industries in awareness and knowledge levels. The geographic closeness of cane farming communities, a cohesive industry body, and relatively stable commodity prices have allowed the industry to grapple with the problems posed by acid sulfate soils.
4.2.2.3 Set goals and transfer best management practices

Benchmarking uses best practices discovered in one group to improve another group’s performance in a “logical, structured and straightforward manner” (Irving and Murphy 1996). It is more than just establishing that practices are different, it is about using the experience of other groups to discuss the relevance of the information for other groups and situations. Establishing a list of best practices does not mean that all these practices can be adapted for other groups. Circumstances vary considerably between groups, and what is applicable to one group, may have no application in another group. Laser levelling is regarded as a ‘best practice’ in the sugar cane and tea tree groups, and greater use of this technology can be set as a goal within these groups. However, it is economically completely unrealistic for graziers to laser level their pasture paddocks. Only some practices can be reproduced external to their group of origin.

One of these practices identified in the landholders survey is ‘acid sulfate soil sampling’. Landholders in non-cane industries, particularly the graziers, stated that they wanted more information about the risk of acid sulfate soils on their properties. They cannot tell from the acid sulfate soils risk maps whether they have it on their property, but if they do, then they can begin to work out how to manage it. Therefore they want to have acid sulfate soils sampling done on their properties. This response was noted in the survey, however, its importance was not obvious until the focus groups. During the focus groups, after landholders saw the results of the survey, and heard about the cane industry soil sampling program, they emphatically stated that they wanted a similar program in their industry, especially beef and dairy farmers. They felt it was the first important step to gaining control of managing acid sulfate soils on their property.

Acid sulfate soils sampling was determined as a goal to be transferred to other industries. A project was funded by the Acid Sulfate Soils Management Advisory Committee (ASSMAC) to initially, investigate the cane industry procedures and record their experience with sampling methods, extension literature and farm management plans. A new model, for other industries developed, using rigorous, iterative on-farm trials of the methods. These new best management practices were presented in an extension publication, Acid Sulfate Soils, Keys to Success (see Appendix III) and are discussed in detail in Chapter 7.

4.2.3 Communicate Information to Wider Audiences

Communicating technical knowledge about environmental problems maybe sensitive and difficult. Information is valuable where it enables better and more informed decisions to be made. However, if landholders don’t perceive that they have an environmental problem, the
dramatic media images and ignorance of early warning signs become a major barrier to change (Vanclay 1992). Extension literature needs to emphasise education on the early warning signs of the environmental problem.

When communicating written information to stakeholders, consideration of writing style is important. Information must be presented in a non-judgemental, simple and empowering format to encourage discussion and adoption. While a relatively rich amount of statistical information needs to be provided, it should not be overwhelming or confusing (Bennett and Morrison 1999). Wynne (1989) discusses the importance of credible information. Abstract scientific knowledge may seem universal, but in the real world, it is always integrated with supplementary assumptions that render it culture-bound and parochial. The validity of this supplementary knowledge crucially affects the overall credibility of ‘science’ or ‘experts’.

Traditionally landholders have been provided with statistical comparisons to work out which crop grows best or what fertiliser has the most effect. Similarly, multi-stakeholder environmental problems require accurate and unbiased comparisons of the facts pertaining to each group to identify the best management practices and effective treatments.

*In the acid sulfate soils study*, communication of credible information is vital, because it has become a very emotive issue during the 1990’s with media attention focusing on dramatic, massive fish kills and deteriorating water quality, as discussed in Chapter 3 and Appendix I. Many landholders identified in the survey and focus groups stated that they were confused and frustrated with conflicting scientific advice and the complex web of government agencies involved in acid sulfate soils, see chapter 5. Now that the consequences of past drainage policies have become apparent, new policies are emerging. Each government agency has its own policies and varying levels of individual knowledge and understanding. A government agency employee stated that “Too many people [working] in acid sulfate soils don’t have the depth of understanding required to comprehensively assist clients. This was probably a function of the diversity and volume of other environmental management issues needing attention (Woodhead 1999). All these stakeholders need credible data if they are to make informed management and policy decisions.

To communicate information about the acid sulfate soils issue, clear and simple guidelines about best practices are needed (agreed best practice by government and landholder focus group participants). The first of these, titled, ‘Acid Sulfate Soils: Farming community ideas about the way forward’ (see Appendix III) was produced in August 1999. It principally explains the range of landholder opinions from the survey and focus groups. A brief section on government agencies and excavator operators survey results illustrated how each
group’s efforts to manage acid sulfate soils were influenced and constrained by other
groups. Comparisons between industries and catchments were used to draw pictures of
each industry to help landholders identify themselves. Attitudes, knowledge and practices
were illustrated along with information about ideas for the way forward. In addition to
information about the bio-physical, socio-economic, attitudes and knowledge levels of
respondents the book contains pictures and quotes from the stakeholders. All survey
respondents and relevant government departments received a copy.

4.3 REFLECTIONS AND CONCLUDING REMARKS

During a conversation with Ted Henzell, a respected Australian bio-physical scientist who
has since retired, Ted said “Technical solutions may be quite straightforward, but applying
them requires an understanding of the social limitations. In the past, scientists have
produced excellent solutions, however, the uptake of these solutions has frequently been
very limited”. At the time that I was developing this project, my thinking was about
environmental monitoring. I was still involved with providing analysis for researchers, and
the issue was how to get data to monitor change. However, I became increasingly aware of
the different ways of approaching scientific problems that led to learning about multi-
methodology approaches.

In Part II, results from the 1998 Surveys and 1999 Focus Groups are presented. In the last
section of these chapters I explore the usefulness of the Social Benchmarking methodology
and include comments on what I would do differently. This is summarised in the concluding
chapter of this thesis along with suggestions not only to improve the Social Benchmarking
methodology but also about how institutions can better support multi-methodological
approaches.

This is the end of Part 1. So far I have introduced myself, the case study, relevant literature
and the methodological approach and methodology. Social Benchmarking attempts to
acknowledge both the needs of those who make decision based on quantitative data along
with participative methods to ‘ground’ the results in the social and economic realities of
individuals and groups. Part II introduces these different realities and builds up the
comparisons and best management practices with the aim of informing decision making
processes. To conclude, I would like to reiterate the principal thesis question: How can
benchmarking, most effectively be used to involve multiple stakeholders in learning and
action in dealing with a complex environmental issue such as acid sulfate soils in eastern
Australia? This chapter has shown how the core concepts of benchmarking developing measures and investigating processes, can be massaged into Social Benchmarking for agri-environmental problems and broadened to move beyond just benchmarks to also incorporate the sustainable development model and participatory research principles.
PART II

RESULTS
Results of the 1998 benchmark surveys and 1999 focus groups with landholders and government agencies are discussed in the next two chapters. While the previous chapter outlined the methodological approach, these chapters describe in more detail the sampling strategies and questions. Results from the 2002 international workshop and the four years on survey are discussed in Chapter 9.

As previously discussed in the introduction to Chapter 4, the original purpose of using a benchmarking methodology was to document and measure change in stakeholders attitude and behaviour to the management of acid sulfate soils. Therefore some data in this section pertains to this objective, however, data in this section also provided the basis for the theoretical concepts discussed in chapters 7, 8 and 9. The findings provided insights beyond the original aims and objectives. The social indicators, that developed from the qualitative survey data indicated that a sense of control was an important indicator of the capacity to change (Chapter 7). The best practice soil sampling that was identified and investigated during the focus groups led to a new project to develop guidelines on soil sampling and an investigation of best practice self regulation (Chapter 8).

This chapter discusses the results from surveys of landholders and government personnel in NSW. Results from the excavator operators’ survey are discussed along with the landholder
and government benchmarking surveys in Appendix III, Farming Community Ideas about the Way Forward, page 21. Results from the oyster farmer survey are summarised at the end of this chapter. These two groups, excavator and oyster, were not considered to be primary resource managers of acid sulfate soils. They were not included in the second stage of benchmarking, however, the survey results and discussions during the first part of the benchmarking process were important to gain an understanding of the scope of impact from acid sulfate soils. They enabled a far greater understanding of the catchment dynamics and perspectives. The book, ‘Farming community ideas about the way forward’, was prepared for survey respondents, it was part of the Social Benchmarking communication strategy.

This chapter introduces the main stakeholders through their responses to survey questions and discussions about the issues within focus groups. The indicators that have been measured developed from both the quantitative and qualitative data. These results represent a snapshot of the problems posed from acid sulfate soils in NSW catchments during 1998.

### 5.1 INTRODUCTION

Developing robust indicators is important for the sustainable use and management of environmental resources, as discussed in Chapter 3. Indicators can provide valuable information about the present status of the resources being measured, the rate and direction of change, as well as highlighting priority issues and guiding policy formulation and measuring the effectiveness of policy. Questions for developing benchmarks in the survey were organised to reflect potential key environmental indicators of acid sulfate soils as well as the key social indicators.

Indicators have many uses depending on who uses them and what was required. Primarily, indicators measure progress towards achieving a target and/or measuring the impact of external actions. Therefore in most cases indicators need to be measurable, but they can also be used for one-off identification and can be anecdotal. In the context of this thesis, this broader definition of indicators was used. Whether an indicator was used beyond the first survey depended on how relevant that information became once analysed both statistically and in terms of relevance to stakeholders. Developing indicators for this thesis considered the following issues:

- Relationship - strength of the relationship of the indicator to the environmental / agricultural issue
• Realism - how easy or possible was it to collect the data (financial and physical which includes issues such as rapid chemical changes in the properties of an indicator)
• Target - was the set target feasible or impossible to meet
• Replicable – when there are multiple sites can the same monitoring be achieved at all sites
• Quantity – are there enough measurements being taken
• Time – how long are measurement going to be taken for
• Location – was the measurement being taken at the right place/s
• Comparability – between farms, catchments, states and countries.
• Prediction – does the indicator provide good or bad predictions
• Present / absent – Qualitative assessment based on experience and subjective indicator assessment
• How acceptable and understandable was the indicator to the target audience

As discussed in Chapter 4, quantitative questions, and by inference, indicators, have to be developed before a survey, whereas qualitative ones were open questions, enabling the building of indicators from the data. The results from the surveys reflect this approach. Within, for example, the farm management section there was ‘hard’ quantitative data followed by ‘soft’ qualitative data. Qualitative data have been depicted as ‘qualitative analysis’ on all tables to distinguish results from quantitative data. The following data therefore includes pre-determined indicators as well as the indicators that emerged from the analysis of the qualitative data.

Sustainability indicators need to cover the three pillars of sustainable development, economic, social and environmental. Indicators in this study were primarily focused on the relationship between socio-environmental and socio-economic. The predetermined indicators include socio-economic traits such as farm size, off-farm income, industry viability and age while environmental indicators relate to water and soil management practices on the farm and in the catchment.

Social indicators such as awareness and attitude were established using predetermined questions about knowledge of risk maps and attitude to the management of acid sulfate soils. Most social data were developed from the qualitative responses because there were very few guidelines available about what to ask. Indeed the Biometrics Department at NSW Agriculture rarely dealt with surveys, preferred not to deal with extension staff, never dealing
with social surveys. Understanding environmental attitudes were important because (Stern and Oskamp 1991):

- “first, it was useful to know whether there were broad, general orientations that link together attitudes on various environmental resource problems.
- second, attitudes may be related to people’s environmentally relevant actions.
- third, regardless of their relation to behaviour, people’s attitudes about specific environmental issues were of interest in their own right and were often cited in public-policy debates”. They continue “The evidence from many types of research indicates that attitudes and behaviour can each influence the other and that other variables often mediate the relationship (Kelman 1980) … there was much need for more longitudinal research, which would more fully clarify the causal patterns. For managing environmental resource problems, the crucial questions were: Do environmental attitudes predict related behavior? Can such attitudes be changed in ways that will affect related behavior? If so, how?”

To effectively determine what attitudes were important to stakeholders and where the links to behavioural change were, it was essential to provide opportunities throughout the survey for the respondent to comment. By analysing the comments it can lead to a better understanding of motivations and reasons behind the quantitative responses and introduce new issues that have not been accounted for in the survey questions. The Theory of Planned Behaviour (TPB)

“attempts to predict and understand behaviour by measuring the underlying determinants of that behaviour: attitudes, subjective norm and perceived behavioural control. The main assumption of the theory was that people behave rationally, in accordance with the beliefs that they hold and that a person’s behaviour was a function of the information or beliefs that s(he) has. The beliefs or information may be based on experience, fact, hearsay or may be fallacious. A farmer (assuming male gender for the purposes of discussion) will weigh up all the influences on him from policy, advisory services, society, his family, friends, peers, the media and based on all these influences and the information available to him forms his beliefs. Ajzen and Fishbein (1977) identified three distinct types of belief that relate to the effects or outcome of a behaviour (termed behavioural beliefs; eg. ‘planting trees on my farm replaces trees lost to Dutch Elm Disease’), social influences (normative beliefs; ‘the county council think I should plant trees on my farm’) and to factors that can make carrying out a behaviour more easy or difficult or even completely prevent it (control beliefs; eg. ‘the provision of free trees by the County Council encourages me to plant trees on my farm’)” (Beedell and Rehan 1999).
By using open, qualitative responses it was hoped that a broader understanding of the beliefs, influences and behavioural attitudes to managing acid sulfate soils would emerge. However, determining or situational factors that influence attitudes and behaviour necessitates an understanding of agricultural functions. There were several ways to view agricultural functions and definitions continue to emerge through schools of thought such as ‘Multifunctionality’ as promoted by FAO and OECD, however it was beyond the scope of this thesis to discuss these functions in detail. In its simplest form agriculture can be defined by industry type, and this has been the primary stratification in this study with catchment as the secondary stratification. This stratification was reversed for the conduct of the focus groups with catchment becoming the primary stratification. The following results represent a snapshot of four farming industries on coastal acid sulfate soils and the associated government agencies in 1998.

### 5.2 FARMER SURVEY

The survey questions are in Appendix II.

#### 5.2.1 Sampling Strategy

A sample size of 987 potential respondent was identified. The list of population units from which the sample was selected was termed the sampling frame (FAO 1996). A multiple frame was constructed using list frames and area frames of potential respondents (n=987). The multiple frame samples were based on the population of beef, cane, dairy and tea tree farmers on NSW coastal floodplains with potential acid sulfate soils. List frames consist of the names, addresses and telephone numbers of producers grouped by industry. Area frame samples consist of respondents sampled from council maps of properties on acid sulfate soils as identified by the Department of Land and Water Conservation’s ‘Distribution of Acid Sulfate Soils, NSW’ risk maps. The cane industry, due to their industry structure had a complete list of all cane farmers (n=714). Ninety percent of cane farms were on potential acid sulfate soils. List frame sampling of cane farmers was executed by choosing every other farmer on the list. The completed sample from the cane industry was 14% these being randomly picked from the 50% provided. Complete lists of landholders in other industries do not exist. Industry organisations, local organisations and agriculture extension officers contributed to determining landowners farming on potential acid sulfate soils. Figure 12, shows the distribution of potential industries within catchments. In some cases the catchment name was not available and this has been shown as unknown. The Macleay catchment is the largest catchment and therefore had the most potential respondents.
5.2.1.1 Benchmark Sample Results

The survey was conducted during May and June 1998. Surveys of landholder respondents were completed by telephone, (n=287). Landholders were classified by their principal source of income from the farm. There were 45 refusals to participate in the survey. Telephone numbers for catchments and industries were randomly allocated to 5 surveyors. The surveyor established that the respondent was a primary producer and was on a coastal floodplain.

The distribution of industries within catchments was variable. The cane industry was located in the three most northern catchments, Tweed, Richmond and the Clarence. The beef industry occurred in all catchments, however it was most dense in the Macleay and the Clarence. Tea tree was only grown in the northern three catchments, the Tweed, Richmond, and the Clarence. Dairy occurred in all catchments, except the Tweed. There were dairy farms in the Tweed but not on acid sulfate soils. Within industry groups ‘other’ comprises the industries stone fruit, macadamias, nursery, soy beans and pigs. There were 10 landholders that were classed as ‘other’. See Figure 13 for distribution of responses stratified by industry and catchments and Figure 14 for actual responses.

Information on responses to the survey was recorded using five categories.

1. Completed survey.
2. Not relevant: Respondents marked as ‘not relevant’ were responding to two questions: “Are you a primary producer?” and “Are you on a coastal floodplain?” If the respondents replied ‘NO’ to either of these questions they were given a rating of ‘not relevant’.
3. Not contacted: No attempt was made to contact the individual because the surveyor ran out of time.
4. Problem phone: The surveyor attempted to contact the person but there was a problem with the phone number.
5. Refusal: Four percent of the total sampled population refused (See Appendix III). The cane industry had a higher rate of refusal than any other group, accounting for 7%; the Richmond catchment accounted for the majority of these with 11 refusals or 10% of cane farmers in catchment. The refusals from the cane industry were generally in relation to the fact that cane farmers trust the cane mill and distrust other agencies, including NSW Agriculture whom the telephone surveyors had announced they were representing. Of the 287 respondents who answered the survey 252 agreed to be re-surveyed in 2 years time.
Figure 12 Potential survey respondents by industry and catchment

Figure 13 Distribution of actual responses by catchment and industry

Figure 14 Phone call responses
The results are divided into sections that reflect the types of information gathered from the catchment. These sections were; socio demographic, management, indicators, catchment committees, and information sources.

### 5.2.2 Socio Demographic Profile of Survey Population

Table 10 compares the relative proportions of income generated off the farm. Off-farm income refers to income earned from activities which were not associated with agriculture and which contributes to the household. Results show that beef farmers get least income (46%) from their principal industry (beef) and dairy farmers get most income (95%) from their principal industry, followed by cane farmers. Dairy farmers also have the smallest standard deviation (sd=12) for this particular question, implying the smallest variation in off farm incomes of all the industries, beef farmers have the broadest range of possible off-farm income (sd=38).

<table>
<thead>
<tr>
<th>Industry</th>
<th>% income off-farm mean (s.d.)</th>
<th>median property size (ha)</th>
<th>years in industry mean (s.d.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cane</td>
<td>16 (25)</td>
<td>80</td>
<td>27 (14)</td>
</tr>
<tr>
<td>beef</td>
<td>54 (38)</td>
<td>68</td>
<td>21 (12)</td>
</tr>
<tr>
<td>dairy</td>
<td>4.5 (12)</td>
<td>85</td>
<td>31 (18)</td>
</tr>
<tr>
<td>tea tree</td>
<td>22 (37)</td>
<td>81</td>
<td>6 (4)</td>
</tr>
</tbody>
</table>

**Table 10 Results of comparisons of industries socio-economic data**

The median property size between the farm industries was used rather than means as tea tree had considerable variability which provided a unrealistic result of property size. There were either small tea tree (family) farms or very large corporate landholders. Cane, dairy and tea tree farmers have similar average property sizes. Diversity within industries was measured, with dairy farmers being least diversified, followed by beef farmers. The tea tree industry was a new industry and the mean years of participation were only 6 years in comparison to dairy at 31 years. Most landholders owned or part owned and ran their properties. Notable exceptions were tea tree farms, managers ran 20%. Dairy farmers had a small portion of tenant farmers running their properties.

In summary although median property sizes were similar (68-81ha) there was substantial variation in off-farm income, with beef farmers having the highest proportion of off-farm income and dairy farmers the smallest, reflecting their high reliance on farm income.
Predicted production changes (Figure 15) were a good indicator of the economic viability of an industry and the level of confidence that producers had in future prospects for their industry. It was found that over 20% of beef farmers were decreasing their production, most cane and dairy farmers were static and tea tree was expanding, rapidly. Nearly 30% of dairy farmers surveyed (Figure 16) fell in the 'over 60 years old' category. Tea tree farmers had over 40% in the 41-50 age group. However, there were some young farmers principally in the 'other' category.

5.2.3 Farm Management

“We realise it's a problem … with a careful management plan we can minimise the release of acid sulfate soils without too much trouble”. Tweed, cane farmer

Results presented in this section cover three aspects of farm management; geographical characteristics of the farms, management of the property, and individual farmer attitudes expressed towards the management of acid sulfate soils land.

5.2.3.1 Geographical characteristics

Questions on land management were asked to ascertain the height above sea level and the extent of cleared land on a property. The question posed to landholders was, ‘What height above sea level is your property at the lowest point?’ Of the 100 landholders that knew the height of their property (based on Australian Height Data), 80% of them were at or below 2m. Land use data were compiled on the percentage of land reported as being under pasture, under crops and the area cleared of trees. Land use compared by industry shows that the cane industry had the most land under crops with dairy having the most under pasture,
followed by the beef producers. Tea tree growers had nearly equal proportions under pasture (21%) and crop (25%). They had large portions of land which was not in production and 19% of this land was not cleared.

There was a strong association between catchment and industries. The Tweed, Richmond and Clarence catchments were characterised by substantial cropping and the principal industry in all three catchments was cane (Table 11). Diversity of industries varies in these catchments; the Tweed was dominated by cane production, whereas the Richmond had a vibrant tea tree industry, and the Clarence had a substantial beef industry. The Manning and Shoalhaven catchments both had negligible cropping, with 93% and 98% respectively were under pasture. These catchments were principally dairy and they also had the highest area of cleared land. The Macleay was principally beef with some tea tree production and had the lowest area of cleared land. The Macleay and the Hastings had been grouped together for the purposes of analysis in this survey as they were geographically very close and indeed the water in certain border areas flows into both catchments.

<table>
<thead>
<tr>
<th>%</th>
<th>Tweed</th>
<th>Richmond</th>
<th>Clarence</th>
<th>Macleay</th>
<th>Manning</th>
<th>Shoalhaven</th>
</tr>
</thead>
<tbody>
<tr>
<td>crop</td>
<td>78</td>
<td>68</td>
<td>58</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>pasture</td>
<td>11</td>
<td>21</td>
<td>28</td>
<td>77</td>
<td>93</td>
<td>98</td>
</tr>
<tr>
<td>cleared</td>
<td>92</td>
<td>92</td>
<td>89</td>
<td>87</td>
<td>97</td>
<td>98</td>
</tr>
</tbody>
</table>

Table 11 Land use by catchment from survey respondent

5.2.3.2 Management of the property

This section looks at the use of lime, performance of general soil tests\(^2\) and the extent to which landholders were measuring pH levels in water and soil. Further, it examines stocking rates of beef properties, and rates of laser levelling and irrigation on tea tree and cane properties. Lime usage was an indicator of a farmer’s compliance with the need to maintain appropriate pH levels.

Figure 17 shows that sugar cane farmers use more lime and have more soil tests than the other industries. The group categorised as ‘other’ farmers have high representation here also. However this group constitutes a much smaller sample size, and these results are to be interpreted accordingly. Soil pH levels were known by >60% of all groups except beef farmers (30%). Knowledge of water pH was low for all groups.

\(^2\) In this first benchmarking survey the distinction was not drawn between general soil tests and specifically testing for acid sulfate soils.
What management actions do farmer’s do?

![Bar chart showing management actions](image)

In addition to establishing if on-farm soil and water pH testing was being performed, landholders were directly asked if they knew whether they had acid sulfate affected soil on their property or not. The surveyors then ascertained what source of information landholders were basing their knowledge of acid sulfate presence or absence on. Of those that responded positively, 71 individuals cited ‘soil tests’, conducted by a variety of authorities, as their source of information. The cane industry responses dominated this category (44 of 71). Authorities cited by respondents as facilitating these tests include the following, (note that these authorities may not actually conduct the tests, but were the authorities perceived by the farmer as responsible for testing), the ‘cane industry’; NSW Agriculture, department agronomists and acid sulfate soils sub-committee members; Agronomist from primary producers Board; test done during ASSMAC field days on individual properties; Roads and Traffic Authority (RTA); Southern Cross University, Wollongong University; soil analysis tests prior to receipt of DA for drain clearance work and consultants.

5.2.3.3 Stocking rates

Survey respondents were asked, ‘What is the stocking rate of your lowest back swamp country in summer and winter?’ to identify whether they were ‘stressing’ their land by causing erosion and scalding (patches of exposed earth). The responses to this question were difficult to tabulate because there were many factors that can affect the results that lie outside the scope of this survey. Some of these issues are; calving numbers, length of time calves remain on the pasture, breed of the cow, age, sex and pregnancy status, whether pastures were improved or native, fertilised or not. Therefore this question was considered a
bad indicator. With these difficulties in mind, however, the following observations have been made on the basis of the responses recorded:

- landholders tend to stock their farms higher in summer and lower in winter
- 40 of the 105 cane farmers had some beef cattle
- dairy farmers had the highest stocking rates

5.2.3.4 Laser levelling and irrigation

Laser levelling assists in the efficiency of the drainage of the land and was often combined with changes to the entire drainage system on a property. It was considered a good tool in the management of acid sulfate soils as it encourages shallow drains which do not penetrate the acid sulfate layer (see Chapter 3, remediation strategies). The cane and tea tree industries were the two farming groups from this study that can use laser levelling as part of their management. These groups were asked if their properties were laser levelled, and if they used irrigation on their crops.

- over 60% of cane farmers laser level only and 5% laser and irrigate
- 30% of tea tree farmers irrigate and do not laser
- over 40% of tea tree and over 20% of cane farmers neither irrigate or laser

NB. The main purpose of irrigation was likely to be establishment of crops

5.2.4 Knowledge and Awareness of Acid Sulfate Soils

This section establishes an understanding of farmer’s knowledge levels and awareness about potential and actual acid sulfate soils. Questions were designed to determine whether landholders had identified any of the ‘classic’ indicators of potential acid sulfate soils on their properties and whether they were aware of any effects from acid sulfate soils. Their understanding of the acid sulfate soils risk maps and acid sulfate soils indicators was assessed by categorising their responses into groupings of ‘high’, ‘medium’ or ‘low’ awareness levels.

Further questions posed to landholders asked; Did they know if acid sulfate soils was present on their property? if so did they know the depth at which it occurred?, were they aware of the risk levels of their soils from the acid sulfate soils risk maps produced by the Department of Land and Water Conservation?, and how did they know they had acid sulfate soils; was it based on results of soil tests, or local knowledge?
5.2.4.1 Presence of vegetation indicators of acid sulfate soils

The presence of paper barks species, smart weed, dark grey mud, buttery yellow soils or coloured water on their properties indicates potential acid sulfate soils. Landholders were asked whether they had any of these on their property.

- paperbarks followed by smart weed were the most observed indicator across all catchments; the Shoalhaven had most sightings of paperbarks and smart weed
- presence of dark grey mud represented about 40% of observations in most catchments
- buttery yellow soils were the least observed indicator in all catchments
- coloured runoff water was observed by nearly 80% of Macleay catchment landholders followed by the Clarence, nearly 50%, and then the Richmond at less than 40%

5.2.4.2 Awareness of potential and actual acid sulfate soils on their properties

To ascertain awareness levels of acid sulfate soils on their properties, landholders were asked whether they had acid sulfate soils on the farm and if so, did they know the depth (Figure 18). Over 50% of cane farmers identified that they had acid sulfate soils on the farm and 43% of the beef farmers. The sugar industry’s sampling survey was cited by 44 cane farmers as their source of information and local knowledge was the other most stated source of information. Half of the beef and cane farmers were aware of risk levels of acid sulfate soils from the acid sulfate soils risk maps produced by the Department of Land and Water Conservation.

It was estimated that over 90% of the farmers surveyed were on potential acid sulfate soils based on the sampling strategy and because over 90% had floodgates and drains, discussed later in this chapter. However, acid sulfate soils are at variable depths depending on how the sediment was layed down over time, therefore they may be quite deep, ie 3m or very near the surface and therefore denoted as high risk on the acid sulfate soils risk maps. See Appendix III, Keys to Success for a full explanation and sample of a risk map.
over 30% of beef farmers identified acid scalds on their properties
over 50% of cane farmers knew that they had acid sulfate soils on their land, beef farmers were the next highest group
few landholders knew the depth of the acid sulfate soils, however, cane farmers had the most knowledge, over 20%, followed by dairy farmers

Analysed as a percentage of those that had acid sulfate soils, it can be seen that although awareness levels between the cane and beef industries was close, the knowledge of depth of acid sulfate soils was very different. Seventeen percent of the beef farmers who had acid sulfate soils knew the depth, verses 41% of the cane farmers who had acid sulfate soils. One third of landholders know what height their property was above mean sea level, and of these, 80% were at or below 2m.

The effects of acid sulfate soils can be seen in scalds on the properties, which are bare patches of land which will not support any vegetation and were often favoured by stock as a gathering point. The question ‘Do you have any acid sulfate soils scalds’ was asked. Beef farmers had responded positively in over 30% of cases, whereas the cane industry had only 15% of respondents with acid scalds. While it was acknowledged that there were other causes of bare scalds, the predominant cause on the floodplain was acid sulfate soils.
From qualitative data, 66 respondents were able to report on the presence of acid sulfate soils drawing on local knowledge, which was gained in the following ways:

- on-farm experience and observation, ability to recognise acid sulfate soils indicators (eg. ‘mud’ or ‘crystal clear water’)
- had taken part in field days
- involved in community groups
- had seen own properties on acid sulfate soils risk maps
- are not sure, but think it’s likely
- assume they do because council restrictions on drain clearance exists
- information was made available at time property was purchased

5.2.4.3 Awareness of acid sulfate soils risk status

This section deals with knowledge levels regarding; acid sulfate soils risk status, awareness of the acid sulfate soils Risk Maps, and acid sulfate soils soil test results on respondent’s properties.

Of the 287 individuals surveyed, 151 (52%) indicated an awareness of the acid sulfate soils risks maps. Table 12 and Table 13 below shows percentage of ‘yes’ responses within catchments and by industry to the question “Are you aware of the acid sulfate soils risk maps?”

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Tweed</th>
<th>Richmond</th>
<th>Clarence</th>
<th>Macleay</th>
<th>Manning</th>
<th>Shoalhaven</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>53</td>
<td>56</td>
<td>58</td>
<td>51</td>
<td>58</td>
<td>40</td>
</tr>
</tbody>
</table>

Table 12 % Awareness of risk maps by catchment

<table>
<thead>
<tr>
<th>Industry</th>
<th>beef</th>
<th>cane</th>
<th>dairy</th>
<th>other</th>
<th>tea tree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>48</td>
<td>52</td>
<td>47</td>
<td>50</td>
<td>79</td>
</tr>
</tbody>
</table>

Table 13 % Awareness of risk maps by industry

Of the 287 individuals surveyed; 109 (37%) indicated an awareness of their acid sulfate soils risk status gained either from local knowledge or the acid sulfate soils Risk Maps. Of those 109; 43% were ‘high’; 18% ‘moderate’; and 38% reported ‘low’ risk. General perceptions of the acid sulfate soils risk maps were as follows:

- maps not thought to be ‘accurate’ enough
- believe maps should indicate acid sulfate soils ‘depth’ as well as ‘risk’
- believe scale was too large, inhibiting interpretation at ground level
• cane industry maps considered more informative
• not available from council on request

Manning River, dairy, "... we supposedly have some acid sulfate soils, but don't think [the] map's accurate ... some areas with plenty of grass [are] killed by salt water after a king tide ... more studies [are] needed before we can accept what's on those maps".

5.2.4.4 Awareness of acid sulfate soils management

This section assesses the extent to which primary producers surveyed were aware of acid sulfate soils as an issue in farm management and is based on qualitative responses. Responses were categorised into three groups; ‘high’, ‘medium’, and ‘low’ awareness. A further grouping was developed titled ‘information required’ as can be seen in Figure 19 for those who also this need. 5% failed to provide any comments during the telephone survey.

High awareness. A majority of respondents (45%) indicated they had a high level of awareness of acid sulfate soils, also that they possessed the knowledge and ability to adapt their on-farm management practices accordingly. Characteristics of this group included;

• willingness to take personal responsibility for modification of practices

Manning, beef, "We are conscious of it, that's why we did the tests before cleaning the drains, it cost us $500 ... we get [the] council guy to check any excavations we do".

• aware of the link between acid sulfate soils management and farm productivity
• reflect an understanding of the science and ecology of acid sulfate soils
• were confident negative impacts of acid sulfate soils were controllable
• had an awareness of appropriate farm management responses
• attributed their awareness to industry support

Medium awareness. Respondents in this category (34%) had a medium level of awareness of acid sulfate soils. The majority would like to become more informed, the remainder were not inclined to think it was necessary to gain further information about acid sulfate soils. Both groups were likely to become aware of the issue indirectly, for example through media coverage, rather than through formal industry or government directed programs.
Characteristics common to the first group, (‘would like to be more informed’), include the following;

- they believe acid sulfate soils may negatively impact their farming in the future
  
  *Macleay, beef,* “Not as yet a problem for me but I can see it becoming an issue in the future. Our water table is only 1m down”.

- they would like help but not sure where to go for more information

The second group, (‘not inclined to gain any more information’), share the following characteristics;

- don’t believe acid sulfate soils was a problem, or believe other land management issues were more important
- are only aware of acid sulfate soils through enforcement of government regulations on land use practices
- had a begrudging awareness of acid sulfate soils issues, gained from its controversial profile in the local community, or as portrayed in the media

**Low awareness.** A small proportion of respondents (6%) indicated that they had almost no awareness of acid sulfate soils, nor with the problems associated with their management. Some simply felt that the issue was irrelevant to their property or interests.

**Require assistance.** This category (20%) were aware that acid sulfate soils were problematic with potential to cause significant negative impacts on their farms and productivity levels, however, they do not believe they had the ability or knowledge to deal with it. Accordingly,
many respondents in this category state that they require assistance in responding to the problem. Other concerns that characterise the respondents in this category include:

- feeling that avenues for support were minimal or non-existent
- are fearful and uncertain of potential negative impacts of acid sulfate soils regulatory implications (for example; catchment re-inundation proposals)
- financial constraints limit their ability to respond to acid sulfate soils management issues
- feel the problem was overwhelming and uncontrollable

Macleay, beef, "I don't know how to tackle it to tell you the truth. Down here its nearly impossible to keep water on it, it dries out and the heavy rains come… need 6 or 7 tonne [lime] per acre”.

<table>
<thead>
<tr>
<th>% Awareness</th>
<th>Tweed</th>
<th>Richmond</th>
<th>Clarence</th>
<th>Macleay</th>
<th>Manning</th>
<th>Shoalhaven</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
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<td>low</td>
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<td>3</td>
<td>9</td>
<td>10</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>information required</td>
<td>3</td>
<td>19</td>
<td>12</td>
<td>29</td>
<td>42</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 14 Qualitative analysis on awareness levels by catchment

Table 14 shows the percentage of respondents in each catchment that indicated an awareness level during conversation, as analysed by catchment. The following points highlight the differences between the catchments:

- the Clarence catchment had a lower level of awareness than the Richmond and the Tweed, which had the most respondents in high awareness; the Clarence had more in the medium awareness than the other two catchments;
- the Macleay and Manning had the most in the require information category;
- only 3% in the Tweed require information on acid sulfate soils
5.2.5 Attitudes to the Management of Acid Sulfate Soils

This section presents an overview of the extent to which survey respondents were modifying their land management practices to address acid sulfate soils issues. Landholders were asked direct questions about their attitudes to acid sulfate soils management. The data presented here were based on the responses to these direct questions, and on additional comments made during conversations throughout the duration of the survey interview.

Respondents were asked how important they thought acid sulfate soils issues were in their farm management and planning. Results from this question (see Figure 20) provide an indication of farmer attitudes towards acid sulfate soils management, and their willingness to take account of these issues in their farm management and planning. The beef and dairy farmers dominate the ‘not important’ category along with those in the ‘other’ category. It was important to recall at this point that the ‘other’ category had only 10 respondents in it and therefore require only 6 responses to represent 60% on this graph. The cane farmers dominate the category ‘very important’ with over 50%, followed by the tea tree farmers with 45%. Dairy farmers had the smallest representation in the ‘very important’ category with less than 20%.

Figure 20 Importance of acid sulfate soils issues to farm planning and management

To further understand farmer’s attitudes to the management of acid sulfate soils, opinions on this topic were analysed using the qualitative data analysis methods noted in Chapter 4. The ‘attitudes’ recorded in the survey are presented here for discussion purposes in six general categories. These categories are in three groups:

1. ‘management in control’, ‘management not in control’,
2. ‘industry cohesive’, ‘industry not cohesive’,
3. ‘future management positive’, and ‘future management negative’.

Characteristics of each category are defined throughout the following text.

5.2.5.1 Management in control

This group (40%) had an attitude of confidence about their ability to manage acid sulfate soils. They believe that acid sulfate soils were either; within their control, not an issue on their property, or their industry body was attending to the problem adequately.

Clarence, tea tree, Talking to different farmers - everyone's aware of acid sulfate soils but farmers have everything under control - if there is a problem we rectify it. We don't have a problem here.

Other respondents here may also be aware of the fundamental aspects of the acid sulfate soils problem and of the changes that they were attempting to make, but they require access to basic resources and assistance to fully implement their intentions.

Clarence, dairy, “Try to maintain high water table. Don't over drain. Don't know enough”.

A small proportion of the overall group was adopting acid sulfate soils management with some reluctance, usually in response to perceived community pressure, or they were simply sceptical that there was any need to change their practices.

Tweed, cane, “I know I shouldn't dig down too deep. Don't want to be called a 'dirty bloody cane farmer'”

Predominantly however, respondents in this category were aware of acid sulfate soils, are sensitive to land management strategies, and clearly indicate that they employ them. A significant proportion of responses gathered from cane farmers (17%) were from individuals who attributed their adoption of acid sulfate soils management practices directly to the influence of the cane industry’s pro-active approach to the issue.

Acid sulfate soil sensitive land management strategies. Those landholders actively employing acid sulfate soils land management strategies cited the modifications they had made to their practices and benefits they had derived from them; replacement of deep drains with shallow wide drains; liming of paddocks; laser levelling; ability to recognise and monitor acid sulfate soils indicators; actively participate N.S.W. Agriculture field-days and information sessions; reduction of negative impacts on-farm productivity and soil remediation.
**Pro-active cane industry.** Almost 40% of cane farmers feel in control of their management of acid sulfate soils, and they were the group most likely to attribute their changed practices to the support of a cohesive industry body. The pro-active cane farmers group specifically refer to the support made available to them from the Cane Industry and NSW Sugar Milling Cooperative as being motivational in their achievement of acid sulfate soils sensitive management practices. Examples of that support were cited as follows;

- development of individual ‘Farm Management Plans’
- sampling and testing of soils for acid sulfate soils risk assessment
- guidance towards and encouragement of ‘best management practice’
- conditions of management built into ‘grower’s agreement’

Richmond, cane, “Most cane growers are pretty strong with it - lazer, removing big drains, filling in big drains. Everyone is trying to do the best they can. If you ignore it you’re only going to bring trouble on yourself”.

The confidence that the cane farmers exude in their ability to control the management of acid sulfate soils was also reflected in the comparison of ‘in control’ attitudinal data across the catchments Table 15. The Tweed catchment, which was predominantly cane, had over 50% of farmers feeling in control. This may be due to the history of the Tweed. The fish kill in 1987 prompted research that had directly involved a number of local properties, landholders and the broader community.

<table>
<thead>
<tr>
<th>Tweed</th>
<th>Richmond</th>
<th>Clarence</th>
<th>Macleay</th>
<th>Manning</th>
<th>Shoalhaven</th>
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<tbody>
<tr>
<td>53</td>
<td>27</td>
<td>31</td>
<td>24</td>
<td>35</td>
<td>20</td>
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</table>

Table 15 Qualitative analysis of farmer sense of ‘in control’ to acid sulfate soils planning and management by % in catchment

5.2.5.2 Management not in control

Respondents in this group perceive the whole issue as beyond anyone’s control. This group was not employing acid sulfate soils sensitive practices. Their inability to do so was related to;

- financial constraints
  
  Macleay, beef, “If I had the money drains should be made three times as wide and half as deep”

- external factors, such as uncontrollable negative impacts of land use beyond the farm, perceived bureaucratic blocks to positive management practices

  Macleay, tea tree, “... the problem is money ... paperwork is very expensive and it takes forever to retain high water table during dry period ... didn’t get permission first ... [was] fined by Council”.
• believe existing catchment drainage was too severe, causing over drying and inhibiting ability to ‘hold’ water
• do not believe acid sulfate soils was the cause of land management problems

Manning, dairy, “It stops cultivation ... who’s running who? ... too much outright interference. Are people keeping themselves in a job?”

• lack knowledge or information regarding management of acid sulfate soils, don’t know how to access help
• reflect a phase of change in the industrial structure of agricultural production, eg. abandonment of family farms, geographical changes, lack of control on-farm linked with a sense of personal failure
• ‘rumours’ encourage fear and uncertainty over their future viability, feel powerless, politically disenfranchised, fear implications of acid sulfate soils management regulations

5.2.5.3 Industry cohesive

This group perceives their industry as being supportive, organised and effective at communicating information on acid sulfate soils issues and practices. These respondents explicitly acknowledge the level of assistance they receive in managing acid sulfate soils from their own industry organisation. Responses from the cane industry dominate this group, however, smaller less formally organised groups with a supportive network were also represented. Characteristics of these responses include;

• over 20% of cane farmers mentioned that their industry was cohesive, and no cane farmers suggested their industry was not supportive
• pride in industry achievements regarding acid sulfate soils management; eg. setting standards and providing a role model to other industries

Tweed, cane, "other catchments are becoming more aware in NSW. ... Very pro-active. Greenies now onside, were antagonistic in the beginning”;

• individuals were very informed as a result of industry efforts
• smaller groups often motivated by the efforts of key individuals

Macleay, beef, "need planning to control ag' production so it's sustainable with ass conditions. .... Can best be fixed by self motivation ... a group of people facing the problem - with assistance of a sympathetic council or local government ...some motivated to address problems, some not. I was involved in a remediation project because I had it on my land - some didn't want to address the issue ... best way to get them involved is to observe remediation on land next door, subtle peer pressure ... talk through the fence ... later they joined - can't force them through government’s 'big stick' regulation approach ..."
5.2.5.4 Industry not cohesive

The ‘industry not cohesive’ group perceives industry as not being supportive, organised or effective at communicating information about acid sulfate soils issues or practices. Characteristics of this group include;

- nearly 20% of beef farmers said their industry was not cohesive and only 2% said it was cohesive
- do not know where to access help or support in responding to acid sulfate soils management, concern for own industry and colleagues
- Manning, beef, “I worry about the old timers being blamed - having the finger pointed at them - we need more education [and] support and to work together. They're doing trials for acid sulfate soils management in cane areas north of Grafton, I think they're getting support and funding from somewhere for that. I'd like to look into whether the same sort of support/funding might be available for us”.
- view the need to respond to acid sulfate soils management as an overwhelming burden, expressions of powerlessness and abandonment
- request more education, advice, support, soil tests and personalised assistance

Macleay, dairy, I'd like to know a bit more - [I] would like someone to come out and have a look and discuss issues with me to see if I have a problem. I don't think I have a problem because I have good pasture’

5.2.5.5 Future management positive

This group reflects a generally positive attitude towards understanding and dealing with acid sulfate soils issues and management including adherence to regulations and implementing acid sulfate soils management strategies. Respondents in this category indicated;

- high awareness of the acid sulfate soils issue
- willingness to comply with regulations, a strong sense of taking personal responsibility to address the issue, willingness to learn new management practices relevant to acid sulfate soils management

Macleay, beef, “Eventually will lime whole place, (but [restricted]… because of cost) … trying to comply with regulations”.

Richmond, cane, “Farmers are saying to each other 'you need to lime there’ … you wouldn't have heard that 6 years ago. The cane community in particular are really on top of it”.

- faith in the expertise of the government and regulatory measures designed by authorities, willing to learn new management practices relevant to acid sulfate soils

Richmond, beef, “Its a matter of biting the bullet … shallowing and widening the drains”

- use concept of ‘best practice'
Richmond, tea tree,"... Having acid sulfate soils is not a death sentence, learn to live with it … responsible management with proper guidance"

5.2.5.6 Future Management negative

Macleay, beef, “Pack of shit - that's my opinion - its good feeding country so it can't be too bad a problem".

This group was sceptical about the existence of the acid sulfate soils problem as defined or about its high profile status, tending to be rebellious towards regulations and sceptical of the role of government. This negative attitude to future management of acid sulfate soils reflects the largest group. The most notable grounds cited for this negative attitude to future management are described below;

Always been fish kills. This group (39 of 89) was sceptical about community attention given to phenomena that were alleged to be negative environmental effects associated with the presence of acid sulfate soil, such as fish kills. Their belief was that such events had been taking place since before changes in drainage regimes were put in place, and hence, reject notions that propose altering current drainage practices.

Macleay, dairy, “Couple of new people came in and really upset the locals. I'm not against the new ones, but I think they should give the old timers a hearing. Fish kills are a problem here, but then they've happened back at the beginning of the century too. Tempers get frayed. The newcomers have turned the place upside down. Problem is that at community meetings, the tensions rise, and the 'old timers' don't get a hearing”.

A particular concern of this group was the notion that alterations to drainage regimes will be implemented. They believe that such alterations will be misguided and ill-informed, with ultimately significant negative impacts for themselves and their farm productivity.

Macleay, beef, “The new ones in the area, they reckon since flood mitigation - that's caused the fish kills - but the fish were dying 30 years before that. Flood mitigation been the best thing since sliced bread. I think they should listen to history from the senior citizens. Some, they're here 12 months and they're running the place”.

No trust in the media. This group (16 of 89) was sceptical about the role the media was playing in dealing with acid sulfate soils issues. They believe the media was responsible for projecting a negative image of landholders and sensationalising issues, such as fish kills. They believe that the media takes stories out of context and only tells part of the story. Respondents here also feel that the media was neglectful in that it does not give enough coverage to the positive efforts of landholders in attempting to deal with the problem.
Fisheries not informed. A small proportion of the farmer groups (10 of 89) which was 3 percent of the total surveyed population of landholders see fisheries groups as representing a new industry that was less informed about the ecological history of the area. They perceive the fishing industry as being uninformed or misinformed about the relationship between acid sulfate soils run-off and fish kills. Respondents here further believe that the fishing and oyster industry’s own practices of harvesting should be reviewed in terms of sustainability.

Government bandwagon. Respondents in this category (32 of 89) resent their industry or practices being targeted by stringent government regulations. They feel that there were major land use impacts from government associated departments, or large scale commercial developments and these issues were not being regulated. Consequently, because they feel they were being singled out as easy targets for regulation, these landholders were rebellious against council regulations that control acid sulfate soils land use practices.

Hunter, dairy, "This is just a case of red tape gone mad - if this was private industry, you'd never stand a chance, this is a waste of time and resources, avoiding the issue of frontline new industries and new developments - but they're let off while it's easier to point the finger at the farmers".

A dominant characteristic of this group was their lack of trust or faith in government bodies, bureaucracy, ‘academics’ and ‘experts’. They often cite their belief that the acid sulfate soils issue was just a ‘band wagon’ generating jobs for bureaucrats. A common concern was the designation of previously productive land into protected ‘wetlands’ and they believe they should be entitled to financial compensation for swampland declared ‘wetlands’.

Many of these respondents express scepticism in the governmental and ‘expert’ interpretations of the acid sulfate soils problem. Alternative assessments include the belief that fish kills were caused by inefficient drainage, where water was left to sit on swamps (wetlands) killing the vegetation present, consequently killing fish due to the resultant deoxygenated and poisoned run-off water. This same process was blamed for the development of scald patches, as the water left sitting on wetlands was believed to effectively boil the vegetation and kill it.

5.2.6 Drains, Flood Gates and Unions

Manning River, dairy, "It’s put everyone on edge, we rely heavily on drainage. There's a lot of uncertainty in community … [people] don't know what their rights are. [We] need good advice to be helped to do [the] right thing, but there's uncertainty … when drains need clearing and development applications take so long".
Drainage is imperative for agriculture on the coastal lowlands and was discussed in Chapter 3. However, to bring context to this section, there were a few points worthy of attention. Without drainage the coastal lowlands can only be farmed for 40% of the year. The depth of a drain is very important as is the density or number of drains both for production purposes and for environmental impacts. If a drain penetrates the acid sulfate layer this can cause oxidation and acid formation. If land is over drained then the exposure of acid sulfate soils is more likely. If land is insufficiently drained, it remains under water for long periods after high rainfall. During these periods the land is unavailable for plant growth or grazing, consequently production is negatively impacted.

Floodgates control the passage of water and fish in both directions, upstream and downstream, and were managed in conjunction with the drains. If floodgates remain closed, fish passage to breeding habitat becomes impossible. Floodgates were used to stop saline water flowing on to agricultural land, especially during high tides; stop tidal ingress and flood water eg. tides can cause a backwash effect during upstream flooding on lower level farms; and to retain water on properties during dry periods.

This section looks at issues concerning landholders about drains, flood gates and the unions which manage some of these drains. Survey respondents were asked questions to gain an understanding of; their attitude to drainage of their land, attitudes to the management of these drains and floodgates, and suggestions for changes to the present system.

Of the 287 survey respondents, 261 (90%) had one or more types of drains on their properties or in their local catchment. This indicates that they are on a coastal floodplain and a high likelihood that they will have acid sulfate soils on their properties. The following section deals with these 261 respondents and percentages are of these respondents.

- 56% respondents had a community or union drain going through their property
- 84% respondents had drains which were linked to floodgates either on the property or via the local drainage system
- 43% had an active land holder group who manage their floodgates and drains

5.2.6.1 Attitude to efficiency of drains in catchment

Drains and drainage regimes were a major factor relating to farm and acid sulfate soils management. Almost all of the individuals surveyed refer to their drainage systems in some capacity, as either; efficient, inefficient, too efficient (causing over-draining), or that they were in need of modification either on or off the farm. Below is a discussion on individuals views on the drain maintenance and efficiency.
Good efficiency. Of the respondent’s attitudes recorded during the survey the majority, over 80% expressed contentment with existing drainage regimes. This contentment was reflected across all catchments. Many respondents state that without drainage production on their land would be impossible.

Shoalhaven, dairy, “[It’s] brought 100s of acres of land into production, [the] greens talk about wetlands … this would have been a swamp, but now [it’s] in production”

A belief expressed by some landholders in this group was that inadequate drainage of salt water kills fish and vegetation. While this group was aware that controversy surrounds the future management of drainage and flood gates, they were compelled to point out that their direct interests and on-farm productivity was best served with the maintenance of current regimes.

Macleay, tea tree, “Since flood mitigation, … [it has] … changed marginal land to productive land, … [it] could have had a negative effect on others, but flood mitigation [is] good for us”.

Respondents in this category may also be implementing acid sulfate soils sensitive drainage regimes, with some cane farmers referring to the benefits of their laser levelling.

Richmond, cane, “Drains water off the paddocks - with laser levelling you don’t need so much drainage”.

Drainage over efficient: Respondents in this section, less than 10% believe that their catchment drainage regimes were too efficient, leaving properties too dry for production at some times in the year. They were mainly beef cattle industry in the Macleay catchment. These landholders believe that Flood mitigation drains were badly designed when they were first constructed. The suite of management problems that they face include the inability to maintain water levels, meaning they struggle to combat acid sulfate soils and other environmental problems that had resulted from over drainage, eg. Erosion and changes in vegetation cover

Macleay, beef, “Honestly, [there’s] no benefit. … Prior to drains … [we] … could put beef on wetland areas. Today … swamps [are] over drained [and] native grasses have died out”.

Drainage not efficient. Comments from this group (6%) were centred on the inefficiencies of their drainage systems. The concerns of this group were that:

- drains were simply not working, or drainage was too slow, or were badly maintained
- drains were not effectively controlled (and control was beyond their domain)
- there was no ‘equity’ in the distribution of flood waters throughout the catchment during flood periods
Changes required. Respondents from the Manning and Shoalhaven catchments both registered prominently in this category. The common concerns held by these landholders relate to issues of drain clearance and council responsibilities in maintaining drains. Concerns cited by this group include:

- council’s policy on not clearing drains was erroneous
- council does not provide, or have, enough funds for drain maintenance
- certain government departments were considered ‘slack’ in their drain maintenance
- government departments also believed to be effecting radically altered drainage flows on some landholders properties without consultation or compensation

Manning, beef, “they have built the highway up, it interrupts the flow of land. We’ve got to drain water up hill and out [the] floodgate …they are the biggest offender in acid sulfate soils as they are slack in cleaning drains and roads”.

- some specific drainage unions were considered responsible for inadequate drainage maintenance

Of concern to this group was the current status of their council’s policy on drain clearance. Many of the respondents here seem perplexed and bewildered that drains should be allowed to accumulate silt, rotting vegetation and “spoil”. These landholders state that their concern was not with making drains any deeper, but simply to clear them of built up material. A common concern to this group also was with control of flood gates in the catchment. Suggestions proposed by landholders include that their relevant floodgates need to be; improved, removed, modified, moved, the capacity increased, or that they simply need to be “blown up”. An associated concern here was the perceived need to alter the drainage regime of the whole catchment. Some respondents refer to levee banks, often recommending their removal. This group felt they had no control over the drainage regime of their catchment, and further, that the current regime was badly controlled as it distributes the negative effects of flood waters inequitably. References were made for the need for cooperation on this matter from; “upstream”, “downstream”, and “the neighbours”. Recommendations for off farm changes to drainage regimes also included a few innovative ideas.

Clarence, Cane “Jack the farm up about 8-10 inches”.

5.2.6.2 Council

This section presents the concerns of respondents (10%) who acknowledged the role of their local council in the maintenance of their drainage systems. The majority (9%) provided
negative feedback on the role of their local council, while 1% provided positive feedback on the role of their council in drain maintenance. Following is a summary of the negative comments and sentiments expressed by landholders:

- frustrated with lengthy, costly and bureaucratic jungle of DA applications
  
  Manning, beef, “To be able to clean [or] clear drains without having to go through cost and hassle of having to get DA’s. … DA’s are impractical. I don’t want deeper drains, just to clear them of reeds. … redesign them altogether … dish drains are better than vertical drains”.

- general dissatisfaction with council’s maintenance of drains
- accusations of bad management decisions by council
- think council drains were more problematic than private ones
- believe council doesn’t take responsibility for drain maintenance

Macleay, beef, “Can’t find out from council … one drain [has] never been cleared … so far there’s no information … the road drain comes to [an] end and water sits on [my] farm”

5.2.6.3 Community or union drain

This sections deals with the 147 (51%) respondents that had a community or union drain going through their property. Landholders were asked; whether they had drains on their property, if their drains were connected to flood gate systems, and if so, how many they were connected to flood gates (see Q9.1, Q9.2, and Q9.5.1, farmer survey in Appendix I). The ratio of flood gates to drains in each catchment was determined (see Table 16). On the basis of these results, the Manning catchment had the most flood gates to drains ratio (45%) of all catchments, and the Tweed had the lowest ratio (32%).

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Tweed</th>
<th>Richmond</th>
<th>Clarence</th>
<th>Macleay</th>
<th>Manning</th>
<th>Hunter</th>
<th>Shoalhaven</th>
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</thead>
<tbody>
<tr>
<td>%</td>
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<td>32</td>
<td>37</td>
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Table 16 % by catchment of density of flood gates in catchments based on survey responses

Survey respondents were asked to comment on the maintenance of the community or union drains on their properties.

- adequate maintenance was cited by 60% of Tweed catchment respondents which was 20% higher than any other catchment. Most catchment residents did not think their drains were adequately maintained.
- lime was not used on drains in most catchments, less than 20% in the Clarence, Macleay, Manning and Hunter
- use of lime was over 30% in the Tweed catchment, and over 40% in the Shoalhaven
- the Shoalhaven also had most plants growing on the sides of drains
• the Clarence had the lowest level of satisfaction on all three issues

5.2.6.4 Flood gates on union drain

One hundred and twenty four respondents had flood gate systems on their drains. Overall the condition of these flood gates by catchment were perceived to be in working order. Notably nearly 60% of respondents from the Tweed catchment believe that their flood gates were falling apart. With reference to Appendix I, Q9.5.1.1 presented respondents with multiple options regarding the condition and working order of flood gates, which explains the occurrence of a 60% (flood gates “falling apart”) and 85% (flood gates “working”) response rate from the Tweed within the same figure. Landholders may also be referring to several floodgates relating to their property.

5.2.6.5 Attitude to flood gates

Of the total survey group 38 respondents (13%) made direct reference to the floodgates in their region. While 3 (all Macleay beef farmers) stated that their flood gates had caused over-drainage, the majority would prefer increased drainage. Following is a list of the concerns of this majority group:

• would like greater control over the operation of the flood gates
• want the capacity of flood gates increased, or more gates installed
• believe pumps were needed at flood gates, or better coordination of existing pumps
• believe existing gates need repair
• request more funds for drainage unions for flood gate maintenance
• believe leakage of sea water kills fish and vegetation
• are concerned about rumours of government plans to re-inundate swamps

Macleay, beef, “[the] gates keep tides coming up the river ... should close gates to keep water out ... water is leaking up into swamp country. Bloody Fisheries say it kills the fish if you leave gates closed too long but the fish get washed into swamps and die anyway with gates open. Fish kills happen with dirty water coming off flooded land”.

5.2.6.6 Drainage unions

Of the total survey population 93 (32%) refer to a drainage union (DU) in their region. The majority refer to ‘formal’ drainage unions, while a minority of 15% refer to ‘informal’ landholder unions. 15% of the 93 refer to their DU in positive terms, while 15% refer to their DU in overtly negative terms. The remaining respondents did not provide any comments.

The Macleay catchment which was principally beef farmers were the major category citing frustration with their drainage. The Macleay had the most involvement with the formal
drainage union and the least with the informal groups. The Clarence had the lowest involvement with drainage unions followed by the Hunter. The Shoalhaven had no drainage unions, management of the drains was handled by the council.

Below is a summary of the categories:

**Positive comments on drainage union.** Following is a summary of comments made by landholders who were satisfied with their drainage union and drain maintenance;

- refer to 'non-formal' organisations of landholders who share costs and work on drain upkeep together
  
  *Tweed, cane, *[There’s a] group of farmers who join together … spray drains etc. Each is allocated a section of land … [it’s] free labour but [we’re] reimbursed for chemicals, etc*.

- appreciate the support of their DU meetings
- feel satisfied with the service they get for paying DU fees
- satisfied with own level of participation and group support

  *Manning River, dairy, *“There’s a privately arranged, mutual agreement among the land holders here who benefit from this drain to share the costs of upkeep*”

- Drainage unions engage in extended maintenance tasks also eg: water quality testing

**Negative comments on drainage unions.** Following is a list of the comments and sentiments expressed by landholders who were not satisfied with the operation of their DU or drain maintenance;

- complained about internal squabbles, personal and political conflicts

  *Macleay, beef, *“…last time drains were cleaned out there was a clash between land holders and union so only some sections got cleared*’.

- accusations of mismanagement of funds and of bad decision making
- feel they don’t get value for the fees they pay into the union
- dissatisfied with the maintenance that the union does provide
- don’t feel their DU had enough political force, or believes their DU was ineffective due to lack of funding

**5.2.6.7 Drains on the property (non union)**

Landholders were asked a series of specific questions that related to private drains on their properties. When asked; ‘Do you use lime on your drains?’ and, Do you control water levels by weirs? (eg: sandbags, drop boards, crossings) 48 landholders responded that they did use lime on their drains. 20 landholders controlled water levels.
5.2.6.8 Drainage suggestions

The following is a listing of a number of specific suggestions made by respondents with regards to drainage or floodgate management issues. Distinction was made between changes required either “on” or “off” the farm. The final section addresses a number of responses that pose direct questions, highlighting the specific concerns of landholders as they relate to drainage issues.

Drainage in need of ‘on-farm’ modifications. 31% suggested that their on-farm drainage needed alteration. When asked what type of changes respondents would need to make, the following suggestions were offered:

- increase the number of shallow-wide drains, dish drains and surface drains
- increase area converted to laser levelling and reduce draining generally
- re-route existing drains, use a pump to redirect drainage
- alter grading of sides of drains, (eg: ‘v’ shaped instead of ‘u’ shaped to allow for easier slashing of weeds)
- clear drains with chemicals rather than mechanically (to avert having to get DAs and pay costs of machine hire)
- retain water with drop boards
- level drains and get rid of hollows
- would like to get a consultant in and get advice on what needs to change

Drainage in need of ‘off farm’ modification. 26% suggested that changes needed to be made to the drainage beyond their property boundaries. The majority of these responses were concerned with ‘drain clearance’ issues. The next most common concern was with the control of flood gates in the catchment. The following list compiles the range of concerns and suggestions made by respondents regarding these issues;

- believe that council should be held responsible for keeping drains cleared
- believe council’s policy of not clearing drains was erroneous and should be changed
- suggest council should provide drainage unions with more funds to maintain drains
- government departments should be held accountable for “slack” maintenance of drains under their jurisdiction
- suggest investigation of government developments, accused of radically altering drainage flows on private land
- suggest DUs be held accountable for drain maintenance practices
- are perplexed about the logic of legislation that restricts drain clearance, when the farmer’s agenda was simply to clear drains, not make them deeper.
Richmond, cane, “... Why [do we need] ... DA for little shallow drains when council drains cause more problems? ... Don't mind accepting blame if causing [the] problem, but needs proof both sides, need co-operation and communication”.

**General drainage suggestions.** This section addresses a number of responses that pose direct questions from landholders regarding drainage regimes and flood gate management. It highlights the specific concerns landholders had regarding these issues, such as;

- believe floodgates should be specifically modified, for example;

  *Macleay, dairy,* “The flood structure on Kinchela Creek needs to be changed and water directed to the ocean. Dam [the] head of the Macleay to control water flows through catchment”.

- suggest removal of levee banks and cooperation from others up and down the catchment

  *Macleay, beef,* “Belmore River and Kinchela are a dumping ground for water from the Seven Oaks area that is levee banked. Open ...[the] dam gates to let water away”.

- believes re-inundation (opening of floodgates) would be a ‘backward step’
5.2.7 Catchment Management Committees

Catchment Management Committees (CMC) were established in 1989 under the NSW Catchment Management Act. Their statutory responsibility was to regulate the sustainable use and management of land, water, vegetation and other natural resources, on a water catchment basis. Accordingly, their agenda was to assist in the achievement of a balance between resource use and conservation within the constraints of their respective catchments. Survey respondents were asked a series of questions about the committees.

Respondents were asked if they knew whether there was a CMC operating in their area. It was important to note in that in the context of this survey the results were representative of whether landholders perceive a CMC in their region, as opposed to it indicating whether in fact there is, or was not, any such CMC operating.

- over 60% of the Manning catchment responded with ‘yes’
- the lowest response was in the Hunter where just over 20% said ‘yes’
- the Macleay and the Shoalhaven had the largest proportion of ‘don’t know’
- the dairy farmers had the highest knowledge of catchment committees with 60% responding ‘yes’, followed by the cane, tea tree and then the beef farmers.

Of the 131 that answered yes to the above question, (Is there a catchment management committee in your area?), 22 were actively involved in a CMC. The following questions were asked of those who were actively involved, but others chose to answer as well; this explains why the total number that responded to the following set of questions exceeds 22.

Respondents involved with, or interested in, their CMC were asked if acid sulfate soils was an issue of concern to their CMC. Twenty-nine landholders replied ‘yes’ and 23 replied ‘no’.

The survey asked if a catchment, river, or estuary plan was being prepared by the CMC, and if so, whether acid sulfate soils was being considered within the context of that plan. Twenty-four respondents stated that such a plan was being prepared, while 19 replied ‘no’. Similarly, 24 believed that acid sulfate soil issues were being incorporated into the plan, while 16 did not believe that their CMC was considering acid sulfate soils as part of their catchment plan.

Landholders were also asked if they were aware of any other groups in their region that were focussed on acid sulfate management issues, such as a landcare group or local action committee. A similar picture emerges as that found in the analysis of CMC awareness and involvement. The Manning catchment returns the highest number of responses when asked if there were any other regional groups focussed on the acid sulfate soils management issue. Respondents from the Richmond and Tweed catchments also recorded a strong response.
rate for this question. The Shoalhaven recorded the lowest number of landholders aware of any local or regional acid sulfate soils focussed groups.

5.2.7.1 Participation in acid sulfate soils groups

The following question was posed to landholders taking part in the survey who were not involved in land management groups: Would you be interested in becoming a part of an acid sulfate soils or Landcare team within your catchment? Table 17 shows that fairly equal total numbers were either interested or not interested in joining groups in each catchment.

<table>
<thead>
<tr>
<th></th>
<th>Clarence</th>
<th>Hunter</th>
<th>Macleay</th>
<th>Manning</th>
<th>Richmond</th>
<th>Shoalhaven</th>
<th>Tweed</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>20</td>
<td>1</td>
<td>31</td>
<td>6</td>
<td>10</td>
<td>5</td>
<td>7</td>
<td>80</td>
</tr>
<tr>
<td>Yes</td>
<td>17</td>
<td>5</td>
<td>26</td>
<td>3</td>
<td>12</td>
<td>2</td>
<td>5</td>
<td>70</td>
</tr>
</tbody>
</table>

Table 17 Interest to be involved in community groups by numbers in each catchment

Why people were interested in joining groups. In order of frequency of citation, the following list is a summary of reasons why people indicated they would be interested in participating in a group focussed on acid sulfate soils issues. While the majority simply showed a general interest, others indicated that they would be interested, but their participation would be conditional on:

- whether acid sulfate soils affected their land or not
- if they had the time
- if it was a "good" or "properly organised" group
- if they could get along with others and it didn’t get “too political”
- if the focus of the group also addressed land management issues they felt needed attention, such as arresting riverbank erosion.

Similarly, a major proportion of respondents indicated that their participation would be based on fulfilling their own agendas, such as:

- correcting what they perceive as misinformation from environment groups
- to eliminate misinformation and “scaremongering”
- to keep an eye on what others get up to.

Many indicated that they would be interested in participating in such a group on the basis of the benefits they perceived might result from their participation, such as:

- to better enable them to "look after the land"
- to gain experience and knowledge in the management of acid sulfate soils
- because they felt it was important to “do your bit”
because they were personally affected by acid sulfate soils
- to help increase production levels on their own land
- some stated directly that they would like to be part of a landcare team
- they would like the opportunity to discuss the issues with colleagues and learn more about it
- because they feel it would be good to "have a say" and keep up with the issues.

_Macleay, dairy, 'Better in a group than out of it!'_

**Why people were not interested in joining groups.** In order of frequency of citation, the following list is a summary of why people indicated that they were not interested in being involved in a group focussed on acid sulfate soils issues. The vast majority of these respondents felt that the acid sulfate soils issue was of no relevance to them, therefore they saw no point in being involved in such a group. Involvement in such a group held no relevance for them because:

- acid sulfate soils did not affect their land
- they were not interested in the issue
- they had nothing to gain by being involved
- they had their own management under control
- their own industry group (cane) had the issue under control
- they were too old to be involved
- they didn’t have enough time

A significant proportion of these respondents cited their lack of faith in the operations of such groups as their reason for not being interested in participating in them. They felt that they were:

- too political and didn't want to be involved
- they thought it would cost too much money to be involved
- believe it would be run by “ferals” and “greenies”, and hence be politically biased
- they believe other land management issues were a greater priority
- believe such groups just “stir up trouble”
- don’t want to be told by people who “have no experience” how to run their farms
- are “allergic” to meetings
5.2.8 Information Sources

Survey respondents were asked how they gained information on acid sulfate soils. Table 18 shows the results. The effectiveness of a cohesive industry body in distributing information to their members was clearly shown by the cane industry response to their information strategy. The cane and tea tree industries were accessing more information than the beef and dairy groups. Information was presented in order of those sources most cited across all industries. The respondent could tick multiple boxes therefore each answer to information sources within each industry was a percentage of 100%.

- seventy-one percent of cane farmers stated that their industry provided them with information on acid sulfate soils, followed by 66% of tea tree farmers
- only 9% of the beef farmers get information from industry bodies
- newspapers and colleagues were an important source of information, for all industries
- the government was an important source of information for all groups except the cane farmers
- colleagues and TV and Radio had similar penetration across all industries and were very close in levels of penetration
- field days and leaflets were another major source of information for the tea tree farmers (48%) and cane farmers (36%), but only 16% of beef and dairy farmers cited them
- workshops and field days were as available to the beef and dairy farmer as they were to the cane and tea tree farmers
- newspapers, colleagues and radio and TV were evenly accessed across all industries and therefore act as control groups
- the median shows that tea tree farmers (38%) were accessing more sources of information than any other group, followed by cane (34%), dairy (31%) and beef (19%)

<table>
<thead>
<tr>
<th>Source of information</th>
<th>% of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>beef</td>
</tr>
<tr>
<td>industry</td>
<td>9</td>
</tr>
<tr>
<td>newspapers</td>
<td>43</td>
</tr>
<tr>
<td>government</td>
<td>27</td>
</tr>
<tr>
<td>colleagues</td>
<td>31</td>
</tr>
<tr>
<td>TV and Radio</td>
<td>33</td>
</tr>
<tr>
<td>field days</td>
<td>16</td>
</tr>
<tr>
<td>leaflets</td>
<td>19</td>
</tr>
<tr>
<td>workshops</td>
<td>7</td>
</tr>
<tr>
<td>newsletter (ASSAY)</td>
<td>9</td>
</tr>
<tr>
<td>%median</td>
<td>19</td>
</tr>
</tbody>
</table>

Table 18 How landholders gain information on acid sulfate soils
The pamphlet, “Introduction to Acid Sulfate Soils” (Sammut and Lines-Kelly 1997), was distributed to cane farmers at the same time that they had their properties soil sampled. The NSW Sugar Mill Co-operation initiated this sampling procedure in late 1997. Over 60% of the 105 cane farms that participated in the benchmarking survey (see Table 19) had been tested at the time the survey was conducted in May 1998. Landholders could also access the pamphlet through NSW Agriculture and other government agencies. The survey questioned landholders as to whether they had seen the pamphlet (see Table 20). If they responded negatively to a sighting of the pamphlet, they were asked if they would like to have one sent to them. There were 183 survey respondents who had not seen the pamphlet and of these 182 accepted the offer.

<table>
<thead>
<tr>
<th>Number Sampled</th>
<th>Clarence</th>
<th>Richmond</th>
<th>Tweed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>29</td>
<td>25</td>
<td>13</td>
<td>67</td>
</tr>
<tr>
<td>No</td>
<td>18</td>
<td>11</td>
<td>9</td>
<td>38</td>
</tr>
</tbody>
</table>

Table 19 Number of cane farm who had been tested for acid sulfate soils in May 1998

<table>
<thead>
<tr>
<th>beef</th>
<th>cane</th>
<th>dairy</th>
<th>tea tree</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>35</td>
<td>20</td>
<td>48</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 20 % of sightings of acid sulfate soils pamphlet by industry

5.2.9 Attitude to Acid Sulfate Soils Issues in the Wider Community

This section presents an analysis of farmer’s attitudes towards the wider community, and identified community groups, in the context of managing the acid sulfate soils issue. Individuals surveyed were inevitably part of a broader social grouping that was responding in some way to the management challenges posed by the presence of acid sulfate soils in the environment. The aim of this part of the survey was to ascertain the type of impact the acid sulfate soils issue was having on the relationships between landholders and the wider community. The importance of the analysis was that it contributed to an understanding of how different communities were responding to the social and ecological challenges posed by acid sulfate soil.
Respondents were asked what level of importance they thought the wider community placed on acid sulfate soil related issues. Figure 21 indicates that, from the perspective of the landholders surveyed, there was a high level of appreciation of the importance of acid sulfate soils issues within their community. The beef farmers were most likely to believe that the issues were not of great importance to their local community. This response, however, was registered from only 30% of the total beef farmer population. From the perspective of the tea tree farmers, they believe that their community places a high degree of importance on acid sulfate soils and the management challenges it poses.

The following two sections (positive and negative attitudes toward community groups) present a closer analysis of farmer attitudes towards groups within their community. This analysis was based on the responses generated by specific questions on ‘attitude’ and ‘community’ in the survey (see Q12 and Q13 in Appendix I), and on general comments offered by respondents in discussion throughout the survey.

5.2.9.1 Positive attitudes towards community groups

Of the total population surveyed 22% responded with a positive attitude when asked their opinion about other groups in their community Figure 22. The category was presented in two groups; ‘others informed’, and ‘sympathetic to others’. Definitions and summaries of the main characteristics of these two groups follow:
Others Informed. 50% of the ‘positive’ respondents believed that other groups in the community were adequately educated and informed about acid sulfate soils issues. They tended also to believe that their own industry was well informed about acid sulfate soils. The cane farmers were a notable group in this category.

Clarence, cane, “I think everybody would have had to of heard of it by now. Would have to have your head in a hole to miss it”.

![Industry attitude v interest groups](image)

**Figure 22 Qualitative analysis of farming industry attitude to community groups**

**Sympathetic to others** The other 50% showed a willingness to view the acid sulfate soils issue from the perspective of other groups in the community;

- concern for fisheries and oyster groups
- acknowledgment that community groups need to work together
- concern for the natural environment being impacted by farm based activities
- concern for other farm groups

Macleay, beef, “It’s getting a pretty major issue here, the Council’s trying to make us aware. It’s more an issue for the dairy farmers. Not so much for beef, they’ve already had hard times and have got other jobs, so they’ve got a buffer. The dairy people, that’s their livelihood”.

5.2.9.2 Negative attitudes towards community groups

This section provides an overview of the range of negative attitudes expressed by the survey respondents regarding the role of acid sulfate soils issues in their community. It provides an indication of levels of community, or political, disharmony in a region. It also presents fears and uncertainties some respondents had regarding acid sulfate soils issues. The larger
proportion of this section is preoccupied with general negative attitudes that landholders had towards other community groups, (see Figure 23) and analysis of the foundations of those attitudes. The second part of this section looks more specifically at groups in the community that landholders believed were not informed about acid sulfate soils issues.

Figure 23 Qualitative analysis of farmer’s negative attitudes towards community groups

**Others not informed.** The respondents in this section (27%) feel that other groups in the community were not informed about the acid sulfate soils issues. They specifically perceived a need for:

- ‘other’ farm groups to become more informed, eg: tea tree farmers
- more education of target groups, eg: ‘green’, ‘fisheries’, ‘media’, and community organisations, to reduce sensationalism of ‘misinformation’
- more media emphasis on positive efforts of landholders (the cane community in particular resent media negligence of their efforts)
- more education on acid sulfate soils issue for the urban community, to achieve a sense of a ‘shared problem’ rather than landholders being left with responsibility

Macleay, dairy, “… [there’s] so many newcomers … all the new guns, the experts, they’re not talking to the old farmers. They’re getting the wrong information across. They reckon it’s good land ruined. We have to live off it, we have to look after it, we’re not ruining it”.

- ‘more science’ from independent bodies to reduce uncertainty and restore trust in debate
- more education of acid sulfate soils issues in schools
- more education for ‘new’ and ‘hobby’ landholders
Macleay, beef, "... some care, some don't. Some just buy the land for investment, they don't care about acid sulfate soils. Because they don't have to get a living off of it, so they don't look after it".

Negative toward others. Of the total survey population 60% recorded a statement reflecting a negative attitude. Response themes common throughout the ‘negative attitude’ category include;

- land based farming interests conflict with 'greenie', or 'fisheries groups'
- perception of a cultural divide between farming community and urban, or city dwellers
- governments priorities urban and city needs at expense of rural community
- stringent government regulations were applied to landholders because they were ‘easy targets’, while ‘other’ developments were not regulated
- frustration with groups who misrepresent landholders, eg. the media
- scepticism of and lack of trust in government ‘experts’, ‘academics’ or bureaucracy
- ‘other’ farmer groups variously were thought to be irresponsible land managers, eg.; ‘new’, 'old', 'hobby', 'cotton' and ‘tea-tree’ farmers

This section discusses the negative comments that were targeted at specific community groups, namely; the urban community, fisheries, the government, greenies, the media, and other farmer groups.

- fishers received negative responses from 20% of cane farmers and almost 25% of cane farmers responded negatively about the general community (in both cases their percentage exceeds other groups by a clear 10%)
- cane and tea tree farmers were the most negative about the media, with about 12% and 14% of respondents each
- cane farmers also made the most consistent contributions of negative comments about community groups
- over all, the dairy farmers contributed the least number of negative observations on the rest of their community, they did however contribute as strongly as all other groups to the negative comments offered about ‘the government’
- negative comments about ‘the government’ received the most number of contributions from all industry groups.

Following is a summary of the negative statements and attitudes reflected by respondents about other community groups.

General Community. This category 30% of negative comments includes any references to ‘city’, or ‘urban’ community. It also includes references to mechanisms that represent the
broader international community, such as ‘multinational corporations’. Farmer’s perceptions of these groups were characterised by the following sentiments:

- they don’t care about problems facing landholders
- the cultural divide between urban and rural populations is a national problem
- they were quick to blame landholders while ignorant of problems landholders faced
- urban developments were not regulated for environmental standards, while landholders had strict laws regulating their land use activities

Clarence, beef, “[I] think they’re fairly ignorant, whole community needs to be aware of difficulties that are being imposed. Equally important to make urban area aware too … needs to accept they’re imposing pressure”

**Government.** This group, 22% of negative comments, directed their comments at governments, ‘experts’ and ‘academics’. Characteristic sentiments of this group of landholders included:

- they resented perceived ‘double standards’ in application of government regulations on land use activities

  Tweed, cane, “... council is bad ... tell us do things but don’t follow through themselves ... [they] set [a] bad example. I don’t see council liming when excavating...”.

  - they believed local councils and government authorities were negligent with acid sulfate soils
  - they believed the acid sulfate soils problem was caused by past governments (eg: Flood Mitigation scheme), so the present one should take responsibility for rectifying it

  Macleay, beef,”... the Government should pay because it was the Government’s Flood Mitigation Drainage policies in the first place that have caused the problem...”.

  - they felt alienated from government ‘experts’, ‘bureaucrats’ and ‘academics’, who were unable to communicate with them, and therefore they lacked trust in ‘expert’ recommendations

Macleay, beef, “[I’m] angry ... devastated ... government regulations stop making a living possible ... [it’s] too expensive to do anything to acid sulfate soils. ... [I’m] head down arse up trying to make a quid. Academics and greenies make fools of farmers ... because farmers haven't time to learn details and aren't any good at public speaking. Some arguments are right ... for example genuine wetlands ... [but there’s] no compensation for land taken for wetlands...”.

**Fisheries.** This group 20%, refers specifically to the fisheries and oyster industries. They consider that fishing was a ‘new’ industry and fisheries were uninformed about the ecological history of the region.
Manning, dairy, "... oyster and fisheries industry in [the] area are quick to point the finger, ... they've only been in the area ten minutes and they're telling us what to do ... they need to take a look at their own practices ... over fishing ... land holders are being used as scapegoats”.

Richmond, cane,"...Fishermen should be doing more, they fish the place out, but they point The finger at us, yet they're one primary that doesn't seem to put anything back into the system”.

- fish-kill events had been happening since settlement and were a natural event

- current practices of the fisheries industry were unsustainable

Clarence, cane, "... The fishing industry don't own the area they're fishing ... [they] have no capital invested in the area they're working in so [they] have no right to interfere with people who have and should not get so much government support. ... acid sulfate soils has been [here] forever ...”.

Greenies. This group, 14% refer to varying notions of ‘greenies’, which incorporated ‘ferals’, ‘alternative life-stylers’, ‘environmental organizations’ generally and Landcare groups. Some comments by this group were negative with regard to environmental groups who landholders perceived as prioritising ‘conservation’ oriented issues at the expense of focussing on acid sulfate soils issues. In the main, however the farmer views expressed here were concerned with anti acid sulfate soils sentiments, and believe that these groups;

- sensationalise negative aspects of acid sulfate soils (eg. fish-kills)
- were too quick to place blame for negative environmental conditions on landholders,

Hunter, dairy, “The farmers are really wary of greenies and talk of wetlands. We like wetlands and look after our county, but we're not getting any support ... just being told we're the problem. ... we really just want the drains cleared so we can keep producing off our land. It's not just for us, it's for the whole community and country ... we're not just producing for ourselves”.

Media. This group, 14% refers specifically to the media and the press. Accordingly they;

- are sceptical about the role of the media
- believe the media sensationalises negatives of acid sulfate soils (eg. fish-kills)
- project a negative image of landholders, ignoring positive efforts by landholders
- take issues out of context and manipulate facts

Richmond, cane "[I] think as a whole [community]] tends to get one sided point of view through media ... fish kills on TV. Many [are] people guessing, ... saying it's us killing fish ... it [has] occurred naturally for years, but [the] media point to agriculture ... Our group responded to the drain problem but that doesn't reach papers".
5.2.10 Conclusions from Farmer Survey

For industry and catchment summaries see Appendix III Farming Community ideas about the way forward, Pages 10 to 13. All of the farming groups surveyed were characterised by the following observations;

- awareness was moderately high but knowledge levels were much lower
- there was a low level of water testing practiced by all industry groups;
- two hundred and sixty one had drains on their properties or in their local catchments and 220 respondents had drains attached to floodgates on their properties or local catchment; 114 had an active land holder group who manage their floodgates and drains;
- only one third of landholders knew what the height their property was above sea level, of these, 80% were at or less than 2 metres;
- perceiving a direct benefit in terms of increased on-farm income was an important factor that motivated both the cane and dairy industry groups in their use of lime, a gain the beef farmers do not see;
- important information sources across all groups, were newspapers (40%) and colleagues (30%) also important but to a lesser extent, TV and radio (30%);
- government agencies supply an important source of information (predominantly via TV and radio) for all groups except the cane industry (71%) which along with the tea tree (66%) industry provides their groups with more information on ASS than any other source;
- there was a lot of confusion over the process of having to attain development approvals through local government to clear drains.
- there are high levels of negative attitude towards community groups
5.3 GOVERNMENT SURVEY

Vanclay and Lawrence (1995) consider that a survey such as this is based on the premise that landholders themselves were best placed to know the nature of the challenges they face, and likewise, government employees were similarly placed with respect to the issues they faced. The following analysis was based on a survey of government employees and their perceptions of the issues and challenges associated with the management of acid sulfate soils. The surveys were completed at the end of workshops, where one day training sessions about acid sulfate soils were conducted. The emphasis of this training was to raise awareness about acid sulfate soils and to alert government employees, particularly local government, about current regulations and the legal implications of disturbing acid sulfate soils and the need for councils to introduce local environmental plans (LEP’s).

5.3.1 Sampling Strategy

The workshops were conducted in three locations; Port Macquarie (mid NSW coast) which had 11 respondents, Grafton (north NSW coast) which had 21 respondents and Moruya (south NSW coast) which had 15. The workshops were widely publicised within government circles, but attendance was optional and at the discretion of the agency. The workshops were designed for government departments who had to deal with acid sulfate soils related issues. A total of 48 completed responses were collected after the workshops (see Appendix II for a copy of the survey).

Table 21 shows the breakdown of departments who sent representatives to the workshops. The acid sulfate soils issue was of most interest to NSW Agriculture and Department of Land and Water Conservation (DLWC) and it should be noted that 62% of the responses analysed in this survey were from these departments.
Table 21 Government organisations attending focus groups

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Number attended</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW Agriculture</td>
<td>15</td>
</tr>
<tr>
<td>Dept. of Land and Water (DLWC)</td>
<td>15</td>
</tr>
<tr>
<td>NSW EPA</td>
<td>2</td>
</tr>
<tr>
<td>National Parks</td>
<td>2</td>
</tr>
<tr>
<td>Dept Public Works and Services</td>
<td>1</td>
</tr>
<tr>
<td>Lower South Coast CMC</td>
<td>2</td>
</tr>
<tr>
<td>Private consultants</td>
<td>1</td>
</tr>
<tr>
<td>QLD Mains Roads Dept</td>
<td>1</td>
</tr>
<tr>
<td>QLD Dept. of the Environment</td>
<td>1</td>
</tr>
<tr>
<td>Local Council</td>
<td>10</td>
</tr>
</tbody>
</table>

5.3.2 Knowledge about Planning and Management

The understood relationship between state agency employees and the farming community was one in which the former provide guidance and information upon which the latter may base their farm management decisions and practices. Successful achievement of this outcome was based on the assumption that agency employees were equipped with the appropriate knowledge regarding resource management problems. Questions posed by the survey of this group were asked in order to ascertain the current status of knowledge that agency’s employees had with regard to acid sulfate soils identification and management techniques after they had completed a one day course that introduced them to the basic concepts of acid sulfate soils.

5.3.2.1 Importance of acid sulfate soils issues

Ninety percent of respondents replied positively when asked ‘Do you identify acid sulfate soils as an issue to be considered in planning and management of properties for agricultural production?’ To gain a further understanding of this response, respondents were also asked to comment on the importance of acid sulfate soils issues in their current position and how much time they spent on acid sulfate soils work.

- there was a slight trend of people finding acid sulfate soils issues more important to their organisation than it was in their own position
- overall the highest response was that acid sulfate soils issues were very important in both the organisation and their own position
- survey respondents anticipated that they will be spending more time on acid sulfate soils issues in the next 12 months (Figure 25)
5.3.3 Local Environment Plans

Only five respondents responded ‘Yes’ to the question ‘Do you have an acid sulfate soils local environment plan (LEP) in your council?’ and 17 responded ‘No’ and 18 responded ‘don’t know’. The 17 respondents who responded ‘No’, were asked to comment on how long they thought it would be before their local council had an LEP (see Table 22). Of these 17, only 13 could provide an indication of a commencement or completion time for an LEP.

<table>
<thead>
<tr>
<th>commence one in</th>
<th>number</th>
<th>complete one in</th>
<th>number</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>1</td>
<td>6 months</td>
<td>1</td>
</tr>
<tr>
<td>6 months</td>
<td>1</td>
<td>1 year</td>
<td>1</td>
</tr>
<tr>
<td>1 years</td>
<td>4</td>
<td>18 months</td>
<td>0</td>
</tr>
<tr>
<td>18 months</td>
<td>2</td>
<td>2 years</td>
<td>2</td>
</tr>
<tr>
<td>2 years</td>
<td>0</td>
<td>3 years</td>
<td>1</td>
</tr>
<tr>
<td>don’t know</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 22 Time until acid sulfate soils LEP in council?

What assistance do you think State Agencies can provide to facilitate the timely introduction of an acid sulfate soils LEP? Respondents here primarily believe that the role of state agencies was to provide information and guidance to land managers, local councils, internal staff and officers, as well as the community at large, to assist in the construction of acid sulfate soils local environment plans (LEPs). Consistent references were made to the need for ‘better’ and more detailed maps of acid sulfate soils distribution, clearer ‘guidelines’ for management, and the establishment of ‘standards’ in those guidelines. These responses reflect the belief that state agency authority in the context of LEP construction was based on their ability to provide certainty with regard to acid sulfate soils management. The tools considered necessary for this purpose, as noted in the survey responses, include; detailed
maps of acid sulfate soils distribution and depth, ‘hazard’ levels, ‘checklists’, ‘protocols’, ‘standards’, and ‘precise and concise’ information. In this context, aspects of the acid sulfate soils issue that were not well understood, or that could not be expressed with certainty were considered unhelpful. This set of responses also called on state agencies to make a commitment to education of the general community, land holders, councillors and government employees about acid sulfate soils issues. A summary of the types of assistance that respondents felt state agencies should provide in the construction and implementation of acid sulfate soils LEPs is listed below.

**Provision of information.** Better mapping and identification of problem areas; include ‘hazard’ levels guidance on interpretation of mapping.

**Management guidelines.** Planning criteria and call for development of ‘standards’ should be specific to local conditions (including development limitations) so presentations can target local councils and their future plans of action; provision of an ‘easy to follow’ protocol of assessment; rules for management; provide more information on drainage and cropping constraints.

**Raise awareness / knowledge of acid sulfate soils issues generally.** Provision of training, manuals and expertise; provision of ‘precise and concise’ information, workshops and field trips to council and community; education of the public and assistance with publicity; education of land holders / users re hazards and rehabilitation methods.

**Staff support.** More moral and technical support, training and information improve extension service with provision of on site advice and testing

**Interaction with local government and council.** State agencies should encourage greater local government participation in local environment plan regulation by:

- facilitation and implementation of acid sulfate soils local environment plans should be done through state environment planning policy
- State agencies should ‘educate’ local government on ‘folly of doing nothing’
- State agencies should provide courses for council staff and councillors
- provide councils with guidelines on assessment and management plans for acid sulfate soils
- provide councils with assessments of profitability of management plans

### 5.3.4 Catchment Management Committees

Respondents were asked to comment on the local Catchment Management Committee (CMC). Sixty six percent of respondents had a CMC operating in their sphere of responsibility. Of these respondents, half said that acid sulfate soils was an issue and half
said that an estuary plan was being prepared. However only 18 said that acid sulfate soils was being considered in the plan.

Respondent were asked if there was an acid sulfate soils action group in their area of responsibility. Eighteen percent of respondents (9 of 48) responded positively. Five respondents felt that a local acid sulfate soils action group should be formed. Sixty percent of respondents said they would be interested in becoming a part of an acid sulfate soils team.

Involvement in drainage unions was also ascertained. Forty-three percent of respondents (21 of 48) stated that there were drainage unions or other organisations involved in drainage or flood management in their area. Thirteen respondents said these unions were involved with a CMC or acid sulfate soils group and ten respondents said they were involved with other planning in the catchment.

Respondent were asked *What role should State Agencies take in developing integrated catchment plans?* (DLW, EPA, DUAP, NSW Agriculture, NSW Fisheries). A number of respondents (9 of 48) believed that the role of state agencies in developing integrated catchment management plans was primarily one of providing expertise. Of equal importance (also 9 of 48) was the concern that State Agencies should bear the responsibility for ensuring, communication, coordination and collaboration within their own divisions. These respondents also stated that State Agencies should be responsible for ensuring coordination between the various external agencies and interest groups dealing with the development and implementation of catchment management plans. One of the roles of state agencies was perceived to be to educate the general community about issues relevant to catchment plan construction. An interesting contrast on this issue was presented by the two following statements, which reflect respectively; the concern by government employees that community politics had too much influence in the drafting of plans,

“… steer the general community but stand firm on government policy, technical issues rather than ending up with plans driven [or] misguided by politics”

and alternatively, the perception that state agencies should encourage greater political involvement from community groups in plan construction.

“… assisting the formation of community action groups which include state agency and local government representation”

Following is a summary of the recommended roles that State Agencies should adopt in the development of catchment management plans;
Provide education, expertise and support (10 citations). Technical assistance and advice, consultations and evaluations, field days and extension; set standards for land use issues; educate general public, raising awareness.

Coordination close collaboration with CMCs, local governments, land users (farmer and developers) and community (9 citations). Ensure inter agency operations, plans, strategies and functions were collaborative, consistent and complimentary, working in co-ordination, not independently; development of vision, goals, facilitation and initiation of plans and strategies; legislation, policy creation, develop recommendations and roles for specific agencies; ASSMAC - major role in provision of expertise and development of catchment plans; EPA – regulation; DUAP - providing planning legislation; NSW Ag. - education of landowners - promote relating production with sustainability - provide advice on impacts of agricultural activities on acid sulfate soils; DLWC - providing information - working with local groups - responsibility for CMC

5.3.5 Information Sources

Table 23 shows how survey respondents gained information on acid sulfate soils in order of most frequently cited source.

<table>
<thead>
<tr>
<th>Source of information</th>
<th>% of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>workshops</td>
<td>72</td>
</tr>
<tr>
<td>leaflets</td>
<td>64</td>
</tr>
<tr>
<td>colleagues</td>
<td>62</td>
</tr>
<tr>
<td>acid sulfate soilsAY</td>
<td>48</td>
</tr>
<tr>
<td>government</td>
<td>44</td>
</tr>
<tr>
<td>field days</td>
<td>33</td>
</tr>
<tr>
<td>acid sulfate soilsST</td>
<td>25</td>
</tr>
<tr>
<td>newspapers</td>
<td>23</td>
</tr>
<tr>
<td>TV and Radio</td>
<td>17</td>
</tr>
</tbody>
</table>

Table 23 How information was gained on acid sulfate soils by government personnel

Workshops were the most frequently cited source. When asked how they would like to get more information on acid sulfate soils, workshops, field days and leaflets were equally indicated (60%) as the source for more information about acid sulfate soils. The internet was indicated by 44% of government survey respondents.
5.3.6 Training

This section discusses the training requirements of the survey respondents attending the workshop. Table 24 is ordered by most cited across all categories, excluding ‘% been trained’.

<table>
<thead>
<tr>
<th>In order of most cited information requirements prior and post workshop</th>
<th>Prior to workshop</th>
<th>Post workshop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%been trained</td>
<td>%need training</td>
</tr>
<tr>
<td>1</td>
<td>remediation techniques</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>preparing management plan</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>DA assessment of issues</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>lime application rates</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>management of acid sulfate soils</td>
<td>33</td>
</tr>
<tr>
<td>6</td>
<td>monitoring sites</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>fish kill protocols</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>legislation</td>
<td>11</td>
</tr>
<tr>
<td>9</td>
<td>interpretation of risk maps</td>
<td>39</td>
</tr>
<tr>
<td>10</td>
<td>recognising field indicators</td>
<td>46</td>
</tr>
<tr>
<td>11</td>
<td>soil / pH tests</td>
<td>35</td>
</tr>
</tbody>
</table>

Table 24 Training requirements for government employees

The table shows the areas of acid sulfate soils issues respondents had been trained in and need further training or information in. ‘Interpretation of risk maps’, ‘recognising field indicators’ and ‘soil pH test’ had the highest levels of prior knowledge. In contrast, ‘remediation techniques’, ‘preparing management plans’, ‘DA assessment of issues’ and ‘lime application rates’ was not an issue that many survey respondents had been trained in. After the workshop, the respondents were continuing to request training in these issues. The ongoing need for training would appear to reflect the complexity of the issues and increased awareness about the importance of managing the issue. This is explored further in the next section.

Respondents were asked, What issues have you found most relevant to your particular situation today? The key features of the workshop that respondents felt were of the greatest benefit and most relevant to their needs were learning about the basic information regarding acid sulfate soils identification (19 of 48), monitoring and management (21 of 48). In particular, discussions on the various management options and strategies was felt to be by far the most relevant information. Other features of the workshop felt to be of benefit were field displays, learning about relevant regulations and opportunities to network with people working with acid sulfate soils. Some noted that they would have liked more emphasis on practical applications of acid sulfate soils remediation and illustrative case studies.
Respondents were asked, *Do you intend changing any of your procedures after today’s workshop?* Just over half of the respondents (26 of 48) indicated that they would change their current practices in response to the material presented to them in the workshop. The types of changes they propose making predominantly involve:

- incorporating their higher awareness of the acid sulfate soils management issues into their own assessments
- dealings with land holders and extension staff
- increase awareness of issues and presence of acid sulfate soils, incorporating provisions from guidelines into strategic advice
- emphasise potential hazards associated with acid sulfate soils in developments
- drafting of relevant policies such as DAs
- will integrate chemical and mechanical drain clearing activities more closely
- a smaller proportion (5 of 48) indicated that they would not be changing their current practices, some of whom noted that their existing level of knowledge of acid sulfate soils management issues had not been improved by attendance to the workshop.

The statements in this category reflect a positive attitude in that government employees were willing to change current practices in response to a raised level of knowledge regarding acid sulfate soils identification and management. Accordingly, it would seem that the current levels of awareness of acid sulfate soils issues among Government employees was only ‘medium’.

Respondents were asked, *Does your organisation provide guidance to your engineers or field staff on managing the disturbance of acid sulfate soils?* The quantitative data associated with this question shows that over half of the respondents (27 of 48) indicated that they felt their organisations did provide field officers with appropriate guidance in managing the disturbance of acid sulfate soils, while only 8 felt that they did not. Respondents were asked to provide examples of such guidance. The examples provided are summarised; advisory officers were informed of management principles; guidance was provided in; the preparation of rehabilitation plans, plan reviews, plan implementation; provision of courses, workshops, training; access to expertise made available if required; access to acid sulfate soils maps and assistance with map interpretation; guidance provided in the management of flood mitigation structures; conditions constituting DAs serve as a guide. A small number of responses indicated that insufficient guidance was provided from organisations; one respondent cites the current workshop as the only source of guidance.
and one respondent states that guidance from their own organisation was ‘limited’ and that
they rely on workshops provided by other agencies.

Respondents were asked, *Do you have any other comments about management of acid
sulfate soils?* Of the total number surveyed, when asked if they had any additional comments
to make about the management of acid sulfate soils, 10 of the 48 individuals surveyed
responded with statements reflecting concern about the current state of knowledge or
management of acid sulfate soils, or requested help with specific issues. Two key
statements, cited below, perhaps best reflect the root cause of these concerns and may
characterise the nature of the challenge facing Agency employees in their extension work
with landholders. The first statement refers to the concern Agency employees had with
comprehending the nature of the acid sulfate soils problem itself. The second statement
expresses concern about dealing with the management needs of the acid sulfate soils
problem, but further, that this challenge was compounded by the growing number of other
environmentally and socially complex management problems.

“We need an improved level of access to experts at the ASSMAC technical
committee in order to obtain a consensus of views on the new developing
remediation techniques”

“Too many people in acid sulfate soils don’t have the depth of understanding
required to comprehensively assist clients. Probably a function of the diversity
and volume of other environmental management issues needing attention”

5.3.7 Government Survey Conclusions

Respondents reflected a positive attitude towards the workshop in which they took part.
They were particularly appreciative of the information that the workshop provided them with
regarding acid sulfate soils, such as identification skills and techniques of monitoring and
managing ASS. While the responses from individuals as recorded here reflected a positive
attitude in receiving fundamental information regarding the identification and management of
acid sulfate soils, it would also seem to reflect a significant proportion of individuals working
in government agencies that were not informed about aspects of acid sulfate soils
identification and management options. Issues highlighted by responses to workshops were:

- preparing management plan,
- DA assessment of issues;
- monitoring sites;
- legislation ie Clean Waters Act;
- interpretation of Risk Maps;
- soil / pH tests

There would seem, on the basis of this survey, to be a case for arguing that there was room
for improvement of the levels of knowledge and awareness of acid sulfate soils
management issues among government employees. Once armed with this information they were clearly willing to employ their new knowledge. Their positive response to the information provided in the workshop, and willingness to change their practices accordingly, would suggest also that there remains significant potential for improvement of acid sulfate soils identification and management within government agencies, and hence in the field as that expertise was disseminated into the broader community.

5.4 OYSTER SURVEY SUMMARY

This survey was conducted during May 1999. The survey was executed by Roberta Dixon, from Ocean Watch during the course of workshops held in NSW coastal catchments where oyster farmers grew oysters. There were 39 respondents and they completed a survey after the workshop. A synopsis of the results is presented here.

The surveyed oyster farmers appeared unsure as to whether it was acid water or other runoff pollution that was adversely affecting oyster yields and health. What was evident was that oyster farmers were going out of business as a result of lower yield, which was impacting on their income. Local oyster farmers in the Richmond explained to me that oysters were like frogs, they’re very good indicators of a systems health. If they’re unhealthy, it’s likely the ecosystem is as well, because oysters were static and filter water to feed. If the water was polluted they closed up and stopped eating and growing. Oyster farmers said this was when they were most prone to disease. Healthy clean rivers resulted in healthy oysters and good sales, ‘the waterways were the life force of our areas’. There was considerable friction noted between the fishing industry and the landholders. Fish were not good indicators, because its difficult to ascertain how many fish there are in a river catchment, and therefore if there were less fish, it’s difficult to know why. Is it due to bad management practices resulting in over fishing, as suggested by land farmers or due to acid sulfate soils runoff, as suggested by the fishermen?
5.5 REFLECTIONS AND CONCLUDING REMARKS

This chapter has presented the results from two stakeholder groups, the landholders and the government. Appendix III has additional information concerning the survey results including suggestions from the farmer respondents for managing acid sulfate soils, commonly asked questions and reasons for refusals to participate in the survey. Results from the excavator contractor’s survey are summarised in Appendix III, Farming community ideas about the way forward, page 21.

How useful was the survey in involving and capturing data? It was not possible to survey all the individuals and groups who were connected to acid sulfate soils. The surveys of the government agencies, excavator operators and oyster farmers were completed as adjuncts to workshops and other researchers work. The amount of data generated when qualitative surveys were used was considerable and analysing it was extremely time consuming and therefore fairly expensive. Notwithstanding these costs and time constraints, respondents greeted the data from the surveys with considerable interest.

When I presented the results and the report (Woodhead and Connelly 1998) to ASSMAC in February 1999, the chief scientist said he was amazed that landholders were still coming up with those sort of beliefs, ie, that acid sulfate soils were not causing water problems. He had been working with a couple of lead farmers and he had changed his knowledge base. He assumed everyone else had. There appeared to be an assumption that landholders had read the very basic awareness of acid sulfate soils pamphlet (which does not show how to identify it) or they were reading academic papers, or visiting government offices to find risk maps of acid sulfate soils. From this information they would then know whether they had it on their land or not and believe that they were the cause of water quality deterioration several kilometres downstream! Therefore for the ASSMAC committee it was very revealing, and they stated that they definitely wanted another survey of the respondents. This first presentation to ASSMAC was when I began to understand the potential influence that this data could have on policy development and evaluation, I urged them to focus on more communication and education. This was challenging for some government agencies who preferred developing regulatory frameworks, such as LEP’s. However, while these were applicable to preventing new disturbances of acid sulfate soils, it appeared unlikely that they would have any impact on existing problem areas, indeed I and others feared that they would alienate rather than empower those with areas requiring remediation.
There was another result from presenting the results to ASSMAC. Few read it, most of the members skimmed the report and I realised that if these results were going to have a large impact I needed to present results in a more concise and inviting manner. So I began work on a booklet “Farming community Ideas about the Way Forward” See Appendix III. This book was completed just after the farmer focus groups were conducted in May 1999 and was greeted with great enthusiasm by the chair of ASSMAC and the committee. It was a summary of the main findings of the survey and the communication considerations that were adopted to develop this book are discussed in Chapter 8. It was sent to all survey respondents, coastal governments and all the relevant state and federal agencies. Since then the book has been quoted frequently, in newspapers, by job applicants and it was used by Universities to introduce students to the social aspects of acid sulfate soils management.

The scope of data that was captured in the survey enabled very comprehensive pictures of farming and government agencies in 1998. I don’t think the survey could have been refined further, but the second benchmarking survey had less qualitative data. However, it was essential when developing a brand new area of knowledge, to keep the opportunities for stakeholders to comment, open. Surveyors noted farmer interest in the survey results, and when landholders received the booklet, there were several requests for the full report.

The next chapter presents the results of the focus groups, when landholders and government agencies discussed the results of the survey with members of the benchmarking group in a series of focus groups between May and November 1999. These survey results also formed the basis for which chapters 7, 8 and 9 emerged.
The previous chapter introduced many attitudes and management practices mentioned by respondents to the survey questions. It also introduced issues that needed further clarification and discussion both within the benchmark team and with the respondents of the surveys. This chapter reports the results from six focus groups with landholders and three with government employees during 1999. The purpose of these meetings was to present the results of the benchmark survey to the participants and discuss the results in light of the perceived roles that each of these groups plays within the catchment. They provided an opportunity for landholders and government personnel to explore further a number of the general issues raised by all respondents during the landholder survey. They also presented an opportunity for all participants to gain further insights into the issues relating to the future management of acid sulfate soils in the catchments. What emerged from the landholder groups were agreed best practices and from the government groups, an agreement that catchment plans were needed along with acknowledged lack of capacity to check compliance to environmental regulations and provide individual service to landholders. Both groups agreed that communication between stakeholder groups and simple guidelines were essential to facilitate better management.
6.1 INTRODUCTION

Informing the groups about the results promoted a participative process for data validation and informs the individuals about the current state of knowledge on the issues. This put community groups in a position of “being informed and able to take a pro-active rather than a reactive position for understanding individuals and groups particular positions” (McComas and Scherer 1999). They argue that “access to information increases the effectiveness of citizen participation in environmental policymaking, although Hadden (1981) pointed out that those who control the flow of information may manipulate the “facts” to achieve certain ends”.

Fundamental to analysis of social qualitative data is the issue of verification of results. “Questions about facts can be verified, whereas questions about attitudes and opinions cannot be verified or observed by anyone but the respondent (Fowler and Mangione 1990).” They argue that this puts community groups in a position of being informed and able to take a pro-active rather than a reactive position for understanding individuals and groups particular positions. While manipulation of data by the controllers of information was always possible, by including the respondents in the process and by sending the groups (both the government and the landholders) the results of the discussions, manipulation of data to achieve certain ends can be reduced.

Chapter 4, in the section “Establish focus group to validate and explore” discussed using focus groups and described them as a process to “further reduce error, by validation of the survey results by the survey respondents”. Social Benchmarking uses triangulation of methods DePloy and Gitlin (1994) argue that triangulation is important to measure and confirm the reliability of the same phenomenon and to see if there was “convergence in the findings across methods that had different purposes and strategies”. Triangulation was also important to develop complete and accurate characterisations of the stakeholders and their partnerships. Leach (2002) found that sampling strategies can be compromised by using only one category of stakeholder. Risks outlined by Leach included participants from interest groups such as agencies and industry bodies having a “higher tendency to express extremely positive or negative perceptions” while participants from non-interest groups, ie landholders, tend to exaggerate the amount of conflict of opinion. Leach concluded that including both groups produces more balanced information about group success and function.
This chapter explores the results from two stakeholder groups, landholders and government employees. The two groups were not mixed, but within each participants from different industries (the four farming industries) and different government agencies were invited, so the groups were interdisciplinary. The focus group for the landholders varied slightly in the process followed from the focus group for the government employees and this is discussed in the next section. However in both cases the same information was presented and similar discussion questions were asked. The next section of this chapter discusses the sampling procedure for both groups, then the results were presented in summarised tables of responses as analysed into categories of responses to issues raised, such as education, communication and research. These responses are then explored and courses of action discussed in light of agreement and disagreement by groups.

This chapter is the second chapter in the result section and it is building up background information for discussing the question: Can this benchmarking information be used, with stakeholder participation, to develop best management practices for transfer to a wider audience? This question is explored in more detail in the following two chapters, this chapter forms an important part of the participative process of Social Benchmarking. Stakeholders were involved in validating the survey results. Thus informed they were involved in the decision making process about possible best management practices and courses of action.

6.2 SAMPLING STRATEGY AND FOCUS GROUP FORMATS

6.2.1 Sampling Strategy

The sampling strategy for the focus groups was different for the landholders than it was for the government. Landholders were chosen based on a distribution of awareness levels and attitudes to acid sulfate soils, as determined by the survey. Sixty seven landholders participated in six focus groups from six catchments (Tweed, Richmond, Clarence, Macleay, Manning and Shoalhaven). Equal representation of landholders from all the industries in the catchment was aimed for. Distribution of landholders was beef (n=20), cane (n=26), tea tree (n=10) and dairy (n=11). The farmer focus groups ran during May and June 1999.

Government focus groups were conducted at three locations, Richmond (northern NSW), Manning (mid coast NSW) and Shoalhaven (South coast). A total of 39 people attended, 15 at Wollongbar, 15 at Tocal and 9 at Berry. At least one representative of each of these organisations listed below was asked to attend each meeting. NSW Agriculture, Department of Urban Affairs and Planning, Department of Land and Water, NSW Fisheries, National Parks and Wildlife, NSW State Forests, EPA, Local Government, Private consultants and Doctoral students. It should be noted that while all agencies involved in managing acid
sulfate soils were invited, there was a predominance of land based agencies and only one representative from NSW Fisheries was able to attend and no one from National Parks and Wildlife or NSW State Forests attended. At the commencement of the meeting, representatives from each government organisation were asked to define their role within their organisation. Table 25 defines the profiles of government agencies and the number of participants from those agencies that attended the three meetings. The government focus group occurred after the farmer focus groups, during November 1999.
<table>
<thead>
<tr>
<th>Name of Agency</th>
<th>No. of people</th>
<th>Roles of employees in managing acid sulfate soils</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept. of Land and Water</td>
<td>6</td>
<td>technical support to coordinate and provide information developing acid sulfate soils management plans and mapping programs; advisory role enquires from community and councils where they were (acid sulfate soils) and what to do with acid sulfate soils; getting local government up to speed on how to manage the application process. ASSMAC level persuade Government to invest in remediation for the worst of the acid sulfate soils hot spots. Promoting some form of incentives to land owners.</td>
</tr>
<tr>
<td>NSW Agriculture</td>
<td>11</td>
<td>researching and advising on management and remediation issues; soil mapping education and extension of information to landholders</td>
</tr>
<tr>
<td>Environmental Protection Agency</td>
<td>3</td>
<td>review regulations and acid sulfate soils management plans planning issues and coordination; provide councils with advice for planning issues and housing development and anything that council asks us for advice on.</td>
</tr>
<tr>
<td>NSW Fisheries</td>
<td>1</td>
<td>regulatory role looking at planning proposals that impact on an aquatic habitat information for any works in regional waters of NSW representing the victims of acid sulfate soils research to determine what were fishing and environmental impacts on fish and aquatic habitats</td>
</tr>
<tr>
<td>Dept. of Urban Affairs and Planning</td>
<td>1</td>
<td>planning role in developing the planning section of the acid sulfate soils manual. developing these planning controls into LEP and other planning aspects of acid sulfate soils to do with SEPP 14</td>
</tr>
<tr>
<td>Local Government</td>
<td>6</td>
<td>environmental strategic planning - plan makers developing regulation models in the planning to make it easier for people who were most affected and also for councils providing education and on ground assistance creation of and management of the flood mitigation schemes. regulatory role, two fold pro-active role in terms of looking at new developments and making sure that new developments don't make the current acid sulfate soils problem worse and reactive role where if somebody does something wrong, then we explain the errors of their ways and seek a resolution to the issue. rehabilitation and restoration projects, encourage and coordinate activities for areas that were already degraded as result of inappropriate land use activities. This area was growing in importance. administrative role, involved in our own rehabilitation and restoration projects and projects run by other groups; funding application assistance financial management of projects, we become the controllers of the funds, distribute and account for funds that other organisations procure through various means.</td>
</tr>
<tr>
<td>Private consultants</td>
<td>4</td>
<td>Consultants who consulted on town planning, environmental, agricultural, soil, ground water and sediments. Clients include public works, mining industry, housing developments, tourist developments. Issues include disposal of sediments, developmental issues, road construction and development consent.</td>
</tr>
<tr>
<td>Students</td>
<td>4</td>
<td>research covering the implementation of weirs and flood mitigation drains to do with raising watertable to minimise the effects of acid sulfate soils, oysters, and scald remediation.</td>
</tr>
<tr>
<td>Landcare</td>
<td>3</td>
<td>Interests were mainly with the low awareness groups of farmers. They were interested in how to raise awareness and change practices, how to facilitate and coordinate on-ground works to remediate acid sulfate soils.</td>
</tr>
</tbody>
</table>

Table 25 Roles of government and other agencies in focus groups on acid sulfate soils
6.2.2 Focus Group Formats

Both groups were presented with a brief overview of what acid sulfate soils are, and the range of land-management problems resulting from acid sulfate soils. The bar charts presented in the previous chapter were used along with photographs, these included an overview of:

- knowledge of acid sulfate soils indicators (Figure 17 Lime and soils and water tests)
- industry characteristics (Table 10 Results of comparisons of industries socio-economic data)
- information sources (Table 18 How landholders gain information on acid sulfate soils)
- attitude (Figure 21 Attitude to acid sulfate soils in the community)

Below is an example of the type of discussion that accompanied the slides:

"The beef industry is an industry characterised by a lack of cohesion, low commodity prices and geographic dispersion. Thirty percent of beef farmers feel management of acid sulfate soils is not under control on their property, and have observed scalded land on their properties. Beef farmers were frustrated with their catchment and on-farm drainage regimes. They were concerned about government policies in declaring wetland areas and rumours about catchments being re-inundated with sea water.

In comparison, the sugar cane industry has made acid sulfate soils a focus, establishing an active extension program and is ahead of other industries in awareness and knowledge levels. The geographic closeness of cane farming communities, a cohesive industry body, and relatively stable commodity prices have allowed the industry to grapple with the problems posed by acid sulfate soils." (Accompanied by slides.)

Landholders were invited along for evening meetings, as daytime meetings were not possible for the majority of landholders. Therefore there was a time constraint, maximum 3 hours. The landholder’s evening was divided into two sections, the first section was about differences between industries, and Questions 1 and 2 from Table 26 below were discussed. Discussions focused on defining what industry could or was doing for landholders. Participants viewed slides about the differences between the industry’s attitudes to and knowledge levels of acid sulfate soils. The second part of the evening’s discussion was about catchments and differences between catchments. It was opened with a statement that if industry groups were not promoting and supporting acid sulfate soils policies, this indicated a need to work in catchments across industry groups to support individuals. Questions 3 and 4 guided the discussions.

<table>
<thead>
<tr>
<th>LANDHOLDER DISCUSSION QUESTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What do you think your industry can do to help you deal with acid sulfate soils issues?</td>
</tr>
<tr>
<td>2. What do you think the government can do to help you deal with acid sulfate soils issues?</td>
</tr>
<tr>
<td>3. How could acid sulfate soils best be dealt with in your catchment? And what do you see as the main issues for farmers working together in catchments?</td>
</tr>
<tr>
<td>4. Why were some farmers unhappy with the community’s views? How can it be improved?</td>
</tr>
</tbody>
</table>

Table 26 Questions developed for focus groups with landholders
The government focus groups were conducted during a full day session, thereby allowing more time to explore issues. A similar format was used for the questions, What was the role of industry? What was the role of farmers and the community? What was the role of the government? However a role playing exercise was included at the start of the focus group. Participants were divided into groups of four and given the role of either a scientist, facilitator, farmer or policy/regulator. An example of the scientist ‘role model’ follows.

There is $600,000 allocated for ASS in the catchment. Your group has to come to an agreement on how and why to allocate this money?

- You are ‘the Scientist’.
- You specialise in oysters. You are very focused, precise and committed.
- You do not understand or comprehend the problems associated with wetland remediation. You know there are problems with water quality, but not what is required or how to get there. You know that from research undertaken over the last 8 years there must be tens of hectares of wetland remediation needed on farmland. You have no group communication skills.
- Have no knowledge of agriculture and do not understand the financial pressures. You love eating oysters, but won’t. You believe they are unhealthy because of the water quality.

For five minutes, please write down below, what are your feelings, beliefs and the issues concerning you.

Participants were then asked to play out their role and work out how to allocate the money, to whom and on what. The main aim of this session was to get participants thinking beyond their profession and about the issue as a whole of ecosystem problem.

In the afternoon the government group also had a strategic planning session. The aim of this session was to identify and prioritise issues, actions and the resources needed to help improve the management of acid sulfate soils from a government organisational perspective. At the end of the morning, after viewing and discussing all the questions, they were asked: What organisation do you represent? Write down in order of priority THREE issues that you believe are important for the future management of ASS?

Validity of the responses to the questions was verified by recording the group responses on ‘butcher paper’ in full view of all participants. At the end of each question, the responses were recited to the groups for further comments.
6.3 MAIN RESULTS: LANDHOLDERS AND GOVERNMENT EMPLOYEES

The following section is a summary of responses given by the Landholders and Government agencies. Responses by landholders and government agencies were analysed for main themes of the discussions. The main themes are summarised below:
Landholders responses by key points:

Education
- visits by departmental officers to farms
- competent (trained/skilled) government advisers
- answers/solutions to problem
- education on basic issues
- on-farm testing to confirm presence of acid sulfate soils
- more specific information on problem spots
- feedback on work done on farms and research by government etc
- clearer guidelines; acknowledge catchment differences
- educate general public on farmers and governments efforts

Organisation/Coordination
- identify a lead agency plus more coordination between departments
- more workable policies
- more farmer committees/action groups/subcatchment groups/body
- use existing groups - drainage unions, Landcare, water uses
- need local champions and dispute resolution process and appeal process
- update Drainage Act to facilitate farmer working groups
- make National Parks and Wildlife Service accountable for its water quality
- support from community through catchment management committees
- coastal floodplain management agreement: HRC - more consultation with farmers re policies etc

Communications
- farmers don’t like being blamed for problem, acid sulfate soils is a community problem
- promote good news: new practices and technologies
- educate primary schoolers re benefits of farming
- educate community re farming practices and improvements
- education is the answer

Funding
- pay for lime used for community needs
- productive and constructive works (pen stocks)
- buy or lease worst affected acid sulfate soils lands
- subsidise drainage union activities
- subsidise farmer training
- support to beef farmers for works
- detailed planning and research
- maintenance of floodgates
- rate relief on SEPP 14 land

Research
- develop guidelines on what farmers can do, not what they can not do
- water testing, maintenance of floodgates and drains, water table movement
- prioritise research for coastal agronomy
- managing land for production vs reversion to wetland
- modelling river flow and drainage
- risk maps updated with depth to acid sulfate soils
- realistic evaluation of acceptable pH values
- more efficient drain maintenance procedures

Controls
- DA’s needed to be speedier and simpler, especially for drain maintenance
- problems with simple farm plans
- DA to apply to whole drain, not sections
- control of floodgates by landowners
- don’t permit oyster industry in high risk areas
- self regulation rather than legislation

Government responses by key points:

Communication
- Less jargon, keep it simple, keep it short.
- Don’t overestimate or underestimate the audience.
- Need different levels of information and visual messages.
- Use survey results to determine strategy for getting information back to the clients
- Look at strategies such as farm walks and using local innovators to get the information out.
- Community needs clear-cut information on what is the problem before we can address what is the solution.
- Local council is first port of call for acid sulfate soils information. Local government needs consistent message, they take advice from many agencies.
- Information on projects, to inform and avoid replication of projects.
- More coordination is needed between agencies.

Education
- Landholders were the key to the problem, we need to resource, support and empower them.
Siege mentality in landholders is a product of top down mentality.

- Less technical information more practical management information about what you can do on the farm.
- Information about what will / won’t happen if you do this / that regarding acid sulfate soils.
- Local government is at the front line. Need technical information specific to the catchment.
- Large technical information sessions for government staff, avoid many small meetings.
- Political will, not a priority for government because it is a sectional problem, not a wider community problem – need to make it the latter by educating the community. General public needs to understand difficulty of the problem so they don’t have unrealistic expectations.

**Funding**

- Funding to trial management / remediation strategies.
- Cost sharing mechanisms to minimise landowners contributions to remedial action.
- Supporting groups who were managing acid sulfate soils. Resourcing technical support people to work with groups and assist groups to raise funds.
- Purchase of poor quality, very low lying agricultural land.
- Local government need to know its levels of responsibility and resources to meet them.

**Planning**

- Consensus agreement by diverse sectional interests on direction ie remediation and/or better management.
- Appreciation of impact on all stakeholders
- Landholder involvement in planning / catchment management.
- Environment / social outcomes to be consistent across state and managed to that agreed level.
- Consistent application of planning controls.
- Clear guidelines, tools and resources to deal with problems in a whole variety of site specific situations, including:
  - Environmental assessment and best practice environmental management.
  - Management and remediation methods to aid landholders and best management for agricultural production.
  - Earthmoving projects.
  - Regulatory roles and responsibilities of agencies and local government.
  - Scientific findings and recommendations eg. flooding with fresh water.

- Legislation to bring soil disturbance and drain activities into the planning system.
- Local government planning instrument to ensure /minimise activities which had potential to expose acid sulfate soils. Clarify and streamline drain approval process.
- Management to recognise and identify site specific problems and solutions.
- Continue validation of issues eg. how large and where.
- Recognising acidification's detrimental effects on entire estuary not just an industry. Integration of acid sulfate soils issues with broader issues eg. restoring wetlands.
- Regulation to set up structures to prevent future land degradation.
- Moratorium on prosecution.

**Research**

- Higher proportion of resources to on- ground projects and management, less to defining the science.
- What will be practical and effective in managing acid sulfate soils to reduce adverse environmental impacts?
- What were the implications of flood mitigation? What problems is acid sulfate soils creating in the catchment.
- More pilot projects to show practicalities of improving management of acid sulfate soils, without adverse impacts on farming.
- Trial sites of different acid sulfate soils strategies for different land use.
- On-going monitoring and research, involving landholders.
The government views on how the management of acid sulfate soils should be conducted were recorded using the form for recording priorities for the future management of acid sulfate soils at the end of the morning session and presented to the group at the start of the afternoon session. Table 27 shows the results by individual priorities and classification. Participants requested planning issues more frequently than any other classification and prioritised them as the most important issue. However it should be noted that ‘Planning’ includes issues on legislation, financial, management, guidelines and consensus. Therefore a response may cover several classifications. Planning was most frequently followed with education as the second priority.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Priority 1</th>
<th>Priority 2</th>
<th>Priority 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Education</td>
<td>6</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Funding</td>
<td>6</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Planning</td>
<td>19</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Research</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 27 Priorities by individual priority and classification.

These priorities were presented with a synopsis of the results to the participants. Participants were asked to discuss why the issues were a priority to their organisation. Government employees felt that future development was being dealt with by legislation in the form of local environment plans (LEP’s). They agreed that the biggest challenge was managing the large areas of degraded land that were farmed by the beef and dairy industries.

Each group compiled these discussions into an agreed list of priorities. The three government groups had different priorities, (Table 28). Each catchment region was at a different stage of development with managing acid sulfate soils. This had implications for the development of strategies, as a generic approach may have provided strategies which were too simplistic for one region and too advanced for another. The southern region, Shoalhaven group (south of Sydney) was keen to benefit from their youthful position. They wanted to learn from the northern, Richmond group (north of Kempsey) and Manning group (between Kempsey and Sydney). Yet their acid sulfate soils management plan which developed during the focus group may well have had application for other catchments. Neither the Manning nor Richmond groups had developed as comprehensive a plan as the Shoalhaven group developed during the focus group. Whereas the northern region, heavily populated by the cane industry, had been able to concentrate on education, the mid coast was still grappling with industries with low income and questioning how to get resourcing and political commitment for change.
Chapter 6 Exploring Processes: Focus Groups

<table>
<thead>
<tr>
<th>Northern</th>
<th>Mid coast</th>
<th>Southern</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Education / Community Groups / Extension Information</td>
<td>1. Documented political commitment to change</td>
<td>1. Use / form steering committee with council as lead agency</td>
</tr>
<tr>
<td>2. Guidelines / Legislation / Enforcement</td>
<td>2. Extra resourcing to coordinate and accelerate people, cost-sharing</td>
<td>2. Apply for funds</td>
</tr>
<tr>
<td>4. Political Will and Incentives</td>
<td>4. Toolkit</td>
<td>4. Educate principle stakeholders</td>
</tr>
<tr>
<td></td>
<td>5. Regulation for changed land use</td>
<td>5. Initiate planning process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Do research</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Within 2 years present either</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• acid sulfate soils management plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• acid sulfate soils component in broader catchment plan</td>
</tr>
</tbody>
</table>

Table 28 Agreed priorities by region / focus group

6.4 ANALYSIS OF KEY ISSUES

The government agencies and landholders both agreed that they needed to know more, they needed more education and information about acid sulfate soils. They also agreed that this was a complex environmental problem. There were many stakeholders with different levels of knowledge, attitudes and management practices. Participants at the focus groups said that they found it most beneficial attending the focus group because it provided them with an opportunity to hear about the problems and issues that confront other farming industries and government agencies. They also said that they would like to have more forums like this, that concentrate on discussing the communication and education aspects of this environmental problem, and not solely the scientific aspects. This was a social problem as well as a scientific problem.

How to reach consensus by diverse parties on the future direction of acid sulfate soils management was a frequent theme with both stakeholder groups. How to get stakeholders to agree on what course of action to take? Also frequently stated was that the government needed to be clear about what ensured environmental outcomes they were trying to achieve. A participant asked: Are we trying to get better management by landholders or better environmental outcomes? There needs to be scientific agreement about proven ways of best management and these need to be communicated simply and clearly at different levels to the many different audiences. The following section discusses the key themes that emerged from the discussions and that came to be agreed on as best practices that could be developed and transferred to other groups or promoted across groups as practices that would facilitate better management of acid sulfate soils.
6.4.1 Research and Education

Landholders wanted the government to do more research and to provide more assistance and education. Landholders call for basic research to develop guidelines to inform them about what they ‘can do’ not what they ‘can’t do’. They wanted:

- guidelines on what landholders can do to improve water quality,
- monitoring of water quality and water table movement,
- managing land for production versus reversion to wetland,
- maintenance of floodgates and drains,
- education of catchment community groups about the role of landholders in the catchment community,
- best practice management plans for landholders,
- modelling of river flow and drainage,
- risk maps updated with more detail at a property levels.

Landholders wanted more information about the risk of acid sulfate soils on their properties. Landholders wanted competent (trained and skilled) government advisers to educate them about acid sulfate soils issues. They would rather have education than legislation and thought that money was better spent on education to raise knowledge levels.

The acid sulfate soils risk maps prepared by Department of Land and Water Conservation have been an invaluable aid for government personnel and landholders for identifying potential acid sulfate soils areas. However, the landholders thought that the risk maps showing the hot spots in the catchments needed to be distributed and publicised to a wider audience. They also saw a need for publications about acid sulfate soils, which included more information about current remediation and best management practices.

Landholders wanted to have sampling for acid sulfate soils done on their properties. The NSW cane industry had sampled all cane farms (over 700) during 1998/99. It had combined soil sampling with extension / education material on acid sulfate soils. Cane farmers surveyed attested to the power of this approach. Landholders in other industry groups requested a similar program to be provided by the government for their catchments. Landholders particularly in the dairy and beef industries and to a lesser extent in the tea tree industry, identified that their industries were geographically dispersed and their industry bodies had not made acid sulfate soils a priority because it constituted a minority of landholders in these industry groups. They identified a need for a catchment focused sampling program to:
1) increase their knowledge of soil and water on their property and beyond
2) enable better on-farm and catchment monitoring
3) develop a better understanding of site specific management practices

Provision of information. The roles of the various government departments confuse landholders, they wanted a 'one stop shop' for information on acid sulfate soils and water quality. Field days were the preferred medium for education with strategic targeting of hot spot zones and general awareness for total catchment.

**Government** employees wanted education. There were many new government employees becoming involved in acid sulfate soils. Government employees wanted training and access to good quality, simple reference material so that they could advise their many and varied clients. Local councils and government agencies had a constant turn around of staff and these new employees were unaware of the implications of disturbing acid sulfate soils. Participants stressed that there was a need for frequent ongoing education of government employees, particularly local councils in basic acid sulfate soils identification and current best management practices. This training must be updated with the changes that were constantly evolving in the knowledge about acid sulfate soils.

Acid Sulfate Soils best management practices. Participants stressed that identification and development of a body of information of current best management practices by government agencies, landholders and community groups was essential. Environmental best practice should not be narrowly construed as merely an agricultural production process. Best management practices encompasses all processes that aid in the better management of acid sulfate soils such as best practices in organising catchment groups; development application process for drain cleaning; extending information to landholders and farm management plans.

### 6.4.2 Community Groups and Communication

**Landholders** wanted well informed and balanced groups (not dominated by non-landholders), with government representatives to provide acid sulfate soils information. Landholders, whose industry was not supporting their efforts to manage acid sulfate soils, recognised the need to tackle this issue within catchments. Many of the drainage union groups were not functioning due to lack of financial resources, focus and enthusiasm. Landholders wanted government participation and help to get these groups and other catchment groups organised and focused on the management of acid sulfate soils and water quality issues. Finally, many cited as imperative, an update of the Drainage Act to support
functions of these groups. These groups need to be focused on problem identification and developing solutions to their local problems.

Landholders wanted government help in providing positive information to the media concerning their role and response to the problem. They resented being blamed for the entire acid sulfate soils problem. They believed it was a community problem and government had also contributed to its cause and scale. Landholders believed education of the wider community was a crucial component of any management strategy; they wanted primary school children to be educated about the benefits of farming.

Due to the large number of government agencies involved at many different levels and geographical locations in the management of acid sulfate soils, there were coordination and communication problems. Government agencies wanted more communication between the agencies and within the agencies. At the top level, representatives from these agencies meet to discuss the issues. However, at the next level, the ‘operative’ level, there was a need for more communication between the agencies. The southern group in particular was eager to meet and have the opportunity to find out what was going on in other parts of the state.

The technical committees, set up as inter agency groups to advise on acid sulfate soils in the north, mid and southern regions had not been able to provide a complete answer. Indeed the technical committees had been in name more than action and never appeared to meet. Members already had existing jobs to fulfil and these groups did not appear to be very active. Funding and time was not allocated to these employees to fulfil this task.

Local councils were in the best position to be the coordinators of information between the landholders, water farmers and the state agencies. However, the agencies and the local councils need a means of transferring information between catchments, so that current practices and research can be communicated to all the catchments.

6.4.3 Regulation and legislation
Local government was acknowledged as the place where most landholders and community members looked for information. Their role was many and varied and included being a regulator, educator, project manager, fund raiser and manager of flood mitigation schemes. Of principal concern to local government was:

1) planning instrument to ensure / minimise activities which had potential to expose acid sulfate soils;
2) to clarify and streamline drain approval process and
3) for the state agencies to provide clear guidelines on all aspects of acid sulfate soils so they can provide credible, simple advice.

DA process for drain clearing was of great concern to local councils and landholders. Both wanted a speedy process with clear guidelines. The councils, limited by staff numbers, cannot cope with hundreds of concurrent applications. Landholders, constrained by climatic and production factors cannot wait long periods for DA approval. Efficient drainage maintenance was imperative for the landholders on these low lying coastal floodplains. They had a small window of opportunity where they can clean the drains. There were concerns that Councils do not have sufficient staff to process up to 300 concurrent development applications (DA) for drain maintenance. The present process was complex, slow and highly variable for obtaining DA’s to clear drains and was a major encumbrance to landholder’s productivity and the cause of much frustration for local government and landholders.

Landholders suggested that the process could be facilitated by streamlining the DA process. For example self regulation, for cohesive industries like cane, where an agreed set of management criteria that relate to best management practices was used. Community based groups would find the submission of a single DA for maintenance of the entire length of drain rather than separate DA’s for individual sections to be helpful. This could be achieved through review of the DA process and review of catchments such as the Manning and the Richmond who had developed models for this process.

6.5 REFLECTIONS AND CONCLUDING REMARKS

Acid sulfate soils management is an emerging field and it is developing in a rapidly changing social and governance environment. It was only in 1988 that the impacts were acknowledged by the cane industry in the Tweed catchment due to the pressure of fishing and other environmental groups. Since then, a group of scientists has collaborated closely with the cane industry and with one farmer in the Tweed in particular. This farmer, Robert Quirk, has promoted the soil sampling program, drainage plans and self regulation. The spread of information through the three catchments was obvious during the focus groups. The Tweed landholders appeared to defer all questions to Robert and the other catchments frequently mentioned the work of the cane industry in the Tweed. The Tweed cane farmers had the highest levels of knowledge about acid sulfate soils.
However, although bio-physical scientists had been studying acid sulfate soils for a number of years and there was a substantial international body of knowledge, these scientists cannot conclusively offer management strategies to other industries. Livestock production is different to cropping. Yet, there appears to have been very limited collaboration between scientists and graziers, even though the beef industry was the largest landholder of the 200,000 Ha which of acid sulfate soils disturbed by drainage or excavation. This drainage combined with varying geographical and climatic conditions and a variety of agricultural industries ensure that one management strategy will not work for all situations. Therefore research emphasis purely on cropping systems in the cane industry is both limiting and will not provide the best management practices that the graziers require.

The economic and social structure of the industries was also different. The government agencies agreed that the biggest challenge was managing the large areas of degraded land that were farmed by the beef and dairy industries. This was partly because financial incentives such as increased production or government subsidies to change drainage regimes were not currently government policy and therefore funding was not available to individuals. Funding was available to organised groups with agreed aims and this will be discussed further in Chapters, 7, 8 and 9.

The cane industry’s soil sampling and self regulation plans based on farm drain management plans, were frequently referenced by landholders and less frequently by the government agency staff. Soil sampling for acid sulfate soils was relevant across all catchments and industries. Non-cane landholders acknowledged that their industries would not support such a program because acid sulfate soils landholders represent a minority of the total industry. Dairy farmers stated that their industry regarded other issues such as effluent discharge and deregulation as much higher priorities. Therefore these landholders regard the government and catchment groups as important sources of information and support to facilitate change in the future management of acid sulfate soils. However, the ‘government’ represented a complex group of agencies that were frequently in conflict over policy priorities. Government employees from all departments did not feel their organisations had the infrastructure to co-ordinate the type of soil sampling program that the cane industry had co-ordinated each farm. Many expressed the view that landholders should not have their ‘hands held’, that other industries had responded to regulations and had encompassed managing pollution (usually point source) as part of their operational costs.

Development application process for drain clearing were of great concern to both local councils and landholders. Both want a speedy process with clear guidelines. Local
governments were concerned about legislative commitments. They were juggling numerous environmental issues and were unsure about how to manage the implications of SEPP 14, Coastal Wetlands on the DA process for drain maintenance. Essentially, SEPP 14 aims to protect wetlands, but it also restricts maintenance of drains, because maintaining drains means disturbing the soil. Guidelines from the Department of Planning were under review and consequently many councils had not introduced new LEP’s on drainage management nor were they allowing landholders and drainage unions to clean drains. This had resulted in conflict and negative feelings towards some State government departments by landholders.

State government personnel, including the one dedicated acid sulfate soils extension officer, also expressed frustration about SEPP 14 and DA’s. Remediation work could not be commenced because of planning constraints. Further confusing the situation was that ASSMAC, an advisory group, had no agency powers, and therefore couldn’t ensure that its aims were communicated widely or supported across all government sectors. Many government personnel felt they had neither the knowledge nor the capacity to effectively manage acid sulfate soils because of their limited understanding of the biophysical issues, time constraints, lack of clear guidelines, lack of institutional support and the confusing legislative and regulatory situation.

Notwithstanding these considerable constraints, it was evident that something had to be done to develop tools and educational material so resource managers (particularly non cane landholders and government) could increase their knowledge about acid sulfate soils. I presented this information to ASSMAC, emphasising the need to extend soil sampling to other industries and government staff to raise knowledge rather than just awareness and presented an education strategy (see Chapter 8). The response was rather frustrating. I left the meeting with ASSMAC feeling that nothing would happen unless I personally took further action. The committee appeared to be focussed on research and regulation even though education was a core part of the strategic plan.

Chapter 8 is about how I responded and developed another team and another funding proposal to develop best practice environmental management guidelines based on what the survey and focus groups had indicated that landholders wanted, to know where it was on their land, soil sampling. The chapter explores the cane industry program and looks at how their best management practices can be spread to a larger group of people using print media, building on the focus group findings that simple, easy to understand, consistent guidelines were needed. There was another important issue that was raised during the course of this research:
• How to reach consensus amongst diverse parties on the future direction of acid sulfate soils management?
• How to get stakeholders to agree on what course of action to take!

The next chapter, is the first of three discussion chapters. It explores how to involve multiple stakeholders in the decision making process and discusses conflict, control and human and social capital. It looks at the conflicting needs of different stakeholder groups and asks whether benchmarking data can effectively involve stakeholders in developing actions and also recommends social indicators to inform the process.

This chapter has discussed the results from the second part of the Social Benchmarking process. Participants in the focus groups acknowledged the validity of the findings when they agreed that the industry and catchment descriptions were realistic. The focus groups also provided a lot of new information and emphasised what was important and relevant from the survey data. This concludes the results section.
PART III

DISCUSSION
The men who have changed the universe have never gotten there by working on leaders, but rather by moving the masses. Working on leaders is the method of intrigue and only leads to secondary results. Working on the masses, however, is the stroke of genius that changes the face of the world.

Napoleon Bonaparte, 1769-1821
A frequent theme with both stakeholder groups in Chapter 6 was How to reach consensus by diverse parties on the future direction of acid sulfate soils management. Another frequent question was how to get agreement on what courses of action to take? Discussions with stakeholders in focus groups about survey results revealed a need for guidelines, along with greater co-ordination and communication between government agencies and other catchment stakeholders. It revealed that inconsistent and irregular communication can result in conflict, loss of control and a sense of abandonment.

This chapter discusses the constraints and factors that influence the capacity of stakeholders to manage environmental change including human, social and organisational capital, and looks in more detail at the beef and sugar cane industry. It asked the question, can the benchmarking data (with explanations) effectively engage stakeholders in better understanding the situation and participating in solutions? Findings indicate that acid sulfate soils study focus groups using participatory processes had succeeded in identifying solutions, but implementing the solutions and building human and social capital, required considerable time and commitment. Caution was needed, because without good communication, support and acknowledgment of the results, this process can cause conflict, reduce individual control and undermine the participative process and ultimately social capital.

### 7.1 INTRODUCTION

There are imbalances in the use of resources such as between the rich and the poor and between generations (Syme et al. 2000). These inequalities are further complicated when environmental and historical perspective’s are considered. These inequalities frequently result in conflict, particularly when one group is adversely affecting another group, (see Chapter 4). Syme et al. (2000) suggests that “members of the same society do not have equal ratios of the total use of ecological resources or the enjoyment of ecological benefits, and they do not bear equal ecological risks”.

Perception of risk was important to individual and group understanding of environmental problems (Vanclay 1992), but stakeholders had other motivations for environmental actions, including money, environmental ethics and competitiveness, all of which emerged as issues during the acid sulfate soils surveys. Axlerod (1994) contends that there needs to be “a genuine recognition of the various interests (motives) involved and acceptance of those interests as legitimate by all stakeholders”.
The previous two results chapters (5 and 6) provided insights into how two stakeholders groups, the government personnel and the landholders, view the major issues raised by acid sulfate soils. Within the industries represented by the landholders there were considerable differences in how they viewed and how they were managing the problem, and this was reflected in a number of different indicators, (see Chapter 5). The cane farmers and their industry group were leading the way. They believed that they were getting the management of acid sulfate soils under control. Why, and what were they doing that was so effective and empowering? Throughout this chapter a picture of the differences between two farming industries, the beef and sugar cane farmers is developed. Section 7.2.2. discusses social capital, how it measures groups and networks strengths and weaknesses and relates this government agencies and their institutional arrangements. For all theses stakeholder groups, the qualitative analysis in Chapter 5, revealed control as a potential social indicator. It appeared to describe the difference between the croppers, who felt ‘in control’ and the graziers who felt ‘out of control’. Why, and what were they doing that was so effective? This question is discussed later in this chapter.

By the end of the focus groups, Chapter 6, the reasons for the different levels of control between the farming industry groups became clearer. The cane industry, and to a lesser extent the Tea Tree industry, was cohesive and it was empowering its landholders. The cane industry had excellent communication networks, newsletters and training programs and was developing self-regulatory policy. The beef industry had none of this, indeed they didn’t even have an industry body and most of them weren’t members of the NSW Farmers Federation either. The dairy farmers had a strong industry body but it wasn’t focussed on acid sulfate soils. The cane industry was saying that they were working effectively with the catchment groups, graziers frequently cited conflicts with members of government, catchment groups as well as with the fishing and environmental lobby groups. These were cited as reasons not to join catchment groups and why these groups were dysfunctional. Similarly government personnel indicated a sense of limited control about their capacity to manage environmental issues due to a range issues that included, lack of staff, guidelines, agreed best management practices and conflicting regulations that undermined their efforts to orchestrate change.

Conflict is an essential element of society. The advocates of the evolving theories of chaos and complexity of social systems argue that “individuals, groups and institutions had an inherent capability and desire to position themselves on the ‘edge of chaos’” (Waldrop 1994).
Conflict, though painful, is part of the natural process of self-reorganisation; it is what maintains the institution at the ‘edge of chaos’ (Warner and Jones 1998).

Conflict is part of the social process. It is essential for making decisions about managing natural resources. “To a large extent, conflict is how natural resources were managed in a democratic and pluralistic society” (Bengston et al. 1999). Conflict will increase according to Klaus Topfer, Director-General of the United Nations Environment Program. He says that there will be ‘a very concentrated conflict over the use of natural resources.’ Troost (2001) expands on this theory and points out that ‘competition for limited resources and space makes coastal regions flashpoints for conflict. This means that much is at stake for the great majority of the world’s countries, 80% of which were coastal, located either adjacent to an ocean or a sea.’

Focusing on the cane industry. In the late 1980’s, the cane industry acknowledged this competition for limited coastal resources and they believed that unless they effectively managed pollution from acid sulfate soils, conflict due to criticism from increasing urban development and other catchment industries would drive them out of production. The cane industry structure was different to the other industry groups in this study, because it was a co-operative, and cane farmers were shareholders. The evolution of the current structure is shown in Table 29.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>Mill bought from C.S.R. Last year of the production under C.S.R. around 1 millions tons produced in N.S.W. C.S.R. says it is not profitable for them to continue as a corporate miller. Purchase price $6 million.</td>
</tr>
<tr>
<td>1989</td>
<td>Growers take on a partner and build refinery. Production increase to 2.2 million tons.</td>
</tr>
<tr>
<td>2002</td>
<td>Assets worth $100 million</td>
</tr>
</tbody>
</table>

Table 29 Recent history, The sugar cane industry in northern NSW

There are 700 cane growers in NSW. There is a board of directors, 3 from each mill area, and the growers elect them. There were no professional directors. There were 3 mills one in each catchment, the Tweed, Richmond and Clarence. There is a strong grower’s organisation. The NSW grower’s council has four growers from each mill area. All industry committees have equal numbers of representatives from the board and cane growers council. This organisational structure and focus on managing acid sulfate soils appears to have empowered the cane growers as expressed in results from the acid sulfate soils study, (Chapter 5 and 6). Table 30 was developed from the results of Chapter 4 and 5. It shows the differences between two industries, the beef representing grazier and cane representing...
croppers, who were consistently the most opposite in the acid sulfate soils study. This table provides the basic comparison for the following discussion in this chapter about conflict, human and social capital and control.

The cane industry and individual cane farmers had a strong sense of control about their future, higher knowledge levels and confidence in their organisations ability to manage future change. To explore why control was important to individuals and groups, the concepts of “locus of control” is introduced in this chapter. It is a potential social indicator, because it can indicate whether people believe that they have the capacity to manage change and what the impacts of conflict and low social capital are likely to be on individuals. While acknowledging individual differences is essential to understand capacity to change, acknowledging group traits is also essential for understanding social capital and group capacity to change.

This chapter will now discuss the implications of conflict and the implications of gaining a better understanding of what creates a stronger sense of control. It explores human and social capital within the context of the acid sulfate soils study and of natural resource management and looks at the role of organisations in building capital. The next section looks at stakeholders and how they are diverse individuals yet required to share and to negotiate the use of the same limited resources within their catchments. The chapter concludes by discussing whether this benchmarking data, with explanations can effectively engage stakeholders to better understand the situation and participate in solutions?
Beef Industry

History and Group structure

Factors influencing levels of interpersonal trust and informal sociability and public engagement

Industry represented by NSW Farmers Federation – an optional membership structure available to farmers in all industries. Some beef farmers are members of Landcare, Drainage Unions and other local catchment groups. Landcare started in the early 90’s. Drainage Unions formed in the 1920’s – many no longer functional. Total numbers unknown. Reciprocity and trust highly variable depending on location and group. But generally low.

Proximity and Scale

Factors influencing informal sociability

Beef farmers are located over a large geographical area (over all catchments in the acid sulfate soils study), frequently sharing borders with other industries.

Shared Vision and Attitude

Factors influencing intensity of involvement in community and organisational life

Beef farmers do not feel their industry body is cohesive nor the Landcare groups, rather that there are diverse views with scattered and fragmented focuses. Beef industry is not attacking acid sulfate soils as an industry. They are working as individuals and in groups that have many different agendas, ranging from ecosystem health and water quality to flood gate maintenance and water management for production. They do not feel that these groups have a focus on practical actions or maintaining production but rather a focus on meeting and talking. “I’m not going to go to meetings and have people just yell at each other all the time, its not constructive”. Survey respondent.

Communication

Beef farmers receive least information about acid sulfate soils (9%). Many did not know where to get information or where to voice their concerns. Landcare and other groups are not necessarily focussed on acid sulfate soils. Beef farmers frequently locked in conflict, left to individuals or little groups of farmers and they feel they are fighting the councils or the greenies. Beef farmers are frequently antagonistic to external groups.

Policy and Management

Beef farmers haveno best management practices or planned self regulatory system. Fear blanket regulations. Frequently state too much top down regulation trying to cover everyone when there is so much individual discrepancy. They believe there is no ground level support and they not being consulted. Correct management options for land are not being acknowledged by regulatory structure – good management is being penalised. They want a case by case approach, not generic, but individual, with standards and best management practices. Government policy is to target these groups using staff from local council, DLWC and NSW Agriculture and set up management plans.

Cane industry

History and Group structure

Industry has been working as a co-operative with a governing body of non salaried growers since 1978, previously a private company structure. Over 700 farmers in the three catchments, Tweed, Richmond and Clarence. They have to sell to the mill and are dependent on co-op for harvesting. They have a high level of interpersonal reciprocity and trust.

Proximity and Scale

Factors influencing informal sociability

Properties located in three adjoining catchments with almost all farmers sharing borders with other cane farmers.

Shared Vision and Attitude

Factors influencing intensity of involvement in community and organisational life

Cane farmers are proud of their industry. They regard themselves as world leaders in the management of acid sulfate soils. Common goals – to maintain production. The industry has got together as an industry, agreed about what they’re doing, how they are doing it and are presenting a cohesive strong strategy to the farmers and the public. They have a shared vision which is centred on maintaining agricultural production.

Communication

Industry provides more information to cane farmers (70%) said receiving information primarily from cane industry. Has effective communication channels back from farmers to industry groups. Industry made acid sulfate soils a focus. Communication to farmers based on practical on the ground input and trials. Cane farmers have got beyond the ‘us and them’ attitude with the community. No noticeable conflict between farmers and general community.

Policy and Management

Cane farmers have a best management practices self regulatory program that has been negotiated between the industry and local government. They are confident in their governing body. They see industry as negotiating effectively with the government. Their auditing process is comprehensive – sampling, farm plan, management strategy. Cane industry policy is to develop self regulatory agreements with all local councils and thereby all farmers in the three catchments to have management plans.

Table 30 Human and Social capital differences between the beef and cane industries
7.2 STAKEHOLDER DIALOGUE AND CHANGE

Integrated Ecosystem Management (IEM) is an emerging paradigm that ‘places demands on adopting agencies to focus on those activities that support organisational change, especially communication activities, both to foster adoption of, and later to support continuance of ecosystem management activities’ (Danter et al. 2000). The human ecosystem is defined by Machlis et al. (1997) as a ‘coherent system of biophysical and social factors capable of adaptation and sustainability over time’. These communities may be linked at many scales from large, such as a state or watershed, to small such as a village or households, they may be hierarchically nested within human ecosystems at different scales. Changes in a human ecosystem at one scale may have effects at larger and smaller scales. This paradigm has emerged because researchers have argued that biophysical boundaries do not reflect the social activities, which operate within these spheres. This is particularly so when dealing with pollution issues where the source of pollution is spatially and temporally separated from the consequences of the pollution.

Chapter 3 and 4 discussed the major roles of government agencies including natural resource management, regulators, researchers and educators. Natural resource managing agencies face similar dilemmas to farming landholders. They have limited staff and funds with many conflicting environmental issues to prioritise, for example, should they be focussing funding on water quality, biodiversity or remediation of agricultural land. Natural resource management requires co-operation and sharing of resources, internally within government agencies, between agencies and externally between non-government groups and industries.

Some stakeholders in the acid sulfate soils study had a land-based focus and others had a water focus. Within the land based group some were using the land for the production of primary products, and those that wish to develop it for urban expansion. Similar conflicts of use exist within the water-based groups. For example the recreational fishing groups were frequently in conflict with the commercial fishing groups over fishing methods and quantity of catch. Both these groups along with the department of fisheries and environmental activist groups were concerned about fish habitat, which was threatened by the lack of riparian vegetation and water quality pollution from both agricultural land and government owned land such as National Parks and Wildlife reserves.

Many landholders and government personnel were recreational fishers and similarly many commercial fishers had lifestyle farms. Therefore it was not possible to differentiate one
group from another group using industry as the only predictor of attitude or awareness. Attitude is a complex social indicator with many situational variables contributing to an individual’s attitude (Kaiser et al. 1999). The evidence from many types of research indicates that attitudes and behaviour can each influence the other, and that other variables often mediate the relationship. However, which attitudes affect which behaviours, and under what conditions, is harder to define (Kelman 1980). Stern and Oskamp (1991) found that “a person’s basic values should be important influences on environmentally protective behaviours. It seems likely that attitudes which were closely related to a person’s basic values will be the ones most apt to be carried into behaviour”. But it is unwise to assume that individuals and groups participating in forums about environmental issues had an appreciation of the views and economic imperatives that concern other individuals and groups as demonstrated by this quotation from a farmer in the Hunter Valley. It illustrates the concern that this individual had towards the environmental movement.

“Farmers are really wary of greenies and talk of wetlands. We like wetlands and look after our country, but we’re not getting any support – just being told we’re the problem. Have our land made into wetlands – we really just want the drains cleared so we can keep producing off our land. It’s not just for us, it’s for the whole community and country … we’re not just producing for ourselves” (Survey Chapter 5)

What this farmer perceives as environmental behaviour was apparently not what the ‘greenies’ perceive as their environmental goals, because they had different agendas. One wants to produce food and the other wants to create more wetlands, yet they both had positive attitudes towards the environment. Further, it is unwise to assume that regulations and economic incentives that are commonly used to change behaviour will change attitude, indeed farmers are most likely to revert to old practices when the incentives or regulations cease (Pretty and Ward 2001).

There is a need for other indicators that provide more information about potential environmental behaviour. Indeed, Stern and Oskamp (1991) suggest that there is little appreciation of the various behavioral, social, and institutional factors on which programs and policies depend for their success. As a result, policymakers learn less from evaluation research than they might, and miss opportunities to improve their programs or policies. This view is shared by many socially based researchers and reinforced by international agencies such as a Food and Agriculture Organisation of the United Nations (FAO) Technical Advisory Committee (TAC) 1996 report that suggested that user participation could be critical in pre-adaptive stages of certain research and that participatory RandD may reduce the costs of applied research. Yet participation can directly challenge the autonomy of individuals and groups and lead them into conflict. Possible partly due to the complications of working with
individuals and groups that hold different values and skills. Abdalla (1996) summarise the problem as such

“The multi-dimensional nature of rural-urban conflict means that effective responses can only be developed through multidisciplinary and interagency collaboration and communication. This includes both technical and non-technical experts, such as experts from the social science fields with specialization in conflict and dispute resolution…To be successful, natural resource managers will need to go beyond their traditional analytical modes and understand the multi-dimensional nature of conflicts associated with modern agriculture”.

Conflict was frequently cited in Chapters 5 and 6 as reasons for not joining groups. This next section discusses why conflict is a necessary part of NRM and how levels of conflict impact on human and social capital.

7.3 REDUCING CONFLICT

Warner and Jones (1998) discuss two sources of conflict, those that were latent in society and those that were as a result of new pressures. The acid sulfate soils issue, like many environmental problems, embodies both of these sources of conflict. Latent issues were evidenced between government agencies such as the control of the allocation of funding money. This conflict becomes confusing as agencies such as NSW Agriculture evolve and change roles from research and production focus to include environmental pollution and water table management. NSW Agriculture begins to share territory with NSW Land and Water, an agency that has evolved from an engineering, drainage background, to become the lead agency in integrated catchment management policy.

There were many such conflicts that were noted during the acid sulfate soils study, and while some had caused major disruption, most were minor. They included:

- Allocation of Funding – How should it be allocated? Mainly conflicts within government agencies and between agencies, but also between scientists. However, the funding bodies had also received complaints from stakeholder groups, most notably consultants and water NGO groups.
- Documentation – Conflict about content between technical specialist who want specialist technical manuals and extension communicators and landholders who want simple guidelines.
- Lack of communication – Vertical and horizontal problems. Lack of communication within and between the agencies causes frustration and confusion.
- Risk maps – Frequent criticism of Dept. of Land and Water by landholders that the maps were too broad. Landholders, whose properties were on the maps, felt that the
value of their property was adversely affected. They wanted to know if they had acid sulfate soils on their property, not that their property was on a risk map.

- Maintenance of floodgates and drains - Who was managing and funding their maintenance? The complex web of floodgates and drains had been largely left without maintenance since acid sulfate soils became an issue because the individuals and groups (usually Drainage Unions and local councils) were unsure about implications of the state regulations (SEPP 14) and LEP’s were not available (see Table 22 Time until acid sulfate soils LEP in council?, Chapter 3). Local government frustrated with State government, Landholders most unhappy with Dept. of Land and Water, the originators of the drains, and with local government. Indeed this issue caused conflicts between all groups.

- Media sensationalising issues - The fishing and environmental groups used the media extensively to activate discussion. Every fish kill was given sensationalised coverage and usually considerable criticism of agricultural practices. This inevitably caused conflict between the land and water based groups.

These disputes can provide barriers to the equitable resolution of natural resource issues. For example, respondents to the survey said they weren’t prepared to discuss future solutions if it was going to become a shouting match. In Chapter 3, (see Table 4) Cullen (1998) defined several characteristics and elements that were common in environmental conflicts and which relate closely to the acid sulfate soils study. Natural resource management requires the resolution of the conflict by recognising mutual interests (Warner and Jones 1998) and by bargaining (Cullen 1998). If these negotiations are not successful then rural development and the environment can be negatively affected or at the least remain in a negative state. Indeed Warner and Jones (1998) argue that it was important that stakeholders recognise that “their mutual interests were best served by sustaining the resource base”. However, when dealing with diffuse source pollution, a landholder may believe that they are effectively sustaining the resource base, because they believe they are managing their piece of land sustainably, and they do not see or acknowledge the off-site impacts of their actions. Therefore proof of environmental impact is also essential to resolve conflict when negotiating diffuse source pollution problems.

Is conflict resolution worth the time? Conflict resolution is a time consuming process that can frequently take years to reach an agreement, if any agreement is reached. It was unlikely that resolving local level conflicts had any real influence on reforming structural inequalities and national policy (Warner and Jones 1998), however, resolving local conflicts can provide
ownership of the solution, building trust and a higher rate of compliance and participation. A cane farmer in the north of the state noted,

‘In the Tweed they were all arguing, but then they started looking at solutions together…Industry now very pro-active. Greenies now onside, were antagonistic in the beginning’. Tweed, Cane farmer

This, however, is provided that the right problems were being solved. Interaction Associates (1986) noted in a summary of problem-solving tendencies that groups were frequently:

- solving the wrong problem
- stating the problem so it cannot be solved
- solving a solution
- stating problems too generally
- trying to get agreement on the solution before there was agreement on the problem”.

They further noted

- the problem definition implicitly embodies preconceptions and assumptions that underpin how one approaches the problem;
- the problem definition guides the strategies and actions taken to address the problem.
- exploration of aspects of the problem influences the quality of solutions”.

A government focus group participant of the acid sulfate soils study focus group described in Chapter 6, asked a question which acknowledges the difficulty of defining the problem “Where are we headed to? Are we trying to get better management by landholders or better environmental outcomes?’ After half an hour of discussion in the government focus groups, it was agreed that the answer depended on which group you represent. Most agencies were not interested in agricultural production, and it was only to NSW Agriculture that the answer, of ‘We are interested in both” was applicable. They argued that you couldn’t have better environmental outcomes without involving the landholders. Stern and Oskamp (1991) suggest that for a psychologist the key questions about an environmental problem are:

- Which actors can make an important difference by ameliorating, exacerbating, or preventing the problem?
- For each type of actor, which actions had a large impact on the problem?

Table 7, (Chapter 3) showed the principal stakeholders and their issues in the acid sulfate soils study, but they represented many different conflicting interests. Excavator contractors were identified as the group that could prevent future problems by ensuring new drains did not disturb potential acid sulfate soils. The media were exacerbating the problem by
publishing provocative articles and landholders and the government were in the position to ameliorate it. Analysis within Chapter 6, revealed common needs within several issues related to acid sulfate soils management, while other issue were exclusive to particular groups. These issues were best represented under three titles, common ground, specifically government agencies and specifically landholders, Table 31 shows the breakdown.

<table>
<thead>
<tr>
<th>Common Ground</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Common ground was where both the landholder and the government agencies agreed on issues and needs.</td>
<td></td>
</tr>
<tr>
<td>• Clarify / co-ordinate roles of government</td>
<td></td>
</tr>
<tr>
<td>• Develop better communication between government departments</td>
<td></td>
</tr>
<tr>
<td>• Government to provide liaison and funding</td>
<td></td>
</tr>
<tr>
<td>• Educate government workers, community and landholders</td>
<td></td>
</tr>
<tr>
<td>• Clearer guidelines for landholders and government employees</td>
<td></td>
</tr>
<tr>
<td>• Greater monitoring and strategic planning</td>
<td></td>
</tr>
<tr>
<td>• Develop better understanding of drainage networks and drain management</td>
<td></td>
</tr>
<tr>
<td>• Develop drain and farm management plans</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Government Agencies</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Agencies</td>
<td></td>
</tr>
<tr>
<td>Some needs were specific to a group, and the government agencies stated these issues and needs below, but they were not stated by the landholder group.</td>
<td></td>
</tr>
<tr>
<td>• Mission statement – where are we headed too? If these details were presently available, publicise.</td>
<td></td>
</tr>
<tr>
<td>• Define environmental outcomes</td>
<td></td>
</tr>
<tr>
<td>• Build partnerships between government agencies</td>
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</tr>
<tr>
<td>• Use industry to involve landholders</td>
<td></td>
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<tr>
<td>• Identify specialist knowledge</td>
<td></td>
</tr>
<tr>
<td>• Define opportunities for best management practice</td>
<td></td>
</tr>
<tr>
<td>• Local council to be coordinators of information</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Landholders</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Landholders also had their unique needs:</td>
<td></td>
</tr>
<tr>
<td>• More information before legislation, then LEP’s if individuals don’t comply</td>
<td></td>
</tr>
<tr>
<td>• Testing information for acid sulfate soils, either government do it or help landholders to do it</td>
<td></td>
</tr>
<tr>
<td>• Fear having to fund flood gates and drain maintenance, this was a government role</td>
<td></td>
</tr>
<tr>
<td>• Clarify effects of farming practices on acid sulfate soils</td>
<td></td>
</tr>
<tr>
<td>• Feedback to owners on research from farm visits.</td>
<td></td>
</tr>
</tbody>
</table>

Table 31 Summary of Government and Farmer issues and needs

Landholders in the focus groups (Chapter 6) agreed that soil sampling for those industries not supported by an industry body, ie beef and dairy, needed support from the government, and that the cane soil sampling model was a success. They believed this was the most important first step to managing acid sulfate soils. Many government staff were sceptical about their capacity to support a soil sampling program, and many did not feel landholders should be supported beyond the provision of information, but they did agree that education and simple guidelines were needed. Many stakeholders cited conflict between stakeholders
and lack of defined goals as a major barrier to progressing with management plans. They agreed that reducing conflict was an important strategy across the catchment and that spiralling conflict would increase the transaction costs of managing acid sulfate soils and impact on the timescale for obtaining improved environmental outcomes. The next section discusses how conflict is an element of social capital and why social capital is an important facet of community capacity building.

7.4 BUILDING HUMAN AND SOCIAL CAPITAL

The concept of human and social capital is increasing acknowledged as an important measure of society’s capacity to respond to situations (OECD 2000b). Indeed, human and social capital is essential to economic growth and explains the variation in growth between OECD countries (OECD 2001c). Human capital is the knowledge, skills and competence that individuals develop during their life. Human capital is widely recognised by economists as a key factor for stimulating economic growth. Schuller (2000) defines human capital as

“focusing on the economic behaviour of individuals, especially on the way their accumulation of knowledge and skills enables them to increase their productivity and their earnings — and in so doing to increase the productivity and wealth of the societies they live in. The underlying implication of a human capital perspective is that investment in knowledge and skills brings economic returns, individually and therefore collectively”.

Human capital is measured by formal and informal learning and includes competencies such as reading and writing, as well as skills acquired on the job such as the operation of technical equipment. Knowledge is the fundamental of learning. In agriculture, knowledge comprise three broad areas under the title Agricultural Knowledge Systems (AKS): science and research in agriculture; agricultural extension services and agricultural education (OECD 2000c).

In the acid sulfate soils study, results indicate that human capital within the beef and dairy industries can be considered low based on their knowledge about the issue, while on cane and tea tree farms the capital was higher. Human capital, measured as knowledge about acid sulfate soils and diffuse source pollution, was also low in many government agencies, in particular local government. Changing human capital is a cumulative process, which builds on existing knowledge and practices through interactive learning.
Social capital incorporates the broader concept of social relationships. A well functioning community can be considered as having strong social capital. It represents the role of institutions and the social relationships of communication and co-ordination, and the more non-specific role of good governance within which all development takes place (Statz 1998; Schmid 2000; OECD 2000b and 2001d). Putnam (1993) defines social capital as the oil that keeps society together, “those features of social organisation — networks, norms of reciprocity and trust — which facilitate co-operation for mutual benefit”. An important feature of social capital compared to other forms of capital is that it is social in origin. Financial capital originates in the financial markets, human capital originates in education and natural capital originates in the environment.

Why are social and human capitals important? UNEP (1996) report states that

*sustainable development will be most likely – and will be achieved at the lowest overall cost to the economy – in those societies where there are the highest levels of trust and other forms of ‘social capital’. The levels – and credibility – of information disclosure by both business and government agencies will play a key role in influencing the extent to which social capital is created, conserved, effectively invested or eroded in any given society”.

The Social Capital Interest Group at Michigan State University, USA. argues that social capital is “owned by the recipients/objects of feelings of sympathy and obligation. Social capital alters educational achievements and access to a wide range of goods or services; it provides emotional support services and social capital addresses distribution of resources issues”. Low social capital implies low trust, community disagreements and difficulties in solving problems or achieving goals. Conversely communities with strong social capital have many networks that are active, with high participation, high levels of trust and low levels of conflict (Kilpatrick et al. 1998). Communities that want to build social capital need to aim for:

- reducing conflict
- increasing group membership
- building consensus and shared visions
- creating transparent decision making and confidence in leadership
- developing networks and
- encouraging financial and institutional support.

Yet the complex nature of environmental problems, such as acid sulfate soils, provides challenges to the existing social structures. Are these structures capable of adaptation to a system that will require a more anthropocentric rather than ecocentric focus? How can strong human and social capital be accounted for in ecocentric dominated systems? Many social
researchers argue that the biophysical scientists are only interested in finding biophysical solutions, and supporting a system that validates their approach. However, self interest is evident in all groups. Regulators are keen to solve problems by creating new legislation, likewise economists will develop new taxes or incentives. To explore these issues, the next section introduces the concept of institutional capital and looks at its role in supporting change in groups.

**Institutional or organisational capital** is a subset of social capital and reflects the shared knowledge, teamwork and norms of behaviour within organisations. Organisations within the context of agriculture represent the government agencies, civic groups, industry bodies, farmer unions and the community based programs such as Landcare in Australia. Landcare aims to raise broad and targeted awareness about sustainable management of the environment, partly through facilitating groups to undertake key land management activities. A crucial characteristic of these groups was their voluntary nature (OECD 1998a). Putnam (1993) believes interactions among people in these groups and organisations create horizontal networks of civic engagement that help participants to act collectively. Public governance based on commitment to public welfare, accountability and transparency provides a basis for trust and social inclusion, which in turn can strengthen social capital. By creating an environment whereby the whole — social capital — becomes greater than the part — human capital—enables the potential for action and sustainable outcomes.

The implications of this for acid sulfate soils issues, are that the cane industry was effectively building human and social capital. The industry was aligning itself with environmentally pro-active policies to limit pollution and reinforcing this position with communication and training to increase human capital and thereby empowering the cane farmers. The cane farmers felt safe because they were part of an industry that had a strategic plan, which was transparent and based on practical solutions. The cane industry represented a homogenous group, that had developed its operational systems over 20 years with a structure that none of the other industries in the study could emulate because it is based on a shared economic interest and binding contract to the Sugar Cane Mill.

Fostering an organisation’s ability to share knowledge was essential for the development of social capital in the whole rural community. Staatz (1988) describes institutions as "the rules of the game", the ways of structuring human independence. These rules affect transaction costs, patterns of production, speed and distribution of economic growth. Institutions reflect the types and levels of human and social capital. Putnam (1993) theorised that horizontal associations and networks that cut across and link associations were important. He found
that they were instrumental “in helping citizens negotiate more effective and productive relationships with both the state and the market”. Bebbington (1998) expanded on this theory and suggested that “economic organizations constituted as social enterprises and with well developed internal management capacity, and external capacity to negotiate in the marketplace, have had more of an impact on local sustainability than those organizations that primarily had political and representative capacities”.

However, other groups were not homogeneous industry groups, they did not have well developed management structures or the capacity to negotiate effectively, they were diverse catchment groups brought together over an emotive issue of poor water quality. Efforts by the beef farmers to find practical management solutions for their land were different to the goals of other group members who wanted environmental outcomes for the whole ecosystem (see Chapter 5). These groups were frequently new and therefore the challenge for them was to develop forums and common language where they could begin to share knowledge and develop agreed goals, challenges that the cane industry did not have to undertake. The landholders were requesting information to inform the groups about acid sulfate soils and government intervention to negotiate within the groups and for the groups, with other government agencies to assist in bring the diverse interests to a shared vision.

Working together requires trust (Pye 1999) so reciprocity can flourish. “Members of a society must feel instinctively that if they do a favour, they will in time receive some benefits in return. Trust was generally highest among those who were most like oneself physically and culturally; those most distrusted tend to look different and follow different practices”. Yet trust and distrust are also shaped by all kinds of unseen forces, such as external pressure from catchment stakeholder groups about diffuse source pollution. Another implication of the important role of social capital was that “people’s identification with larger social groups should be influential in promoting ecological responsibility” (Stern and Oskamp 1991). A downside to building social capital is that networks are much easier to form in opposition to a person, cause, or creed than in support as demonstrated by the successful strategies of the fishing lobby group to raise awareness of acid sulfate soils by attacking landholders and their management practices. Instead of forming groups to discuss the issue, the lobby groups had used the media to raise awareness, but the result was increased conflict and distrust. This next section explores the implications of sharing the control of future outcomes within diverse stakeholder groups and looks at why control is important for individuals and groups.
7.5 REGAINING CONTROL

The survey results in chapters 5 and 6, indicated that having control over the future was important and that conflict over different visions of the future between catchment groups was a concern to many graziers. To understand why control is important, the concept of locus of control is introduced here. Researchers have moved away from looking at personality types and their associated attitudes to behavioural change therefore leading to an interest in locus of control. There are two categories of locus of control, external and internal. Rotter (1966) defined them as follows:

- External control is when a reinforcement is perceived by the subject as not being entirely contingent upon his action, and it is perceived as the result of luck, chance, fate, as under the control or power of others, or as unpredictable because of the great complexity of the forces surrounding him.
- Internal control is when the person perceives that the event is contingent upon his own behaviour or his own relatively permanent characteristics.

Locus of control is a means of predicting behaviour change (Marks 1998). Marks argues that, “for behaviour change to occur the reinforcement must be of value to the person. Individuals with an internal locus of control experience reinforcements of value as more meaningful or influential to them because they believe that they had control over reinforcements; to increase or decrease the reinforcement, they change their behavior. On the other hand, individuals with an external locus of control were less likely to change their behavior because they do not believe that changing their behavior would have an effect on the reinforcements. Instead, they believe that what happens to them was primarily due to luck, chance, fate, or powerful others”.

A study of landholders in the U.S.A., McNairn et al. (1992) found that the majority of the landholders had an internal locus of control. Rugged and individualistic is one popular image of the farmer. Landholders tend to take pride in taking responsibility for their actions – and indeed it could be considered an essential character trait for running a high risk business. However, in terms of locus of control, internals, “are more likely to experience a deficit in self-esteem when faced with failure. They may also respond to uncontrollable events less well than externals. Such responsibility leads internals to believe that difficulties were brought upon oneself and so they may be less likely to offer assistance to those in need of help. Therefore it can be argued that externality may be associated with altruism and collectivist attitudes and internality with selfish and ruggedly individualistic models of action”. (Furnham 1993).
This has considerable relevance for managing behavioural change with landholders in relation to the impacts of acid sulfate soils as a diffuse source pollutant that causes environmental problems for downstream dwellers. If landholders tend towards internal locus of control, they were likely to react badly to external events that were out of their control. Landholders in the acid sulfate soils study stated having control was important to them. Control over flood gates, feeling in control of management of their farm and the water management in the catchment were frequently stated along with concern about the lack of knowledge of the general public about farming practices and impacts of legislation. Therefore public outcry about acid water and dead fish, with blame directed at the farmer, without meaningful reinforcements from the government about management strategies, not only create an environment for conflict between these groups, but also encourages selfish and ruggedly individualist behaviour within the landholder, rather than the desired altruistic, collectivist behaviour.

An understanding of the theory of locus of control also enables a greater understanding of the potential impacts of group conflict on the individual.

Positive successful life experiences probably increase internal locus of control beliefs through optimistic attribution. These may increase confidence, initiative and motivation and, in turn, lead to more successful experiences. The opposite may be seen to occur with negative, unsuccessful life experiences which leave the individual feeling at the whim of powerful and hostile forces beyond their control. A pessimistic style may thus develop which will diminish one’s sense of agency and control, such that further unsuccessful experiences are likely”.

(Furnham, Sadka and Brewin 1992)

Landholders who were at the extremes of either being in-control or out-of-control were less able to deal with stressful situations than those that had a healthy balance. For example Marks (1998) says that “bilocals” have a healthy balance between internal and external control...healthy individuals facing stressful events are able to accurately assess their level of control in situations, and they have the flexibility in coping strategies to draw on the most effective intervention. Developing a more bilocal view should be encouraged when levels of control were going to be challenged, both in decreasing a high level of control, and increasing when control was low. Marks further discusses how

“counselors should make an effort to gain an understanding of clients’ views about control, be accepting of clients’ cultural values regarding control, and discuss these beliefs with clients. Counselors also might suggest the multiple ways to think about control when appropriate, explore how clients’ notions of control fit with their concerns, and examine how clients’ beliefs about control might be used in facilitating change and enhancing functioning and growth”.

“...
Cultural differences, gender and age are some of the attributes that affect an individual’s locus of control. Within individuals, locus of control will varied depending on the situation. Landholders, for example, will accept, as most people do, that they have no control over the weather. Yet landholders in Australia, who have less regulated agriculture than landholders in, for example, Denmark (pers comm. Anni-Kerr Pedersen, Dept. of Danish Agriculture) would find it more difficult to adapt to regulatory reforms over which they have no control. This would be particularly so if the landholders believe that the reforms were going to challenge their control over production and environmental management. Indeed Furnham et al. (1992) argue that “individual goals often conflict with those of the political and social system”.

![Farmer attitudes to acid sulfate soils](image)

**Figure 26** Qualitative analysis of farmer attitudes to acid sulfate soil management sorted by industry

In this thesis the cane farmers and the cane industry showed a high level of control, as well as human and social and industry cohesion while the beef industry did not, (see Appendix III, Farming community ideas about the way forward, Pages 14 and 15). Landholders who felt in control (see Figure 26) were confident about their ability to manage the problem. They believed acid sulfate soils were either; ‘within their control’, ‘not an issue on their property’, or ‘their industry was attending to the problem adequately and effectively negotiating with external groups’. Landholders who don’t feel in control of acid sulfate soils management feel the whole issue was beyond anyone’s control. They felt powerless, and they fear the implication of acid sulfate soils management regulations. Rumours encouraged fear and uncertainty over future farm viability. Landholders who did not feel in control tended to be
landholders who were not supported by a cohesive industry. They did not see their industry as being organised or effective at communicating information about acid sulfate soils issues or practices. Consequently, they:

- did not know where to get help or support in acid sulfate soils management,
- saw the need for acid sulfate soils management as an overwhelming burden,
- requested more education, advice, soil tests and personalised assistance.

Landholders who felt supported by a cohesive industry, mainly the cane farmers saw their industry as organised and effective at communicating acid sulfate soils information.

Landholders appeared to feel most out of control when they received conflicting information or no advice at all and they were under pressure from the community or other external groups to change their management practices (see Chapter 5). Conflict among scientists as to appropriate methods, led to a lack of credibility within landholder and government groups and exacerbated the problems. Regaining control is important to stakeholders who are under pressure to change. Unless stakeholders were involved in the process and gained a better understanding of the reasons for the pressures that they were being subjected to, research on locus of control infers that they would respond by becoming more aggressive and less altruistic and that conflict would spiral.

### 7.6 REFLECTIONS AND CONCLUDING REMARKS

Landholders have had a long history on the land and many realise the importance of conservation of resources into the future. Frequently landholders in the acid sulfate soils study said, “if we understand what the problem is, we will work out how to manage it”. Landholders and government workers agreed that it was critical that they deal with environmental problems, such as acid sulfate soils, if they were to develop more sustainable agricultural practices and to maintain a competitive place in local and world markets that required environmentally acceptable production methods. Yet the process of negotiating with many diverse interest groups has been fraught with problems. Landholders found the picture of the cohesive industry that was empowering farmer’s capacity to manage vs. the non cohesive industry that provides no support and leaves its landholders feeling ‘out of control’ very relevant. There appears to be an association between control and industry cohesion. Control appears to be important for building human capital and is reinforced by strong social networks and social cohesion, with loss of control likely to result in conflict, erosion of social capital and a negative attitude towards learning about environmentally sensitive land management. This has important implications for managing diffuse source
pollution and sustainable development, because success with tackling such catchment scale issues depends on working with groups to reach consensus about future management of natural resources. The importance of social capital in organisations and institutional arrangements need greater emphasis in policy forums.

Social networks can be viewed as the glue that enables society to not just develop human capital, but to become more cohesive and develop more shared solutions, altruistic attitudes and build social capital. Conflict undermines the social fabric and the potential for sustainable development. A good stock of human and social capital enables a more dynamic and flexible approach to the future management of the environment. The cane industry was building human capital and fostering a ongoing building human capital approach for its landholders. It was increasing knowledge and thereby enabling individuals to be more involved and exercise control over decisions that effect their well being. Locus of control appears to be a valuable social indicator for understanding the capacity of stakeholders to change management practices within their organisational structure and legislative environment.

The benchmarking data were most effective in engaging stakeholders in discussions about the management of acid sulfate soils and identifying best management practices. It had also been most effective in providing new knowledge and indicators. These findings also indicated that acid sulfate soils study focus groups using participatory processes had succeeded in identifying solutions. However, building human and social capital to instigate these solutions, required political will, funding, time and commitment. Caution is needed, because involving stakeholders in participating in solutions using the Social Benchmarking process and raising stakeholders knowledge and expectations, without also gaining organisational support for the changes, (for example, supportive policies, communication strategy, training, acknowledgment of the results), can cause frustration and conflict. This could therefore result in the reverse of the desired effect, dis-empowerment, loss of trust, reduced control, increased conflict and ultimately undermine the participative process and social capital.

Reflections. After the farmer focus groups, all of us involved felt committed to try and get a soil sampling program up and running. Participants in the government focus groups seemed interested but unenthusiastic about a soil sampling program, even though it had obviously been successful in the sugar cane industry and other industries had agreed it was a first step towards environmental best practice. I approached NSW Agriculture to develop a project and I presented the findings to ASSMAC. I explained to both groups that it was bottom up, participative research, as current policy encourage and that farmers would be involved in the process. Although interested, they did not ask for expressions of interest. So I invited a soils
advisory officer and the Richmond Catchments Landcare officer for the Tuckean catchment to form a team with myself. I prepared a funding proposal, for developing guidelines, which ASSMAC funded. The book has been produced, and the program implemented and is currently ongoing (2003).

It appeared that even though the results of the survey and focus groups of this thesis were ‘interesting’ and ASSMAC was most impressed with the book, ‘Farming community ideas about the way forward’ (Appendix III), gaining further recognition for recommendations by stakeholders was going to be difficult. Indeed unless I was going to personally drive the issue, government agencies were seemingly not interested in taking the lead on the soil sampling project, or on developing a focus on social issues and communication and education policy. Recommendations to form interest groups and investigate ways to increase communication between government agencies were not acknowledged or acted upon. Thus the benchmarking data and Social Benchmarking process was not initially successful at influencing government decision-makers or policy. However, part of the strategy of the Social Benchmarking process was to create pressure to change, hence the quote from Napoleon at the start of this chapter. Social issues and participatory policy development will gain more acceptance with decision making forums once pressure is applied from multiple stakeholders and when the benefits become more apparent. This can best be facilitated by informing broader stakeholder groups of policy issues, creating a transparent operating environment, and using social terminology, such as human and social capital within policy discussion forums. Another tool for influencing policy forums in the acid sulfate soils study will be the second benchmarking survey, this will provide evidence of change and this will be discussed in Chapter 9.

The next chapter reviews how the cane industry successfully changed its polices and practices, and how this thesis then designed a project based on this learning that could have application for other stakeholders and industries.
8. DEVELOPING TOOLS FOR BEST PRACTICE ENVIRONMENTAL MANAGEMENT

8.1 Introduction

8.2 Implementation of a Best Practice Environmental Management (BPEM) Tool

8.2.1 Case Study: The sugar cane soil sampling program

8.3 Information dissemination and BPEM

8.4 Developing "Keys to Success" BPEM guidelines

8.5 Communication strategy for "Keys to Success"

8.6 Beyond BPEM to Best Practice Environmental Regulation

8.7 Reflections and Concluding Remarks

The peasant and the apple tree: A peasant had in his garden an apple tree, which bore no fruit, but only served as a perch for the sparrows and grasshoppers. He resolved to cut it down, and, taking his axe in hand, made a bold stroke at its roots. The grasshoppers and sparrows entreated him not to cut down the tree that sheltered them, but to spare it, and they would sing to him and lighten his labors. He paid no attention to their request, but gave the tree a second and third blow with his axe. When he reached the hollow of the tree, he found a hive full of honey. Having tasted the honeycomb, he threw down his axe, and, looking on the tree as sacred, took great care of it. Self interest alone moves some men.

Fables, AESOP, Sixth Century B.C.
Coastal landholders and government personnel are major stakeholders in the present and future management of acid sulfate soils in NSW. As discussed in the previous chapter, complex environmental problems can cause conflict, lack of control amongst some stakeholders and disagreement on future goals. In the acid sulfate soils study (Chapters 5 and 6) a need for consistent information and simple guidelines for use by both government agencies and other stakeholders including landholders was identified. Landholders participating in the study also identified sampling for acid sulfate soils as the means of obtaining their most needed information based on the success of the cane farmers program.

This chapter investigates the cane soil sampling program and discusses developing guidelines for other industries (see Appendix III, Acid Sulfate Soils: Keys to Success). However, for the cane industry, it was more than just soil sampling, it was a move towards best practice self regulation and industry believed it was taking more control over its future. Can the learning that cane farmers have profited from be of benefit to other industries when industry structure and incentives are different? Findings, (see Chapter 3) indicate that traditional government extension programs had little application to situations where there was no economic gain and that a participatory, adult learning approach was likely to be more successful. But this needs institutional support to involve landholders in a best management practices self regulatory program.

8.1 INTRODUCTION

Despite considerable biophysical research and organisational support, Globally we are facing increasingly complex environmental challenges due to surface and groundwater pollution, soil acidification, salinisation and acid sulfate soils (Brezonik 1999; Cornish 1999). Part of the problem was the issue of how to incorporate stakeholders in the decision process and foster ownership of these decisions when the ‘generation’ of knowledge was separate to policy and technical fora where fundamental decisions were made about natural resource management. This integration, of knowledge-generation and decision-making about resource management, is crucial for enhanced decision-making.

There is an increasing trend across OECD governments for more open and transparent decision making processes, which is compatible with greater decentralisation of decision making and the search for partners to work with governments for environmental protection. The widening of stakeholder circles to include the public at large, whose collective actions make them a central actor rather than a passive participant, requires new strategies by
government agencies. However, public scepticism about the credibility of environmental information is increasing along with farmer scepticism about government policies and their ability to effectively manage the environment (OECD 2001b). Therefore, the challenge is to reduce the complexity and the quantity of information by developing specific, credible and relevant information, to incorporate local knowledge into the process, and to encourage innovation. Why? Because the social dimension was significant to the success of economies and needs to be considered when developing policy. OECD (2001c) states that:

"Investment in information, communication and technology (ICT) and human capital, together with more innovative ways of producing goods and services, are essential to explaining the diverging patterns of OECD growth since the start of the 1990's".

For participatory processes, (see Chapter 4) to be effective there needs to be an information feedback loop. As discussed in Chapter 1, a fundamental concept behind this research work was that each stakeholder has a vested interest in their own future and they need credible information to enable them to reach agreement and take action on future ecosystem issues.

There are different motivations for landholders to change management practices to account for environmental issues (see Chapter 4) such as financial incentives from increased production. However, environmental problems that cause no immediate negative impacts on the land, may require more complex stimuli, such as tax incentives, subsidies and regulations. There were other motivations for conservation behaviour, (see Chapter 7) and those with higher levels of education and who were informed about the environmental issue were more likely to respond to environmental problems.

Extension and education programs, discussed in Chapter 4, were frequently cited as necessary for improved farm management and to change farmer’s attitudes. But Vanclay (1992) contends that landholders were not antagonistic towards the environment, rather they generally had positive attitudes about environmental management. They may, however, have different views about what environmental management means, about how to implement it, and they had concerns about whether the agricultural management practices being promoted as sustainable are, in fact, sustainable, and/or profitable. As such, the problem was not one of landholders having the wrong attitude, but one of a conflict of views about the right way to manage the farm. “People will modify their personal demands if they feel there is adequate knowledge about the available environment, and that management practices will alleviate the problem” (Syme et al. 2000).
Benchmarking uses best management practices discovered in one group to improve another group’s performance, as discussed in Chapter 4. It was more than just establishing that practices are different. Benchmarking is about using a group’s experience to find out if practices can be transferred for the benefit of another group. Establishing a list of best management practices does not mean that all these practices can be reproduced in other groups. Circumstances vary considerably between groups, and what is applicable to one group, may have no application in another group. There are problems with the current use of benchmarking, and they include the poor use of “farmer as learner” methodology (adult learning principles) and the lack of evaluation to measure change or outcomes (Camp 1989; Murray 1997; Irving and Murphy 1996; Ronan and Cleary 2000). Benchmarking has traditionally measured the indicators but has not looked at the ‘how’ processes, and there had been a failure to communicate benchmarking results to wider audiences (RIRDC 2000). Ronan and Cleary (2000) discuss how benchmarking was promoted in Australia as a farm business tool with ‘expectations that it will help landholders in the pursuit of better practices and profits’. Where best management practices had been identified it had been on the basis of assessing the unit cost of the practice, but they propose that best practice benchmarking should provide a more balanced set of information including production, financial, environmental and social indicators.

Best practice environmental management (BPEM), must be attractive to landholders, and therefore must be both cost effective and technically feasible (Abdalla 1996). Benchmarking can provide a valuable source of information, however, the benchmarks need to indicate the direction that must be pursued; best management practices, rather than specific operationally quantifiable metrics that were immediately achievable (Camp 1989). This information should be presented in a form that is easy to interpret, so a key part of the process which needs special attention is the degree of communication backwards and forwards between the various spheres of decision-makers, and the extent to which this is reflected in the various plans (Williams and Walcott 1998).

Accordingly to Ronan and Cleary (2000), there is an expectation that benchmarking information will automatically help landholders in the pursuit of better practices and profits. However, getting value from farm benchmarking depends on three things

- “whether the farmer had an existing business plan, budget and physical and financial record system;
- which type of approach was used in the ‘benchmarking’ activity in which the farmer participates, and
• whether and how the farmer uses the information to identify opportunities for gain and
implemented changes to how he or she does things” Ronan and Cleary (2000):
They concluded that while benchmarking was a pointer to potential change, it was not a
trigger for automatic change.

Literature on agricultural benchmarking studies used the landholders production systems as
the benchmarking target for analysis, with increased profit as a stimulus for change. The
authors fail to take account of the important roles that government and industry bodies have
or the relevance of regulation and legislation. Focussing solely on production systems has
caused considerable environmental problems in the past, such as excessive use of nitrogen
and the deep, dense drainage systems that had caused acid sulfate soils problems. Further
the role of institutions has not been acknowledged.

In this thesis Social Benchmarking has been applied to an environmental problem, acid
sulfate soils that had no immediate productivity or financial benefits except for the sugar cane
industry, who had managed to find some production gains by reducing drainage density
(Woodhead and Hughes 2000). However, in most cases, landholders will incur financial cost
and it requires time to remediate acid sulfate soils problem areas and they may see no
immediate benefit on site. The roles of the government and industry bodies were therefore
crucial for developing polices and facilitating debate. They must develop policies that
support environmental change and acknowledge the efforts made by stakeholder groups.
Therefore Social Benchmarking definition of BPEM is broad and is defined as “any practice
that aids in the better management of an environmental issue”. Stakeholder groups identify
BPEM’s and they include social, economic and environmental initiatives. The acid sulfate
soils BPEM were identified in Chapter 6 and they included simple guidelines; soil sampling;
organising catchment groups; DA process for drain cleaning; extending information to
landholders; farm management plans; and developing better communication between the
government departments.

As previously mentioned, acid sulfate soils is a complex problem because of the range of
stakeholders and because diffuse source pollution has spatial (on-farm and off-farm) and
temporal pollution dimensions that involve both soils and water. There are many indicators of
potential acid sulfate soils on the land, including rust stains on drain walls, clear (acidic)
water and bare, scalded land. Some landholders and government personnel had developed
a high awareness of acid sulfate soils best management practices that include changing
drain design from deep and narrow to wide and shallow and measures to avoid cattle
destroying edges of drains. For others to develop a perception that they had a problem with
acid sulfate soils, they need to learn how to identify and manage acid sulfate soils (Chapter 5 and 6). Further they need to understand how to identify problem areas and how to develop short and long term remediation strategies. This often requires a change in the way the land was viewed. Many landholders have been farming their land for a long time and they have observed changes in the landscape over this period such as expansion and contraction of acid scalds and the change of water colour in drains and rivers on their property. Negative impacts on production are relatively easy for the landholders to observe, but impacts on the wider environment and understanding the whole bio-physical process, are less understood. Visual signals can be misleading. A large area of acid tolerant lilies can look beautiful and become a stunning backdrop for tourist attractions, yet they are a sign of a most unhealthy ecosystem.

A major challenge with raising awareness of diffuse source pollution, is for individuals to understand that their actions had wider consequences in the ecosystem. The attitude expressed by a landholder participating in the survey (Chapter 5):

"I've got a big area here and it doesn't affect any one but me, so I can do what I like".

reflects the sense of property rights and that some landholders believe that their agricultural practices do not adversely affect the external environment such as water and air. This attitude had frequently put landholder against landholder and against the general public. While this attitude is not the sole domain of landholders, and the general public are equally capable of acting in isolation and not taking responsibility for their actions, it presents a major challenge for future agricultural and environmental policies. Local problems are going to seem more imperative than global ones, no matter how much attention the media gives to the problem (Bardwell 1991). Yet with diffuse source pollution, the problem may be local but the landholders may not perceive that they are the cause of the problem. They may well reject the concern expressed by the community and the media and deny their contribution to the problem until it has been proven that their land was causing a problem.

This chapter will now discuss how to learn from the successful initiatives of one industry and how to create a learning environment in other groups where organisational characteristics may vary considerably. Stakeholders agreed that the sugar cane sampling program was a success, and they also identified a need for simple guidelines that could be used by all stakeholder groups to aid stakeholders’ understanding of acid sulfate soils. Landowners wanted a soil sampling program similar to that conducted by the cane industry where farms were visited by an employee of the Sugar Cane Co-operative, yet the government employees did not feel this could be supported because of lack of funding and political will. As discussed in the previous chapter, the benchmarking team decided to investigate the
cane soil sampling program and to develop guidelines for soil sampling that could be used by the government, other regional groups and individual landowners. These two BPEM issues that were identified by stakeholders group were agreed to be of fundamental importance to the better management of acid sulfate soils, because soil sampling was successful in the cane industry and because all groups agreed they needed simple guidelines. The investigating of soil sampling and developing information using participative processes are discussed in the next section. How to develop this information for wider audiences is then discussed along with developing the guidelines. The cane industry had developed their soil sampling program into best practice environmental regulation (BPER), so the chapter concludes by discussing whether this was possible for the other industries in the acid sulfate soil study.

8.2 IMPLEMENTATION OF A BEST PRACTICE ENVIRONMENTAL MANAGEMENT (BPEM) TOOL

8.2.1 Case Study: The Sugar Cane Sampling Program

Many cane farmers feel in control of managing acid sulfate soils (see Chapter 5 and 6). Why did they feel in control? What was the cane industry doing to make them feel in control? These two questions are explored here. The cane industry conducted a major acid sulfate soils extension program on all the cane farms in the three cane producing catchments of northern NSW, the Tweed, Richmond and the Clarence. In the cane extension model, landholders were visited individually by a cane industry representative and their farm was tested for acid sulfate soils. The extension program involved 3 people (1 full time) and they averaged four farms a day, with each visit averaging 1 hour. There was considerable publicity in the cane industry newsletters, however landholders were usually informed the previous day of a soil sampling visit. Three soil cores were taken from each farm and processed in the laboratory. Tests for acid sulfate soils were not done on the farm. The following section, Table 32 shows an extract from the cane industry’s best practice guidelines for acid sulfate soils. It demonstrates both their commitment to managing acid sulfate soils and their capacity to enforce BPEM.
The NSW Sugar Industry Best Practice Guidelines for Acid Sulfate Soils

“Best practice is the currently recognised farming techniques capable of delivering environmentally and economically sustainable sugar cane production. Best practice in acid sulfate soil management is set out in the ASSMAC Manual and summarised in these guidelines”

Commitment to Best Practice

The Sugar Industry is committed to minimising the production and outflow of acid from the acid sulfate soils which occur beneath much of our cane land to protect the soil and water quality on farms and to protect surrounding ecosystems for current and future generations. The industry’s objective is to ensure that activities of its members do not contribute to or exacerbate acid sulfate runoff. To this end, the Sugar Industry will adopt current best management practices in its farming operations. All members of the NSW Sugar Milling Cooperative Ltd are signatories to a Memorandum of Agreement that individually confirms this commitment. The Co-operative may refuse to accept or pay for cane from land not managed according to best practice”.

The sugar industry has previously taken initiatives to manage acid sulfate soils including:
- Survey of all cane farms for acid sulfate soils
- Funding of external research
- Development of acid sulfate soils management protocols
- Subsidy of intensive soil sampling and analysis of cane lands for pH and nutrient monitoring
- Monitoring of water quality
- Extensive use of lime to improve field pH
- Extensive laser grading and filling of existing open drains
- Opening of floodgates to provide tidal flushing
- Education of landholders and excavator contractors

On-going technical support is also provided for members to manage acid sulfate soils. The Co-operative will only support expansion onto new land where new acidity will not be produced and existing acidity can be managed according to best practice.

Interviews were conducted with five cane farmers and cane industry representatives, extension officers and researchers. Table 33 reviews the outcomes from these interviews. The strengths and outcomes from the program are shown along with the constraints to the effectiveness of the program.

<table>
<thead>
<tr>
<th>Strengths and Outcomes</th>
<th>Constraints</th>
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<tbody>
<tr>
<td>Grower involvement</td>
<td>Little scientific rigour in sampling design</td>
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<tr>
<td>Industry driven</td>
<td>Lack of training methodology</td>
</tr>
<tr>
<td>All landholders in industry involved</td>
<td>Farm management plans were too broad</td>
</tr>
<tr>
<td>Extension message linked with inhouse publication</td>
<td>Limited advice on management issues: ie ‘Add lime and add some more’</td>
</tr>
<tr>
<td>Increased knowledge and awareness</td>
<td>Little interaction in management decision process</td>
</tr>
<tr>
<td>Understanding of depth but not of the technical testing process</td>
<td>Program not designed to be participatory, often extension person not with farmer for entire sampling process</td>
</tr>
<tr>
<td></td>
<td>Farmer did not keep data sheet at time of visit</td>
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<tr>
<td></td>
<td>Data sheets hard to understand</td>
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<tr>
<td></td>
<td>Slow to get to all landholders (over 3 years for nearly 630 landholders)</td>
</tr>
</tbody>
</table>

Table 32 Sugar cane industry BPEM

Table 33 Review of Cane Extension Programme
The strong commitment that the cane industry had shown to managing acid sulfate soil reflects the industry’s heavy reliance for its ongoing existence, on maintaining clean environmental production. The cane industry had several environmental issues that caused concern to local communities, most notably burning of the cane and water quality through acid water and use of pesticides. Cane farms are very close to the rapidly developing coastal towns. If the cane industry does not tackle environmental issues, public criticism could easily drive the industry from northern NSW, (pers.com Robert Quirk, cane farmer).

![Figure 27 A deep narrow drain on the right is reshaped to a wide shallow drain on the left that does not enter the acid sulfate layer of soil](image)

It appears that the individual farm visits and the clear guidelines which had since developed on how to manage acid sulfate soils, ie lazer levelling and drain re-shaping, (see Figure 27) have contributed to the cane farmers sense of control about managing acid sulfate soils. However, the cane industry has also found economic benefits from these best management practices and this has provided an incentive for cane farmers to invest in best management practices. Two key discussion points arose from the cane industry study. The first concerned the effectiveness of the program in turning information into knowledge and action. Knowledge and extension styles were discussed in Chapter 3. The next section looks at information programs and strategies for dissemination of information to a wider audience. The effectiveness of this information program and whether it results in action and changed knowledge will be discussed in Chapter 9. The second discussion point, is the organisational support and the incentives for change which are discussed later in this chapter.
8.3 INFORMATION DISSEMINATION AND BPEM

The mass media are important in creating awareness and arousing interest, but they appear to have little direct influence on decision-making (Van den Ban and Hawkins 1988). However, when making decisions, individuals tend to value the judgement of others whom they know and trust. This was emphasised during the acid sulfate soils study. Alongside TV, radio and newspapers, landholders stated that they got most information from colleagues, (see Chapter 5). The trust that the landholders displayed towards different government agencies became evident during the focus groups, where landholders had a more positive attitude towards NSW Agriculture than towards natural resource Departments such as Land and Water and National Parks (see Chapter 6). It appeared that they perceived NSW Agriculture as having an interest in production as well as environmental issues because of their historical connection with agricultural extension officers. However, they also noted that advice provided by NSW Agriculture and other state government agencies was the cause of many current environmental problems, (see Chapter 3).

The relationship between information and landholders’ beliefs about environmental quality (and thus landholders’ compliance with environmental protection measures) is complex. Landholders’ beliefs may colour their selection of sources of information and their assessments of information from different sources (Lichtenberg and Zimmerman 1999). Napier et al. (1986) cite a number of works in the area of information diffusion that point to the fact that information was important in the adoption of conservation technologies. Their own work indicates that the frequency of use of either institutional or non-institutional information has a weak positive relationship with environmental concern but does not have a statistically discernible influence on the degree of environmental concern. “Landholders who are concerned about the environment must be convinced that adoption will not result in higher risks to their farms before they will adopt new technologies. Simply making people aware of environmental problems will not bring about adoption” (Napier et al.1986).

How information is communicated through the media can become distorted. Both the sender and the receiver tend to employ selective processes when using mass media, which often results in the receiver distorting the sender’s messages. A study in America by Napier and Brown (1993) found that when land operators learned that there was little to be concerned about at the present time, it was possible that they would disregard the information as not having an environmental imperative. Another problem was identified by Bardwell (1991) as a fatalistic pessimism that the problems were so big nothing can be done. It was also common...
for landholders to consider that the problem was not relevant to their farm because of situational differences. For this reason, it was important to state the conditions under which the result was obtained (Senn 1996). Regardless of these non-adoption reasons, there was pressure on landholders to adopt some form of ‘best-practice’ (Lockie 1998) and as discussed in the acid sulfate soils study, there is considerable public and institutional pressure to do so.

Extension programs in agriculture have been directed at landholders by government agencies, as discussed in Chapter 3. However much information dissemination from government departments is indirect and is aimed more at raising awareness about the issue in the general community. Landholders and government personnel in the acid sulfate soils study agreed that community education was important because without the support of the community, initiatives would not be funded and their benefits understood or widely adopted. They believed that they’re contribution needed to be complimented by increased understanding in the broader community about what landholders had done and why. Landholders were particularly adamant, (Chapter 6) that if they were going to put time and money into changing drainage systems that would have no direct benefit to their production, that the community and the press should acknowledge their efforts.

The audience for acid sulfate soils information includes

- councillors from local government who had the authority to direct council activities and were considered strategically essential for support of regional initiatives such as coordinated funding for better water quality and enforcement of local and state environmental legislation;
- schools; school children were frequently mentioned as having a major influence on the farm. Children were regarded as important sources of information for their farming parents, who may not have access to information if they were not part of an industry body,
- the farmers federation, and other industry groups
- land management group including Landcare or other catchment organisations.
- other landholders such as Aboriginals and other government departments including National Parks and Wildlife who own considerable areas of potential acid sulfate soils.
- environmental and community groups including stream watch and ocean watch

The first step in managing complex problems is to simplify the information available (Woodhead et al. 2000, Bardwell 1991). While strategies for addressing current
environmental problems call for a better-informed public, the effectiveness of information is hampered by a number of opposing factors (OECD Environmental Outlook 2001), these are:

1. People’s reactions to volume and complexity of information which makes it difficult to interpret information effectively and accurately.
2. Skepticism about credibility of information.
3. Number of consumers is decreasing who are looking for information to guide decisions.

The report concludes that governments, the private sector and NGOs should all find more effective ways of communicating environmental information to citizens because there is increased need for public and stakeholder participation.

Results from bio-physical research needs to be in a credible format that landholders can incorporate into their management systems. Credible information is especially important when on-farm changes require capital input, time and involve risk, as demonstrated by the scientists’ response to the Chernobyl nuclear fall-out (Wynne 1989). Scientific experts lost most credibility with British sheep farmers when they failed to recognise that the farmers were very knowledgeable about the local environment, farming practices and decision making. Scientists delivered contradictory and impractical information about how to manage the impact of radioactive contamination. Informal knowledge needs to be incorporated with more abstract and formal scientific knowledge to create an effective response. Landholders in the acid sulfate soils study frequently complained about contradictory information from a number of different government departments.

Understanding informal information about landholders’ perceptions, ideas and knowledge of their own land management systems is critical for the development of successful information packages for landholders and the wider community. An understanding of the decision processes of landholders is also necessary to influence change. Research by Barr and Cary (2000) identified eight stages of decision making:
1. anticipation of degradation
2. seeing degradation
3. seeking information
4. weighing the alternatives and risks

5. making a decision
6. undertaking a trial
7. making a change
8. reaffirming the decision
This decision making process applies to visual sighting of on-farm degradation and does not apply effectively when there is no visible signs of degradation on the land. Bennett and Morrison (1999) recommend that “respondents need to be supplied with adequate information in a way that was relevant to them. Respondents need to be told about the current state of a natural resource, about what restoration was proposed and how it will happen. Care must be taken to ensure that the information was simple and parsimonious. While a relatively rich amount of information needs to be provided, it should not be overwhelming”. With this in mind, the next section discusses the acid sulfate soils study and looks at what tools were needed to help landholders understand the potential for degradation that their farm holds, so that they can ‘enter’ this decision making process.

8.4 DEVELOPING “KEYS TO SUCCESS” BPEM GUIDELINES

Earlier in this chapter, the need for “information about how to sample for acid sulfate soils” and “clear simple guidelines” was identified as BPEM. Many landholders in the focus groups were very aware that they had little knowledge about acid sulfate soils. They had observed bare patches of land, but they ‘came good’ when the season was good. They could not see the connection between bare patches of land, acid sulfate soils, water quality and environmental degradation. To understand this ‘cause and effect’ relationship required analytical tools to test the soils, to provide hydrological and geographical information, and to assist in an appreciation of the historical changes that had occurred within the catchments. There were also many government agencies involved with acid sulfate soils, many staff were unfamiliar with the complex issues associated with them. There was a technical manual on acid sulfate soils, however this manual was frequently referenced as being too big (it was several hundred pages), too technical and complex. Making this information simple and relevant to landholders management practices and creating a useful tool that government agency staff can use to educate themselves and other stakeholders, is the focus of this section.

A multi-disciplinary team “the team” was formed, consisting of myself, a soils advisory officer and a landcare group co-ordinator. The team agreed that the first step to developing a better co-ordination of information and a tool for better understanding of acid sulfate soils, was to develop simple guidelines for testing on the farm. The first step in this process was to review the cane sampling process, as discussed above. While the cane program had conducted sampling in labs after visiting the farm, our program acknowledged the lack of laboratory facilities available to landholders and therefore used a simple field test, using peroxide. This
enabled an instant response, with the caveat that a further soil test may be required. Initially the project aimed to just develop guidelines, however, it became evident that a simple kit that could be supplied separately was also necessary. To manage acid sulfate soils, the team found, after discussions with scientists and extension staff, that these issues were of particular relevance:

- Knowing what the risk of acid sulfate soils was on your farm from the risk maps.
- How to recognise acid sulfate soils using vegetation, soil and water indicators
- What to sample and where and how often
- How to sample soil and water
- Testing procedures, on-farm vs. laboratory tests
- Coordinating on-farm information on a catchment basis
- When to get further tests
- How to use the information for better drain and land management

An iterative, participative approach was adopted to develop the guidelines and the kit, (see Appendix III, Acid sulfate soils: Keys to Success). Twelve landholders who were respondents in the benchmark survey and had a low awareness of acid sulfate soils (4 tea tree, 4 beef and 4 dairy) were visited in two catchments; the Richmond in northern NSW and the Macleay which was half way down the coast. The Macleay, had the largest area of landholders with a low awareness of acid sulfate soils, mainly beef farmers.

Soil and water sampling for acid sulfate soils was conducted on the farms with the landholders present at all times. Farmer responses were recorded on tape and the procedure was adapted after each visit in response to their comments. Information on the tape was transcribed and analysed for frequently occurring comments and language style. This information was used to ensure the guidelines were communicated using language that was agreeable to both landholders and government employees. Responses from the landholders and government employees were also used to ensure that the issues discussed in the guidelines addressed the needs of both the landholders and the other stakeholders. Once a draft of the guidelines had been prepared, landholders and government employees were asked to read it and respond, particularly outlining any areas that they found confusing. Drafts of the guidelines were taken to farms and our team did training simulations, observing where the landholders respond positively and watching how the trainers used the guidelines. Once again, using an iterative process, these comments were incorporated into the guidelines, literally (as quotes) and for clarification. Agency staff were also asked to use the guidelines and kit without training to see if they could ‘make sense’ of it.
Emerging out of this process was a strong reinforcement of adult learning principles, as discussed in Chapter 3. For example on the cover the words, ‘see, touch, smell and test” alongside pictures attempted to reinforce learning using all the human senses. The title of the guidelines, ‘Keys to success’ developed from a conversation with a farmer, where he stated that what they need to know were ‘the keys to successful management of acid sulfate soils’, not how to be a scientist. There was frequent use of farmer quotes and information was provided in two columns using different colours and varying emphasis. Important messages were repeated throughout the guidelines. For example, the message that it’s not difficult or expensive to test your soil was frequently emphasised. Table 34 shows how information from the survey and quotes was used to acknowledge the constraints that many landholders felt about tackling acid sulfate soils.

### Regaining control

The 1998 benchmarking survey showed that many landholders feel powerless to do anything about acid sulfate soils. Therefore, some landholders would rather not know whether or not they even have it. These sentiments were made clear in the survey responses. (Throughout this guidelines we will make extensive use of what landholders had to say in the survey.)

The following direct quotes from the survey sum up the sense of exasperation:
- ‘Acid sulfate soils will be very expensive if we have it”
- ‘Our land will have less value”
- ‘It's my land, it's my soil, it's my business”
- ‘How do I know how to manage it if I don't know what I've got”

These were all valid concerns, but the experience of other landholders gives cause for hope. Their experience shows that you can regain control. And it won’t necessarily cost a lot or take a lot of time.

### Table 34 Using empowering language in communication material

Source: Acid Sulfate Soils Keys to Success

Empowering language was used throughout the guidelines, such as ‘regaining control’ above. The guidelines also used quotes to challenge the way landholders think. Choosing the key messages by analysing the responses from the landholders could show where the messages needed to be delivered. Quotes were used as the basis for diagrams (see page 7 Keys to Success). Pictures and simple diagrams were used extensively. There were reasons for this. First, discussions with the landholders revealed that many were not comfortable with large pages of text and government staff and landholders had limited time to assimilate information. Also the majority of landholders were older and most wore glasses. They found dense, small text harder to see, so they requested larger text and more pictures. Using pictures and diagrams provided a link between the text and the external environment within which the testing process was occurring. The text is multi-levelled throughout the guidelines and was used to reinforce and explain the diagrams and pictures, to define technical terms and to explain the case studies.
“Keys to Success” is a set of guidelines that can be used with a kit for testing for acid sulfate soils. It is an education tool for use by government staff, drainage unions, landcare and other catchment groups.

### 8.5 COMMUNICATION STRATEGY FOR ‘KEYS TO SUCCESS’

*Who to target?* There were many people other than landholders that were making decisions impacting on agricultural resource use. When designing the book, the authors considered their audience to include local, state and federal governments and statutory agencies.

The model depicted in Figure 28 was developed in 1999 to help define who the stakeholder groups were and what the information flow was between the stakeholders in the sulfate soils study. The model shows the communication flow that was desirable within the catchment stakeholders. Whereas scientists need to incorporate historical and current land management practices into their research, they need to communicate back to the landholders, cohesive and practical management and bio-physical information. Using co-learning principals it was desirable to build on the knowledge data base by incorporating new knowledge into existing knowledge.

![Figure 28 Communication Flow](image)

*Source:* Adapted from Information Transfer, Woodhead and Hughes (1999)

The most obvious stakeholder group that needed information were the landholders as identified by ASSMAC and discussed in Chapter 3. The government agencies had limited resources and need to be strategic about how they used them. Cane and tea tree farmers were supported by their industries, and the success of this support was reflected in the
higher levels of knowledge about acid sulfate soils. “Keys to Success” could assist these organisations in expanding their information dissemination tools. In terms of raising base level understanding in agricultural industries it was the graziers that required most assistance. The benchmarking survey data indicated that dairy and beef farmers found acid sulfate soils less relevant to their farm management practices than the cane industry, indeed they were significantly different. Figure 29 shows the responses to the question ‘How important are acid sulfate soils to your farm planning and management?’ Beef and dairy, the upper two lines show a higher proportion of landholders who believed it was not important to the farm planning. Their response to this question indicates that just knowing a farmer may have potential acid sulfate soils may not make it important to their farm management.

Awareness levels about the risk of potential acid sulfate soils on the farm between the cane and beef industries were close. Over 50% of cane farmers and 43% of the beef farmers identified that they did have potential acid sulfate soils on the farm, from sources of information such as local knowledge, risk maps and the cane industry. The knowledge, however, about the depth of the soils was very different (see Chapter 5). Analysed as a percentage of those that were aware of acid sulfate soils, only 17% of the beef farmers knew the depth of acid sulfate soils on their properties, versus 41% of the cane farmers.

Evidence of negative environmental impacts from acid sulfate soils can be seen in poor water quality, low pH, on the farm and in the catchment (see Appendix III, Keys to Success) and can also be seen in scalds on the properties, which are bare patches of land which will not support any vegetation and were often favoured by stock as a gathering point. The question ‘Do you have any scalds’ was asked, and beef farmers had responded positively in
40% of cases, whereas the cane industry had only 15% of respondents with acid scalds. While it was acknowledged that there were other causes of bare scalds, the predominant cause on the floodplain was acid sulfate soils. Figure 30 showed that there were significant differences between the croppers (cane and tea tree) and graziers (beef and dairy) in their attitude to the importance of acid sulfate soils in the community when asked the question, ‘How important are acid sulfate soils to your community?’ Graziers believed managing acid sulfate soils was significantly less important in the community than the croppers.

Based on these results, and because graziers were not getting support from their industries, they became the major landholders who were to be targeted with the guidelines. However to target them, required trained government staff. The results from the survey and focus groups had shown that government agencies required ongoing training, both because they had a high turnover of staff and because current staff did not have the skills to test for acid sulfate soils, or manage remediation and monitoring projects. Therefore they were also considered as primary targets for the guidelines, with local government being given the highest priority due to their increasing role in managing acid sulfate soils and their contact with all stakeholder groups.

How to target the information? ASSMAC’s role was as a co-ordinating body with representation from government, industry and NGO. Yet the focus groups and subsequent reviews of ASSMAC (May 2002) found that communication and co-ordination continued to frustrate agency staff and undermine the effective management of acid sulfate soils. The concern expressed by participants in the government focus groups was that, unless the communication barriers within agencies were acknowledged then it was difficult to comprehend how effective adult learning and systemic approaches could be developed for natural resource and integrated ecosystem management-style programs, given the increased level of complexity of these issues.

Communication and integrated ecosystems management are not viewed in the same school of thought generally, whereas biological sciences and agriculture were. Environmental degradation was an emotive subject that frequently commanded headlines in the press based on hearsay and conflicting perspectives rather than sound research. A communication strategy for getting information back to the stakeholders is a very important part of the Social Benchmarking methodology because it is part of the process of empowering stakeholders and thereby building human and social capital. Yet, it was also the part that had received the least support from government agencies who preferred to have a more ‘ambiguous’ approach to information dissemination.
The overall strategy developed using the principals of the *Social Benchmarking* model was to provide government departments and catchment group coordinators with tools for extending information and practical demonstrations about acid sulfate soils. These individual and groups could use the guidelines, “Keys to Success” and the kit to discuss and test for, acid sulfate soils with landholders and other stakeholder groups with the aim of:

- increasing their knowledge of soil and water, on their property and beyond
- enabling on-farm and catchment monitoring and interpretation of results
- increasing their understanding of the need for site specific management practices

The proposed strategy for government staff was that they would develop an information dissemination strategy based on using “Keys to Success” and other locally relevant acid sulfate soils material such as the risk maps that was targeted at groups identified above, as well as the whole catchment community, including the media. Given the organisational and economic characteristics of the farming industries, and the constraints of government agencies a strategy for landholders, (mainly graziers) was proposed to ASSMAC. The strategy is presented in Appendix III, Four Years On, Page 34, Building Partnerships.

A farm and catchment strategy and environmental plan can build knowledge in stakeholder groups about acid sulfate soils, but many non agricultural industries and the cane industry had moved further, towards self regulatory systems. The next section explores what these were and looks at how the cane industry had implemented self regulation into their policy approach to managing acid sulfate soils and thereby aiming to maintain control of their production.
8.6 BEYOND BPEM TO BEST PRACTICE ENVIRONMENTAL REGULATION

Best practice environmental management (BPEM) does not necessarily provide any economic benefit on the farm. The economic benefits with reducing diffuse source pollution are more frequently off-farm, for example to the fishing and oyster industries. Where best management practices do provide a benefit is when the industry supports the activity and promotes it to the public, which contributes to awareness of clean production and confidence in the transparency of the production. Lockie (1998) discusses how “best-practice has thus been seen as necessary not only to ensure the competitiveness of agricultural industries, but to limit the extent to which negative impacts, or externalities, were generated that place at risk: the health and safety of communities living in close proximity to sites of agricultural production; the safety of end-consumers of agricultural produce; and the environmental sustainability of agricultural production”.

The knowledge about BPEM schemes comes from other industries such as the manufacturing sector (Australian Manufacturing Council (AMC) 1993). The AMC had used BPEM to facilitate better compliance with environmental legislation. “Under BPEM the acceptable level of environmental performance is no longer limited to compliance with regulations. Rather, comparison with the best environmental performance of peers and competitors (ie. Benchmarking) becomes the management criterion” (The Department of the Environment Protection, Western Australia 1996). The department defines three issues for creating a cultural shift:

- the integration of production operations and environmental considerations;
- a focus on pollution prevention rather than pollution control; and
- an attitude of proactive and continual improvement rather than a reactive approach limited to compliance with changing environmental standards.

Best Practice Environmental Regulation (BPER) has evolved from BPEM and the adoption of identified practices that had produced outcomes consistent with enhanced environmental performance and improved competitiveness. BPER represents a “move by regulators away from prescriptive standard setting to a regulatory process which provides encouragement for industry to continually improve its environmental performance. Embodied in this process was the increasing co-operation being displayed between regulators and stakeholders in the development of regulatory controls. This joint approach was more likely to maximise the potential for the production of desirable outcomes because it takes account of industry’s capacity to comply with any ensuing regulation. Throughout the benchmarking process due consideration must be given to attaining the twin goals of BPER, that is, achieving improved
environmental protection, and where possible increasing the international competitiveness of industry” (Australian Manufactures Council 1993). The Australian Manufacturing Industries notes these important characteristics of BPEM (Table 35).

<table>
<thead>
<tr>
<th>“Certainty”</th>
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<tbody>
<tr>
<td>To achieve international competitiveness regulators must develop a regulatory environment where industry can operate with confidence that its investment will not be threatened by significant unexpected changes to environmental standards”.</td>
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<tr>
<th>“Consultation”</th>
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<tr>
<td>Timely consultation with key stakeholders will ensure that appropriate standards are developed. Early discussions are critical to the development of regulatory initiatives, enabling key stakeholders to discuss the potential likely implications of regulatory initiatives and to suggest improvements or alternative tools”.</td>
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<tr>
<th>“Cost-effectiveness”</th>
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<tr>
<td>In considering the range of regulatory options, regulators should undertake a cost-benefit assessment of all regulatory controls under consideration, thus ensuring decisions account for measurable net economic and social benefit”.</td>
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<tr>
<th>“Efficiency”</th>
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<tr>
<td>Efficient regulatory systems support streamlined inputs which consist of concise submission requirements, require consultation with a minimum number of authorities, and have clearly identified points of contact”.</td>
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<tr>
<th>“Flexibility”</th>
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<tr>
<td>Regulatory authorities have recognised that industry does not have unlimited resources to spend on environmental initiatives, and to minimise its environmental impact requires a shift away from end-of-pipe solutions”</td>
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<th>“Integrity”</th>
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<tr>
<td>If a regulator shows integrity in the development of regulatory controls, stakeholders are more likely to accept the decision and to comply with the regulation”.</td>
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<th>“Practicality”</th>
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<tr>
<td>Practicality infers that objectives are set which are sufficient to achieve the environmental aims of the regulators. If objectives are over-rigorous or impractical the net effect will be to discourage industry from undertaking its own initiatives to meet, and where economically feasible exceed, prescribed standards”.</td>
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<th>“Responsibility”</th>
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<tr>
<td>Responsibility is a clearly defined process for the setting of regulatory goals and for documenting the accountability of individuals within a regulatory agency”.</td>
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<tr>
<th>“Transparency”</th>
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<tbody>
<tr>
<td>Transparency is an important principle because it engenders confidence in the development and application of objectives and leads to acceptance of the umpire’s decision. Confidence in the identification and achievement of objectives supported by an open decision making process demonstrates fairness to all stakeholders”.</td>
</tr>
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</table>

Table 35 Characteristics of Best Practices Environmental Management

Source Australian Manufacturing Industries (1993)

There are many factors affecting decisions by institutions to support strategies such as the ‘costs of designing and implementing the new structure, the prevailing political order, the potential impact of the changes on other interests, the costs of negotiation and the relative bargaining strengths of the parties’ (Jacobsen et al. 1996). Therefore institutional change, technical innovation and improved resource management are of equal importance as farmer adoption of new techniques. Yet the need for institutional change was rarely acknowledged in institutions and it was the landholder that must adopt new management practices. Jacobsen et al. found that the constraints to institutional innovation are identified as the “lack
of a common agenda among the external agencies, and a lack of mechanism to enable them to co-ordinate their activities”.

The sugar cane industry was developing a self-regulatory set of best management practices and had changed organisational culture to be pro-active rather than reactive. This self regulatory approach has been possible because they had negotiated agreed environmental management conditions with the local governments and state government agencies (NSW EPA) and they have strong industry cohesion.

How did self regulation work? Cane farmers had signed an agreement to maintain drains at a certain depth and use specific management techniques, such as monitoring pH of the water and liming once an agreed level was reached. Drain reshaping was defined as best management practices by the cane and tea tree industries and had been actively promoted because there was some economic gain. Drains are easier to keep clean when they are wide and shallow. All these landholders had had their soils tested for acid sulfate soils and had had individual farm management plans from the mill. The BPER agreement required random testing of farms by the mills. One major benefit for cane farmers was that they no longer required DA’s for drain cleaning and maintenance, saving time and expense. Although the cane industry has not been actively promoted its BPEM and BPER programs, in other industries it is used for competitive advantage.

8.7 REFLECTIONS AND CONCLUDING REMARKS

The acid sulfate soils study in line with key principles of Social Benchmarking has produced communication material in three broad formats:

1. Technical reports primarily for policy development by senior management
2. Research papers published at conferences and in journals for the research community
3. Information books and guidelines for wider audiences – social, economic and environmental issues presented in an easy to understand, simple format for those not familiar with acid sulfate soils. Audiences were the landholders, government agencies and the catchment community.

This chapter has focused on the third area, communication material for wider audiences and using tools for raising knowledge levels and supporting BPEM and BPER. Landholders wanted education not regulation. Earlier awareness campaigns had raised the level of understanding of the consequences of the problem, fish kills and acid water. But, if solutions
on the land were not available it left the unknowing perpetrators of the problem in an invidious position, aware that they are causing pollution, but unable to act due to scientific, institutional or legislative constraints. Landholders had indicated that they were prepared to change their practices provided they had information about the problem, practical management solutions and agreed best management practices, along with institutional support. The cane industry had developed a compromise, by developing its own BPEM and BPER and negotiated agreements with the government.

The organisational support that the cane industry had provided to its landholders had enabled the implementation of BPER on the farm. But one industry cannot make changes in isolation of other stakeholder groups when managing diffuse source pollution if environmental benefits to the whole ecosystem are to be achieved. This is naturally what other stakeholder groups want. Therefore all landholders and other catchment stakeholders that are causing diffuse source pollution need to be involved in management and remediation projects along with government partnerships.

There were two extension staff dedicated to acid sulfate soils in NSW Agriculture and it was unlikely that given the current range of industries, perspectives and lack of communication between the government departments involved with managing acid sulfate soils that self regulation for the other landholders could be developed. But building knowledge about BPEM was feasible.

In 2000 when the guidelines, “Keys to Success” was published the book it was promoted through ASSMAC’s news letter ASSAY and some extension staff in State and Local government. Within the first 6 months over 2000 books had been requested and distributed to local councils and government agencies in NSW and other states. Initial findings from discussion with an acid sulfate soils extension officer in NSW Agriculture indicated that the guidelines were proving to be an important resource. This was because it facilitated the organisation of field days around the guidelines and thereby entry into discussion with landholders. Testing for acid sulfate soils, as well as indicating the presence or absence of acid sulfate soils, provided an opportunity to discuss broader catchment issues such as drainage, water and land management, regulations and so forth. The guidelines were used as a tool, a door opener for first contact, to format workshops. From this initial meetings, individual farm visits were organised, groups were formed and partnerships developed with local councils to get funding for remediation work, based on the strategy discussed in Appendix III, Fours Years On.
There was criticism of Keys for Success. Some government personnel felt that it was more important to negotiate drainage remodelling and other large projects than to allocate time to facilitating stakeholder learning about acid sulfate soils. There was also concern that landholders would misinterpret the peroxide test (See Appendix III, Keys to Success, Page 16) and the test was not accurate enough and therefore laboratory tests and a consultant should be used, even thought the guidelines were extensively peer reviewed and the peroxide test was agreed to by scientists as a valid field test. However this criticism raises several issues.

- First that acceptance and ownership of new guidelines by government extension staff is important for an effective communication strategy over several catchments. Government personnel need training about the relevance of the guidelines.
- Guidelines that simplify complex problems, use simple field tests and empower stakeholders can threaten scientists and agency staff.
- Focussing on major engineering projects for remodelling the catchment hydrology is important, but, acid sulfate soils cause diffuse pollution, this means landholders also need to have the skills to manage the source of pollution on their land.
- Successful implementation of BPER for acid sulfate soils is predicated on stakeholders being informed and having high levels of human capital so that they can understand BPEM and the regulatory requirements. This requires a learning strategy that empowers landholders so that they can take responsibility.
- Without a strategy of involving and empowering landholders and catchment dwellers with knowledge about acid sulfate soils and remediation projects, large scale, expensive, projects are in danger of being seen as less relevant than other environmental issues and therefore may not get support from local councils and catchment residents.

This chapter has discussed developing guidelines and communication of information for catchment audiences, wider audiences than traditional extension programs that are directed at landholders. Based on the development of guidelines about soil sampling for acid sulfate soils, a BPEM, a participatory, co-learning approach was discussed. Whether or not this has been effective is the topic of the next chapter. However, out of this co-learning process emerged a success story beyond soil sampling. The cane industry self-regulatory model is a self regulatory systems based on BPER. It aims to provide environmental benefits and production benefits by auditing certain BPEM processes in collaboration with local and state government agencies.
The social capital and vertical collaboration within the cane industry is strong. This combined with horizontal collaboration between government agencies, stakeholder groups and the cane industry has provided a successful outcome, BPERS. It is difficult to achieve horizontal collaboration between private and government agencies because of the different world views, objectives and operational constraints. Indeed it was horizontal collaboration that was causing landholders working in catchment groups so much frustration and rendering many groups dysfunctional. Lessons from the cane industry indicate that achieving horizontal partnerships between diverse groups requires facilitation and a steering group to negotiate the many factional interests.

The next chapter looks at indicators and policy both from the perspective of looking for evidence and participatory development. Horizontal communication between disciplines is explored using an inter-disciplinary workshop that was funded by the OECD. This workshop was based on the cane industry management strategies for acid sulfate soils as a case study. The chapter also discusses the second benchmarking survey of landholders where evidence of change is revealed along with more characteristics about these industries and individual landholders.
9. WHAT CHANGED? INTERDISCIPLINARITY AND EVIDENCE FOR POLICY DEVELOPMENT

9.1 Introduction

9.2 Creating and Measuring Change

9.3 Policy Overview

9.4 The 2nd Benchmarking Survey of Landholders

9.5 The OECD Interdisciplinary Workshop

9.5 Reflections and Concluding Remarks

"Public relations, spin and green-washing will provide no lasting boost to corporate reputation. It will, in many cases, detract from reputation".

David Butcher, CEO, World Wide Fund for Nature Australia (WWF)
There are many levels of decision making in society, therefore not all indicators and best management practices for ecosystems management can be used for the same purpose or need to be replicated in a benchmarking investigation. For policy developers in government agencies this had challenging implications. Governments and society need evidence that policies are working and accountability that investments had been wisely spent. Policies need to have clear and measurable objectives, they need to be transparent, monitored and evaluated with appropriate indicators (economic, environmental and social). But indicators of social capital and diffuse source pollution are difficult to measure because they represent complex systems, and are therefore providing interesting challenges for ‘evidence based’ policy analysts. Equally challenging is that sustainable development requires the involvement of more stakeholders in the decision making process to allow for bottom up policy development. As a result of a fellowship that I undertook with the OECD, fifty international and Australian experts visited Ballina, in the Richmond catchment, northern NSW to participate in an interdisciplinary discussion about agriculture and ecosystems management. A core theme of the discussion was how to incorporate a broader set of indicators, particularly social into the policy development process.

To address the question and issues raised for policymakers this chapter is split into two sections. The overall question that I address is: Can best management practices and indicators identified in the acid sulfate soils study, inform policy development so that these approaches are reinforced by local, national and international policies? The first section discusses the results of the second benchmarking survey of landholders conducted 4 years on in 2002 and looks for evidence that regional and local policies on raising awareness and knowledge levels were working. The second section explores the process and the results of the interdisciplinary meeting and the national and international policy implications that the OECD gleaned from this workshop. The final section brings these concepts together.
9.1 INTRODUCTION

There is a strong link between the levels of human and social capital enjoyed by individuals and groups and the capacity to change. The greater the level of education (both formal and informal), knowledge and social cohesion the greater the capacity to respond to external events (Putnam 1995). While conflict between stakeholders is synonymous with management of natural resources, the demands of sustainable development require that these same stakeholders work towards mutually agreed outcomes and a recognition that they want to be a part of the process (Abdalla and Kersey 1996; Warner and Jones 1998; Cullen, 1988; Syme et al. 2000). Ecosystem management needs to take into account the economic, environmental and social dimensions within a well-functioning institutional framework. The science relating to ecosystem management in agriculture is generally well understood, yet ecosystems remain under threat. There is considerable literature that points to the fact that human and policy elements have proven to be less tractable than the technological ones in delivering effective ecosystem management. At the heart of the sustainable development debate Moffat (1995) contends that there is an acknowledgment that “current patterns of economic growth and development were seriously damaging the ecology of the planet”. This is partly because so-called free markets provide a disincentive for landholders to internalise their external costs, including costs to the environment, and partly because there is limited understanding about the social impacts of policies at a regional scale.

Social sciences have an anthropocentric (people) focus, while agri-environmental sciences had an ecocentric (bio-physical) focus. This causes conflict between the sciences because they have different priorities, methodologies and research questions and therefore generate different results that reflect the priorities of the researcher (Rhoades 2000, Wolfenden 1998). There is therefore a danger that important data will be ignored or not used by either opposing discipline. Given that biophysical scientists tend to manage NRM organisations, and economists tend to run the policy forums, the social data is frequently perceived as less relevant because bio-physical scientist and economists had difficulty in understanding how to use the social information within their world view of NRM management. This becomes a self-satisfying loop, whereby predominantly bio-physical data satisfies the needs of technical experts and their resulting solutions are technical interventions (Martin 1993). Stern and Oskamp (1991) argue that “policymakers need to become more sensitive to psychological and social processes, and social scientists need to take more initiative in trying to make policymakers listen”.
Developing an understanding of the effectiveness of policies and creating policies that facilitate a sustainable future is difficult, because institutions and individuals have changed and developed responses to historical forces and current policies, many of which are now regarded as unsustainable. When governments measure the effectiveness of policies this is known as ‘evidence based policy making’, where policy is judged on the basis of research results rather than supposition. Policies are put to the test, with the hope of improving government outcomes and saving money and to show how decisions relate to the social and institutional environment (Gass et al. 1997). Agencies also need to effectively argue for more money for future projects, so data from these investigations can provide evidence for future directions. Indeed consistent lack of testing of policy effectiveness, and the review of their broader impacts has caused some of the current environmental problems. For example (as discussed in Chapter 3), the Drainage Act 1939 has created the current water quality problems from acid sulfate soils. In another similar issue, tree clearing, a condition of land ownership in the 1950’s has contributed to salinity.

There is very little evidence-based policy in NRM. This is because there are few measures that provide the validation needed to argue the success or failure of research and policies, (see Chapter 3) or to measure change and define targets for a sustainable future (see Chapter 5). Accounting for the social dimension, including community participation and building social capital, is the least developed of the three pillars, economic, social and environmental, of sustainable development. Yet the OECD and others (see Chapter 3 and 7) acknowledge the value of social capital for accounting for the variation in a country’s growth. Chapter 5 discussed how to establish social indicators for benchmarking. This chapter discusses how they can be re-measured using a benchmarking system to measure change.

While the lack of development of social indicators is one major hindrance, environmental indicators are also problematic. They are frequently difficult to measure. For example when measuring acidity in water from acid sulfate soils run-off, problems arise from confounding factors such as episodic rainfall events, scale and temporal effects. These factors undermine the validity of water quality monitoring data. However, most challenging is the fact that diffuse source pollution (or non point source pollution) enters water diffusely in the run-off, from many sources on private and public land. In the United States it has been identified as the major problem for US water quality, and agriculture is regarded as the major contributor (Ribaudo et al. 1999).

How much of the pollution is coming from agricultural land and which pieces of land? The complexity of this question also provides problems for accurately measuring economic
indicators. Ribaudo et al. (1999) notes that “71 percent of US cropland was located in watersheds where the concentration of one of four common surface contaminants (nitrate, phosphorus, fecal coliform bacteria, and suspended sediment) exceed criteria for supporting water-based recreation activities”. Yet comprehensive estimates of the impacts of this pollution were lacking, soil erosion in the US was estimated to cost water users somewhere between US$2 billion and US$8 billion annually. An estimate with a very wide range. Likewise in the Australian economic analysis of the impacts of acid flowing into the waterways from acid sulfate soils, the impacts on industries is conservatively estimated at about AUS$10 million (National Working Party on Acid Sulfate Soils 2000). Scientists can therefore only estimate the number and location of the sources, the quantity and the impacts of diffuse source pollution and confirm that it is increasing world wide.

Environmental degradation is therefore primarily a social problem, a problem of defining the actions of local people who are acting as rational economic people (Grimble and Wellard 1997). Therefore, a vision of what sustainability means to stakeholders, would assist people to incorporate sustainability into their management systems. It is the lack of a picture of the relevance of social, economic and environmental issues that is providing serious constraints to good policy design at a regional level (Waltner-Toews, 2003). Rhoades (2000) suggests there needs to be a marriage of ‘participation’ and ‘watershed’ that addresses the historical preferences for “top-down, heavy subsidy approaches of the past which had alienated local populations and even contributed to further land and water degradation”. For example the NSW Wetland Management Policy 1996 was designed to protect wetlands whereas, in fact it has caused considerable frustration and conflict between catchment stakeholders who are trying to remediate acid sulfate soils because its restricts any soil excavation in wetlands.

To adhere to the sustainable development model, governments need to broaden their stakeholder base by moving towards investing in participative planning and policy development rather than concentrating on remediating problems that had been created by past policies. Institutions and individuals need to become more accountable for and more involved in the decision making process (Ashby and Sperling 1995). This change in thinking from short term gains driven by political reactions and production gains to a realisation that long term impacts of policies need to be acknowledged and planned for prior to the implementation, was implicit within the concepts of sustainable development. As previously discussed in Chapter 4 and 7, there is considerable evidence to support government investment that is informed by broader stakeholder groups, (OECD 2001c).
Participative policy development is attempting to incorporate ideas from stakeholders who were both outside government agencies and within, who hold a broad range of views which can inform the decision-makers and controllers of funds. Advocates of participatory methods argue that bottom up participatory methods can help the senior management to better target funds and create a healthier climate for change within their organisations. Centrally controlled, government-run watershed projects had suffered, since there had not been local ownership and management (Rhoades 2000). Therefore those that need to change were potentially neither informed about the process, nor understood the reasons why nor had a sense of the new vision. Advocates cite benefits such as:

- those that are being asked to implement the change and possible change, have an opportunity to contribute their ideas.
- management strategies are based on the historical and management knowledge of the stakeholders, both within and external to government agencies.
- resulting strategies are addressing some of the goals of all interested parties.

It also infers that more people are informed about the objectives and the constraints within which all stakeholders are operating.

However, Martin (1993) warns that participation can challenge the traditional ‘expert-centred’ approaches of state agencies. Problems arise because developing a bottom up policy forum, requires developing trust and cohesion and acknowledging group dynamics all of which takes time and compromise. Probably most confronting, the control of the project is no longer totally in the hands of senior management. But one of the major problems of top down policy is that unworkable and unsupportable strategies can develop that do not address the problem or empower the staff and the stakeholders. More drastic effects can be complete breakdowns in communication with staff ‘going their own way’ and no uptake of the technology by the stakeholders. Wolfenden (1998) suggests that “participative decision making cannot be successful unless there was empowerment, and empowerment can only be assured if the key decision makers were a part of the process and participate in developing the solutions”. Better ecosystem management is not a foregone conclusion of participative policy development.

This chapter first discusses tools that policy developers use for natural resource management, followed by a section that reviews social indicators and discusses results from the second acid sulfate soil benchmarking survey of landholders, conducted in late 2002. It discusses whether these results provide evidence that ASSMAC’s policies on increasing awareness and developing best management practices were successful. The next section discusses an interdisciplinary workshop on diffuse source pollution in ecosystems.
management that was funded by the OECD, the University of Western Sydney and NSW Agriculture in Ballina, Australia. The workshop used the example of acid sulfate soils, and in particular the cane industry and their self-regulatory best management practices program, as discussed in Chapter 8. Communication material was developed from both these projects. The book ‘Four Years On, What Change’ is in Appendix III along with a CD of the proceedings of the workshop (editors Woodhead, Jenkins and Packham, 2003). This chapter concludes by addressing the question, Can these best management practices and indicators, inform policy development so that these approaches were reinforced by local, national and international policies?

9.2 POLICY OVERVIEW

Research into policies for diffuse source pollution by the US Department of Agriculture (USDA), (Ribaudo et al. 1999) identified five classes of policy instrument that have been either applied to non-point-source pollution or were feasible tools. They were economic incentives, regulations, standards and best management practices, education and research. In a broader context the NSW Environment Protection Agency (NSW EPA) has defined four policy tools and these are summarised in Table 36 (Young 2000). The NSW EPA does not identify standards and best management practices as a policy instrument. Whichever policy tool was used (Legg 2003) suggests that policies should have the following key characteristics:

- “clearly defined objectives;
- be effective and efficient in achieving well-targeted outcomes;
- be implemented at the appropriate administrative level;
- be compatible with market signals;
- be flexible to reflect the dynamic nature of agriculture and societal demands;
- and be monitored and evaluated regularly”.


## Tools for Environment Protection

<table>
<thead>
<tr>
<th>Tool</th>
<th>Broad Characteristics</th>
<th>Examples</th>
</tr>
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<tbody>
<tr>
<td>Regulation</td>
<td>Promotes: standards &amp; compliance&lt;br&gt; Is: mandatory &amp; prescriptive&lt;br&gt; Targets: point sources, some diffuse sources, activities &amp; issues</td>
<td>* fines and penalties for companies and individuals&lt;br&gt; * on-the-spot fines&lt;br&gt; * setting limits and conditions within licensing of scheduled premises&lt;br&gt; * setting product standards&lt;br&gt; * licensing users</td>
</tr>
<tr>
<td>Policy Development &amp; Research</td>
<td>Promotes: strategic frameworks; outcomes based programs; integration&lt;br&gt; Is: consultative; pragmatic; overarching&lt;br&gt; Targets: sectors; activities; decision makers</td>
<td>* development of legislation&lt;br&gt; * strategic plans&lt;br&gt; * social, economic and biophysical research&lt;br&gt; * risk management&lt;br&gt; * community consultation processes&lt;br&gt; * environmental guidelines&lt;br&gt; * research and needs assessment&lt;br&gt; * model building</td>
</tr>
<tr>
<td>Education</td>
<td>Promotes: knowledge, attitudes, skills, behavioral ownership, participation&lt;br&gt; Is: pro-active, supportive of choices&lt;br&gt; Targets: diffuse &amp; point sources, individuals, groups &amp; communities, sectors</td>
<td>* school curriculum&lt;br&gt; * VET sector curriculum&lt;br&gt; * community education&lt;br&gt; * environment centres&lt;br&gt; * green labelling and advertising&lt;br&gt; * community environmental monitoring&lt;br&gt; * publications, information and research&lt;br&gt; * extension services&lt;br&gt; * interpretation programs&lt;br&gt; * eco-tourism&lt;br&gt; * advocacy</td>
</tr>
<tr>
<td>Economic Incentives</td>
<td>Promotes: choice, valuing&lt;br&gt; Is: flexible, cost effective, polluter pays&lt;br&gt; Targets: diffuse &amp; point sources, markets, producers &amp; consumers</td>
<td>* load based licensing&lt;br&gt; * environmental management systems&lt;br&gt; * best practice management&lt;br&gt; * full cost environmental accounting&lt;br&gt; * tradeable permits&lt;br&gt; * grants/funding programs&lt;br&gt; * subsidies and incentives&lt;br&gt; * taxes, tariffs and levies&lt;br&gt; * impact assessment and cost benefit analysis</td>
</tr>
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Table 36 NSW EPA Tools for environmental protection

Source: (Young 2000).

Regulation relies on a high level of compliance and compliance requires an understanding of the regulatory requirements. Therefore a high level of knowledge on the issue underpins any successful regulatory policy. Situations where a regulatory framework works well, is point source pollutants such as effluent discharge, where the source and therefore the polluter is easily defined and treatment can be administered to render the pollutants benign. The
pollution can be monitored. Diffuse source pollution, as previously discussed in Chapter 3, is difficult to measure accurately and has complex temporal and spatial issues. Thus knowledge is not always adequate amongst the stakeholders, including government agencies. However, there is another issue that impacts on levels of compliance to policies and Schuller (2000) defines it as the “quality of policy debate, the way people and social institutions behave depends on the social relations which prevail. The more that people are able to share information, and to conduct reasonable conversations, the more chance there is of widespread commitment to sustainable development”.

Therefore an approach that combines all or several policy instruments is likely to be more successful, such as where education is used to reinforce regulatory frameworks. For example, landholders in Australia need to have completed a one day course before they can purchase pesticides. Similar systems are used for obtaining loans in some countries, for example in France, a defined level of education had to be reached before special low interest loans become available, although landholders can get a loan at commercial rates without qualifications. The qualifications required are the baccalaureat (generally taken at 18 years of age) and one year of technical agricultural training, the Technical Agricole Baccaloureat (BTA). The bank also requires landholders to prepare a 5-year farm management plan. Alternatively, French landholders who had not acquired these qualifications, can gain cheaper loans through experience. A landholder is required to attend around 140 hours of training and work for six months on an accepted training farm.

The Australian Manufacture Council (1993) discusses how overly prescriptive regulation on its own can diminish internal firm efficiency, misallocate resources and discourage the adoption of BPEM. As previously discussed, the acid sulfate soils study showed that stakeholders need to have a sense of control over their future and if they do they are more likely to adopt new technology and change. Regulatory frameworks can adversely affect the control level of landholders, as was seen by their comments on the development applications (DA’s) required to clean their drains. These DA’s infringed on their farm management practices and therefore adversely affected their income earning capacity. It is important to develop regulatory frameworks that meet the needs of the producer, the government agencies and the public. This is particularly important given the change in public attitude to pollution of the environment. There is strong support for stricter or harsher laws in an effort to protect the environment. A large proportion of people regard current environmental regulations to be too lax as found in a survey by the NSW EPA, “Who cares about the Environment 2000” (Young 2000), Appendix III, Four Years On: What Changed).
There are many stimuli for change, and financial incentives are important when the change requires an investment of time and money by an individual and the impacts of the change will not directly benefit that individual. Europe has a culture of providing subsidies to individuals for managing production and through these can influence change in rural communities. While this had benefits there are also negative impacts. In Australia, subsidies for landholders are less than 10% compared to an average of about 50% in Europe. In Europe, agriculture remains politically much more powerful, and the economies are wealthy enough to heavily subsidise landholders. Other incentives for change that were identified in the acid sulfate soils study (see Chapter 4) included gaining respect from community, frustration with existing systems and if there was support for the change process.

Governments worldwide (OECD 2001b) were increasingly finding that for many environmental problems, especially those for which a small group of people can be held collectively responsible, implementing policies through groups, such as catchment groups, can be more effective and less costly than those aimed at individuals. The OECD report found that most of the time the government had been an observer of voluntary programs, however, there were only limited examples where government was adapting policy to complement these programs. There is a need to develop policy and frameworks that best assist voluntary programs and participatory policy development forums could be a valuable course of action because it could enable representation from members of voluntary groups.

Australia’s Landcare program is one such voluntary program. It provides subsidies for NRM through groups not individuals, and is now entering its second decade of this policy approach. Incentive programs from Australian federal, state and local government aim to promote better management of the natural resources by providing funds to groups such as Landcare and thereby build social capital as well as human capital. The Australian Landcare Council (2001) recognises that there needs to be active engagement of the community in natural resource management planning, decision making and implementation processes in order to achieve long-term sustainability. A review of Landcare concluded that “every dollar of government investment in natural resource programmes and management has been more than matched by landholders and the community” (Dames and Moore 1999). Landcare (Australia) believes investing in group based incentives was an investment in both human and social capital.

Cary and Webb (2000) further expand this view by proposing that Landcare had contributed to changing social norms about land conservation in rural areas. It has been important for
raising awareness of resource management issues in the rural communities. The operation of Community Landcare projects recognises the effectiveness of groups in promoting self-reliance, developing social capital and social norms that encourage the adoption of sustainable farming practices addressing on-site degradation. This participatory approach has become the dominant policy paradigm for NRM in Australia. However, many other countries have community based programmes that assist in other areas of society such as drug abuse, community health and housing, and citizens’ advice bureaux.

This pressure for new approaches to NRM is driven by the failure of many past policies to create sustainable future development. Past failures have created an environment where governments need to consider more widely the impacts that new policies will have, particularly in relation to society and long term environmental impacts (Brezonik et al. 1999). Indeed, Barr and Cary (2000) highlight findings from recent research that suggests that ‘barriers to change in farming practices were overwhelmingly structural’ in their report for the Bureau of Rural Sciences. They continue, ‘There is a strong link between the need for structural change and the capacity to implement alternative management strategies’.

These changes need to be supported by an understanding of decision-making processes and the environment within which they operate. Combining all five policy instruments in various combinations and gaining a better understanding of the impact that these policies will have, beyond, just economic or just environmental, but across all three pillars of sustainability, social, economic and environmental and in all stakeholder groups, is clearly a strategy that policy makers need to take into account.

The next section discusses indicators, and how they can provide evidence for the impacts of past policies. The discussion is based both on literature reviewed and on the finding from the second benchmarking survey.
9.3 THE SECOND BENCHMARKING SURVEY OF LANDHOLDERS

Indicators are used in many contexts, including state of the environment reporting, policy development, monitoring for research, education, management, quality control, and production and planning such as defining targets for funding of projects by identification of problem areas such as acid sulfate soils hot spots. While some scientists will contest that indicators have to be measurable, indicators are frequently used in the field to indicate a problem. Therefore indicators do not have to be measurable. Chapter 8 has discussed how indicators have been used to identify potential acid sulfate soils, using a variety of senses, sight, smell, and touch. Indicators can serve as important tools in the communication of scientific and technical information. As such, they can play a major role in increasing stakeholder’s capacity to comply with regulations. While economic and environmental indicators are important, the focus of this thesis has been the need for more robust social indicators (OECD 2000a).

Increasingly, there is realisation that socio-demographic, psychological and attitudinal factors play an important role in moving individuals and industries towards more sustainable resource management practices. Indeed many of Australia’s sustainable resource management policies and programs are predicated on changing knowledge, skills and attitudes based on the assumption that changed behaviour will follow. Most indicators on societal responses have a shorter history than indicators of environmental pressures and indicators of environmental conditions and are still in development both conceptually and in terms of data availability (OECD 1998b). Indicators of societal responses show the extent to which society responds to environmental concerns, and refer to individual and collective actions intended to:

- mitigate, adapt to or prevent human induced negative effects on the environment;
- halt or reverse environmental damage already inflicted; and
- conserve nature and natural resources.

One way to measure actual changes occurring to environmental degradation is to use sustainability performance indicators. When used as part of a benchmarking system, sustainability performance indicators can provide evidence that changed behaviour was occurring that benefited the environment. This can provide support for Best Practice Environmental Regulation (BPER). Sustainability performance indicators are in the early stages of development, but are increasingly regarded by scientists, industries and governments as a realistic way to set targets, measure behavioural change and environmental benefits. There are a number of sustainability performance indicators being
developed for improving environmental management on the farm, such as nutrient management and water usage (OECD 2001e).

Figure 31 illustrates a construct for analysing social indicators, within sustainability performance indicators into the sustainability model. It shows five composite social indicators that contribute to our understanding of how society can or is responding to an ecosystem issue along with environmental and economic indicators. Further research is required, but indications are that a composite scale of social responses could provide a model for measuring the capacity to change behaviour to BPEM. Composite social indicators of human and social capital can identify significant weaknesses in the underlying organisational processes, systems and competencies. The chart in Figure 31 provides the ‘road map’ for rest of this section which reviews results from the 2nd benchmarking survey of acid sulfate soils landholders.

These indicators and policy concepts are also discussed in Appendix IV, Four Years On, What Changed. The book, Four Years On is the final publication of three developed for the acid sulfate soils project. It discusses the results of the second benchmarking survey and is written for all stakeholder groups including the landholders, the government agencies and the general public. Its aim is to place the policy debate discussed earlier and the results of the second survey into an easily read format, similar to, Farming community ideas about the way forward, and Keys to Success.

As discussed in Chapter 7, human capital, is a measure of an individual’s capacity to manage change and is measured by level of education and age in OECD countries. Education is acknowledged as directly impacting on the quality of labour. Scarpetta et al. (2000) states that improvements in the quality of labour have directly contributed to growth in virtually all OECD countries. Education is defined by the attainment of formal qualifications, such as university degrees. Training also incorporates shorter irregular courses with a specific purpose. In an international context, there are a relatively small numbers of OECD countries where more than 40% of landholders had even basic agricultural training, although there were wide variations in the educational attainment levels of landholders across countries. This low level of training, the OECD suggests, could reduce landholders’ adaptability to new economic, social and environmental conditions in the future.
Figure 31 Sustainability Performance Indicators used in the acid sulfate soils study for showing the capacity to change to BPEM

Source: This thesis
Although further education provides the potential for greater environmental awareness, this will also depend on landholders’ own personal motives, attitudes towards risk and other factors driven by socio-economic conditions (Commonwealth of Australia 1998). In the United States it was found that landholders with some formal training were more likely to adopt conservation tillage practices than a farmer with no training (Huffman 1999). Evidence from Australia and Germany shows that landholders with a university degree usually participate in training to improve their farm management skills, adopt best management practices and were more likely to have a farm plan, compared with landholders with no formal education (Mues et al. 1998; Nieberg and Isermeyer 1994).

In most OECD countries, the number of landholders has declined, mainly through retirement and migration to urban areas, which has not been offset by new entrants into agriculture. The age distribution of landholders shows that a major share were over 55 years in many OECD countries (OECD 1998c). The entry into agriculture of young landholders can provide some indication of the potential long-term viability of agriculture, given that a younger well-educated workforce was more likely to be able to respond rapidly to changing economic and environmental conditions. However, there were very few countries where the majority of entrants into agriculture were less than 35 years old. Reeve (2001) in a draft report for Land and Water Australia found the following when comparing Landcare between 1991 and 2000:

- the proportion of older landholders has increased
- the proportion of respondents with a tertiary or postgraduate qualification has increased
- inter-generational continuity of ownership is declining.

In the acid sulfate soils study, it was found that over 50% of the landholders were over 50 years old and 75% of the landholders had no more than secondary education and there were no significant differences between industries groups or catchments. Therefore age and education did not account for the differences between the industry and catchment groups. The second benchmarking survey of landholders was conducted in 2002. The 1998 benchmarking survey of landholders used industries (social) and catchment (spatial) as the stratification for comparison. The 2002 benchmarking survey also had temporal stratification, indeed it is this temporal stratification that is the main area of interest, because it indicates changes that have occurred and further analysis reveals reasons for this change, the capacity to change.
The following section provides a brief overview of the main findings from the second benchmarking survey, (see Woodhead (2003), Appendix III, Four Years On for more results). The aim of the first survey was to develop a broad overview of landholders attitudes and management practices on the coastal floodplains with acid sulfate soils. The second benchmarking survey was more targeted. Respondent to the second survey (n=122) (see Table 37) from a potential sample (n=233) represented those who agreed to be re-surveyed and who had indicated that they had drains and floodgates on their land or in their local catchment in the 1998 survey. Having drains and floodgates indicated that they were on low lying land and therefore potential acid sulfate soils. Any respondent that could not be contacted after 3 phone calls was deleted (n=62). Other reasons that 1998 respondents did not complete the 2002 survey included:

- Disconnected phones (n=12)
- Sold, leased, moved (n=18)
- Retired (9)

The 2002 sub-sample represents between 40% and 50% respondents for each industry of the total 1998 sample, except for tea tree (17%). The low proportion of tea tree farmers can be explained, firstly, they tend to be absentee landlords and were very difficult to contact because they are often based in cities (any respondent that could not be contacted after 3 phone calls was deleted), and secondly, decreasing returns have driven tea tree farmers to other industries. The comparisons between the years are based on landholders that responded to both surveys.

<table>
<thead>
<tr>
<th>Year</th>
<th>beef</th>
<th>cane</th>
<th>dairy</th>
<th>tea tree</th>
<th>other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>94</td>
<td>105</td>
<td>49</td>
<td>29</td>
<td>10</td>
<td>287</td>
</tr>
<tr>
<td>2002</td>
<td>41</td>
<td>52</td>
<td>20</td>
<td>5</td>
<td>4</td>
<td>122</td>
</tr>
</tbody>
</table>

Table 37 Total farms surveyed in each industry in each year

The survey respondents were targeted with two sources of information. In 1998 all survey respondents received the results of the first benchmark survey, “Farming community ideas about the way forward” (Woodhead 1998). Since June 2000 they have been included on the distribution list (over 2000 people) for ASSAY, a quarterly newsletter about acid sulfate soils. However the identity of those surveyed has remained confidential in line with privacy laws and no government employee has access to their contact details except the author. The survey respondents were not sent “Keys for Success” or targeted with any other information by any government agency or industry body.
Over the three year period since “Keys for Success” was produced guidelines have been developed by the dairy industry and other groups and there has been considerable activity in the acid sulfate soils catchments. In particular local and NSW state government agencies have been involved with drain management research, manipulation of floodgates, monitoring of water quality and remediation trials. It is beyond the scope of this thesis to discuss these projects, but the economic value of these projects exceeded 7 million dollars during the 4 year period between 1998 and 2002.

In addition to repeating many of the original questions from the first survey, (see Appendix II), new questions were developed. These questions included sustainability performance indicator questions based on drain modifications and new attitude and knowledge questions arising from the results of the first benchmarking survey and from new knowledge about acid sulfate soils management. Such qualitative data provided further information and contributed to a more holistic understanding of the processes that contributed to differences between the two surveys.

Economic data revealed that cane farmers were fairly static with their production levels, whereas tea tree production was in decline and 25% of beef farmers and 40% of dairy had a more positive outlook. Cane farmers believed their industry was not as viable as in 1998 and was at the mercy of world prices. There had been an increase in beef prices and a decrease in tea tree prices. The dairy industry had been de-regulated causing small dairy farms to either leave the industry or expand.

Human capital was measured using indicators discussed in Chapter 5, which included awareness, attitude and knowledge, as well as age and education. Awareness about acid sulfate soils has increased across all groups, 83% compared to 45% in 1998, indicated high awareness, were aware (2) to very aware (1), (on a scale of 1=high to 5=low) of acid sulfate soils, with an average score of 1.6.

Similarly, there was attitudinal change to the management of acid sulfate soils, with a 25% increase in perceived importance to farm planning from 1998 to 2002, 58% had a static attitude and 18% believed in 2002, that acid sulfate soils were less important to farm planning than they were in 1998. There was similar trend to the importance of managing acid sulfate soils in the community with a 30% increase in its perceived importance to the community from 1998 to 2002.
Despite a considerably higher level of awareness of the risk maps across all landholder groups, (59% in 1998 to 84% in 2000), many landholders did not know their levels of risk or the soil indicators of acid sulfate soils. However, 70% of the total respondents believed they had acid sulfate soils in 2002 compared to only 57% of the sampled population in 1998.

Knowledge of the depth of acid sulfate soils within the group who believed they had the soils continued to be variable with the cane industry remaining the most informed group. The percentage of all landholders who believed they knew the depth of the acid sulfate soil had increased to 86% from less than 40% in 1998. Of this sub sampled group, by industry, the beef industry had increased their knowledge by 25% in 2002, with a 15% in cane farmers knowledge.

Based on these results, it can be concluded that there has been an increase in the levels of human capital since 1998 within all landholders and most notable the beef industry. Landholders capacity to manage acid sulfate soils is also highly correlated to the industry they are a member of (see Chapter 6). It is therefore necessary to build knowledge about social and organisational capital. To understand communities, Parkins (1999) contends that new ways of measuring progress toward community well-being are required, which have multiple indicators of community well-being – indicators that account for numerous social and economic conditions at the community level. Beckley et al. (2002) defines the aforementioned indicators (age, education etc) as ‘Profile indicators’, indicators that describe how things are. “How things come to be that way or what needs to happen to be different” was what Beckley et al. (2002) described as process indicators, these indicators “examine social processes, relationships between groups, individual perceptions of their well being and individual and collective behaviour based on these perceptions”.

Pearce (1999) discusses the lack of knowledge about the relationships between the social and environmental impacts and suggests that measuring social capital was a major challenge. Indeed, the measurement of social capital is in its infancy in all areas of society and further research is required to establish good measures. Putnam (1995) has proposed a composite index covering:

- intensity of involvement in community and organisational life;
- public engagement;
- community volunteering;
- informal sociability; and
- levels of interpersonal trust
Other social scientists have used constructs such as quality of life, community well being, community capacity building and community resilience. Which ever construct is used, the essential indicators for them are based on attitudinal and behavioural traits. For instance, levels of interpersonal trust is an attitudinal trait, while community volunteering is a behavioural trait. Therefore the results below are not strictly aligned to social capital but incorporate human capital indicators within this construct.

Results from the acid sulfate soils study indicated that although many beef farmers showed higher levels of knowledge about acid sulfate soils issues, there continued to be a considerable gap in their ability to manage acid sulfate soils compared to the cane industry. Many indicated active involvement in field trials with Landcare and/or government groups. However, they felt these groups had a broader membership and focus that included non-farm issues, such as the ecosystem and water quality off the farm. Some groups, mainly dairy and beef farmers in two catchments were in conflict with the councils and/or the environmental lobby to maintain production. They were struggling to find agreeable ways to move forward. Beef farmers were still the most antagonistic to external groups, whereas the cane farmers appeared to have gone beyond the ‘us and them’ approach. Their industry had built effective communication networks with the public. Cane farmers said they believed the critics had moved on to concentrate on the beef industry or other areas where it was easier to criticise, areas where there was no industry body actively managing acid sulfate soils. Cane growers could say ‘we’ve done it, we’ve got it under control, so back off, you have no grounds for attacking us now.’ Whereas in other areas there were individuals and small groups who did not have the organisational structure and agreed best management practices to defend themselves against criticism of their farming practices.

Results from the 2nd survey indicated that successful groups (non-cane) were due to long term active involvement with government agencies to negotiate conflict, funding and a focus on the implementation of practical management solutions. However, a question used to gain a better understanding of attitudes to the community, asked landholders to respond to the statement, “My efforts are not recognised in the wider community”. Responses showed little difference between the industry groups with 60% of all landholders agreeing or moderately agreeing that their efforts were not recognised and 15% believed they did nothing for the community.

Another question, exploring locus of control, asked whether it was wise to plan ahead. These responses showed a more balanced distribution, slightly skewed towards agreeing that it was not wise to plan ahead. This indicated that there was a slight, but not significant
tendency towards external locus of control in these landholders, inferring that they were more likely to participate in altruistic behaviour and manage criticism and information from external parties.

Some landholders were antagonistic towards government agencies. Over the last 4 years the current state government had designated large areas of land, including areas with acid sulfate soils, for new national parks. Landholders believed that they were incompetent managers, stating ‘they don’t do anything’, and expressing frustration at the lack of equity for responsible management across the catchments amongst different (particularly government and landholders).

Sustainability performance indicators for measuring changed management practices were based on the removal (reduced density) and/or reshaping (wide and shallow) of drains. This indicated the volume and speed of water removal, and aims to raise the drains above the acid sulfate soil layer. It therefore required knowledge about the depth of acid sulfate soils by the excavator contractor and the landholder. Removing and reshaping drains was an agreed environmental best management practice as discussed in Chapter 8. Table 38 shows the industries and number of kilometres of drains that had been modified. The tea tree industry was excluded because it had not done any drain modifications. 57% of cane farmers had filled in drains, averaging 2 km with a range between .1 and 15 km. Dairy and beef farmers had filled in considerable less. There were similar results for the reshaping of drains, although there were some farmers in the beef industry who were very active. Beef farmers discussing the cane industry said

“Look we know they’ve got their act together, but we can’t do it in the same way because we haven’t got the same industry structure, haven’t got the budget”.

Landholders saw the cane industry as taking a practical land management orientated approach focused at the farm levels and developing specific guidelines for BPEM, such as how much lime to put on drain banks. The landholders believed that they were doing BPEM but it didn’t matter because the regulatory framework did not complement it. The cane industry had managed to marry BPEM with the regulatory framework. Landholders argued that current legislation such as SEPP 14 did not take into account managing wetlands with current BPEM.
Although cane farmers were generally very confident with BPEM, (Table 39), they believed their ongoing ability to manage acid sulfate soils depended on their financial position and on the price of inputs used for environmental management, eg. lime. The implication from the cane farmers were that if lime was not subsidised it would be the first farm management practice to stop. Landholders expressed strong opinions about subsidies and believed that they should be subsidised for providing environmental benefit. However, over 50% of landholders in all industries, see Table 40, did not believe that acid sulfate soils were causing acidification of water in the catchment and over 30% did not believe farm management would have any effect on catchment water quality (Table 41). Landholder priorities were long term economic sustainability (39%); closely followed by concern for future generations (37%); and ecosystems sustainability (16%). It should be noted that many landholders said that these issues were interrelated and it required some prompting for them to indicate which was the most important to them.

The previous chapter, 8, discussed best practice environmental regulation and the cane industry program. Cane farmers frequently expressed concern to the people conducting the survey that it should be understood and noted how comprehensive the BPER process was and their sense of pride in what they had done, this was reflected in their attitude to regulations. One farmer most explicitly expressed the reasons for the motivation for BPER by cane farmers:

“*The industry made it very clear to us that they were going to put down the regulations. And we were to follow those regulations because the alternative was that we would have to be answerable to whatever the government said. You do it our way and we will protect you as best we can OR you will be thrown to the wolves. Very persuasive*”.

Landholders in the beef and dairy industries continued to express concern about blanket regulations and generic solutions from government agencies that did not consider production
issues. They did not want to be told what to do through legislation, preferring to be told what
to do by practical application. Support needed for change, as identified by stakeholders,
include:
  • technical knowledge
  • planning tools
  • the government to commit to a long time frame of facilitated negotiations;
  • tools for learning about and management of ecosystems
  • facilitators to help reduce conflict and enable shared visions of the future and actions.

Interestingly responses to a new question about the strictness of regulations revealed that
beef and dairy farmers either believed regulations were too strict or they didn’t know what the
regulations were, and even expressed surprise that there were any. The majority of cane
farmers believed regulations were about right or a bit strict. The cane farmers sometimes
couldn’t comment on what government regulations were, but they knew what the industry
BPER were and they had confidence that the industry and government had negotiated an
agreement on regulations. Whereas other industries were asking:
  • Why was the government trying to regulate?
  • What do the regulations mean on the farm?
  • Why drain maintenance?

Dairy farmers appeared to be more removed from both the social and physical context of
acid sulfate soils issues. They didn’t have the cane industry’s intense strategy to get BPEM
but they also didn’t have the beef industry’s intense antagonism about the issues. They were
overwhelmed with other new regulations for sewerage effluent and deregulation issues, both
of which were causing fundamental changes to the industry structure by driving farmers to
either expand, sell up or retire. There were considerable fewer tea tree farmers in this
survey and it was therefore not possible to draw conclusions about this industry.

A broad conclusion that can be drawn from the comparison of industries is that the cane
industry continues to have higher levels of human and social capital as indicated by the cane
farmers higher levels of knowledge and the industries strong networks, levels of trust and
shared vision of the future. Human and social capital in other industries was dependent on
local groups and was highly variable. Where such groups were shown in the survey to have
low social capital it was said to be the result of:
  • Diversity of stakeholders causing conflicts within meetings
  • Lack of guidelines about the environmental problems
  • Lack of consensus on environmental goals
Lack of focus on practical management solutions
Size – groups too small to effectively negotiate all the diverse issues
Lack of appropriate support from government agencies

Cane farmers were extremely confident about their industry’s ability to manage acid sulfate soils. They also appeared to have a better understanding than other groups of how their management practices can contribute to the ecosystem and water quality. The cane industry was managed by landholders and therefore had a practical land management orientated approach directed at the farm, rather than Landcare groups. The challenge for beef farmers was to implement a BPER system. However, given the problems of small groups noted above, it was unlikely to be successful without considerable institutional support from both local and state government agencies.

Results from this 2nd benchmarking survey of landholders were not available at the time of the interdisciplinary meeting in Ballina. However, the meeting still used the cane industry as a case study, and participants were introduced to the BPER program along with a broad overview of how to manage acid sulfate soils during a tour of the Richmond catchment. They were also shown the diversity in stakeholder groups and institutional structures.

9.4 THE OECD INTERDISCIPLINARY WORKSHOP

The OECD Interdisciplinary Workshop on Agriculture and Ecosystems Management (see Appendix III for proceedings) brought together many disciplines and interests: natural scientists, social scientists, economists, landholders, government agencies and community activists to increase understanding of the issues in the broad context of sustainability (Woodhead et al. 2003). The key aim of the workshop was to promote an interdisciplinary and multi-stakeholder dialogue to discuss policy and market-based options to achieve the multiple societal goals involved in managing agricultural ecosystems, in particular with regard to diffuse source pollution from agriculture. International experts in policy were invited to discuss, within the context of an interdisciplinary dialogue, what could be learnt and what were the implications for international policy development, from the regionally based, acid sulfate soils study and other regional examples presented by participants.

Interdisciplinary policy forums aim to develop a common understanding and expectations about the management of resources by developing bridges between the disciplines and by improving communication between and the involvement of many stakeholder groups. This
can therefore also be considered to be participatory policy development, because it was devolving responsibility for policy to a larger stakeholder base. By defining whose agendas were driving the process and what organisational innovations were needed Ashby and Sperling (1995) argue that policy could be developed that also better supported participatory research.

A problem with homogeneous groups is that they tend to be inward looking and therefore their view of sustainability is limited to their discipline. Interdisciplinary groups are heterogeneous, and have many views, and participants challenge the views held by others. Such a forum needs to increase integration between disciplines and to acknowledge and accommodate different interests, because in the past economists have dominated policymaking and therefore shaped how issues were dealt with and valued. An interdisciplinary framework provides an opportunity to incorporate other perspectives into the discussion on how to define and value sustainability and write the rules. However to create pictures of sustainability that have meaning to individuals and groups it is necessary to incorporate new values and visions. For example it is easy to envisage economic wealth as a benefit, but frequently the social and environmental benefits are omitted from discussions because it is harder to envisage a well functioning group as an equally important asset for community well being.

The aim of an interdisciplinary dialogue thus becomes to build a collective understanding, with diverse stakeholders (culturally and in disciplinary terms) and to create a collective focus about an issue, in this case diffuse source pollution. While achieving consensus may be an optimistic goal, aiming for an accommodation between different interests so that purposeful actions can be undertaken, is more realistic. The selection of participants and developing the right balance of stakeholder groups was important, and the aim of the workshop needs to be aligned with these stakeholders who participate if the interdisciplinary process is to be properly informed.

With the Ballina interdisciplinary workshop, the dialogue developed within the framework of the OECD “pressure, state, response” (PSR) model using the acid sulfate soils case study. However, the workshop also included studies from other countries about water quality and diffuse source pollution, with the reply allowing for dialogue about what could be learnt from the areas of commonality and what was different about the approaches of each discipline to similar problems. The dialogue at the workshop enabled representatives from the technical, economic and social aspects of ecosystem management to present ideas that could be examined from the perspective of a range of disciplines and interests.
The **key messages** for international policy makers and stakeholders, that emerged as from the Interdisciplinary workshop (Woodhead and Legg 2003), were:

- Effective ecosystem management in agriculture needs to draw on a wide range of disciplines, but often there was too little dialogue and understanding across the different interests; the evaluation of the workshop by the participants indicated that most found it a unique and valuable opportunity to engage in such a dialogue.
- Evidence from the scientific analysis of ecosystem management was sometimes too remote and not meaningful to be practically applied at the farm level.
- Landholders generally resist taking self-regulatory voluntary actions to alleviate environmental damage unless they expect some net benefit - if they have a financial incentive to do so (“cannot be green if in the red”); if they can foresee the consequences of their actions; and were able to take a long enough time perspective to deliver results they were likely to adopt best management practices to address environmental pollution and remain economically viable.
- Voluntary actions were often only taken when there were evident shocks or crises (such as dead river fish due to acid sulphate river pollution or erosion of coral due to increased sediment, nitrogen and phosphorus run off from agriculture), or there was the threat of the imposition of policy controls and regulations.
- Defining and enforcing property rights was an essential requirement for tackling environmental damage (implementing the polluter pays principle), but was particularly difficult when pollution was dispersed and due to the actions of many landholders (non-point sources).
- Policies need to have clear and measurable objectives; were transparent, monitored and evaluated with appropriate indicators (economic, environmental and social); and conflicting policy signals facing landholders were minimised.
- It was not clear what was the future vision for sustainable agriculture or how much society was prepared to pay to achieve it through a combination of market approaches and policy interventions. But building up trust among stakeholders, getting an active commitment among the highest level of policy making, ensuring a coherent mix of the right incentives from policy instruments and market approaches, and appropriate institutional structures were all vital elements.

During discussions there was a frequently recurring theme that, policies must be aligned with the change processes that stakeholders need to undertake to sustainable manage ecosystems. It was agreed that there was often a disconnect between policies at the national level and regional outcomes. Policies and management processes currently in place
generally do not prepare people for change or encourage ownership of the change process. The management style needs to build and manage the change process and thereby encourage individual ownership. Therefore, policies must align and reinforce both the changes being requested of stakeholders, as well as supporting sustainable agriculture and triple bottom line (economic, environmental and social) standards.

Participants said they gained a better understanding of how sociologists, economists, scientists and regulators thought about problem solving for agricultural issues. Lessons from this workshop indicate a need to learn more about other effective platforms to facilitate interdisciplinary dialogue. An interdisciplinary format can be used with any issues requiring resolution between multiple goals. It can be used as a way to involve policy makers so that they can scope the range of perspectives and explore options for attention. While the pressure was to redesign our current knowledge base, integrating multiple insights into decision making and policy formulation was time consuming and challenging. Policy makers (Pers. Com Wilfrid Legg 2002) indicated that the discussions were of considerable value for how to achieve and how to consider a wider range of options and associated broader policy implications at a regional level for agricultural ecosystems management.

### 9.5 REFLECTIONS AND CONCLUDING REMARKS

This chapter has discussed two events that occurred at the end of the *Social Benchmarking* process both based on the acid sulfate soils study. The 2nd benchmarking survey and the interdisciplinary workshop. Each event was discrete, that is, neither event informed the other, and yet the findings from both studies have similar implications for future management of acid sulfate soils and broader NRM. The question addressed in this chapter to draw these events and findings together was; Can best management practices and indicators identified in the acid sulfate soils study, inform policy development so that these approaches were reinforced by local, national and international policies? The benchmarking study addressed the first part of the question and here I briefly outline the main implications from this that also have relevance to the second part of the question which was addressed using the interdisciplinary workshop.

Social indicators have been the focus of this thesis and this chapter has shown how sustainability performance indicators and BPEM indicators (see Figure 31) can be viewed in the same model and how social indicators can be used to identify the capacity to change behaviour within the sustainability model. Evidence for change between 1998 and 2002, was
found with landholders on acid sulfate soils, overall there has been a 25% increase in knowledge. The extent of behavioural change, use of BPEM, differed between the landholders groups, cane farmers showed considerable more behavioural change than beef or dairy farmers. Social capital showed a similar pattern, with beef farmers continuing to cite conflict in catchment groups as reasons for not participating in group activities and frustration with relationships with government departments whereas conversely, the cane industry cited cohesion and trust as reasons for their success.

Findings from this thesis indicate that most landholders were willing to learn and change management practices providing they could achieve dual goals of maintaining production while also improving long term sustainability. Government agency staff were equally sensitive to gaining satisfaction from achieving results, and although they may have more experience with negotiating with bureaucracy, they were equally capable of suffering from high levels of frustration when their attempts to facilitate activities within groups were consistently undermined by conflicting policy signals.

Implications for other situations are that a more cohesive industry can move rapidly towards instigating behavioural change. Industries and groups require support to become more cohesive. Industries that demonstrate less cohesion or have no industry body will require institutional support to facilitate BPER and environmental change. The 2nd benchmarking survey of landholders and dialogue within the interdisciplinary workshop both pointed to the importance of aligning policies to the change process and developing policies that reinforce stakeholders capacity to develop sustainable management practices. A cohesive industry can negotiate with government agencies to align policies to production imperatives, something that small, dispersed groups cannot do effectively without government support. Recognition of the need to align policies to management practices needs to be incorporated into regional governance.

Despite friction within Australian Landcare groups, there was a considerable wealth of social capital that had built up over the last decade and these groups were contributing extensively to making Australian agriculture more sustainable (Curtis 2003, Chapter 8). Delegates who attended the workshop from highly regulated countries such as Denmark were surprised at the structure and importance of these groups to Australia. For these groups to function effectively, satisfaction with obtaining environmental outcomes and a sense of control about their future are important social indicators. But, given the tightening economic conditions, incentives to produce environmental benefits is becoming increasingly important to many farmers in the acid sulfate soils study.
Reflections:
The NSW Government and ASSMAC, made acid sulfate soils a focus for the state government since 1993. ASSMAC along with other state and federal government agencies funded over 2 million dollars worth of projects annually. The rapid changes that have been evident over the last three years in landholder groups, particularly non-cane groups, have been due to the support of government funding for extension staff and groups.

During recent discussions with the Chairman of ASSMAC I discussed the initial results of the 2002 benchmarking survey. They were not requested, although offered, for the funding proposal for the next triennium. I enquired as to why they were now of interest. ASSMAC’s request for more funding for another 3 years has been refused. They were confident that funding would be granted based on a favourable external review of the ASSMAC funded projects by consultants. However this has not been the case and they were criticised because they did not provide evidence of change, either economic, environmental or social. Thus the importance of the social based benchmarking data has become more evident and may provide evidence to argue the success of ASSMAC and re-funding. Given the age of the current farming population, within 5 years, the knowledge that has been built up within landholders will have gone, and the new generation, potentially with new farming industries will be managing the land without knowledge about the potential impacts of acid sulfate soils. If ongoing support is not provided then a major concern is that the gains that have been made in recent years will cease.

Another forum that can be used effectively to argue for a program’s success or failure as well as developing new polices is the interdisciplinary forum. Effective forums for discussing real life problems and providing platforms for policy development need to be incorporated into government departments. Participatory processes are frequently directed by researchers at community level stakeholder groups, whereas, these outcomes also need to be debated at an interdisciplinary level at regional, state, national and international levels. One outcome of this would be a better understanding by those deciding funding at a more senior government level about issues that concern catchment level management. Previously discussed in Chapter 7 and 8 was the danger of undermining social capital with participative processes because decisions reached in these community participative forums are not accounted for in policy development that is isolation from these forums. Policy makers need to change their policy development processes to be more interdisciplinary and participative and to focus on supporting the change process at a regional level. As has been demonstrated by the failures
of some policies, there needs to be more effective relationship between policy theory and practical outcomes. Interdisciplinary forums provide the opportunity to investigate multiple perspectives and potential outcomes and to raise interest across different dimensions and to trigger more effective problem solving.

This concludes Part III. This has included three discussion chapters based on the results from the acid sulfate soils study using the Social Benchmarking process. The final chapter draws together the conclusions from this thesis and discusses the benefits and constraints of using Social Benchmarking for the acid sulfate soils study, together with the broad implications arising from the acid sulfate soils study.
PART IV

CONCLUSION
10. THE MAIN FINDINGS AND CONCLUDING REMARKS

Ecosystems are complex, conflict prone systems. Managing them is causing new challenges to our institutional structures and is requiring major changes in management within stakeholder groups. The philosophy behind this thesis has been that providing more relevant and credible information will enable stakeholders to make more informed and better decisions about our individual and collective futures. The particular research problem that this thesis examined was that current methodologies for agri-environmental problems fail to combine measuring change with actively creating change by informing decision makers at all levels so that policies and actions can be better aligned. Participatory methods while creating change generally do not produce measurable outcomes, information that policymakers prefer. Conversely, methodologies that measure things do not create action. Benchmarking in Australia and elsewhere has tended towards measuring changes in agricultural and other industries production systems but has failed to effectively measure sustainability and inform stakeholders with meaningful information about best management practices or to facilitate the change process.

Social benchmarking was proposed as a new method to account for this diversity, while also facilitating change. The previous three chapters have discussed outcomes that have emerged from using Social Benchmarking on the acid sulfate soils study. This chapter summarises these findings and reviews the effectiveness of the Social Benchmarking methodology. It commences with a summary of the questions that have been discussed in the preceding chapters.

10.1 CONCLUSIONS ABOUT EACH RESEARCH QUESTION

The overall question that this thesis addressed was: How can benchmarking most effectively be used to involve multiple stakeholders in learning and action in dealing with a complex environmental issue such as acid sulfate soils in eastern Australia? To answer this question surveys of stakeholders were conducted and focus groups were used to explore and validate the information. Emerging from this process were three questions that have contributed to answering the overall question. They were:
1. Can this benchmarking data with explanations effectively engage landholders and government agencies in better grasping and better understanding the situation and engaging in acts?

Chapter 7, titled, Stakeholder, Conflict and Control looked at the findings from the acid sulfate soils surveys and focus groups and found that landholders and government workers agreed that it was critical that they deal with environmental problems, such as acid sulfate soils. Yet the process of negotiating with many diverse interest groups has been fraught with problems. Landholders found the picture of the cohesive industry that was empowering farmer’s capacity to manage vs. the non cohesive industry that provided no support and left its landholders feeling ‘out of control’ very relevant. There appeared to be a correlation between control and industry cohesion. Control appeared to be important for building human capital and was reinforced by strong social networks and social cohesion, with loss of control likely to result in conflict, erosion of social capital and a negative attitude towards learning about environmentally sensitive land management. This has important implications for managing diffuse source pollution and sustainable development, because catchment scale issues depend on working with diverse groups and some form of agreement and shared vision is needed about future management of natural resources. The main findings from this section were:

- The importance of how to build organisational capital and institutional arrangements needs greater emphasis in policy forums
- Locus of control appears to be a valuable social indicator for understanding the capacity of stakeholders to change management practices within their organisational structure and legislative environment.
- The benchmarking data was most effective in engaging stakeholders in discussions about the management of acid sulfate soils and identifying best management practices. It had also been most effective in identifying best management practices and providing new knowledge and indicators.
- Building human and social capital to instigate best management practices, required political will, funding, time and commitment.

Initial results indicated that the benchmarking data and Social Benchmarking process was not as successful at influencing government decision-makers or policy. Caution is needed, as involving stakeholders in participating in solutions using the Social Benchmarking process and raising stakeholders knowledge and expectations, without also gaining organisational support for the changes, (for example, supportive policies, communication strategy, training,
acknowledgment of the results), can cause frustration and conflict. This can therefore result in the reverse of the desired effect, dis-empowerment, loss of trust, reduced control, increased conflict and ultimately undermine the participative process and social capital.

2. Can information be used with stakeholder participation to develop best management practices for a broader group of people?

Chapter 8, focussed on best management practices identified in Chapter 5 and 6 and used the soil sampling program developed by the cane industry model as a basis for guidelines for other industries. From this process emerged the guidelines “Keys to Success”. Results from Chapter 7 had indicated that if stakeholders have both unambiguous comparative information about practical, agreed ‘scientific and industry’ solutions, they were more likely to positively embrace changes to work practices (government) and their production systems (farmers) Providing:

- conflict of interests can be negotiated;
- sense of control is not threatened ie. it does not place their systems at risk;
- it does not involve major expense and time, and;
- people are supported through the process
- the government provides consistent messages

The guidelines were developed using participative, systemic and adult learning principles. The guidelines, “Keys to Success” aimed to encourage and create the involvement of individual landholders, catchment groups and government staff. A commonly held view of those in risk communication is that a crisis is frequently a trigger to create pressure for change. In the acid sulfate soils study, the beef farmers in particular were under pressure from the fishing and oyster industries who were in crisis, but not just from the impacts of acid sulfate soils, but from multiple causes. Consequently awareness of acid sulfate soils had increased due to media interest and public outcry. Social Benchmarking is about pro-active rather than reactive research. During the period between the surveys information was provided, and the landholders and other stakeholders in the catchment communities were involved in learning, aimed at building understanding and capacity to manage environmental problems.

The second benchmarking survey provided evidence that the guidelines combined with other initiatives by government departments were successful in raising knowledge about the depth of acid sulfate soils. Responses to the guidelines, “Keys to Success” and the first booklet,
“Farming community ideas about the way forward” indicated that the information was well received in both government agencies and other stakeholder groups. Constraints to broader use of the guidelines were identified and included gaining acceptance by government staff and the need for the acceptance of a communication strategy by government agencies and funding bodies. The third book in the series, Four Years On, reports on the change that has between 1998 and 2002, aimed at once again, informing the general public, particularly landholders and government agency staff, so that they can see what is working and what requires areas require further attention.

Successful implementation of BPEM for acid sulfate soils was predicated on stakeholders being informed and having high levels of human capital so that they could understand the best management practices, the management plan and the regulatory requirements. This requires a learning strategy that empowers landholders so that they can take responsibility for best practice environmental management. Too date ASSMAC has chosen not to dictate policy, but to support a broad range of learning initiatives. I believe that it is necessary for a stronger focus, endorsed in government policy, for guidelines and learning for BPEM if successful outcomes for acid sulfate soils improvement are to be achieved across all industries, especially to achieve BPER in a co-operative and useful way.

The cane model is creative, it incorporates both the need for environmental benefits with society’s need for assurances that industry is trustworthy and is producing food sustainable. It also demonstrates successful vertical communication within the cane industry and horizontal collaboration between government agencies, stakeholder groups and the industry. To successfully impact on a broader group of people, building horizontal communication is the primary challenge and is considerably more difficult than vertical communication within same discipline groups. The guidelines “Keys to Success” succeeded in communicating across stakeholder groups because they were developed participatively with the different stakeholder groups, rigorously tested and based on shared learning principals rather than transferring knowledge. The third discussion chapter addressed policy and indicators and looked for evidence of community capacity building and change.

3. Can Social Benchmarking indicators (as measures and for learning) be developed to inform policy development so that decision making and ecosystems management is reinforced by local, national and international policies?
Chapter 9 discussed the use of the acid sulfate soils study both to provide evidence for policy forums and for influencing policy makers to make better choices by providing evidence that policies are or are not working. The social indicators effectively provided evidence of change. Some of this change can be attributed directly to policies on raising awareness and increasing knowledge through the best practice guidelines. The environmental indicators have remained too complex and expensive to measure across all catchments and the economic ones have not been developed either because the ASSMAC committee believes that they will not provide information that will help them manage the problem (pers.com John Williams April 2003). Human and social capital indicators provided valuable contextual information that demonstrated what made some groups more successful than others, incentives for change included knowledge about regulations, frustration with existing drainage systems and institutional support for the change process. The second survey also showed that support structures and the personalities of the individuals within those organisations are essential for reaching agreed outcomes, facilitating change and capacity building. Further that the government needs to commit to a long time frame of facilitated negotiations between groups to increase human and social capital and ultimately provide a better ecosystem by reduced pollution from agriculture.

It was found that sustainability performance indicators, by measuring behavioural change, have the potential to indicate the directions that society is going and why it is going in that direction as well as measuring social, environmental and economic change. Locus of control is one of a set of social indicators that needs to be incorporated into this model. It is a highly significant indicator because it can indicate an individuals and groups capacity to change and thereby predict the likelihood success of policies and management initiative such as BPER. Stakeholders who believe that the problem is real and that they can manage it are more likely to comply with regulations and encourage others in groups to adopt conservation practices.

Compliance to regulations is based on the capacity to comply, which includes information, knowledge and attitude as well as economic and environmental issues. Diffuse source pollution is particularly difficult to provide information about because it does not have direct links with the management practices, and bio-physical consequences are separate both temporally and spatially from management actions. Therefore it was not surprising to find that significant numbers of landholders did not believe that their management actions were having any effect on water quality, or that they were causing water quality deterioration. Thus any environmental program that is not reinforced by a complimentary regulatory compliance and/or incentive program is likely to have limited success because these farmers
will be incurring both a financial and time cost for a management action that they can see no benefit from. This is further exacerbated when society is not aware of the actions and the consequent benefits that they receive from the landholders, therefore some form of reward system is also imperative. Table 42 shows an article that discusses the lack of acknowledgment for altruistic behaviour by large corporations.

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<th>Australia: Corporate philanthropy struggles in the face of public vilification</th>
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<td>Australian businesses contribute over $1.5bn a year to the community only to endure the cynicism - and even vilification - of the public, according to the Business Council of Australia.</td>
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<td>Katie Lahey, CEO of the BCA, told a conference on philanthropy that businesses remained committed to their role in the community regardless, but that this was having little impact on public perceptions - considerably beyond what might be expected even in the wake of the Enron and HIH scandals.</td>
</tr>
<tr>
<td>&quot;An almost perverse relationship exists between the amount of effort and money that some companies contribute to the community and the level of negative feedback, rather than positive acknowledgment they receive&quot;, she said.</td>
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<tr>
<td>&quot;What is the rationale for business – both in a commercial and moral sense - to contribute large amounts to communities which reciprocate in such a way? I think the finding in the BCA/Centre for Corporate Public Affairs study which detected a clear unease among business over the lack of acknowledgment it receives from community giving is an issue for concern&quot;.</td>
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<td>A further challenge, she said, was that CEOs - now being required to spend more time on core ethical issues, such as governance – would have less time to spend on matters of pure corporate philanthropy.</td>
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Table 42 Corporate philanthropy struggles in the face of public vilification


To build human and social capital and therefore community capacity for sustainable ecosystems management we need to develop a constant flow of information between stakeholder groups so that they can keep creating, modifying and developing new knowledge and partnerships. To measure change we need robust indicators that describe whether or not we are having any impact, what is working best and why, such as those described in the last chapter. However, influencing policy makers at senior levels of government to make decisions based on a broader base of information that includes inter-disciplinary forums that are grounded in locally based studies are equally important. Results from this study indicate that this process has proven harder to promote because it can threaten the power structures within organisations.

### 10.2 CONCLUSIONS ABOUT THE RESEARCH PROBLEM
As previously mentioned the main research problem that this thesis deals with is: How can benchmarking most effectively be used to involve multiple stakeholders in learning and action in dealing with a complex environmental issue such as acid sulfate soils in eastern Australia? This section discusses the Social Benchmarking model and shows the adaptation to the original model that evolved while using it on the acid sulfate soils study.

Social Benchmarking evolved from the concept of benchmarking, which had been frequently used in corporations and production situations based agricultural issues. The Social Benchmarking model was endeavouring to account for changes in multiple stakeholders who were involved in managing acid sulfate soils, an agri-environmental problem. The original concept of benchmarking was grounded in competition and economic gain. The Social Benchmarking model developed in thesis has an emphasis on social indicators and informing dialogue between stakeholders and policy development. Problems with the application of benchmarking in agriculture were noted as an over emphasis on benchmarks and measurement, and an under emphasis on participative processes, developing best management practices and communication. Therefore the Social Benchmarking described here is a new process that attempts to build on the original concept and by involving stakeholders in solutions and acknowledge and record variations between individuals and groups using sustainability reporting and best practice guidelines.

In Chapter 3 a Social Benchmarking model was shown (Figure 10). This model failed to adequately account for the constant ongoing importance of communication. Therefore it was adjusted (see Figure 32) to reflect the new emphasis on developing a constant flow of information between stakeholder groups so that they can keep creating, modifying and developing new knowledge and partnerships and inform policy forums.
Underling this new emphasis on communication are clues to the answer to questions that were raised in Chapter 3, that evolved out of discussions while I was on the fellowship at the OECD in Paris. In Chapter 3 human and social capital was shown to explain the variation in countries growth (OECD 2001c), and this point was followed by two questions:

1. How can the adaptation best be undertaken with existing human and social capital?
2. How can agricultural knowledge systems be best developed to change human capital to enable sustainable agriculture?

I believe the answer to them both lies in communication and support systems that are complementing BPERM. Evidence from the 2<sup>nd</sup> benchmarking survey indicated that considerable change had occurred in the farming community during the 4 year period between surveys and that the amount of change was correlated with the industry body. Thus change in the cane industry is directly attributable to that industry’s comprehensive soil sampling and extension strategy that has enabled them to develop BPER and agreement with government agencies and the community. Change in knowledge in other industries can be partly attributed to the availability of simple guidelines that provided practical advice, such as the soil sampling kit that made identifying and managing acid sulfate soils, simple and easy. Communication strategies are needed for several reasons, including:

- To own a problem, you need to understand that you have one in the first place.

Guidelines showing the results of the research written for both landholders, the
government and broader stakeholder groups, are important for helping stakeholders learn, understand and own the issue.

- Landholders fear that changes may adversely affect their property. Support structures for change whether it is an industry group or a catchment based group are required to dissipate management information, address concerns and negotiate conflicts.
- Other stakeholders fear that nothing will happen and environmental degradation and economic loss will not abate. A broad scale communication strategy is needed to broadcast the outcomes of the remediation and other activities that are being undertaken by stakeholders.
- Local stakeholders become frustrated when their concerns are not taken into account in political and government forums. Communication between local and regional stakeholders with state, national and international agencies is needed, to ensure that new policies support the change process on the land and vice versa to ensure that local initiatives meet national strategies.
- Individuals from different disciplines frequently have trouble understanding other disciplines and their perspectives. Increasing communication between disciplines by encouraging interdisciplinary dialogue in policy forums will increase the potential that new policies will draw on a wider base and meet the criteria for sustainable development and thereby avoid some of the mistakes of past policies that have developed in single-discipline forums.

Benchmarking can be more than just a point to measure from, it can identify differences within and between industries and catchments and facilitate new directions by identifying best management practices. Using the Social Benchmarking methodology and sustainability reporting system to provide feedback to stakeholders about their industries over a 4 year time span has influenced the change process and provided proof of change (or not), while investigation of processes provided further evidence to back up these assertions. This information has proven to be valuable for both the government and landholders. Government can structure credible future education and policy, based on stakeholders local knowledge. Local stakeholders can contribute their ideas to the dialogue and all stakeholders thereby contribute to the future management and become part of the solution.

While applying Social Benchmarking to the acid sulfate soils study, many stakeholders involved noted that issues became clearer and this in turn created more confidence for planning the way forward. Further, there was a greater appreciation of individuals' perspectives. Social Benchmarking needs a lot of planning and a multi-skilled reference group to guide the process, which may span several years. Institutions can better support
multi-methodological approaches such as Social Benchmarking by developing policies and frameworks that require:

- evidence that targets have been met
- best management practices that are developed in participatory forums
- interdisciplinary policy development forums that are aimed at both assisting industry and voluntary programs to manage the change process, and to provide environmental, and economic support (whether to individuals or groups)
- an emphasis on communication between agencies and stakeholder groups

This concludes the discussion on the Social Benchmarking methodology. The next section summarises the broad policy implications that arose during the acid sulfate soils study and looks at their implications for other situations.

### 10.3 IMPLICATIONS FOR POLICY AND PRACTICE

The acid sulfate soils study has wider implications because it deals with diffuse source pollution and discusses strategies to use collective action to both deal with the pollution and encourage sustainable agricultural practices. Environmental issues frequently cross-farm, local council, state and country boundaries. Therefore they can benefit from holistic thinking about the social, environmental and economic dimensions. This requires changed attitudes and practices to the roles and responsibility of farmers that incorporates agriculture not just as a collection of farms producing commodities in isolation from the environment, but as an integral component of all three dimensions of sustainable development. Developing a benchmarking system to report on the social dimension of sustainable development has been the main subject of this thesis but finding a balance between the three dimensions of sustainable development is a major challenge. The following suggestions are intended to facilitate the further discussion and development of the social dimension in sustainable agriculture and of monitoring sustainable development.

1. **Define more clearly the social dimension in agriculture.** This thesis has further developed social sustainability indicators for use by policy makers, with a particular emphasis on human capital (awareness, attitude and behavioural change) and social capital (involvement in groups, reciprocity and trust). While elements of the social dimension in agriculture have been outlined, the components of human and social capital within broader situations, such as the whole food chain, need further definition. The effects of actions, for example, are frequently inter-generational and often go
beyond the time horizon for governments. Actions are also reliant on a chain of events, therefore the impacts of corporations on small business needs further definition particularly the horizontal and vertical relationships that exist between the different entities.

2. **Further develop social indicators for use in sustainability reports.** Policy makers as well as other stakeholders need a credible, broader information base to make decisions about sustainable development. Key questions such as how much human and social capital is needed to reduce organisational resource costs and increase environmental benefits, under different economic and environmental conditions need to be answered in a variety of situations. While data is available on age, education and training, there are no comprehensive data available on awareness, attitude, knowledge and generally on social capital. These indicators need to be further defined and monitored over time so that the social dimension can provide information for use by policy makers and other decision making forums at regional, national and international scales.

3. **Develop new ways of providing information for building human and social capital.** The Social Benchmarking project has both structured the problem in a way that enables different groups to gain an appreciation of a broader range of perspectives and it has enabled the identification of best management practices. There needs to be increased emphasis on knowledge systems. Social Benchmarking can provide the background evidence to both monitor change and inform the learning process. Developing communication material in a variety of media about BPEM and results from sustainability monitoring programs needs to have greater emphasis in research and industry programs.

4. **Models that guide diverse, catchment based landholder groups in negotiations with government departments are needed.** Results from the acid sulfate soils study indicated that participative processes can undermine rather than build social capital when the efforts made by individuals are not acknowledged, supported or acted upon by senior decisions makers and results are not communicated back to the stakeholders. Facilitating the communication process between the diverse groups is an essential element of building strong social capital.

I believe that many farmers and government agency staff are now on a roll. They are moving towards sustainable solutions that benefit everyone. The aim of the study was not to
determine which industries are performing better or worse, but rather to indicate which systems work best, which ones can be improved, to draw some broader policy implications and to broadcast these findings to multiple stakeholders.

Over the last four years major changes have occurred. Certain management practices were defined as best practices after the 1998 study. They included soil sampling, drain management, improved communication between stakeholders and the development of best practice guidelines. Some of these initiatives were developed between 1998 and 2002 and the results in the previous section reflect changes that can be attributed to these initiatives. Overall, during the 4 years from 1998 to 2002 there was a 25% change in awareness, attitude, knowledge and behaviour or management practices.

But many landholders still do not believe that acid sulfate soils are causing water quality problems, or that their best management practices are impacting on water quality. Publishing results in local media about water monitoring data will help to provide proof that their actions are providing environmental benefits and build confidence in the community that landholders are managing land responsibly. Building knowledge, partnerships and trust takes time. Over the four years, many government agency staff and farmers have frequently cited the Social Benchmarking reports as an invaluable, credible source of information for informing the debate and measuring change.
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