

LEGISLATIVE ASSEMBLY



Standing Committee on Natural Resource Management

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ORGANISATION (ISCO) CONFERENCE
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TERMS OF REFERENCE

- (a) current disincentives that exist for ecologically sustainable land and water use in New South Wales;
- (b) options for the removal of such disincentives and any consequences in doing so;
- (c) approaches to land use management on farms which both reduce salinity and mitigate the effects of drought;
- (d) ways of increasing the up-take of such land use management practices;
- (e) the effectiveness of management systems for ensuring that sustainability measures for the management of natural resources in New South Wales are achieved;
- (f) the impact of water management arrangements on the management of salinity in NSW.

CHAIRMAN'S FOREWORD

As in Australia, people all over the world depend upon healthy soil and clean water to sustain them. Governments and communities the world over, are increasingly concerned about the amount of soil, vegetation, water and biodiversity is being lost from the impacts of increasingly intensive agricultural practices and other forms of modern development.

So we could improve our knowledge in this area, members of the Standing Committee on Natural Resource Management attended the 13th International Soil Conservation Organisation Conference in Brisbane, Queensland in July 2004. The Australian Society of Soil Science Inc. and the Australasian chapter of the International Erosion Control Association hosted this biennial event.

Conference delegates heard about the important role of integrating science and other information to develop better institutional arrangements and on-ground practices. They also heard that Australia's own *Landcare* program is being implemented in many countries and that in many of these countries, women play an increasingly important role in conserving and managing arid and semi arid landscapes.

During the course of this inquiry, the Committee has heard consistently that we need to renew our efforts to find more environmentally sustainable farming systems to prevent soil from being lost from production. The eminent Dr John Williams, Formerly of the CSIRO and a Member of the Wentworth Group of Concerned Scientists iterated this view, saying that conserving soil is a global issue and in many countries the land "is literally blowing away."

The key message from the conference is that if societies are to remain wealthy they need to stop soil degradation and minimise land clearing and intensive farming practices.

The Government of New South Wales has been making much progress through developing a number of programs that depend on good policy and scientific input, as well as community involvement. Through the development of Catchment Action Plans and water sharing plans communities and science will have more of a say in our natural resource management practices. Practical programs like *Dustwatch* and the Environment Services Scheme also contribute greatly. We do need to heed the Queensland's Department of Natural Resources, Mines and Energy when they predict the success of the new approaches in protecting natural resources will depend upon the extent of community commitment and participation and robustness of regional partnerships.

The Committee was able to learn much from this conference that will inform and contribute to the inquiry and I would like to thank the organisers for developing such a timely program.

Hon Pam Allan MP
Chair

Chapter One - Addressing Soil and Water Degradation

- 1.1 Successful agricultural enterprises depend upon healthy natural resources. Despite this, farming practices the world over, continue to degrade water, soil, vegetation and biodiversity. Given the prediction for exponential increase in human populations, this is a major concern to many governments and communities.
- 1.2 So that people could share their knowledge and experiences in sustainable landscape use, the Australian Society of Soil Science Inc. (ASSSI) and the Australasian Chapter of the International Erosion Control Association (IECA) hosted the 13th International Soil Conservation Organisation Conference (ISCO) on 4-9 July 2004.
- 1.3 The conference was held at the Brisbane Convention and Exhibition Centre and attracted 390 delegates from 36 countries. At least 993 papers were submitted discussing a wide range of ecosystem and cultural issues, in agricultural, built and natural environments.
- 1.4 The opening address was made by Dr John Williams, a member of Australia's Wentworth Group of Concerned Scientists¹ who told conference delegates that because so much damage to the natural ecosystems and assets has already occurred, renewed effort to find more sustainable farming systems that also increase agricultural productivity is urgently required.²
- 1.5 Other keynote addresses highlighted inter-related issues around the links between soil health and a nation's wealth and therefore the need to halt soil degradation processes,³ the complex nature of soil and water conservation and the need for integrated approaches^{4,5} and policy reform.⁶
- 1.6 Concurrent session and posters demonstrated the wide range of research and facilitation activities, modelling and measurement, science and policy and practice that is being undertaken across the globe. In particular it was noted that women play an increasingly important role in conserving and managing natural resources in arid and semi-arid, such as in Africa.
- 1.7 Delegates from State Parliament learnt more about the importance of soil health management, soil erosion modelling, controlled traffic and carbon management, soil suitability and capability, Catchment Management, economics and policy and salinity management.

¹The Carr Government sought advice from the Wentworth Group regarding the continuance of existing ways of farming and "drought-proofing" Australia by turning rivers in-land. As a result, the *Report to Premier Carr: A new model for Landscape Conservation in NSW* detailed a plan of action for fundamental reforms to bring about sustainable agriculture and prevent further degradation of natural resources developed. The Wentworth Group also produced *Blueprint for a Living Continent*.

² Williams, J Bordasa V. and Gascoigne, H. *Conserving Land And Water For Society: Global Challenges And Perspectives*. CSIRO Land And Water, Po Box 1666, Canberra City, Act 2601 Australia with Hester Gascoigne and Associates, 35 Mirning Crescent, Aranda, Act 2614 Australia. Keynote address to the 13th International Soil Conservation Organization Conference Brisbane, 4-9 July 2004.

³ Professor Mildred Alali Amakiri, Dean of the Post Graduate School, Rivers State University of Science and Technology, Nigeria.

⁴ Winfried E.H. Blum #Institute of Soil Research, University of Natural Resources and Applied Life Sciences, Vienna, Austria.

⁵ Dr John Williams, op cit.

⁶ Dr Ian Hannam, Department of Infrastructure, Planning and Natural Resources, New South Wales Government.

- 1.8 All of these issues are currently being evaluated as part of the enquiry into the natural resources of New South Wales.

Chapter Two - Keynote Addresses

SOIL AND WATER DEGRADATION

Global Challenges

- 2.1 Soil erosion is one of the most severe environmental problems in the world and affects the production of both food and fibre.
- 2.2 Dr John Williams, the former CEO of Land and Water Division CSIRO⁷ told conference delegates that protecting and conserving the natural resources on which nations' depend for their wealth, means that innovative management approaches to agricultural and population pressures are required.⁸
- 2.3 He said that existing agricultural management practices are unsustainable and as a result, much energy, water, nutrient and carbon is being lost.
- 2.4 Dr Williams also said that the Ecosystem Wellbeing Index (EWI) indicates that environmental degradation is widespread. He said as a matter of priority, natural habitats need to be restored, protected areas expanded, agricultural diversity conserved and water quality improved. He also said that industrialized countries, including Australia, should focus on reducing greenhouse gas emissions.
- 2.5 According to Dr Williams, most communities have insufficient knowledge about farming systems and land uses that will not harm the environment. He said that such farming systems should be based on 'adaptive management' cycles where research about innovative practices can be implemented, monitored and reviewed and their efficacy reported. This process should integrate the biophysical sciences, economics and social sciences, engage the community and promote institutional and policy reform.

Impacts of environmental degradation on food production

- 2.6 Dr Williams said that because of the insidious nature of the impacts of native vegetation clearing, stock grazing and water extraction, substantial damage to biophysical systems has already occurred. He said that land "is literally blowing away" and that unless something is done to reduce environmental degradation across the globe, grain production will decrease significantly within the next few decades. He said the United Nations predict a widening gap between the expected demand and production of grain, particularly in Asia, Africa and Latin America.
- 2.7 Dr Williams posed some enlightening statistics. Up to 5,000 litres of water produces one person's daily food requirements, as opposed to that same person drinking 4 litres of water that day. He also said that 1,000 litres of water produces only one kilogram of grain and 100,000 litres of water produces one kilogram of meat.
- 2.8 In order to cope with this demand, he said that developing countries will need to produce an additional 120 million hectares for crops and irrigated areas are expected to expand from 202 million to 242 million hectares. This means the demand for water extraction will increase by 14 percent.

⁷Land and Water is a major research arm of the CSIRO addressing the sustainable management of natural resources.

⁸ Williams, op cit.

- 2.9 On a more positive note, Dr Williams said that “conservation farming”, which reduces soil erosion and water loss, protects soil biology and structure and increases yields is being taken up by an increasing number of farmers around the world, particularly in the USA, Canada and Latin America.

Australia - a case study

- 2.10 Dr Williams told delegates that Australia has some of the best natural resource scientists in the world and many Australians themselves recognize the need for change. In response to the water and soil deterioration that has resulted from the trend to replace native woodlands with annual pastures, at least 8,640,000 hectares of agricultural land in Australia was under “conservation farming” by 2000.
- 2.11 He also said the move towards integrated catchment management, Landcare and water management reform has been important in dealing with competing priorities. Combined with the Wentworth Group’s *Blueprint for a National Water Plan*, these reforms aim to achieve the efficient and sustainable use of Australia’s water resources.
- 2.12 Dr Williams warned that two critical issues might impede progress, however. He also said that developing profitable and ecologically sustainable farming systems can be both scientifically and socially difficult.
- 2.13 Firstly, landscape improvements have long lag times in demonstrating the positive benefits and secondly, the complex nature of landscape interactions cannot be always predicted. He was concerned that local or catchment actions may not have the anticipated results downstream. He also said that at this stage there is some uncertainty as the effectiveness of on-farm management in improving water quality in large catchments.
- 2.14 Another concern for Dr Williams is that Governments and individuals alike should not assume that current knowledge would be sufficient in providing ecologically sustainable land use. He said whilst new scientific knowledge is imperative, environmental and natural resource solutions also require institutional, structural and social reforms backed by strong economic drivers.
- 2.15 In providing the example of water management in Australia, Dr Williams said that water policies should be implemented at international, national and local levels of government and should treat water as a suitably priced economic commodity and social right. He also said that sustainable water management means there is a need for suitable water markets that have effective assessment and approval processes and that provide for pricing arrangements and water trading and factor in the cost of environmental impacts, such as salinity.

Comment:

- 2.16 Dr Williams has also been a witness during the course of the inquiry into natural resource management. His views on redesigned landscape systems and ecosystem services can be obtained in the report on sustainable and profitable farming.

A JOURNEY THROUGH SUSTAINABLE AGRICULTURE

- 2.17 Another speaker from the CSIRO, Mr Brian Keating, supported Dr Williams’ views and says that agriculture is only likely to remain profitable where resources, markets, management and innovation allow.

- 2.18 Mr Keating told conference delegates that while Indigenous Australians lived sustainably on the landscape, after two hundred years “Australian” agricultural systems are still trying to adapt to a flat, salty ancient landscape with fragile, relatively infertile soils.⁹
- 2.19 Mr Keating argues that overall, Australian society is increasingly expected to value “ecosystem services” provided by clean water, greenhouse gas abatement, healthy catchments, flora and fauna, open space and amenity values.
- 2.20 He provided the findings from the National Land and Water Resources Audit (2000), stated that soil degradation was increasing as a result of salinity, acidification and erosion and that catchment degradation was occurring through increased nutrients and sediments. The audit also said that wherever water resources exploited there were becoming increasingly limited. Such degradation was continuing to increase the rate of biodiversity loss.
- 2.21 Mr Keating also said the relentless pursuit of economic development at the expense of natural capital is a continuing issue. He stated that while agriculture was the foundation of the present day Australian society and economy, its significance in terms of GDP, exports and employment is now much reduced. Yet, he says it continues to command an important place in the national psyche and political landscape.
- 2.22 He concluded by saying that regardless of the future economic and social drivers for agriculture:
- “the skilful combination of scientific and practical knowledge will remain the essential vehicle on this journey towards sustainability.”

USING SYSTEMIC INTERVENTION TO DEVELOP BETTER POLICY

- 2.23 A paper on ‘systems thinking’ to involve communities in natural resource management was presented by Dr Gerald Midgely from the Institute of Environmental Science and Research in New Zealand.¹⁰
- 2.24 Dr Midgely says that natural resource management issues are highly complex and, given the often opposing economic and environmental values and systems, there is high potential for conflict.¹¹
- 2.25 He explained that “institutions” set up “rituals” or rules to insert dominance over interpretation of issues. He said that in order to facilitate effective stakeholder participation and develop answers to problems, it is important to understand the “how, who, when and why” of all situations. He also says it is important to ask the right questions and apply appropriate scientific analysis. More importantly it is necessary to question the credibility of fundamentally important values and the role of

⁹ Keating B.A. and K. Harle. *Farming in an ancient land – Australia’s journey towards sustainable agriculture*. CSIRO Sustainable Ecosystems Australia. Plenary Paper to the 13th International Soil Conservation Organization Conference Brisbane, 4-9 July 2004.

¹⁰ Dr Midgely is a Senior Associate at the Institute of Environmental Science and Research (ESR). He has authored “Systemic Intervention: Philosophy, Methodology, and Practice¹⁰” and edits “Systems Thinking (a four-volume set of readings)

¹¹ Bakera V.E., Footea, J.L. Gregora, J.E Houston, D.J. and Midgely G. *Boundary Critique As A Means For Improving The Effectiveness Of Water Conservation Campaigns And Community Involvement In Small Watershed Management* Plenary Paper to the 13th International Soil Conservation Organization Conference Brisbane, 4-9 July 2004.

the proposed intervention. He said that entrenched attitudes could influence the ability of an organisation or an individual to shift their perspectives.

2.26 Questions that should be asked include:

- what motivates, or what is the purpose behind the action?
- who is in control about any decisions that need to be made?
- what expertise is available on the issue?
- how are they affected? and,
- how legitimate is the action/enterprise?

2.27 Dr Midgely also said that multiple boundaries exist in any given situation and different groups will judge think differently. Usually, ideas from groups that have been excluded from the process will be marginalised. He said it is important to work out why some members of society are included in any given decision-making process and why others are excluded needs to be explored. Examples of such groups include the unemployed, “greenies” and Aboriginal communities).

2.28 Dr Midgley argues that it is extremely important that the views of these groups are sought and their words communicated to the policy creators. According to Dr Midgley:

“Boundaries indicate what information is considered relevant and what is considered superfluous, and are the result of value judgments.....Ulrich (1983) discusses how the exploration and setting of boundaries can be undertaken through dialogue between stakeholders, making boundary judgments more ‘rational’ and robust than if simply imposed by planners or external researchers in the absence of meaningful community participation.”¹²

2.29 Finally, Dr Midgely said it is crucial to learn from others along the way and that systematic intervention involves a synergy of critically understanding boundary issues. More than one analytical method must be used to work out what is the best action.

2.30 His paper concludes that “the systemic intervention approach can be useful to unravel and work with stakeholder concerns, and can enable decision makers to make robust policy choices that are more inclusive of political, social, environmental and economic concerns than they might otherwise be.”

SCIENTISTS, STAKEHOLDERS AND POLITICIANS SHARING KNOWLEDGE

2.31 Ms Winfried Blum from the Institute of Soil Research, University of Natural Resources and Applied Life Sciences in Vienna, Austria also highlighted the complexity of soil and water conservation. She said scientific knowledge is to be incorporated into an understanding the driving forces, the pressures state of the resource what the impacts likely to be and potential responses, or DPSIR indicators.¹³

¹² Ibid.

¹³ Winfried E.H. Blum, *Soil Indicators For Decision Making – Sharing Knowledge Between Science, Stake Holders And Politics* Institute of Soil Research, University of Natural Resources and Applied Life Sciences, Vienna, Austria. Plenary Paper to the 13th International Soil Conservation Organization Conference Brisbane, 4-9 July 2004.

- 2.32 Understanding this complexity would allow stakeholders, politicians, decision makers and the broader public to better understand and deal them. Ms Blum said that framework indicators must reveal a clear cause-response relationship. She also said that such indicators must be easy to interpret and understandable so that those at the grass-root level, who are the main stakeholders can fully comprehend them.
- 2.33 The Institute has developed indicators for five different targets. They have found that the driving forces can be cultural, economic, social, technical and ecological and range from market conditions to climate change. Secondly, the pressures, or mental and physical expression of the driving forces, such as emission to air, water and land, infrastructural changes can urban expansion, deforestation, intensive rainfall, storms, forest fires, and nutrient mining.
- 2.34 Dr Blum also said that state of the soil must be evaluated, because it can be degraded through a number of ways, such as through contamination, acidification, salinisation, eutrophication, nutrient depletion, loss of organic matter, compaction, biodiversity loss or soil loss through erosion and landslides. The fourth indicator listed by Ms Blum was direct changes in soil functions, through lost soil fertility, or indirectly, through changes in population size and distribution, local climatic change and water stress.
- 2.35 Finally Ms Blum said that the responses to alleviate such impacts could be through legal or administrative instruments, economic instruments such as market regulations, incentives and technical interventions.¹⁴

APPLICATION OF SOLUTIONS

- 2.36 Professor Mildred Alali Amakiri, the Dean of the Post Graduate School, Rivers State University of Science and Technology in Nigeria told conference delegates that Africa nations were facing considerable issues in conserving soil health. Currently Africa faces issues with food security, poverty, land degradation process and environmental services. She also said that climatic factors and adverse agricultural practices were contributing to soil degradation.
- 2.37 She said this is a major concern, because the civilisation and wealth of a nation is linked to good management of natural resources and that soil conservation was crucial to addressing reduced food production.
- 2.38 She told delegates that potential solutions being evaluated included shifting cultivation to appropriate areas, using cover crops and crop residues, as well as tree litters and prunings, spot trees, mulching, proper crop combination and arrangement, agroforestry and appropriate species.

AN EFFECTIVE ROLE FOR INTERNATIONAL ASSOCIATIONS

- 2.39 Mr Ben Northcutt from the International Erosion Control Association (IECA) in the United States of America, highlighted the role played by the organisation in expanding programs and the role that international associations have in achieving soil and water conservation success.¹⁵

¹⁴ Op cit, pages 1-2

¹⁵Northcutt, B. *The Role Of International Associations In Achieving Soil And Water Conservation Success*, Executive Director, International Erosion Control Association, Steamboat Springs, Colorado USA. Plenary Paper to the 13th International Soil Conservation Organization Conference Brisbane, 4-9 July 2004.

- 2.40 Mr Northcutt said there is no single worldwide association or organization whose mission is to conserve soil and water resources and that success does not happen without action from individuals.
- 2.41 According to Mr Northcutt 'associations' serve many purposes, most fundamentally to provide information and to be effective must have a solid foundation of individuals, know and meet their needs and continue to adapt to the dynamics of today's information systems. He also said that globalization demands an understanding of cultural differences, language differences, appropriate engagement etc.
- 2.42 He said that in order expedite improvements in soil and water conservation, international associations must provide knowledge based resources that satisfy the needs of their members. He also provided five major roles fundamental and vital objectives that ultimately lead to environmental benefits by providing a framework to achieve sustained soil and water conservation success.
- 2.43 These are through:
- providing education that improves skills and knowledge;
 - creating communities that are rich in government, business, knowledge and people connections;
 - representing member interests to government officials and shape public policy through advocacy and political involvement;
 - advancing the mission and the cause of the association; and
 - establishing credibility to the profession and members.
- 2.44 Finally Northcutt said in order to remain relevant, viable and effective as agents of change, associations need to focus on delivering application driven knowledge, anticipating and be prepared for competition, embracing different expectations and needs of upcoming generations and evaluating business and governance models regularly.

INSTITUTIONAL ARRANGEMENTS FOR BETTER SOIL CONSERVATION

- 2.45 Dr Ian Hannam from the New South Wales Department of Infrastructure, Planning and Natural Resources, an international consultant expert on legal, institutional and policy aspects of land degradation and desertification, provided the background to the Amman Soil Resolution (October 2000) toward the development of a new international instrument for soil and the development of various legal and institutional frameworks for national soil legislation.¹⁶
- 2.46 Dr Hannam said that the Amman Resolution wanted explore the adequacy of existing legislative and policy material regarding management of soil and land degradation and the sustainable management of soil in relevant jurisdictions.
- 2.47 It also proposed to develop specific elements that may be used to formulate environmental law and policy to manage soil and land degradation and prepare

¹⁶ Hannam I.D. *Progress Towards An Improved International And National Legal Strategy For Sustainable Use Of Soil: Partnership Between The Soil Science Community And The World Conservation Union*, Department of Infrastructure, Planning and Natural Resources, New South Wales, Australia; Member, IUCN Commission on Environmental Law; Member, International Law Association.

outlines of suitable legislation that may be adopted by respective nations and jurisdictions.

- 2.48 The Amman Resolution also resolved to prepare guidelines and explanatory material to accompany the principles of legislation and policy, possibly as “model” legislation, to assist States in developing legislation to manage their specific soil degradation and land degradation problems.
- 2.49 Dr Hannam also said the World Conservation Congress (WCC) called for the IUCN Environmental Law Program to specify the ecological needs of soil and the ecological functions of biodiversity conservation and the maintenance of human life.
- 2.50 He said that IUCN recognises that an ecosystem-based approach is appropriate for the integrated management of land, water and all living resources. It promotes conservation and sustainable use in an equitable way.¹⁷ Additionally, the Convention on Biological Diversity urges governments and relevant bodies to apply the ecosystem approach in their environmental law reform.
- 2.51 He said that the principles of ecosystem management have been adopted as a basis to approach the development of the international and national framework for soil and thus, recognises that the well-being of human society, its survival, may depend on a more conscious effort to slow down the rate of modification of biological aspects of soils.
- 2.52 Dr Hannam says this means developing legal mechanisms to enable ecosystem-based approaches to be applied in all aspects of soil protection and management. Such approaches should study the relationship between soil, as living ecological communities, and the environment. An effective legal system for soil would therefore depend on selecting appropriate ecological concepts and a legal structure with the appropriate elements to implement these concepts.
- 2.53 Documents on legal and institutional frameworks for sustainable soils and a guide to drafting soil legislation have been prepared to assist States to manage specific soil degradation problems and to investigate the format for an international instrument for sustainable use of soil.¹⁸
- 2.54 In conclusion, Dr Hannam said that the continuing support of the soil science community is vital to the success of the Soils Program and to generate and maintain adequate legal frameworks for sustainable soils.

Comment

- 2.55 While soil conservation has been consistently raised as an issue for New South Wales and while there appear to be some measures towards on ground practicalities achieving soil conservation, for example through catchment action planning and property planning, there has been little commitment to reviewing and evaluating relevant soil conservation instruments and statutes.

¹⁷ Op cit. 2002

¹⁸ Hannam and Boer, Legal and Institutional Frameworks for Sustainable Soils' Publishing details 2002 and Hannam and Boer, 2004 The guide to drafting soil legislation

Chapter Three - Relevant Concurrent Sessions

- 3.1 Everyday there were a considerable number of concurrent sessions available for delegates to attend. Committee delegates attended a number of concurrent sessions relevant to the terms of reference of the current inquiry.

SOIL CONSERVATION IN CROPPING LANDS

Considering the Problem and the best Solution

- 3.2 Rob Loch of Landloch Pty Ltd in Toowoomba, Queensland, undertook a review to evaluate the effectiveness of some soil conservation practices currently used in the agricultural, mining and urban construction industries.
- 3.3 He said that soil conservation practices observed in Australia and overseas suggest that inappropriate solutions are commonly applied. Often this achieves only a partial solution to the identified “problem” with associated unforeseen detrimental impacts. Reasons for this include that many conservation objectives are poorly defined and rectification strategies poorly targeted and/or executed.
- 3.4 He presented a problem-solving framework to better interest soil conservation issues.
- 3.5 This framework firstly defines the problem by asking “What/when/where is the problem” and “What/when/where **is not** the problem.” The second component is to devise ways of preventing or avoiding the problem.
- 3.6 For example, firstly, the properties of the site/situation with the greatest impact on the erosion process of concern need to be determined. Secondly, the properties of the site can be altered or controlled need to be evaluated. He also said that technological change can greatly change what is possible, but unfortunately solutions are often adopted before the problem is properly identified.
- 3.7 Mr Loch provided the example of soil conservation in cropping lands in the eastern Darling Downs of Queensland, as an example of where early soil conservation efforts were undertaken. In this case, the focus was on constructing mechanical barriers to water flow, with design and surveying of graded banks and waterways carried out by State Government officers.
- 3.8 As such soil conservation methods provided no immediate benefit to farmers, construction, maintenance of such structures was seen as both an investment in the future productivity of the land and as a common good. Mr Loch said that adoption of such measures was neither as rapid nor as complete as was considered desirable for a range of reasons.
- 3.9 He also said that on 1973, areas of Erosion Hazard were declared and subsidies paid to farmers for erosion works within those areas. A considerable increase in the area of land on which soil conservation structures were constructed was achieved. By the early 1980’s, it became clear this approach was not successful in controlling erosion, however.
- 3.10 The options were to either recommend a halving of the spacing between graded banks, or to encourage the greater adoption of stubble retention and reduced tillage.

- 3.11 The latter of these options was implemented and subsequently, reductions in tillage, increased cropping frequency and retention of crop residues have become common practice in the region. This successfully produced:
- better use of soil moisture;
 - reductions in labour and costs;
 - greater flexibility in cropping; and,
 - better returns being the primary incentive, which are considered more effective than government coercion (Cramb 2004).
- 3.12 Mr Loch concluded that while soil conservation is perceived to be important and has received considerable effort and expenditure, much of this has been wasted however, due to inadequate problem definition and inappropriate or ineffective practices being relied upon. He said that implementing a “problem solving approach” would lead to somewhat different soil conservation methods being adopted and should achieve a higher level of success.

Improving Crop Yield In Semiarid Regions

- 3.13 Dr Bob Stewart from the Dryland Agriculture Institute, West Texas M University in the United States of America told delegates that dryland agriculture exists in twenty percent of the worlds semi-arid regions.¹⁹
- 3.14 He said that farmers in such areas faced management issues through wind and water erosion, low levels of organic matter, soil compaction and soil fertility loss occur rapidly due to high temperatures and low and high erratic precipitation. He also said that restoring degraded soil is influenced by climatic conditions that limit the choice of crops that can be successfully grown.
- 3.15 Dr Stewart said the infamous Dust Bowl of the 1930s in the Great Plains, is a classic example of devastation that can occur from soil degradation in semi-arid regions. This experience resulted in major changes in tillage practices and cropping systems.
- 3.16 He told delegates that while dryland farming in this region remains a risky enterprise, conservation agriculture principles by avoiding mechanical soil disturbance, maintaining soil cover, and crop rotation have increased crop yields and enhanced soil quality.

SOIL CONSERVATION PROVIDING ENVIRONMENTAL SERVICES

- 3.17 One topic that has been raised frequently during the course of the inquiry is that of the environmental benefits of protecting water and soil resources. By looking after their landscape farmers can provide both environmental and social goods and services.

¹⁹ Stewart B.A. *Arresting Soil Degradation And Increasing Crop Yields In Semiarid Regions* Dryland Agriculture Institute, Division of Agriculture, West Texas A&M University, Canyon, Texas, U.S.A.

Farmers providing environmental goods and services

- 3.18 Mr Julian Dumanski, a Consultant in Sustainable Land Management from Canada told delegates that land management decisions by individual farmers have implications for many environmental goods and services. He said that the increasing emphasis on environmental quality creates a window of opportunity for soil conservation and for the world's farmers.²⁰
- 3.19 Mr Dumanski explained that carbon sequestration is the permanent and semi-permanent carbon locked up in soil or plant materials.
- 3.20 Current estimates are that carbon sequestration can deal with about 10 - 20% of global atmospheric greenhouse gas. He said that whilst countries that have ratified the Kyoto Protocol have already assumed obligations to reduce their contribution of greenhouse gases to the atmosphere, including carbon, it is unlikely that these obligations can be met without the benefit of soil carbon sequestration.
- 3.21 He also said that currently, the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol are the only international environmental conventions that potentially provide financial benefits to farmers for the environmental services provided by carbon sequestration.
- 3.22 Mr Dumanski concluded by saying that under improved systems of land management, involving soil conservation and related technologies, agriculture can be both economically rewarding and provide environmental benefits to society. This means that agriculture can actually be a major partner in providing environmental solutions through well-designed farmer-centered sustainable land management as vehicles for pursuit of joint agriculture-environment objectives.

The NSW Environmental Services Scheme

- 3.23 The New South Wales Department of Infrastructure and Natural Resources have developed the Environmental Services Scheme. This Scheme included the development of Carbon Sequestration Predictor (CSP) that aims to promote land use change to maximise off-farm environmental benefits, including the mitigation of greenhouse gas emissions.²¹
- 3.24 The project focuses on predicting the level of carbon sequestration resulting from proposed land use changes under the Environmental Services Scheme. Such land-use changes would include replacement of annual herbaceous species, such as crops and pastures with woody perennial species.
- 3.25 Department staff reported that aim of Environmental Services Scheme was to inform landholders, policymakers and the public about the potential for carbon to be sequestered by land use changes in lower rainfall (<800mm) areas of NSW. They said that the Carbon Sequestration Predictor²² is a valuable tool for predicting changes in biomass (trees, shrubs and grasses) and soil carbon stores associated land use changes where empirical data are currently sparse.

²⁰ Dumanski J. Soil Conservation And Environmental Management: Lessons From The Kyoto Protocol. Consultant in Sustainable Land Management, Ottawa, Canada

²¹ Wilson B.R., Rawson, A. Montagu, K.D. Cowie A.L, and George B. Predicting Changes In Carbon Storage In Soils And Vegetation Following Land Use Change: The NSW Environmental Services Scheme, Carbon Sequestration Predictor.

²² The CSP can be downloaded from http://www.forest.nsw.gov.au/env_services/ess/default.asp or used online at <http://www.greenhouse.crc.org.au/calculators/cseq/>.

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Comment:

- 3.27 In the report on sustainable and profitable farming the committee agrees with the view that farmers should be financially supported for undertaking land-use projects that promote environmental services. Little attention has been given to the carbon sequestration benefits that can be promoted by conservation farming practices.

CATCHMENT LEVEL INPUTS AND IMPACTS

- 3.28 Catchment management is another issue that the committee has reviewed in detail as part of the inquiry process and is of the view that the 13 Catchment Management Authorities provide opportunity for landholder engagement and education to improve natural resource sustainability.

Spatial Impact Mapping

- 3.29 The Department of Natural Resource, Mine and Energy, Queensland also considers soil erosion and should be effectively managed. This is because it contributes to major land degradation and to on-site costs and off-site infrastructure, conservation assets and adjacent farmlands.²⁴
- 3.30 The Department has been actively researching runoff and erosion processes at a farm scale for sometime. They said that there is a need for broad-scale assessment of the potential for soil erosion at the catchment scale, within a natural resources context, so as to predict where the impacts can be expected and solutions investment prioritized.
- 3.31 The Department has developed a spatial version of the Universal Soil Loss Equation (USLE). This factors in rainfall erosivity, soil erodibility, slope and length of slope. When combined with a cover index, a spatial map of the inherent hazard to hillslope soil erosion based on the physical features of landscapes, land management and climate is produced.
- 3.32 This map of soil erosion assessment can then provide a framework for government and catchment community groups to focus their activities in areas where the risks of potential soil erosion are greatest.

²³The CSP can be downloaded from http://www.forest.nsw.gov.au/env_services/ess/default.asp or used online at <http://www.greenhouse.crc.org.au/calculators/cseq/>.

²⁴ Brough D., Lawrence P., Fraser, G. Rayner D. and Le Grand J. *Improved Inputs For Prediction Of Regional-Scale Soil Erosion Potential For Queensland*. Department of Natural Resources, Mines & Energy, Brisbane, Australia.

Salinity and erosion modelling

- 3.33 Maintaining water quality and minimising land and environmental degradation is a key issue for Queensland. The Department also provided a paper on regional and sub-catchment scale modelling for salinity and erosion management.²⁵
- 3.34 They said that developing and collating information on soil attributes is important when trying to understand salinity and erosion processes and to underpin priorities in landscape management. The Department has created a series of soil attribute surfaces derived in a Geographic Information System using available soil and land information.
- 3.35 During the first phase of developing the system, soil attributes for regional scale analysis of environmental issues were estimated. Expert knowledge was captured in the local soil classification schemes. The second phase involved describing detailed soil mapping in key areas. Then a series of nested soil attribute surfaces were created based on the scale of information available in different sub-catchments.
- 3.36 The attributes were predicted for a series of functional horizons and are being developed nationally as part of the second stage of the National Land & Water Resources Audit.

COMMUNITY INVOLVEMENT

- 3.37 Staff from the Department of Natural Resources, Mines and Energy in Queensland²⁶ also told delegates that in Australia, protecting and managing valued environmental, social and economic assets such as water quality, native vegetation, productive land and soils is becoming more community based and regionally focused. Integrated natural resources planning and management builds upon a range of programs and strategies such as the National Landcare Program, the National Soil Conservation Program and the National Dryland Salinity Program.
- 3.38 They said that regional planning and investment priorities are determined by all partners, based upon best available scientific and other information. Community stakeholders participate in planning and target setting based on consideration of regional community aspirations.
- 3.39 Staff did foresee some challenges to the success of this approach, however. They include better coordination and integration at the regional scale and the availability of support information on natural resource condition and trends. Institutional support through policy direction, technical and professional support in long term support and developing the capacity of community based regional bodies, such as catchment management authorities, Landcare groups etc.
- 3.40 They predict the degree to which the new approach will be a success and assets are protected, will depend upon the extent of community commitment and participation and the robustness of regional partnerships.

²⁵ Brough D. M, Claridge J and Grundy M.J. *Predicting Soil Attributes For Regional And Sub-Catchment Scale Modelling*. Natural Resource Sciences: Natural Resources, Mines and Energy; Brisbane, Australia

²⁶ M. Woods and E. Power *Future Directions For Community Based Natural Resource Planning And Management* A Queensland Murray Darling Committee, Toowoomba, Australia, B Department of Natural Resources, Mines and Energy, Toowoomba, Australia.

Assisting landholders to manage natural resources

- 3.41 Andy Grodecki from the Department of Natural Resources, Mines and Energy in Queensland said that land managers are now required to meet environmental performance requirements. The increasing public debate on issues such as the impacts of tree clearing, salinity, water quality and flow have stimulated the development of Best Management Practice, Environmental Management Systems and Eco-labelling.²⁷
- 3.42 Mr Grodecki said that there is a need for a comprehensive suite of monitoring tools so that land managers can demonstrate their environmental performance and provides them with reliable information for so that they can continuously improve their land management practices in adaptive way.
- 3.43 In response, the Queensland Government has developed the Landholder's Monitoring Guide. The guide is designed for property level monitoring by land managers for more sustainable decision-making and has broader regional, catchment, and national implications by encouraging consistency in information gathering techniques in relation to natural resource management indicators.
- 3.44 The guide assists landholders by providing information about how to collect, interpret and share the data for each indicator and provides:
- information the importance of monitoring and how to develop a monitoring strategy;
 - a tool to assist in the selection of the most relevant indicators;
 - information on approximately 50 key natural resource monitoring indicators.

DustWatch

- 3.45 Dr John Leys from the New South Wales Department of Infrastructure and Natural Resources Management, talked about the agency's DustWatch program, a community based wind erosion monitoring program.
- 3.46 DustWatch was established to complement a range of government programs that monitored the extent, severity and impact of dust storms.
- 3.47 Dr Leys said that around 145 community members where invited to take photographs and complete an observers form that noted: visibility, wind speed, dust event type and anecdotal comments. The information would be e-mailed to the Department who would then produce a collated report using all the available information.
- 3.48 He presented case studies to demonstrate how dust storms moved between cropping country and rangelands. According to this information floodplains have provided the largest source of dust storms during the previous season and during which sandblasting of crops was a major impact.
- 3.49 The DustWatch program demonstrates that linking community based observation networks to data generated government and that this provides rapid dissemination of relevant and important information.

²⁷ Grodecki A.J., Hey K. and Gardiner D. *A Landholder's Monitoring Guide For Sustainable Natural Resource Management Practice*. Department Of Natural Resources Mines, And Energy, Indooroopilly, Qld, Australia.

IMPROVED WATER USE EFFICIENCY

- 3.50 Agency staff from Department of Agriculture in Western Australia told delegates that broad-acre agriculture in southwestern Australia has brought about major changes in hydrology, resulting in an apparent excess of water in a semi-arid environment. They presented a paper exploring how effectively recent water management developments have been implemented.²⁸
- 3.51 There have been a number of changes to water management over the past 40 years. From the late 1950s to late 1970s, soil conservation techniques were adopted in the dryland agricultural districts of Western Australia. Then in the 1980s, waterlogging and inundation were viewed as the biggest issue. Therefore, drains were developed to intercept the water and levee banks were built.
- 3.52 The decade of Landcare underpinned by 1990s and salinity issues became more apparent. This meant that tree planting and revegetation were promoted. Recently, drainage of saline water, developing out saltland agronomy and perennial farming systems have become prominent.
- 3.53 In almost all cases the object was to manage water more effectively, as either surface runoff or groundwater recharge. Most practices were evaluated and implemented as plot trials or at the farm scale but with only limited applications at catchment scales.
- 3.54 The authors say that while landholders and government agencies all proclaim to apply water management techniques with success, implementation has generally occurred in an *ad hoc* manner with little integration of on-ground works targeted to achieve whole-of-catchment outcomes however.
- 3.55 Generally, water management problems have been treated as one-off symptoms and the implications of unmanaged rainfall in cleared catchments appears to have largely gone unnoticed. They also said that while symptoms such as salinity, have been highly publicized, the direct cause has quietly continued to contribute to the problem. They argue that intervention by government and landholders is adopted enthusiastically, that the scale of the problem is likely to continue to increase.
- 3.56 They also saying that the level of investment is considered unacceptable, then future for land and water management techniques need to be examined and practical approaches to managing saturated and saline landscapes is required.
- 3.57 They recommend that funds should be transferred into programs that will develop farming and land management systems which assume that the long-term degradation that is now apparent will continue into the future, as it has for the last 100 years. For example, targeted investment and incentives within “whole-of-catchment” approaches can be successful if the approach assesses the hydrological processes at landscape scales, develops a conceptual management strategy at catchment scales and promotes localised adoption at farm scales.
- 3.58 According to Department staff, the lack of widespread co-operative integrated adoption remains the single most significant barrier to effective water management and that the process provides a relatively simple means of communicating cause and effect.

²⁸ Coles, N.A., Cattlin, T.V., Farmer, D., and Stanton D.J. *Water Management: What's In A Name?* Engineering Water Management Group. Department of Agriculture, South Perth, WA. Australia.

- 3.59 They say the major benefit of using landscape approach to whole of catchment planning is that management options tailored to specific problems, rather than a host of recommendations based upon prescriptive treatments can be developed.

Chapter Four - Occurring Mid – conference field trips

- 4.1 Delegates attended two of the four mid-conference tours, which featured a range of land use and management issues in south-east Queensland – an area that has the highest rate of population growth in Australia.
- 4.2 The purpose of the tours was to enable delegates to inspect problems and solutions associated with land degradation issues including soil erosion, salinity and acid sulphate soils, as well as the impact of development on biodiversity, water management and good quality agricultural land.

MANAGING SALINITY, FLOODS AND ACID SULPHATE SOILS

- 4.3 One tour was to the highly productive agricultural area of the Lockyer Valley and the Darling Downs, which is famous for vertosols. These basalt and sandstone landscapes are valuable dryland and irrigated horticultural, cereal, oil seed and fibre cropping areas. Practical and experimental sites covering salinity, erosion, flood mitigation, pesticide run-off from agriculture and soil water balance were included.
- 4.4 The Rocky Point sugar cane area is one of the last remaining areas of rural land between Brisbane and the Gold Coast. Maintaining water quality, especially in relation to the disposal of wastewater and the management of acid sulphate soils are key environmental issues in this sensitive area that supports significant wetlands, mangroves and estuaries.
- 4.5 Delegates were able to inspect an acid sulphate soil site and project where lime slots have been used to control acid groundwater.

SOIL CONSERVATION AND RIPARIAN MANAGEMENT

- 4.6 Delegates also visited sites where a range of soil conservation initiatives, such as erosion and sediment control protection measures were demonstrated.
- 4.7 A pineapple farm provided an opportunity to discuss recent research into the role of riparian buffer zones in protecting water quality and aquatic ecosystem health.
- 4.8 A visit to the Centenary Suburbs on route to Wivenhoe Dam, including Jindalee, flooded in 1974 to make way for Wivenhoe Dam. Here, the Wivenhoe Alliance discussed the construction of new spillway, which will provide increased safety in the event of a massive flood event.
- 4.9 The International Erosion Control Association (IECA) demonstrated erosion control products at Sheepstation Inlet. Pumicestone Passage is an important tidally dominated estuary and Marine Park located between Brisbane and the Sunshine Coast. Reducing the flow of sediments, nutrients and acidity into the estuary are key concerns of community catchment groups and research organisations.
- 4.10 A pine plantation where the hydrological effects of harvesting and site preparation was also part of the tour.

Chapter Five - Concluding Comments

The range of knowledge and solutions that was represented at the 13th International Soil Organisation Conference cannot be adequately reflected within this report. Many of the 390 delegates were also presenting on their own topics, which ranged from the specific, such as improving crop yields in semi-arid regions of the United States of America to the general need of society to take seriously the need to promote conservation over economic needs.

Clearly, soil and water conservation is a complex and important issue for communities the globe over and judging from the number of presentations and posters, it is also clear that there are many individuals and organisations who are working at determining solutions to a whole range of problems connected to soil and water conservation.

Soil and water are basic needs of all communities. For without each there is no way to grow the vegetation needed to feed communities and stock. Without the vegetation, the soil and the water become degraded. It is not surprising then to see that many of the keynote speakers and many of the concurrent sessionalists are discussing their issues within a “whole-of-community” and “whole-of-catchment” perspective.

In highlighting the needs of a growing world population, Dr John Williams also highlights the potential for catastrophe should institutional and policy reform not take place in a timely manner. The importance of engaging the community to be confident that best practice science can be used to facilitate change in a way that they understand and can implement effectively is something many governments need to address.

The idea of simple scientific principles underpinning policy is not a new one and the DPSIR indicators discussed by Ms Winifred Blum indicate the need for a multi-disciplinary approach. The driving forces behind unsustainable soil and water use must be considered within the variety of scientific approaches that exist – and link, ecological, economic and sociological variables that interact – and which may be as Gerard Midgely points out – “opposed”.

Closer to home, Mr Brian Keating reinforced that traditional European practices can no longer be seen as being suitable for Australian landscapes and again, asks governments to better protect the natural resource capital. He suggests doing this by identifying what resources are available, support innovation and better management and provide for markets that can sustain better practices. He also highlights the importance of valuing environmental services that in the past have been taken for granted.

The consistent issues raised at the conference such as market regulations, incentives and improved technological approaches, have also been consistently raised in the course of the Committee’s inquiry to date. However, current legal and institutionalised frameworks for soil conservation in New South Wales are not based strongly on an ecosystem approach. It is arguable that current soil management legislation may need to be reviewed in the light of the proposals coming from the IUCN, in a way similar to the recent catchment, water and vegetation reforms.