

Interdisciplinary Dialogue for Sustainable Systems

Alice Woodhead*, Abigail Jenkins** and Roger Packham***

Abstract

Why do ‘birds of a feather flock together?’ Is it possible for individuals and groups from different philosophical backgrounds and disciplines to agree on ways to solve problems? Arguments about the importance and necessity of involving all stakeholders in decision making. Some say that interdisciplinary groups are essential to such a process to avoid the narrow focus of uni-disciplinary groups, yet others argue that competition among disciplines may be more fruitful than co-operation. Most do agree that the way forward, to achieve more sustainable development so as to avoid past mistakes, is seen as requiring more debate from a broader stakeholder base, one that does not just involve ‘experts’. Why then does this so rarely happen satisfactorily? There are many blocks to the interdisciplinary approach at societal and policy levels. Even though, at different levels in our daily lives we interact with many different citizens. But, when it comes to professional decisions, we seem to feel more comfortable interacting with those of the same ‘feather’. Linking farming with the many levels of government and private sectors and other parts of the food chain system is a complex process. This paper reviews the dialogue between experts at an interdisciplinary workshop funded by the Organisation for Economic Co-operation and Development (OECD) in Ballina, Australia. The Pressure State Response model formed the basis of the dialogue. Within the example of a biophysical context of diffuse source pollution from agriculture, 50 experts from the social, environmental and economic disciplines, therefore representing the sustainability model, discussed how to overcome the barriers to effectively, aligning policies and acknowledging and working with the vastly different world views of the participants.

Introduction

Transparency, traceability, capacity building, partnerships, inclusion, and diversity are all part of the new sustainability vocabulary. *Ad infinitum* these terms appear in reports and policy statements. There is also continuing pressure for the reform of institutional arrangements, and demands for greater transparency and participation by civil society in debates that shape our common future. Major institutions such as the WTO Ministerial meetings are confronted with civil action, because civil society believes that they are not being adequately accounted for within the discussion process of the WTO and other such bodies.

But what processes do we use to negotiate this new reality? What reality do we want to create? Each individual and organisation and link in the food chain differs in the way they see, perceive and define social, economic and environmental issues. Therefore how these issues are acted upon differs. How do we define and manage the change process within all this complexity? This was the focus of the dialogue at the OECD Cooperative Research Program (CRP) workshop on Agriculture and Ecosystems

* Bureau of Rural Sciences, Canberra, Australia & student at the University of Western Sydney, Australia - alice.woodhead@brs.gov.au.

** New South Wales Agriculture, Australia abigail.Jenkins@agric.nsw.gov.au.

*** University of Western Sydney, Australia, r.packham@uws.edu.au.

Management in Ballina, Australia. The key aims of the Ballina dialogue were: to identify a process through which the stakeholders in rural ecosystem management can progress to envision new options, for which appropriate policy support and enabling instruments can be developed; and to evaluate the workshop process as a model for wider OECD use. Such an outcome has applicability to any system seeking sustainability, such as the food chain system.

Why Interdisciplinary?

An interdisciplinary dialogue process is an attempt to include a broader range of participants who bring different frameworks of ideas to the decision making process. Interdisciplinary dialogues are made up of representatives from different disciplines, cultural backgrounds, and institutional affiliations. This may not appear very revolutionary in day-to-day life, but in government decision-making processes interdisciplinary forums are not very common. Interagency groups meet more frequently, but how often do these groups actively try to balance the perspectives of the sociologist, the biophysical scientist and the economist?

Since environmental issues frequently cross farm, local council, state and country boundaries, as does diffuse source pollution that is from many sources, improvement requires collective decision making and action across water sheds. Developing greater collective action to reduce run off from agricultural land and to encourage sustainable agricultural practices are therefore key policy issues in Australia and other OECD countries. To many stakeholders these complex, systemic environmental issues seem intractable. These issues require a holistic approach, with social, environmental and economic dimensions all being included in the policy development process. Indeed participatory research and effective public-private sector partnerships are considered to be key components of successful research projects in many countries (Pretty and Ward 2001; Lovell et al. 2002). Changed attitudes are required by government agencies, landholders and the community alike, and new models are needed to facilitate broader decision making platforms.

What is Dialogue?

Dialogue is a process developed to answer the question “Why do seemingly intelligent people keep on making matters worse?” Our culture has conditioned us to debate, to argue, to engage in dialectic, which may or may not lead to a synthesis. This kind of dialogue is more of “a cacophony of monologues” as Bohm and Factor (1996) describe it. What they proposed was a group conversation where people join together to explore whatever seems important, such as the assumptions that are making a particular topic seem important. The word “dialogue” comes from the roots *dia* meaning “through” and *logos* which means “the meaning of the word”; so dialogue can be seen as a flow or stream of meaning, which never becomes fixed but continually forms and reforms; out of this emerges some new understanding, something creative. It is different from but complimentary to *discussion*, which emphasises the idea of analysis rather than synthesis.

In dialogue, the aim is not to try and gain points for your particular view. Bohm used the metaphor of the laser light, which produces a very intense beam because all the light waves are coherent – going in the same direction – rather than being incoherent as in ordinary light, with the waves not in phase. At the heart of dialogue lies the *suspension* of thoughts, impulses, judgments and the like. Suspension involves attention, active listening and looking, and is essential to exploration. When we are upset by what someone else says, we have a choice between voicing a reaction or letting the matter go, thereby

suspending our reactions. The choice of suspension is particularly difficult if it is perceived that a particular point has been misunderstood or misinterpreted, never the less if suspension occurs, often further conversation clarifies the issue and active intervention can be avoided. Suspension helps a person to know their thoughts as they are having them (Issacs, 1993).

The dialogue *process* is as essential as the task or goal of the group and proponents believe that dialogue is the root of all effective group action. While dialogue emphasises the natural flow of conversation, it discourages feedback and direct interpersonal encounters, with the *whole group* being the object of learning. The group members share the potential excitement of discovering collectively ideas that individually none of them might ever have thought of.

One response to seek answers to some of these questions and dilemmas was a unique gathering that occurred in Ballina, at the mouth of the Richmond River in Eastern Australia in November 2002. The objective of the four day workshop was to put the theory of interdisciplinarity into practice. The next section outlines the process of the Ballina workshop and overviews the papers that were presented.

The Workshop Methodology

The OECD, the University of Western Sydney and NSW Agriculture hosted an *interdisciplinary dialogue* in Australia, to discuss the relationships between agriculture and the ecosystem (Woodhead, Jenkins, Packham, 2003). The fifty delegates invited broadly represented the sustainability model, that is disciplines represented included environmental scientists, social scientists, psychologists, economists, government representatives, from the local, state and federal agencies, farmers and other stakeholders. Therefore they also represented all levels of society from senior government to community level and from within and outside the agriculture and natural resource management paradigm. They also represented different cultures; twenty-five were from international locations including Canada, Denmark, France, Great Britain, Japan, New Zealand, The Netherlands, and USA, together with 25 Australians.

The environmental pressure driving this debate was declining water quality in agricultural watersheds. This is a complex problem encountered all over the world. While the science of water quality decline is quite well understood, water quality continues to deteriorate - the human element has proven to be less tractable than the technological one. The Ballina dialogue enabled the examination of technical, economic and social aspects of this issue from a range of perspectives and interests, along with the policy options for improvement through economic incentives, establishing clear property rights regulations, standards, best practice, education and research.

Contributors prepared papers that avoided discipline specific jargon, and that provided case studies rather than theoretical arguments. Authors prepared papers with a theme of either *Pressure State* or *Response* based on the OECD (PSR) model. Specifically

- **Pressure** on agricultural ecosystems from diffuse source pollution,
- **State** of agricultural ecosystems as a result of pollution
- **Response** within agricultural ecosystems including policy and community action to address pollution

The dialogue process

Following the framework of the PSR model, delegates debated in interdisciplinary groups what the nature of the problem was and how to deal with it in the future. The dialogue process revolved around

five interdisciplinary groups with between eight and 10 participants in each group. Participants were members of three such groups that were reformed progressively over the week of the workshop. The role of the first group was to consider the papers about 'Pressure and State' and the summary presentations of them, and to formulate and ask questions of the presenters. After a one and half days in these groups, participants then changed groups and the role of the second group was similarly to consider the papers about 'Response'. The third group was formed on the final day to discuss some provided (new) case studies, and to develop policies that might work in these particular contexts to improve the complex environmental issues that the workshop had learnt about through the week. Such policies are often developed by groups of people that do not know each other well, but that come together at infrequent meetings to develop policies. Thus the workshop was reflecting this real-life circumstance.

In conjunction with the 'pressure' paper presentations, a tour of the Richmond River to look at oyster farming and the impacts of diffuse source pollution on aquatic systems was held at the end of the first day. Similarly, after the 'state' paper presentations, a tour of cane farms and water management facilities was held.

The three groups and tours were used to ensure that by the end of the workshop, individuals had interacted in small group dialogue formally and informally with most of the other workshop participants. This allowed for different perspectives to be raised in response to the papers, and for informed questions to arise from the group dialogue process, not just from individual perspectives. It also aimed to ensure that an interdisciplinary approach was maintained throughout all sessions of the workshop. The next section looks at the scope of these responses and also introduces contributed papers.

The dialogue

Five overview papers provided the basis for the dialogues over the three days. These scene-setting papers discussed the PSR model and the role of indicators for monitoring change (Parris 2003) and the role of a State agricultural agency in natural resource management (NRM) (Scott-Orr and Banks 2003) along with the major challenges for achieving sustainable agriculture. A paper about the psychology of change (Furnham 2003) explored why it is difficult for individuals and groups to change and what are the drivers of this change process, such as technology, globalisation and the changing nature of the workforce. Two papers discussed the biophysical case study, acid sulfate soils. One focussed on participatory interdisciplinary mechanisms (White 2003) and the other on the institutional context (Williams 2003). According to White and Williams, both representatives of the Acid Sulfate Soils Management Action Committee, interdisciplinary groups produced a workable situation (state) in relation to the issue of the systems sustainability of acid sulfate soils in Northern NSW Australia. In the acid sulfate soils study dispirit visions and conflict amongst those involved were overcome through participatory interdisciplinary mechanisms.

Several authors noted the importance of the time factor, which is vital if groups and individuals are to co-learn and build up trust and rapport. They argued that all too often the significance of time is not appreciated. That it takes considerable time to build trust and rapport in communities and between organisations. However, Morris (2000) also concluded that the predominant *pressure* is time. The environmental imperative is *now*, time is 'running out'. The pressures placed on the ecosystems such as the Great Barrier Reef (GBR) is *now*, yet there are no easy solutions (response), since many of the impacts are land based and beyond the GBR park authority's control. While time may be short, Morris acknowledged that the complexity of diffuse source pollution issues makes an interdisciplinary approach

critical. Authors agreed that dialogue and learning that happened in these fora generated new and useful information to enable forward movement. White and Williams argued that maintaining constant dialogue reduced the conflict that surrounded the acid sulfate soils issues, and enabled useful action to emerge. However, they acknowledged that it took several years to reach consensus and for most representative to move from their entrenched positions.

Move forward, but to where? According to Rölíng (2003) pressure is the realisation that we have got it wrong. With rapid change causing crisis, the challenge is to develop the ability to learn together and to be able to see our reality as something we have the power to invent (within biophysical limits), rather than just assuming it is something there to discover. Thus the process of creating policy requires conditions in which dialogue can be effective, despite the fact we will never totally agree. Rölíng asked “Whose truth? if everyone is inventing different ones?” Rölíng inferred that what we need is a mechanism to learn together to bridge those truths. The important point is to look for what will work in what situations. What makes this challenging is that our rich and messy reality is characterised by non-linear feedback loops (Waltner-Toews 2003). As such, the creation of a vision of sustainability is not easy. Drawing on ideas from the systems sciences, Waltner-Toews proposed that the continually changing pressures on complex multilevel ecosystems require continuous adaptive processes. Both Rölíng and Waltner-Toews show the necessity for an interdisciplinary process to solve complex issues and to measure change. Rölíng suggests that everyone’s reality is different, therefore the indicators that individuals choose to determine the success of a given project or reality will be different. This difference is essential to make that reality encompassing. While Waltner-Toews suggests that these issues are not static, and therefore any indicator or measure and the process must be flexible to encompass these issues as they occur.

The three papers looking at the *state* of agricultural ecosystems also highlighted the necessity of interdisciplinary dialogue in agro-ecosystems management while mentioning the blocks that exist. A paper about a case study of water sharing and management across national boundaries outlined an attempt to find a middle ground between the top down enforcement approach and the bottom up voluntary approach (Jiggins 2003). Adaptive policy formulation was rooted in the local area, allowing for the feedback that was required for this kind of activity to continue. Farmers and naturalists needed to be both involved in discussion about environmental issues, and how to set plans based on individual farms and environmental objectives.

This approach has ramifications far beyond the individual landholding / catchment boundary, such that there must be interdisciplinarity at all decision making levels to ensure representation from all levels. Specificity is particularly important. Interdisciplinarity is more than different disciplines, it is also different levels of governance. Those making policy at ‘higher’ levels have to be brought into the local picture: Local actions can be thwarted because the decisions occurring at higher levels are not informed by an interdisciplinary approach (Steyaert 2003). The indicators and points of view at any one level are no more important than at another level. The challenge is to develop communication and transparency between the levels.

However there are blocks in functioning through all levels of decision making, because each level has their own goals, language and culture, making dialogue a challenge. Valentine *et al* (2003) argued that in New Zealand the use of soil indicator tools were hampered by the lack of interdisciplinarity, “for research organisations to be successful in applying their output to the management of natural resources,

the users should be involved in the development” New Zealand farmers “feel that (*they*) have lost certain rights to manage the land resource” because they have not been consulted about policy changes.

Group dialogue following these papers took up these issues, particularly focussing on how much representation would be satisfactory, how to get that representation, and what mechanisms could be used to get dialogue going between the people drawn in, rather than people only defending their existing positions. The groups agreed that there were no simple answers, and that each local context had to be treated on its merits. All that could be generalised were the overarching principles that people should strive to achieve. However, listening to other people’s stories of successes and failures helped others to plan future actions, and so such stories needed to be made available through conferences, meetings and publications; they gave encouragement to people to keep seeking better ways to act.

The *response* section presented papers that discussed the complexity of the change process and methods to facilitate interdisciplinarity. This section was split into two parts with eight presenters. The first section dealt with institutional, policy level responses and the second with community level responses.

The role of *policy* in interdisciplinary dialogue was a strong theme of the workshop. There was a strong argument for vertical interdisciplanry dialogue. Conflicting policy messages interfered with biophysical signals received by farmers to manage land sustainably (Legg 2003). According to Legg, policies and markets need to be consistent and lead to a sustainable outcome, which means in particular the phasing out of environmentally harmful subsidies. A mix of regulation, education and economic measures can be used to promote the sustainable management of water resources (Journeaux 2003). New Zealand policy and regulation allows for some site specificity, so there can be a mix of incentives and regulation, while economic measures are targeted at providing answers through research rather than by direct payments to farmers. The education/ facilitation arm of this package involves interdisciplinary groups that contribute to policy development and interpretation in their local region.

Scientific understanding and technical knowledge are not limiting factors; rather the limits relate to the socio-cultural, economic, and political environments within which technical solutions need to be implemented (Brezonik 2003). Indeed it was stated that: “Stakeholder participation is a necessary but not sufficient condition for developing more sustainable ways of managing natural resources” (Campbell 2003), highlighting the fact that these other limiting factors still needed to work within the bio-physical constraints of a particular context.

Community response to pressure made up the second part of the *response* section. One of the reasons that this workshop was held in Australia was because of the *Landcare* program. Landcare facilitates cross-disciplinary dialogues and as such interdisciplinary dialogue at a community level has been a policy initiative in Australia for over 10 years. The Landcare program provides a framework to form groups. It brings together ‘neighbours’ in a geographical defined community for collective action to address environmental issues that are prioritised by the Landcare group. As such the groups are frequently diverse with lifestyle farmers, urban dwellers and professional farmers dialoguing about land management issues. The success of *Landcare* in Australia, and its role in building social capital to facilitate action according to Curtis (2003) has been substantial. However, Curtis acknowledged that there was criticism of *Landcare*. Criticisms about the limitations of *Landcare*, especially those regarding its reliance on voluntary action, the ongoing support it needs to ensure long term viability, and that *Landcare* has been used as a way for governments to divest themselves of responsibility for acting on NRM issues at a local level. Curtis argued that a stronger policy mix to ‘back up’ *Landcare* was

essential. Ringleman (2003) argued that the success of *Ducks Unlimited* was due to the diverse nature of the group, that included policy makers, landholders, conservationists and duck hunters. This Ringleman argued provided diversity both in paradigm and realities along with stronger institutional support.

In another community response from Japan, researchers functioned as catalysts for the development of new technology, but more importantly they helped to set up soft systems processes that facilitated the uptake of this new technology. While they enabled the new technology to function properly, forces outside their control (changes in national trade conditions) meant that the marketing of rice became the most pressing issue. (Sato & Taniguchi 2003). This further reiterates the message by Waltner-Toews above, that unforeseen issues will arise. A process of true interdisciplinary dialogue needs to encompass these dynamic events.

The nature of the processes and partnerships that occur between some human activities and institutions was a key theme throughout the three days of papers, tours and dialogue. Ison (2003) put forward the argument that as an individual is only able to respond to his or her own apparent area of responsibility, *systems practice* can be a useful means to orchestrate ecological conversations between these individuals. In this way, communities can be enabled to enact a *learning process* that will help them to respond in appropriate ways to environmental issues of concern.

But systems practice needs to be incorporated into all levels of decision making. While groups such as Landcare may be effectively negotiating horizontal relationships at a community level, there appear to be problems with vertical integration among levels of government, scientific disciplines and the community.

Participants reactions to the process was overall very positive, and gave the participants an understanding of what was involved, and encouraged them to try interdisciplinary dialogue out in their own research settings. Reaction to the final day was varied and depended on the case study and the facilitator. Because the case studies were ‘not real’ to many people, particularly those from non-Australian backgrounds, they therefore felt they had no responsibility to help create new policies for change. This highlights the need for policy makers and others to be involved in the situation, to view the biophysical issues, and to have interdisciplinary dialogues before enacting assumptions they may be holding. This was very evident as a result of this workshop process. Why was it that this was the first time many of these people had met in this way with people from other disciplines? All agreed that there was a need to encourage such processes in complex issues such as those that formed the basis of this meeting.

Learning outcomes

Discussion

Advocates of the interdisciplinary approach argue that by forming third party interdisciplinary groups (Allison et al. 2003; Hoggett 2001), decision makers from different levels are brought together, for example from the international government level through to the local government level. Benefits emerge such as increased integration between disciplines, thereby challenging individuals to acknowledge and accommodate different interests. Consensus on management can often be achieved, albeit after a period of negotiation (Ewel 2001) with moving from collaboration to conflictive representing an important part of this negotiation period (Ramirez 2001). Advocates also argue that an interdisciplinary framework provides the opportunity to incorporate other perspectives into discussions on how to define and value sustainability leading to appropriate re-writing of the rules. The credibility of science with the general public relies on a broader base of decision-making. Freudenburg (2002) argues that the “true need is thus

not to argue about differences - or to create them - but instead to develop synergies across differing points of view”.

A single agency or uni-disciplinary group cannot accommodate the required broad scope of views necessary with complex societal issues, nor is it able to develop the ‘ownership’ of proposed improvements that an inter-agency group can. A single agency cannot stimulate the level of debate in a third party organisation that is needed to manage complexity; there is the further potential benefit, as the adage goes, that “a problem shared is a problem halved?”. Shared ownership avoids one group colonising an issue. Single discipline ownership implies domination over how issues are dealt with, valued and acted upon. Third party interdisciplinary groups potentially have strong communication and negotiation powers. Group representatives that straddle federal and state agencies, local councils, industry and NGO groups can influence a broader scope of decision makers. They can also increase agency ownership and facilitate the transfer of knowledge among groups including scientists, policymakers, producers and civil society.

In a paper to the OECD Workshop on Accounting Frameworks to Measure Sustainable Development, Smith (2003) described an experience in Canada with a cross agency group. It was noted that had the group not existed, a government ministry would have had to fill the role. “*Given the ministry’s roles of advocating policy in specific domains, their ability to seek and find common ground on a question as broad as sustainable development is somewhat compromised.*” Smith concluded that ‘open and free debate’ was needed to resolve the complex issues surrounding sustainable development. The aim of interdisciplinary groups or inter agency groups is to avoid the mistakes of past single disciplinary groups, who often do not know what it is they do not (but should) know. When uni-disciplinary groups do not deal with the issues and points of view of other groups in the decision making process, important considerations can be neglected, thereby influencing the success of an activity, a policy or the like. Uni-disciplinarity, however, is not always intentional, but often occurs simply because ‘*you don’t know what you don’t know*’.

Detractors of the interdisciplinary dialogue process frequently fail to extend their meetings to third parties because of organisational and time constraints. Opposition may not be overtly stated but occur by simply failing to broaden the scope of participants. Building networks beyond their immediate professional interests takes time and effort. Conflict of views and the resultant increased time needed to reach conclusions can result in an initial sense of chaos, and the perception that the issues are not being resolved; more confronting still is a fear of loss of control. Homogeneous groups tend to be inward looking, that is they reinforce their own belief systems and insufficiently acknowledge the breadth of complex issues (Furnham, 2003). Interdisciplinary groups can threaten exclusive clubs and power blocks. Moreover, some would argue that competition among disciplines might be more fruitful than co-operation.

Some politicians are currently arguing that issues should be sorted out before meetings, as exemplified by the following quote by Craig Knowles:

“Differences between government agencies should be sorted out before meetings so that a single, coherent government position can be presented to other stakeholders, not myriad turf arguments”.
‘Hard road to hoe’, Sydney Morning Herald, 20 May 2003.

Craig Knowles is the NSW minister for the newly created department of Infrastructure, Planning and Natural Resources.

Other politicians fear that this approach is suffocating dialogue. Governments presenting one point of view can deny important information on the scope of the debate. One danger with this approach is that ideas become over simplified and diluted, and important messages from the broad range of agencies involved in Natural Resource Management (NRM) will not be delivered to the general public. After all, the major aim of including different parties in a dialogue is to avoid the uni-disciplinary decisions that have caused many of the current environmental, social and economic problems, even if this is a time consuming, noisy and chaotic process. Members of the New South Wales Acid Sulfate Soil Management Advisory Committee (Woodhead et al. 2003) have said that the interdisciplinary, multi-agency process they developed was invaluable because of the complexities of the problems: *'don't sink in until you see it and hear all the different viewpoints'*. They also said that the most important part of the meeting process (they meet four times a year with one two day field workshop) were the two day workshops where they had time to talk with all the other members and make visits to sites.

Criticism of many interdisciplinary projects was that they failed to be truly interdisciplinary, either because they failed to integrate vertically and involve policy within their ranks or that they failed to involve a diverse representation of skills. Therefore the groups were reinforcing their own beliefs. Many workshop participants also agreed that the time factor works against interdisciplinarity. Building interdisciplinary teams takes time yet the imperative problems faced by NRM issues is a lack of time.

The outcomes from the Ballina workshop can be seen to be twofold; first there is the set of agreed principles that are described in the 'Summary, Lessons and Conclusions' paper (Woodhead and Legg 2003) of the Agriculture and Ecosystems Management proceedings. These aim to guide dialogue amongst stakeholders when developing policies for diffuse source pollution. The main points from the conclusions are that:

- Effective ecosystem management in agriculture needs to draw on a wide range of disciplines, but often there is too little dialogue and understanding across the different interests;
- Evidence from the scientific analysis of ecosystem management is sometimes too remote and not meaningful to be practically applied at the farm level.
- Interdisciplinary dialogue is essential for developing policy.
- Evidence of policies success or failure must be provided from a great range of indicators that are developed from many realities.

Secondly there is the proceedings record itself (Woodhead, Jenkins, Packham 2003), which has a particular function to play in feeding in to government and community thinking and action at all levels. Given the complexity and broad scope of the issues that the Ballina dialogue dealt with, no single proceedings can possibly claim to be all-encompassing; however those and this paper do represent an expansion of the concepts of the pressure/state/response model, and an attempt to integrate the thinking of diverse perspectives and actively work through how interdisciplinarity can be built into sustainability and policy frameworks.

Conclusion

The papers and the workshop process clearly make a strong case for the benefits of interdisciplinary dialogue, even though this requires extra time and effort. There is an inevitable learning process and adaptation of concepts and language from the different disciplines. While this is not an easy road, and often there is no roadmap, the potential benefits make it well worthwhile. To ease the way, we need to experiment with new and innovative approaches, and the Ballina dialogue was an example of this. Such

innovations need to be documented to help those that follow to avoid pitfalls and to build on successes, for surely this is a big part of the function of interdisciplinary dialogue. We would encourage the incorporation of these ideas into research, policy and activities associated with food systems, to deal with the many complex issues raised by this workshop.

References

- Allison, E. H. and McBride, R. J. Educational reform for improved natural resource management: Fisheries and Aquaculture in Bangladeshi universities. *Society and Natural Resources*. 2003; 16(3):249-264.
- Bohm, D and Factor, D. (1996) (Eds) 'Unfolding Meaning: A weekend of dialogue with David Bohm', Routledge, UK.
- Brezonik, P. & Renwick, M. (2003) 'Integrating Science in Decision-making for Agricultural Nonpoint Polluti Management: Perspectives from the Minnesota River Drainage Basin' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.150-161.
- Campbell, A. (2003) Policies & People - learning to manage an old continent' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.182-199.
- Curtis, A. (2003) 'Landcare in Australia: facilitating dialogue & action' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.200-217.
- Ewel, K. C. 'Natural resource management: The need for interdisciplinary collaboration.' *Ecosystems*. 2001; 4(8):71-722.
- Freudenburg, W. R. (2002) 'Navel warfare? The best of minds, the worst of minds, and the dangers of misplaced concreteness.' *Society & Natural Resources*. 15(3):229-237.
- Furnham, A. (2003) 'The Psychology of Change Management' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.34-45.
- Hoggett, P. 'Democracy, social relations and ecowelfare.' *Social Policy & Administration*. 2001; 35(5):608-626.
- Ison, R. (2003) 'Systems practice & the design of learning systems' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.235-250.
- Issacs, W. (1993) 'The Power of Collective Thinking' *The Systems Thinker*, 4 (3), 1-4.
- Jiggins, J. (2003) 'Inter-Agency Learning Processes' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.8-101.
- Williams, J. (2003) 'Acid sulfate soils' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.123-131.
- Journeaux, P. (2003) 'Policy Approaches to Water Quality Issues - The New Zealand Experience' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.162-170.
- Legg, W. (2003) 'Evaluating Policies: Tools and Methods' Proceedings of the OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.132-149.
- Lovell, C.; Mandoondo, A., and Moriarty, P. 'The question of scale in integrated natural resource management' *Conservation Ecology*. 2002; 5(Z):355-384.
- Morris, S., Brodie, J., Mitchell, A., Furnas, M., Haynes, D., Waterhouse, J., Ghonim, S., Yorkston, H. and Audas, (2003) 'Tackling Water Quality Issues for the Great Barrier Reef- Gains, Pains & Lessons' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.171-181.

- Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia.pp.78-87.
- Parris, K. (2003) 'A Framework for Analysis of Sustainable Agriculture: An OECD Approach Applied to Soil & Water Management' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.10-33.
- Pretty J.N. Ward H. (2001) Social Capital and the Environment. *World Development*. 29(2):209-227.
- Ramirez, R. (2001) 'Understanding the approaches for accommodating multiple stakeholders' interests.' *International Journal of Agricultural Resources, Governance and Ecology*. 1(3-4):264-285.
- Ringelman, J. (2003) 'Working with landowners to conserve grasslands & wetlands: the effectiveness of public-private partnerships.' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.218-225.
- Röling, N. (2003) 'Pressure facing failure of knowledge based action.' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture Australia.pp.46-68.
- Sato, S. & Taniguchi, Y. (2003) Local Problem-Solving for Building Sustainable Agriculture in the Case of Ogata, Japan: Goals, Process, Organization & Cost Payment OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.226-234.
- Scott-Orr, H., Banks, L. (2003) 'Agriculture & the Environment - Adaptive policy responses by NSW Agriculture' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.1-9.
- Smith (2003) The Role of Institutions in Building Frameworks to Measure Sustainable Development: The Canadian Experience. OECD workshop on Accounting Frameworks to Measure Sustainable Development: OECD Paris.
- Steyaert, P. (2003) 'How to deal with agricultural change for sustainable management of French atlantic coast wetlands?' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia.pp.102-113.
- Valentine, I., Stephens, P., Kelly, T. & Reid, J. (2003) 'Use & Utility of Soil Health Indicators' OECD CRP Workshop "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture, Australia. pp.114-122.
- Woodhead, A., Jenkins, A., Packham, R. (2003) Agriculture and Ecosystems Management. Proceedings of OECD Cooperative Research Program Workshop, Ballina, Australia.
- Woodhead, A., Legg, W. (2003) 'Summary, Lessons and Conclusions' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture Australia.
- Waltner-Toews, D. (2003) 'Who's Pressure is this? Pressure in Context' OECD CRP Workshop on "An Interdisciplinary Dialogue: Agriculture and Ecosystems Management" (Ed. A.Woodhead, A.Jenkins, R.Packham). NSW Agriculture Australia.pp.69-77.

