



Department of
Primary Industries



NSW

SOILS POLICY LOOKING FORWARD ACTING NOW

DRAFT NSW SOILS POLICY

DECEMBER 2011 v1



Acknowledgments

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Cover photograph: The soils of NSW sustain livelihood and ecology.

Foreword

The *NSW Soils Policy 'Looking Forward, Acting Now'* sets the direction and strategic vision for the management, protection and, where possible, the improvement of soils in NSW. The policy becomes a stepping stone in efforts towards ensuring best practice management of soils and in providing the stimulus to revitalise interest and action in soils across the whole community. Soil is the mainstay of healthy people and environments and provides the essential foundation for all terrestrial ecosystems as well as the production of food. It is vital that this important role is recognised and integrated within the context of the wider natural resource management agenda.

The NSW Soils Policy provides the basis for an integrated framework to respond to the issues and opportunities presented by NSW soils and to address the natural resource management targets established by the Natural Resources Commission. The NSW Monitoring Evaluation and Reporting Strategy was developed to monitor progress towards those targets. Action arising from the policy will be supported by a cooperative interagency working group to focus on soil issues.

In the sometimes uncertain environment of climate change impacts, concerns about food security, energy requirement and population growth, soils take on an even greater level of significance. Rising temperatures, more frequent extreme weather events and less effective rainfall are currently being experienced throughout the world, including NSW. These are predicted to increase in frequency and intensity as climate change progresses with increasing greenhouse gases being emitted to the atmosphere. A well managed soil environment provides opportunities for a long term sequestration of carbon, thus helping to reduce the adverse effects of climate change on our rural and urban environments, forests, rangelands and nature reserves. The NSW Soils Policy responds to this challenge as well as providing for food security into the future.

The *NSW Soils Policy* builds on the work of the 1987 *State Soils Policy* and has been subject to a comprehensive process of review and refinement to reflect contemporary thinking on effective soil management. Whilst the 1987 *State Soils Policy* was primarily concerned with soils used for agricultural purposes, the new policy applies to all soil landscapes within the state – urban and rural. This policy takes a more comprehensive approach to soils management and seeks to bring focus to achieving an improvement in soil condition within NSW, and acknowledges the significance of productive soils when balancing competing land uses. It promotes best practice models for soil management, and encourages exploration of methods for sharing the costs of soil management and improvement between individual beneficiaries and the wider community.

Acknowledgment of the value of data about soils and making this information readily accessible throughout the community underpins this new policy. Where there are gaps in knowledge and its delivery, these are to be identified and rectified to increase the capacity to deliver effective soil management practices at all levels – from the individual land manager through to community groups, councils, Catchment Management Authorities, institutions and government.

The *NSW Soils Policy*, a policy for the sustainable use and best practice management of soils, encourages responsibilities for soil management to be shared throughout the community and calls for a collaborative approach across government, research and educational institutions, professional bodies, farmers and the community as a whole.

The Hon. Katrina Hodgkinson, MP
Minister for Primary Industries



Soil and land capability – the basis of sustainable soil and land management at a farm and landscape scale.

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Introduction

Soil is the most basic of natural resources, and sustains all other terrestrial ecosystems. The capability of soils to continue supporting our natural, economic and social environments is often taken for granted. However, degradation of soil through human activity is widespread and is one of the most difficult environmental problems facing New South Wales (NSW). Soil erosion, salinity and acidification, decline in soil structure, loss of soil fertility and loss of valuable agricultural land to urban and other non agricultural uses are some of the stresses and pressures presently affecting soils across NSW.

Whilst NSW has had a *State Soils Policy*¹ since 1987, contemporary focus on high profile environmental issues such as climate change, water quality and loss of habitat, tends to overlook the linkages between soil condition and these environmental issues. Adverse changes in soil processes are not only costly and difficult to repair, but can also be a precursor to many other environmental problems. The *NSW Soils Policy* seeks to build upon the foundation set by the 1987 policy by addressing emerging issues and new government initiatives, as well as expanding its focus by widening its geographical application and encouraging a more integrated approach to improving soil condition.

This new policy forms part of the efforts being made to meet the priorities and targets of the *NSW Natural Resources Monitoring, Evaluation and Reporting Strategy*².

Policy Development

The policy was developed by the NSW Soils Policy Working Group, a multi-agency group convened by the Department of Primary Industries (DPI). This working group sought further advice and contributions from a range of relevant stakeholder groups including scientists, educators, policy makers and industry. The policy is intended to guide a wide range of stakeholders towards sustainable use and management of soils, emphasising collaboration and also providing opportunities to mitigate climate change impacts.

Why are Soils Important?

Soil is critical to the maintenance of life on the planet. It is one of the most complex ecosystems on Earth in addition to being essential for conservation of biodiversity and generally a key component of all terrestrial ecosystems. It is also host to a significant proportion of the world's biodiversity in its own right. Soil contains thousands of different organisms which solely and through their interactions throughout the environment, contribute to the maintenance of global water, food and nutrient cycles. It is on these relationships and processes that all life depends.³



Red sunrise: Topsoil from the western areas visits Sydney, September 2009.

Soils perform a wide range of ecological, cultural and land use functions. These factors have shaped the way soils have been perceived and managed by the community over the years. This extends from the traditional land management techniques practised by Aboriginal communities prior to European settlement through to the contemporary agricultural practices and urban settlement patterns that occur today. The variety of soil types are also recognised in their own right as contributing to geodiversity of our natural landscape.

At the most basic level, soil provides us with food, biomass and raw materials. It is a key component of the state's terrestrial ecology and provides:

- A platform underpinning natural landscapes.
- The core element of agricultural activities.
- An archive for heritage.
- A central role as a habitat and gene pool.

The soil stores, filters and transforms many substances, including water and nutrients and, after the oceans, acts as the biggest cyclical carbon store in the world (1,500 gigatonnes).⁴ There is also considerable potential for soils to provide additional carbon storage through better land management practices.

In social terms, the soils of NSW have made a significant contribution to the economic wellbeing of the state, but this has not been without great cost. Whilst there have been improvements in some aspects of soil health and condition in recent years, human induced soil degradation remains widespread and is one of the most challenging and often difficult environmental management problems facing the state. This is because almost every area is experiencing at least some loss of soil condition, and there are significant areas experiencing multiple forms of degradation.

The severe economic impacts arising from soil degradation mean that ensuring soil improvement and best practice soil management are inherently economically rational objectives for NSW.

¹ Soil Conservation Service of NSW (1987) *State Soils Policy*

² Department of Environment, Climate Change and Water (2010) *New South Wales Natural Resources Monitoring, Evaluation and Reporting Strategy 2010- 2015*

³ Campbell, A, 2008, *Managing Australian Soils*, Triple Helix Consulting, Queanbeyan, p2.

⁴ Commission of the European Communities, 2006, *Thematic Strategy for Soil Protection*, Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, 22/9/2006, p2.

Soil Degradation

Soils degrade through inappropriate land use and soil management practices. The changes brought about by such use and practices alter the physical, chemical, biological and hydrologic balances in the landscape. This gives rise to adverse soil and environmental conditions such as soil acidification, rising water tables, salinisation, soil erosion, decline in water quality, contamination and loss of biodiversity and heritage values. While inappropriate land use and soil management practices continue, our soil assets are under threat.

Soil degradation problems have major impacts, both on and off site, that result in considerable environmental, social and economic costs to the NSW and Australian communities. These costs ultimately affect everyone by reducing food security, polluting the water and air, and generating additional greenhouse gas emissions⁵. The impacts arising from soil degradation and poor soil management are extensive, and sometimes impossible to rectify or disproportionately expensive to remediate.

Complementary Directions

The *NSW Soils Policy* recognises that there is a need for a contemporary, long-term and integrated plan to reduce and reverse the adverse impacts of soil degradation and overcome the impacts of past, and some current practices that threaten the physical environment and the social wellbeing of the state.

A great deal of work is being conducted by a number of government agencies, educational and research institutions, professional groups and individual land managers, through programs and activities that have positive impacts upon soils. The policy seeks to better coordinate those programs and develop partnerships between government and others, to enable information sharing and alignment of existing resources and to better target future investment.

It also seeks to promote soil structure and condition as a fundamental element underpinning biodiversity and ecosystem sustainability. *Figure 1* (page 7) demonstrates the linkages between key existing natural resource management (NRM) programs, processes and legislation.



Mass movement of deeply weathered soils from road cutting: NSW North Coast.

External Drivers

An additional consideration in the development of the *NSW Soils Policy* is the significant changing circumstances in the external operating environment affecting land use and management in NSW. These changes mean that soil management in NSW is now occurring in a very different context from that applying when the 1987 *State Soils Policy* was developed. In summary:

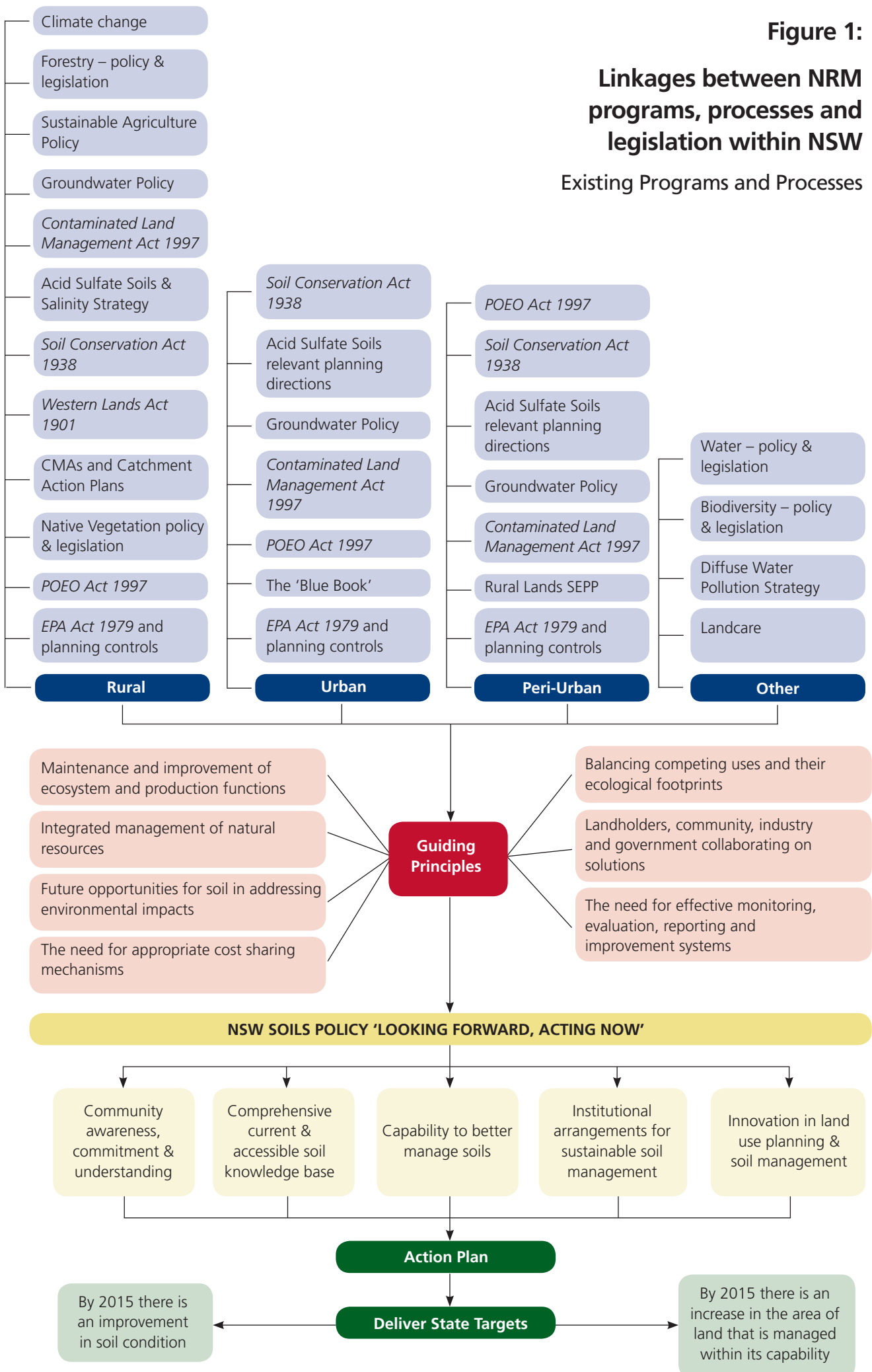
- The demand for the products from well-managed soils - food, fibre, clean water and carbon storage - will intensify considerably over coming years.
- Soil management is predicted to occur in changing and potentially more difficult climatic conditions, with more climatic variability, less reliable seasonality and more extreme weather events.
- The consequences of poor soil management in terms of declining water quality and quantity, lower agricultural and forestry production, dust storms and loss of long term productive capacity, declining biodiversity and carbon pollution, and their negative impacts on communities, industries and economies, are predicted to be more critical in the future.
- Competition for land and water resources will place considerable pressures on agricultural lands in rural, peri-urban and urban locations, underlining the importance of effective strategic land use planning, zoning, rating and development approval systems in achieving better-integrated approaches to managing soil, water, energy, biodiversity, transport, mining and infrastructure.
- Soils that have been significantly degraded from their natural state are less likely to be able to provide essential ecosystem services, such as filtering water, growing crops, absorbing carbon dioxide and supporting biodiversity.

5 Campbell, A, 2008, op. cit, p18.

Figure 1:

Linkages between NRM programs, processes and legislation within NSW

Existing Programs and Processes



Principles for Effective Soil Management

There are a number of important principles relevant to soil conservation and management including those that emphasise the protection and management of soil, and those that address specific environmental issues and concerns for soil. Based on this broad context, and including the emerging influences discussed above, the following seven principles have been adopted in developing the goals and objectives of this policy, and the strategies and actions that will be implemented to achieve them:

- Soil management is critical to the **maintenance and improvement of ecosystem and production functions**.
- Sustainable soil management is most likely to be achieved through the **integrated management of natural resources**.
- **Future opportunities for soil management in addressing environmental impacts** require recognition.
- The increasing significance of **competing land uses and their impact on soils** must be factored into decision making.
- **Landholders, community and industry groups, government agencies and educational and research institutions** must be **encouraged to collaborate on sustainable soil management**.
- **Effective monitoring, evaluation, reporting and improvement systems** must be supported and consolidated to measure the success of investment in sustainable soil management.
- **Cost sharing mechanisms**, acknowledging the nature and extent of responsibilities for sustainable soil management, must be refined and enhanced.



Sheet and rill erosion also means loss of stored water, high turbidity and reduced productivity: Ploughed sloping field, Southern Tablelands, NSW.

Maintenance and improvement of ecosystem and production functions

Soil underpins and sustains natural, human-made and social environments (whether directly or indirectly) and impacts on all ecosystem functions. Soil health and resilience is determined by the characteristics and condition of its surrounding environment.

The way soil is used and managed within its environment can modify the physical, biological and social elements around it.⁶ Considered in this holistic way and similar to the integrated management of natural resources discussed below, the maintenance and improvement of ecosystem functions and ensuring 'ecosystem health'⁷ is fundamental to achieving improvement in the condition and health of the soil.

A key element of this principle is to enable the protection, management and better understanding of soil biodiversity and the role of soil in biodiversity maintenance generally. The maintenance of biodiversity in NSW is specifically addressed by the *NSW Biodiversity Strategy*⁸ and matters relevant to soil biodiversity addressed by the *NSW Soils Policy* will be consistent with the objectives and actions within that strategy.

Sustainable soil management to improve ecosystem function and to enhance soil biology is also critical for underpinning the production benefits of soils in agriculture and forestry.

⁶ Hannam, I and Boer, B, 2002, op. cit, p16.

⁷ Rapport, D.R. et. al in Hannam I, and Boer B, op. cit. p17.

⁸ NSW National Parks and Wildlife Service, 1999, NSW Biodiversity Strategy



Dust storm near Deniliquin 2009.

Integrated management of natural resources

It is important that the best practice management and improvement of soils in NSW not be carried out in isolation, but forms part of an integrated approach to natural resource management.

Soil is interlinked with air, water and vegetation in such a way that it assists in regulating their quality. Soil functions also contribute to other natural resource areas such as biodiversity, vegetation, marine protection, coastal management and the mitigation of climate change. If soil is not adequately protected and managed, resulting soil degradation will ultimately undermine sustainability across the entire natural resources spectrum.

Approaches for the delivery of improved soil management will vary considerably depending on geographic and biophysical context. The level of interaction with, and likely impacts on, other natural resource elements will need to be carefully considered as part of an integrated NRM approach. For example, in some circumstances it is possible to deliver soil improvements on a catchment or regional basis as part of an embedded integrated package without giving specific attention or priority to soils as an element in their own right. The *NSW Salinity Strategy*⁹ is an example of this approach.

Work undertaken on a systems or sectoral basis, such as within the cropping belt, provides an example of a somewhat different approach. Here, the priority of the soils component within the integrated natural resource model is substantially elevated to ensure soil improvements can be achieved given the serious nature of soil degradation that had occurred in these areas. The soils decision support tool used within the *Native Vegetation Act 2003* (NV Act) for property vegetation plans is a further example of this approach. The NV Act stops broadscale clearing of native vegetation unless environmental outcomes, including those for soils, can be maintained or improved.

Soil erosion and associated sedimentation of waterways can have an impact on water quality and prevent the community's desired uses for the waterway being achieved. The greatest source of nutrient pollution in NSW waterways is from soil erosion. The dominant source of phosphorus (over 50%) is from hill slope erosion with the majority of total nitrogen loads in coastal NSW also attributed to hill slope erosion. High concentrations of nutrients may lead to eutrophication of waterways and associated algal blooms as observed in many inland waterways, wetlands, estuaries and coastal waters. High concentrations of suspended sediments which impact on downstream users such as irrigators can also lead to higher levels of treatment for human consumption being required, and can smother aquatic life.



Farmers discussing soils and land capability: Walgett, NW NSW.



Gully erosion in a highly dispersible soil: Higgens Bay catchment.



Grass Tree (*Xanthorrhoea species*), part of a unique native vegetation association growing on serpentine derived soils: Tumut NSW.

⁹ Department of Land and Water Conservation, 2000, *Taking on the Challenge: NSW Salinity Strategy*

Future opportunities for soil management in addressing environmental impacts

Employing best practice management techniques for soil offers numerous opportunities for addressing wider environmental issues, including those associated with the impact of improved soil condition on climate change:

- Use of soils as a carbon storehouse (refer to information box) creates added opportunities for conservation and farming due to the benefits provided to soil physical and chemical fertility, and processes such as water infiltration and available water capacity, aeration and root penetration. Soils which contain high levels of carbon also securely hold nitrates, phosphates and other fertilisers that may otherwise pollute our waterways or the atmosphere.
- The management of plant materials for ground cover through grazing strategies, cultivation practices and the revegetation of soils can help to prevent desertification by trapping valuable soil moisture and minimising wind erosion.
- Support for interventions which address the hazards of landscape desertification; for example, the use of stewardship payments within an incentive based model to encourage good soil management practices, can help mitigate degradation during droughts.
- Ground cover management is an important means of mitigating erosion and sedimentation control associated with the frequency and intensity of rainfall that may be exacerbated by climate change.

The carbon storehouse

Soil carbon is implicated in almost all indicators of soil health, being beneficial for nutrient retention and availability, soil structure improvement, erosion resistance and water infiltration, retention and drainage characteristics. Similarly, organic materials are fundamental to soils and their conservation and farming, due to benefits they provide to soil physical and chemical fertility, and processes such as water infiltration and available water capacity, aeration and root penetration. Management of soil carbon has received increasing interest, politically and within the research community, over the last two decades, culminating in the announcement at the Commonwealth level of support for soil carbon and land management research via the Australia's Farming Future Initiative, and more recently, the Carbon Farming Initiative. The timing of *NSW Soils Policy* is well-placed to respond to these national initiatives and where possible, capitalise on positive outcomes as they might be applied in the NSW context.

Most recommendations aimed at improving land management and reducing land degradation, either directly or indirectly can be measured by improvements in soil carbon dynamics and/or carbon sequestration. Projected climate change impacts suggest that soil carbon can play a significant role in both mitigating greenhouse gas emissions (via sequestration), and buffering likely impacts wrought by changing climates. As the potential store of carbon in soils is very large relative to anthropogenic emissions, soils will undoubtedly play a significant role in any future carbon trading scheme. For these reasons, continued action and research on soil carbon measurement and monitoring should be seen as a high priority for NSW.

With its key roles in both carbon sequestration and in improving soil condition, increasing the organic content of soils has a dual effect, in terms of both climate change mitigation and adaptation. Natural resource management policies need to recognise these coupled benefits of soil carbon and invest strategically to maximise the overall benefit.



Accumulation of plant residue, organic carbon and biota – signs of a healthy, stable and productive soil.

As with other natural resources, the impacts and preferred management responses to the effects of climate change will vary in different regions. However, improved understanding of the magnitude of the risks associated with climate change in different regions is needed in order to prioritise natural resource investment. In particular, the effects of changing climate on the various processes that degrade soils will be different across regions. Research that informs this issue can therefore contribute directly to the capacity of the NSW Government and Catchment Management Authorities in particular to prioritise soil related investment, as well as to the capacity of catchment based action to promote the state-wide NRM targets. For these reasons, additional research effort is required to quantify the regionally specific potential for carbon sequestration in soils and the associated likely implications for climate change mitigation and adaptation.

Balancing competing land uses and their ecological footprints

The 1987 *State Soils Policy* was primarily concerned with soil conservation within rural areas. The *NSW Soils Policy* applies to management of all soils throughout the state. Whilst soil issues in traditional urban areas are generally well addressed by existing legislation, policies and controls, the management of soils in peri-urban areas is more problematic and requires specific attention. As identified by the CSIRO¹⁰ peri-urbanisation or expansion of urban areas to house an increasing population, including the provision of additional infrastructure, is occurring in many rural areas, particularly in locations close to the coast. Expansion of housing choice into semi-rural areas can be at the expense of significant soil assets. It involves a change from traditional farming uses to emerging trends in rural-residential development, hobby farming and amenity agriculture, often in close proximity to intensive production enterprises. These may have both positive and negative impacts on local soil use and management.

There is a need to address emerging issues in peri-urban areas to ensure that agricultural requirements are balanced with the growing demand for lifestyle rural development – ‘sea and tree changers’.

A strategic framework within the NSW planning system currently exists to address the balance between competing land uses at the state, regional and local levels. The *State Environmental Planning Policy (Rural Lands) 2008* has provisions to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the state. Additionally, there is a provision to identify state significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, although no state significant land has been listed in Schedule 2 of the SEPP at the present time.

¹⁰ CSIRO, 2008, *Landscapes in transition – improving the sustainability of peri-urban growth*, at <<http://www.csiro.au/science/LandscapesInTransition.html>>, accessed 1/4/08.

Regional strategies identify where future growth and development should occur and are based on balancing the need to protect high conservation value biodiversity and other considerations such as servicing the needs of population growth, reducing vehicle kilometres travelled and protecting strategic agricultural land. Policies relevant to soils in urban and peri-urban areas will therefore need to be consistent with those regional strategies.

At the local level, councils are required, by Planning Direction Nos. 1.2, 1.5 and 5.3 to protect rural zones, rural lands and rural lands of state and regional significance.¹¹

The conflict between the rapid expansion of the mining industry and coal seam gas industry into highly productive soil landscapes in NSW is also emerging as an issue in some regions.

Strategic regional land use planning should optimise the use of land for mining, agriculture, industry and housing in a balanced manner so that the commercial activities of these industries and community needs are not compromised.

¹¹ All Planning Directions issued under section 117 of the *Environmental Planning and Assessment Act 1979* can be found at www.planning.nsw.gov.au



Inter-row sowing of no-till crop uses GPS technology.

Landholders, community, industry and government collaborating on solutions

Further cooperation and coordination between all levels of government and other stakeholders in all areas of soils management is likely to lead to the most balanced socio-economic and environmental outcomes.

The NSW Soils Policy Working Group, which consists of representatives from a number of government agencies with an interest in soil management, was established to develop this policy as a first step in this process. A NSW Soils Network will be established, comprised of soil practitioners and professionals from a wide range of government and non-government organisations to assist with the implementation of this policy.

In addition, the NSW Catchment Management Authorities have set up a Soil Network Community of Practice to share information and approaches to address soil management issues.

Community understanding of the importance and functions of soils is likely to foster the development of partnerships among industry, business, land managers, community groups and individuals.

Effective monitoring, evaluation, reporting and improvement systems

The success of this *NSW Soils Policy* depends upon the development of effective monitoring, evaluation, reporting and improvement systems. All strategic actions identified must be able to be evaluated in terms of a clear performance outcome evaluated with a specific indicator(s). These must be measurable, relevant and time bound. The agencies responsible for the implementation of strategic actions will also be responsible for reporting on performance outcomes and indicators as part of a performance evaluation program.

Soil knowledge and information must be securely and appropriately managed and maintained and be accessible to all involved in soil planning and program development. The repository of soil information should be used in conjunction with water and vegetation data to direct effective and integrated NRM decision making and inform strategic regional land use planning.

The *NSW Soils Policy* is focused on achieving an improvement in soil condition based on current conditions. Monitoring, evaluation, reporting and improvement systems must be modelled on contemporary baseline data to allow future meaningful assessment of whether improvements in soil condition have been achieved.



Soil management in semi-arid lands; monitoring impact of grazing rangelands: Bourke district.

Appropriate cost sharing mechanisms

Strategies to address soil degradation and other soil management related issues must be clearly linked to public interest policy objectives and supported by transparent cost sharing approaches.

Equally, in an environment where public resources are limited, public investment programs must maximise public benefits. Government should generally intervene when the benefits of government action are expected to outweigh long term costs (including the costs of policy development, administration, monitoring, enforcement and compliance).

Cost sharing arrangements must deliver the maximum public benefit for public dollars invested, whilst private benefits should generally be appropriately funded by the beneficiaries.

Within the range of policy tools which guide the framework for assessment of public and private interests in soil management, market based instruments offer the possibility of delivering outcomes at lower management cost than the more traditional approaches such as fixed grants. These work best when there are significant cost differences faced by the users of soil resources to achieve good NRM outcomes, or where such benefits differ across a landscape¹².

NSW Catchment Management Authorities (CMAs) will have an increasingly significant role in the application of market mechanisms to better guide strategic investment across catchments, and to provide rigour in the consideration of private and public good in investments in soil management. A range of approaches are currently being used by CMAs in the delivery of improved soil management outcomes. These include auctions and tenders for allocation of funding for environmental projects, an environmental services ratio¹³ and other spreadsheet based decision support tools, cost benefit analyses, targeted incentives, stewardship and change management schemes and services.

The *NSW Soils Policy* endorses and supports appropriate and well managed application of market based instruments, and the orderly evolution of the delivery of improved soil management outcomes through their application. Where possible, the application of these instruments will be integrated with the delivery of other NRM services.

¹² BDA Group and CSIRO, *Use of market based instruments by Catchment Management Authorities in NSW to achieve landscape scale change*, report to NSW CMA Chairs' Council, 17 October 2007 at <<http://www.bdagroup.net/wp-content/uploads/2010/05/CMA-Chairs-MBI-Oct-2007.pdf>>

¹³ Symbolix 2010: Decision Making for NRM Investment, Central West CMA

Goals

The *NSW Soils Policy* will improve soil condition and productivity and increase the area of land that is managed within its capability, by promoting sustainable use and management of soils, and providing a framework for coordination and collaboration across all stakeholders in NSW.

Objectives

The *NSW Soils Policy* has five key objectives that are based on increasing the understanding, knowledge, commitment and capacity¹⁴ to improve the sustainable use of soils throughout NSW.

- **Objective 1**
Improve community awareness and understanding of soils, to enhance commitment to better soil and land management.
- **Objective 2:**
Provide a comprehensive, current and accessible soil knowledge base to inform strategic land use and catchment planning.
- **Objective 3:**
Develop the human capacity to better deliver management of soil resources.
- **Objective 4:**
Improve institutional arrangements that encourage and support sustainable soil management and discourage practices that damage soil condition.
- **Objective 5:**
Foster technical and policy innovation to develop new sustainable soil use and management practices, markets and other institutional arrangements.

Objective 1

Improve community awareness and understanding of soils, to enhance commitment to better soil and land management

There is a fundamental problem in the lack of public awareness of the linkages between soil management and environmental issues such as greenhouse gas pollution, water and air quality, biodiversity and other increasing concerns such as maintaining food security. There is a need to rebuild commitment to soils issues within NSW and to promote the message that improving soil condition has subsequent flow on benefits to the whole community. Landcare and other similar community groups are well placed to foster this understanding given their widespread networks and readily recognised brand.

Strategy 1.1

Increase community awareness of the intrinsic environmental and biodiversity value of soils

There is a significant need to raise the awareness of soil issues within the community and target the 'consumers' of soil. A new dialogue between government, soil professionals, industry groups and the wider community is required, which encompasses the importance of better soil management, and the measures needed to achieve it. The core message will be consistent with the principles for effective soil management. A variety of communication techniques and methods will be used, including available and emerging technologies appropriate to the target audience.



Land managers discuss implications of soil management on productivity and sustainability: Cropping belt south western NSW.

Strategy 1.2

Increase community engagement and citizen science

The need to go beyond simply raising awareness to the building of understanding about soils and commitment to soil conservation and management is central to this policy objective. The most effective learning method in this area is experiential. Community engagement can accelerate development of skills, tools and initiatives to build soils literacy at the community and regional levels. If such engagement is through 'citizen science' or community environmental monitoring (CEM) activities that involve people in systematically observing, measuring and monitoring trends in their local environment, there is an added benefit through generation of useful data at low cost as well as community understanding about soils. There is also a need to provide support to ensure continued commitment to actions or activities that have occurred from investment or change in land management practices.



Strong interest in soil management systems: Field day, Condobolin NSW.

14 Including individual, institutional and technical dimensions

Strategy 1.3

Increase support for community NRM groups

Landcare and other community NRM groups remain extremely relevant to a soil and land management policy framework. Landcare groups and other similar networks are capable of delivering landscape-scale improvements in land condition¹⁵ and they play a crucial role in changing social norms in favour of more sustainable practices, in sharing information and social learning at a community level, in attracting and sharing resources, and in making it easier for landholders to implement more sustainable practices¹⁶. Landcare and community NRM groups are particularly relevant in areas where land ownership is changing rapidly (such as peri-urban, 'tree change' and 'sea change' areas), as a means of assisting newcomers to meet like-minded people and to access information and other forms of proactive support for NRM outcomes.

One of the key challenges is to set out clearly the relationship between existing and new voluntary community land care actions and the more strategic regional approach through CMAs. In some circumstances, targeted attention is needed to rebuild relationships and capture synergies between local voluntary action and strategic regional planning and investment. Increased emphasis on the promotion of voluntary conservation agreements and land use agreements and covenants will also complement this strategy.



Searching for soil biota in ground litter: Mudgee Soil Life workshop.



Healthy Soils field day for farmers: Walcha, NSW.

¹⁵ Curtis, A & De Lacy, T (1996) *Landcare in Australia: Beyond the Expert Farmer, Agriculture and Human Values*

¹⁶ Campbell, A (1994) *Landcare – communities shaping the land and the future*. Allen and Unwin, Sydney

Strategy 1.4

Embed soil management within the school curriculum

Early introduction to the importance of soils through the school curriculum will assist in achieving widespread learning about soils across urban and rural communities, as well as encourage long term and further education in soil related fields. It is recognised that influencing the school curriculum is challenging and needs to be a collaborative activity involving curriculum managers within the school education system. However, an achievable approach is to provide teachers and educators with resources on soils to support soils related topics already within the curriculum.

Objective 2

Provide a comprehensive, current and accessible soil knowledge base to inform strategic land use and catchment planning

Repairing soil degradation is expensive and often — in practical and economic terms — soil degradation is irreversible. With good soil management, such degradation is preventable, and preventative actions represent good value investments. Good soil management requires a good knowledge base.

On-ground data collection must be improved to produce quality data sets for natural resources such as soil, land, vegetation and biodiversity for effective strategic land use planning. In essence, there is lessening ability to ascertain whether the extent and condition of our natural resource base is improving or declining, and whether or not major public investment is making a difference. Investing on a poor, thin or patchy information base collected and managed inconsistently is inherently risky.

In areas of emerging significance, such as climate change impacts, food security, soil carbon markets and carbon sequestration opportunities, targeted research and development programs will be required to ensure effective future planning and decision making for soils.

Strategy 2.1

Strengthen programs to develop soil data, information and knowledge management systems

Current soil knowledge is fragmented, with key soils data, information, knowledge and capabilities scattered across several agencies at both the state and national level. The NSW soils information that is available on-line is fragmented across federal and state agencies and some web links are not up-to-date and not working. To enable informed and appropriate soil management decisions by users, a widely accessible, complete and up-to-date database is required.

Strategy 2.2

Better co-ordinate soil resource assessment and mapping

Government, CMAs, landholders and researchers need good data and information to establish base lines and priorities, target investment, evaluate land use plans, create general awareness and permit sound compliance. Although it is generally acknowledged that soil degradation is widespread and severe, there remains uncertainty about extent, severity and impacts. Proper assessment of the soil resource and the data it generates is required to replace assumptions about trends, thresholds and land capability, with acceptable precision both spatially and temporally.

Although there is a continuing demand for the information, there has been a lack of coordination of soil and land resource assessment, particularly regarding the application of agreed standards for information gathering and management. The uncertainty about the extent of impact and trends in soil quality will only be exacerbated by dynamic environmental conditions driven by climate change.



Measuring soil salinity trends using electro-magnetic induction device: Inverell NSW.



Measuring water filtration rates into the soil profile tells a story of soil structure, stability and productivity.



Land Resource Assessment, Moss Vale NSW: Soil landscape mapping is the basis for selection of appropriate soil management options.

Strategy 2.3

Foster soil research and development (R&D) in areas of emerging significance

Soil research and development needs a dual focus – filling knowledge gaps through well-targeted research; and disseminating the research in an appropriate manner. Ideally, research should be integrated with change management programs (refer Strategy 3.4), and action based research methods utilised where appropriate, to engage end-users in the research process¹⁷. Working with other R&D jurisdictions at a national level will be beneficial to access the limited pool of high-calibre soils researchers, reduce the risk of duplication across organisations, and make best use of scarce research resources. To extract maximum value from such collaborations, it will be necessary first to have identified knowledge gaps and priorities.

Prospective areas for new soils research and development are likely to include:

- Better methods for monitoring soil condition — for example, calibration of mid-infrared spectroscopy for measurement of soil organic carbon pools, and remote sensing methods for assessing bare soil and land use.
- The likely impacts of climate change on NSW soils in different soil climate zones.
- The sequestration potential of soil carbon under a range of different management and climatic scenarios in different regions.
- The impact (and cost-effectiveness) of increasing soil carbon through soil management on a range of physical and chemical qualities such as soil structure, infiltration, soil moisture storage; acidity and soil nutrients.
- Quantifying and costing the resilience benefits of improving soil condition (defined broadly to include ecological and social benefits including human health), in particular through increasing soil organic carbon.
- Consideration of a more complete understanding of the significance of soil biology in the provision of improved soil management, ecosystem services and agricultural production.
- Improving nutrient use efficiency through new technologies and better integration of soil, crop and climate information.

Strategy 2.4

Consolidate a monitoring, evaluation and reporting strategy for NSW soils

Soil degradation has multiple impacts on the natural resource base, on agriculture and food security, urban development, the economy, institutions and standards of living. There is a need to design and apply multi-dimensional, multi-scale and multi-functional indicators to assess these wide-ranging impacts. Coupled with these indicators, there must be adequately supported monitoring systems to determine the level of improvement in soils and to monitor mitigation impacts where appropriate. Monitoring is also essential to evaluate adaptive management change due to activities occurring on the ground and resulting from incentive funding, field days, workshops and other professional training.

¹⁷ Campbell, A & Schofield, N (2007) The Getting of Knowledge – a guide to funding and managing applied research Land & Water Australia, Canberra

Much work has already commenced in NSW, including assessment of the extent to which land and soil management in NSW is moving towards the state-wide targets. For example, in 2008 the NSW Government commenced an extensive project to monitor soil condition and the impact of land management, consistent with the NSW Monitoring Evaluation and Reporting Strategy. This research incorporated more than 800 monitoring sites across a range of catchments, soil types and land uses. For soils monitoring per se, as with research, it is important that NSW consolidates and integrates this work with any nationally coordinated approach, to share expertise and resources and to maximise the congruence between NSW and national priority setting approaches for soil investment.

Soil scientists have developed a rigorous system to assess the sustainability of land management actions against soil and land characteristics. The rule-based system allows the sustainability of land management practices to be assessed. It can also be used to determine which practices are best suited to various combinations of soil and land condition in NSW. The community and landholders already participate in community soil monitoring activities, such as the SoilWatch program which is a tool that enables land holders to collect soil samples and return them to government laboratories for testing. Sampling is done in 5 year cycles, and is intended to measure the effectiveness of incentive funding.

Objective 3

Develop the human capacity to better deliver management of soil resources

Soil issues are inherently multi-disciplinary in nature. The sustainability and improvement of soils requires knowledge across many fields including law, policy, social sciences, economics, engineering and physical sciences, as well as agricultural, soils and natural sciences.

Support for practitioners within soil related fields, through professional networks and associations, is necessary to provide opportunities for knowledge sharing and the mentoring of younger professionals. This will assist in the better delivery of soil resource management as a key component of integrated natural resource management.



Farmers learn soil biology by identifying soil-borne bugs.

Promotion of professional soils education, either as dedicated, specialist soils courses at a tertiary level or by way of soil related subjects available to students studying in related areas, will be necessary to develop the next generation of soil managers. However, the capacity challenge is not just about attracting and developing professional graduate soil scientists. It is equally important to ensure that others outside the soil science field also gain understanding, skills and expertise in soil management and soil related issues. Farmers and other land and water managers, planners, practice change staff and teachers are just some of the groups of people who could benefit from in-service training in various aspects of soils and their conservation and management.

Strategy 3.1

Encourage and support collaboration across the soils professional network

The development of professional networks across organisational boundaries, and across the public/private sector divide, can maintain the overall knowledge base, mentor young professionals and keep them engaged. An important function of these networks is that they keep the 'memory' in the knowledge system, even when formal institutional structures change frequently. To this end, a NSW Soils Network will be established, comprised of soil practitioners and professionals from government and non-government organisations.

Strategy 3.2

Encourage increased emphasis on professional soils education within a wide range of NRM and related tertiary disciplines

A multi-faceted education and training approach is required, of which professional soils education is important, but far from the only component. Given the changing context for soil management fostered in the *NSW Soils Policy*, in particular the new emphasis on the potential of soil carbon as a climate change mitigation measure, there is a pressing case for dedicated, specialist soils courses at tertiary level and for post-graduate training and research in soil science. As a minimum there is a need to ensure that soils are treated adequately within other subject areas.

Strategy 3.3

Develop and promote in-service training in soil management

Upgrading and expansion of the skills of existing professionals and others working in the NRM sector is required to ensure that these people are literate in soil conservation and management, and to ensure connections are made between work undertaken in other NRM areas and the soils discipline. Given the target for land used within capability in the NSW State Plan, in-service training around 'soil and land capability assessment' is a key need.



Soil pits: An effective extension tool, requiring experienced officers.

Strategy 3.4

Update and enhance soil change management programs

There is a continuing case for publicly-funded soil practice change programs closely linked to rigorous research and monitoring activities. At present, there are a range of messages on land and soil management advocated by different deliverers, which is resulting in competing claims and fragmented advice to land owners. Well-understood core parameters around soil structure, fertility, carbon storage, water balance and soil biology with user-friendly assessment tools, would enable independent evaluation of the performance of diverse farming systems in a given location, or of existing farming systems in new locations.

Such assessment tools would support soil practice change programs delivered by various combinations of state agency staff, specialist consultants and contractors, grower groups, industry associations and catchment bodies. The assessment tools would receive various degrees of public support according to the wider public benefit and the potential for commercial returns. Practice change programs are most likely to be effective as a distinct component in an integrated suite of policy measures including incentives (both positive and negative), technology development and R&D.

Objective 4

Improve institutional arrangements that encourage and support sustainable soil management and discourage practices that damage soil condition

There is a wide range of potential institutional instruments that may be brought to bear in promoting and supporting better management of the soil resource. These include education, research, change management programs, incentives, planning, regulation and compliance. Government intervention can result in improvements in soil management that have the potential to deliver benefits in terms of increased production and lower overall costs. There is a need for existing markets to better reflect soil degradation costs. There is also a need for the development of new markets that encourage positive change, such as trading in carbon sequestered in soils.

The linkages between soil management and the range of NRM considerations must be clarified and strengthened, as soil is not only a concern in its own right, but is also a subset of other components of the environmental landscape in the matrix of integrated NRM. It is important to avoid an approach that treats soils separately from water, vegetation, land use and other related issues within Catchment Action Plans (CAPs) and the land use planning system.

In addition, the balance between providing land for housing or other uses, and the protection and retention of highly productive agricultural land, must reflect the value of soils and the best management solutions for soils, together with other related components such as the availability of water supplies, proximity to markets, infrastructure and transport, as well as the suitability of land for housing or other competing land uses.

Since the commencement of the *Soil Conservation Act 1938* a new framework of natural resource, environmental and urban planning legislation has been introduced. Review of the soil management legislation and its relationship with other relevant legislation is necessary to ensure a comprehensive, contemporary and effective legislative base exists to facilitate the improvement and best practice management of soils in NSW.



Erosion and deposition in an urban catchment: School playground, Rathmines, NSW.

Strategy 4.1

Further integrate soils within the regional NRM model, particularly within Catchment Action Plans developed by Catchment Management Authorities

Significant gaps in regional NRM plans exist in relation to soils, soil condition targets and land capability assessment. To a large extent this reflects capacity issues within CMAs, and the lack of accessible, user-friendly soils information and interpretation and decision support tools. Measures pertaining to the knowledge base, human capacity, networks and change management would assist in addressing these gaps. However, it is still important to consider how soils issues can be better integrated into the regional NRM model, and CMAs in particular. As emphasised by the NRC (2008) in its review of NSW Catchment Action Plans, it is also critical to avoid defaulting to a 'siloed' approach that treats soils in isolation from water, vegetation and other related issues.

Strategy 4.2

Support the consideration of soils in local and regional planning and development approval processes

The *Environmental Planning and Assessment Act 1979* (EPA Act) provides a suite of measures to enable the consideration of soils within the planning system. Land use controls contained within environmental planning instruments such as State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs) can be used to identify and protect specific natural resources including soils, through land use zoning and development assessment. Strategic planning initiatives such as the regional strategies that have been developed for all high growth areas of the state identify important biodiversity corridors, areas of conservation value, strategic agricultural lands and important areas of natural resources and cultural landscapes. Soils are provided *defacto* protection through these land uses.

Population growth means that there will be increasing development pressures and competing demands placed on soils, both in rural areas and particularly in peri-urban, coastal and urban areas. Pressures from increasing intensity in some regions of rural-residential development, hobby farming and amenity agriculture can often be at the expense of traditional farming and horticultural practices, and can result in the loss of strategic agricultural land. Taking highly productive land out of food and fibre production creates a long term risk of reducing the domestic ability to feed and clothe the nation and to generate export income. Globally, this also threatens potential food security and demand. However, this must also be balanced against the competing needs of housing, employment and other export industries.

The key to incorporating soils related issues into the land use planning system will be for soil managers, in close consultation with local government, to clearly identify land uses that provide the best management solution for the soil resource in question. Strategic land use planning should then be used to identify and map agricultural land that is highly productive with unique natural resource characteristics and socio-economic values.

These would be the first steps to assist informed decision making related to balancing competing land uses and socio-economic objectives. Additional steps related to agriculture, would include assessments of related components of the agricultural production system, such as the availability of requisite water resources, proximity to markets and transport and also the synergies available through clustering related industries. Such assessments would also need to recognise the different requirements of different agricultural industries, not all of which are dependent on productive soils. For example, feed lots, poultry farms, mushroom production and hydroponics all require dedicated land resources but not fertile soils. Similarly, different broadacre agricultural industries, such as fine wool production, can prosper on relatively poor soils.

Strategy 4.3

Develop strategies to better manage competing land uses particularly on soils of strategic agricultural lands

Some land uses can threaten soil health, including irreversible damage. There are a range of competing land use interests that utilise or impact soils including agriculture, mining, forestry, and urbanisation. These must be managed to ensure that the most appropriate land uses are allocated and that the value of high production soils is not compromised by other uses.

Mining is emerging as a significant competitor for agricultural land and water resources in several regions of NSW, notably the Liverpool Plains and the Hunter Valley. There are two key dimensions to this from a soils perspective:

- The potential loss to agriculture and food production from highly productive soils and valuable water resources being used for non-agricultural purposes.
- The extent to which mine site rehabilitation post mining is fit for purpose and recognises the desirability of restoring the productive capability of soils as well as preventing future degradation.



Expansion of residential land uses within an agricultural setting.

Decisions regarding competing land uses need to finely balance the public interest, which involves assessment of the different socio-economic values and benefits to the state. The importance and value to the environment and the economy of protecting soil resources must be recognised as key components of this assessment.

Strategy 4.4

Encourage and facilitate innovation in the use of existing and new market instruments

Government intervention to address the public interest elements of soil management falls into several categories; education, regulatory measures, direct provision of environmental services and market mechanisms, including price instruments (such as taxes and subsidies) and quantity instruments (such as permits and offsets). The improvements in soil management arising from these interventions often deliver private benefits in terms of increased production and lower costs.

There has, however, been significant market failure in soil management as the cost structures for products have not reflected the total cost of production, especially the cost of environmental degradation. In addition, primary producers often have not been subject to appropriate market signals to change soil management practices, as the benefits of improved soil management occur on and off site.

Therefore, there is a need for market signals to better reflect and internalise the cost of soil degradation with the aim of achieving protection of high production soils.

Strategy 4.5

Improve incentive programs for better soil management

Governments should generally intervene through incentive programs when the benefits of government action are expected to outweigh the costs (including the costs of policy development, administration, monitoring, enforcement and compliance). Good soil management is expected of landholders and legislation supports this expectation. Incentives generally should not be used to encourage land managers to do what they are already required to do, and from which they already derive a benefit.

However, incentives for improved soil management may need to be extended or new programs implemented, in cases where the public benefits of such incentives exceed the full implementation costs. Programs should be clearly linked to public interest policy objectives and supported by cost benefit analysis and transparent cost sharing approaches.

In an environment of limited public resources, cost sharing arrangements should deliver maximum public benefit for public funds invested. While private benefits should ideally be funded by the private beneficiaries, there are often instances where there are considerable spillover public benefits from measures that improve soil management and productivity. The fact that private benefits also accrue should not preclude public investment. Instead it underlines the need for well-grounded, transparent cost sharing approaches and careful choice of policy instruments.

Strategy 4.6

Review soils and related legislative frameworks

While the *Soil Conservation Act 1938* remains applicable to all NSW soils, its role in effective soil management has altered over time. In particular, the introduction of complementary natural resource and planning legislation (e.g. *Protection of the Environment Operations Act 1997*, *Native Vegetation Act 2003*, *Catchment Management Authorities Act 2003*, EP&A Act) has provided other direct and indirect mechanisms for soil protection and management. The resultant interrelationships among these legal requirements could be better clarified to improve community understanding of the current legislative framework.

Objective 5

Foster technical and policy innovation in developing new sustainable soil management practices, markets and other institutional arrangements

Development of pilot schemes will be essential to engender widespread adoption of new and evolving systems. This will be the case particularly in relation to carbon sequestration and storage in soils, and its role in mitigating greenhouse gas emissions and buffering impacts of climate change. To be successful, schemes must be both financially feasible and capable of practical implementation.

Participatory approaches to soils research will be used where practicable. In a rural context for example, this will ensure that the research is relevant to, or at least cognisant of farmer needs, it will increase farmer ownership of research results, and will be more effective in incorporating local knowledge, skills and experience into the research process¹⁸. Continued research into innovative systems and practices, by scientific professionals and by leading farmers who have trialled on-the-ground improvements, will require linkages into the formal publicly-funded NRM knowledge system, to enable dissemination and adoption of those innovations.

Innovation in agriculture and soils management will also be necessary to maintain production levels in the face of increasing pressures such as increasing energy and transport costs, decreasing water security, and competition from non-agricultural land uses such as mining and expansion of urban and peri-urban areas to house an increasing population.



Alluvial soil, upper Macquarie catchment NSW: Shows good structure and stability, a response to sound soil management practice.



The same soil as above, management practices commence to show loss of organic matter, decline in soil structure.

¹⁸ Pannell, D., Marshall, G., Barr, N., Curtis, A., Vanclay, F., and Wilkinson, R., (2006) "Understanding and promoting adoption of conservation behaviour by rural landholders" Australian Journal of Experimental Agriculture 46: 1407-1424 CSIRO Publishing, Melbourne.

Strategy 5.1

Develop and promote new and improved soil management systems for resilience to climate variability and resource use efficiency

The level of current expenditure on drought subsidies, especially in cropping and grazing regions, underlines the need to develop and promote more resilient broadacre farming systems that can be profitable within the climatic conditions that can be expected in those regions, while enhancing the resource base.

Soil management is central to building greater resilience into NSW farming systems. There are many facets to the need to improve farming systems in the face of climate variability, frequent and intense droughts, rising energy prices and the need to reduce greenhouse gas emissions. There will be an increasing need for more efficient water management, improved food and energy security, drought resilience and biodiversity enhancement as well as a reduction in the reliance on nitrogenous fertilisers. It is important however, to bear in mind that improving soil management in NSW farming systems involves more than simply improving soil organic carbon levels and that better soil management practices vary from region to region and industry to industry.

Strategy 5.2

Develop and promote new and improved soil management systems for climate change mitigation and resource use efficiency in agricultural and forestry systems

As the potential store of carbon in soils is very large relative to anthropogenic emissions, soils can potentially play a significant role in any future carbon trading scheme. Continued action and research on soil carbon measurement and monitoring is essential to take advantage of emerging opportunities in this area. Increased soil organic carbon is also the important key enabling farmers to develop more flexible and robust farming systems that can exploit unseasonal rainfall and survive a run of poor seasons.

Strategy 5.3

Develop and promote soil carbon farming market initiatives and methodologies

Improving soil organic carbon levels could potentially deliver returns to landholders over and above productivity and resilience improvements if soil carbon is recognised in emissions trading or offset schemes. Presently at the enterprise level, the transaction costs (in baseline setting, accreditation, monitoring and reporting etc) may be high relative to the amounts of carbon involved and the likely returns for most individual agricultural enterprises. However, the situation may look rather different at the landscape scale. While the incremental increases in stored carbon per hectare may be modest, the areas involved are vast, and soil carbon sequestration can commence relatively quickly compared with other mitigation measures. There is considerable enthusiasm

from some stakeholders for establishment of a trading or offset scheme based on best land management practice and calibrated through regional soil sequestration experiments.

Strategy 5.4

Develop methodologies to protect and manage agricultural soils within urban and peri-urban areas

Maintaining food producing soils and continuing food production in proximity to urban areas is becoming increasingly important to ensure a reliable supply of food close to market. Within the context of potential rises in energy and transport costs, expanding urban populations, water scarcity and demand for agricultural lands for other land uses, there is an emerging need to produce more with less. Expanding peri-urban food production will require innovative methods of food production and soil management in these locations, such as greater use of recycled water and comprehensive mapping to identify existing and potential agricultural clusters.

Use of soil amendments produced from waste products is expanding in urban and peri-urban areas. There is a need to develop management systems that maximise the beneficial use of these products whilst managing risks associated with chemical, biological and physical contaminants.

Policy Implementation

Responsibility for the implementation of this policy rests in the first instance, with government agencies and authorities. The Soil Conservation Commissioner appointed under the *Soil Conservation Act 1938* will have the key coordinating role.

Land owners, industry groups and the community also have a vital role in adopting the principles and undertaking direct initiatives on the ground. Where there are shared or overlapping responsibilities between stakeholders, it is crucial that there is cooperation in the implementation of soil management programs.

The *NSW Soils Policy* proposes to employ the full scope of implementation tools available in the most effective combination to improve soil health. Partnerships with land managers, educators, researchers, community groups, business, philanthropic organisations, NGOs and agencies will seek to maximise contributions from all relevant stakeholders.

A NSW Soils Network will be established, consisting of soil practitioners and professionals from government and non-government organisations, to assist in coordinating the implementation of the policy and to determine responsibilities, priorities and timeframes for the actions required to achieve the policy goals and objectives.

Roles and Responsibilities

The Soil Conservation Commissioner will coordinate the implementation of the *NSW Soils Policy*, with the assistance of relevant government agencies and authorities and NGOs. This will facilitate the formation of collaborative partnerships to prioritise and implement the actions across government agencies and with other relevant groups who have responsibilities or interests in soil management.

Roles and current responsibilities of the relevant agencies, authorities and some other organisations are summarised in Appendix 1.

Monitoring and Review

Progress in implementing the *NSW Soils Policy* will be monitored to ensure the principles and identified actions remain relevant, achievable and current. Progress reports will be coordinated by the Department of Primary Industries (DPI) in consultation with the NSW Soils Network. Progress will be reported to the Soil Conservation Commissioner and the Natural Resources and Environment CEO Cluster Group. Where relevant, data collection and reporting will be undertaken at both the catchment scale through the existing 13 state of the catchment reports, and at the state scale through state-wide assessments published in the state of environment reports. DPI will also coordinate the exchange of information throughout the NSW Soils Network.

It is intended that the *NSW Soils Policy*, will be formally reviewed in five years time to ensure that it is effective and meeting contemporary needs.

Appendix 1

Roles and Responsibilities

Department of Primary Industries

The Department of Primary Industries (DPI) has a regulatory role, as well as supporting Catchment Management Authorities and being a significant provider of research and education in soil related issues. DPI conducts a variety of projects, research programs and training, such as the Soil and Organics Research Unit undertaking soil survey and site characterisation for both research and commercial uses of agricultural and forest land; and research to protect and enhance the chemical, physical and biological fertility of soil resources that underpin agriculture and forestry production systems. DPI provides adult education resources and practice change programs related to primary industries, agricultural and conservation land management through services such as PROfarm, Tocal and the Murrumbidgee Rural Studies Centre which provide training to farmers, primary industries, agribusiness and the community. In addition, DPI runs LandLearn NSW, which is a state-wide schools education program about primary industries.

The Catchments Management directorate within DPI provides Natural Resource Management (NRM) investment support critical to the function of CMAs.

The Crown Lands Directorate of DPI practices sustainable management of state-owned lands for the benefit of the people of NSW. The division manages a total area of approximately 47.3 million hectares.

DPI also administers the provisions of the *Soil Conservation Act 1938* (some parts jointly with the Office of Environment and Heritage), under which the position of the Soil Conservation Commissioner is established.

DPI will establish and convene a NSW Soils Network which will comprise representatives from relevant agencies and other groups. The NSW Soils Network will be responsible for the coordination of actions and the oversight of the implementation of this policy. It is intended that the NSW Soils Network will replace the existing Soils Policy Working Group.

The Office of Environment and Heritage (within Department of Premier and Cabinet)

The Office of Environment and Heritage (OEH) has broad responsibilities within the soils discipline including managing the state's natural resources, actions to minimise the impacts of climate change, regulation of activities to protect the environment, and carrying out biodiversity, plant, environmental and cultural heritage science and research to improve decision making. OEH develops and coordinates strategic policies and programs, including the NSW response to climate change. OEH is also responsible for NSW state of the environment reporting and the regulatory responsibilities of the *Native Vegetation Act 2003*.

The Environment Protection Authority lead the state's response to regulating a diverse range of activities that can impact on the health of the NSW environment and its people. The Scientific

Services Division undertakes scientific research, investigation, monitoring, analysis, evaluation and reporting on a wide range of natural resource and environmental issues.

Within OEH, the National Parks and Wildlife Service is a major land manager of 875 national parks and reserves across NSW

Department of Planning and Infrastructure

The role of the Department of Planning and Infrastructure (DP&I) is to administer the NSW planning system and achieve the management of natural, environmental and cultural resources, facilitate sustainable growth in appropriate locations and integrate regional infrastructure and government activities through its strategic and regulatory functions. DP&I has a major role in regional strategic land use planning, having developed regional strategies for all high growth areas of the state. These direct the location of future development into areas most suited to development whilst protecting significant environmental and natural resources. DP&I also has a role in the assessment of major economic developments, such as mining, and infrastructure projects, and ensuring that there is adequate and appropriate land reserved and available for industry, commerce and services.

Catchment Management Authorities

CMAs are responsible for managing natural resources at the catchment scale. Their key roles include preparing Catchment Action Plans (CAPs) and managing incentive programs to implement the plans. The preparation of CAPs involves integrating previous work with the latest information and science and with local knowledge. CMAs work with farmers, Landcare and other 'carer' groups, Aboriginal communities, local government, industry and state agencies to respond to the key NRM issues facing their catchments. CMAs have a role in delivering funding to priority regional projects, administering and managing native vegetation agreements under the *Native Vegetation Act 2003*, capacity building and delivery of practical environmental outcomes at the local level.

Community Organisations

Community and volunteer environmental groups such as Landcare play a significant role in the sustainable management of soils. The National Landcare Program was established in 1992 to work towards sustainable ecosystems. Its primary focus on sustainable agriculture included improved management of the natural resource base — soils, water and vegetation — at the farm level. The National Landcare Program finished on 30 June 2008, and funding is now provided from the Australian Government through the Caring for our Country program. Caring for our Country encourages collective action by landholders, businesses and communities. This partnership between government and the community is critical to sustainable management of our rural environment and natural resources. Landcare continues to foster projects under the Caring for our Country program particularly to build community capacity, and bring together farmers, conservationists, local councils, scientists, business, national parks, schools, the general public and more, to form powerful partnerships that result in on-ground improvements.

Local Government

Local councils have a significant role in the direct management and conservation of the environment. Land uses and their impacts on land and surrounds are regulated through the application of local environmental plans, development control plans and development assessment criteria. Additional responsibilities relating to land management include the use and care of public lands under their control, preparation of state of the environment reports, and enforcement of the approval requirements of the *Local Government Act 1993*. Local councils are also involved in working with their communities to improve and protect their local environment, including soil resources whether directly or indirectly.

Industry and Land Owners

The occupiers of land who benefit from the natural resources available to them seek to understand their land's capability and constraints, in order to implement new or improved technologies not only to achieve sustainable management and use of soils and the ecosystems of their land, but also to maintain and improve their business viability and longevity. Additionally, industry groups and land owners can take advantage of government initiatives such as incentive funding, training and change management programs to help them improve their land management practices.

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Abbreviations

CAP – Catchment Action Plan

CEM – community environmental monitoring

CEO – Chief Executive Officer

CMA – Catchment Management Authority

DPI – Department of Primary Industries

DoPI – Department of Planning and Infrastructure

EPA Act – the *Environmental Planning and Assessment Act 1979*

NGO – non government organisation

NRC – Natural Resources Commission

NRM – Natural Resource Management

NSW – New South Wales

NV Act – the *Native Vegetation Act 1997*

POEO Act – the *Protection of the Environment Operations Act 1997*

SALIS – Soils and Land Information System

SEPP – State Environmental Planning Policies

SiX – Spatial Information Exchange

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