11 SUSTAINABLE LAND MANAGEMENT

Land and soil resources in NSW are generally being managed sustainably at both statewide and regional scales at the current time. However, some parts of the state are not being managed sustainably for individual soil hazards.

Whether land is managed within its capability is a short-term assessment, based on the impact of present land management practices and the resultant risk of soil degradation occurring. Sixty-nine per cent of soil monitoring units surveyed were rated as poor or very poor for the management of one or more of the seven land degradation hazards.

The main hazards of concern, identified at various locations across the state, are soil acidification and wind erosion. Salinity and decline in organic carbon are also issues for particular soil types and specific regional areas.

Land and soils subject to more intensive land uses are at greater risk of not being managed within their capability.

The unpredictability of severe climate or weather events, and of economic conditions, interacts with management decisions to increase the risk of degradation where land use is marginal for a district.

NSW indicators

G Good M Moderate P Poor U Unknown

Indicator and status		Environmental trend	Information availability
Land management within capability	M	Unknown	✓

Notes: Terms and symbols used above are defined in About SoE 2015 at the front of the report.

Context

Appropriate land management is vital for the sustainable use of soil and land resources to meet the demands placed on it by current and future generations and to maintain soil productivity and ecosystem services. Managing land within its capability is essential to ensure that soil condition, productivity and valuable ecosystem services are maintained.

The land's capacity to support a range of uses is constrained by intrinsic factors such as soil properties, terrain features, water availability and climatic variability, as well as extrinsic social and cultural factors such as market conditions and government policy. The greater the land's inherent physical capability, the more intensive the land management practices it can support. The key to sustainable land management is to understand the processes that lead to land degradation at any particular place and then manage the land within its inherent capability.

The related Theme 10: Soil condition, describes current soil condition at a particular point in time, which results from the cumulative changes that have occurred over the longer term, since European settlement. It describes the processes that have led to changes in soil condition and accounts for any soil degradation that has occurred.

This Theme 11: Sustainable land management, is an assessment of current land management practices and whether these practices are being conducted within the inherent physical capability of monitored sites to support these practices. It describes the risk or potential change in soil condition over the short term (5–10 years) due to the specific effects of the present land management regime. This is important to inform sustainable management, given the lag between changes in land use or management practices and the subsequent appearance of land degradation or recovery.

The establishment of soil monitoring units (SMUs) across NSW and the land management within capability (LMwC) framework provides baseline data on soil condition and land management. Ongoing monitoring of these sites will enable future SoE reports to report on changes or trends in soil condition and land management over time.

Status and trends

'Land use' is the purpose to which land is put (such as forestry or cropping) whereas 'land management' practices are the detailed activities involved in undertaking the land use (such as tree thinning or stubble burning).

Land and soil capability (LSC) is a classification system to describe the capacity or resilience of land and soil to withstand the known impacts of various land uses. The LMwC framework describes the capacity of the land and soil, for any given LSC rating, to sustain the actual suite of land management practices to which it is subject without causing degradation to soil, land and water resources (OEH 2012).

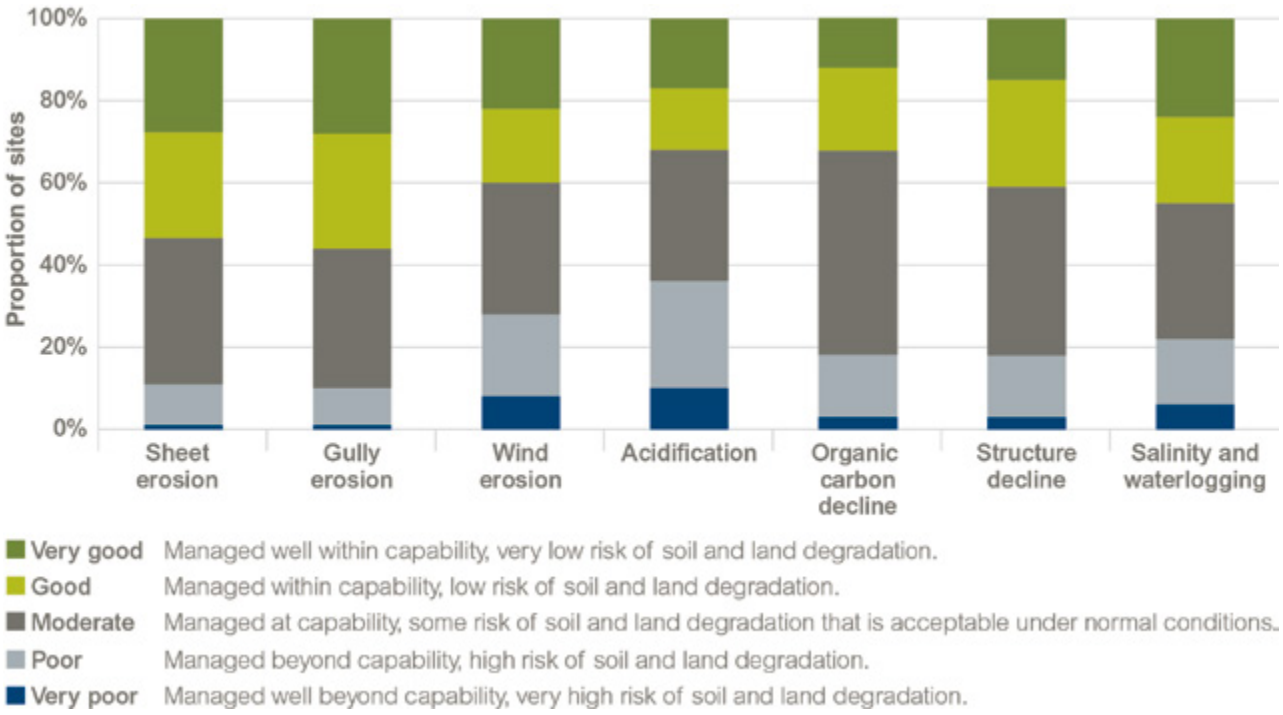
The intensity of the disturbance created by human uses of land, coupled with the characteristics of the land and seasonal conditions, defines the risk of a decline in soil health or the occurrence of land degradation.

Soil health is maintained and does not lead to soil degradation over the longer term where land is managed within its capability, but prolonged exposure to risk increases the probability of a loss in soil condition.

While the processes resulting in land degradation are well understood, the complex relationships between land management, LSC and climate variability, and the cumulative impacts on soil condition that result, are more difficult to assess or readily quantify (Bennett et al. 2010). The LMwC framework was developed to assess these complex relationships. The LSC for each SMU was determined at 662 sites across NSW, to describe their capability to support a range of current land uses. These sites were drawn from the network of soil condition monitoring sites, updated in 2012.

The LMwC of the sites was assessed by comparing current land management practices, based on landholders' records, against the assessed LSC at each site and rating these practices for whether they were within, or beyond, the capability of the land. This assessment was conducted following the methodology and rules specified in the LMwC framework (Gray et al. 2011; Gray et al. 2015).

Figure 11.1: Proportion of soil monitoring units in each land management within capability rating class by soil degradation process



Source: OEH 2014a

The final ratings indicate the extent of present impact or likely risk of each of the seven soil degradation processes or hazards occurring, that describe soil condition outcomes. The same soil degradation processes or hazards (but with waterlogging combined with salinity) were used to assess the overall sustainability of current land use and land management practices, as were used to assess the overall condition of soil in NSW – see the related Theme 10: Soil condition. While Theme 10 describes the cumulative impacts on soil health over the longer term, land management within capability describes the present and ongoing sustainability of current management activities over a shorter term (around 5–10 years).

On a statewide basis, the results presented in Figure 11.1 suggest that land in NSW is generally being managed at a level or intensity that is in accordance with its inherent physical capability; however, there are some parts of the state where individual land degradation hazards are not being managed sustainably. Soils subject to more intensive land uses tend to be at greater risk of being used beyond their natural capability.

The distribution of outcome ratings for each SMU is displayed in Figure 11.1 for each soil degradation process (or hazard).

The percentages of SMUs in each local land services (LLS) region with poor or very poor ratings, that is, those being managed slightly or well beyond capability, so that the risk of land degradation is high or very high, are shown in Table 11.1 (overleaf) for each land degradation hazard.

Of the surveyed SMUs, 69% had a poor or very poor rating for at least one hazard. In these areas, there is a risk of ongoing or future land degradation occurring, due to specific hazards that are not being adequately managed at present.

A brief summary is given below of the main land degradation issues (hazards or risks) that occur where the intensity of management practices exceeds LSC, as revealed by the LMwC assessment process.

Acidification

Thirty-five per cent of all sites have ratings in the poor or very poor range. In many parts of NSW, management of this issue is poor relative to soil capability, with the majority of LLS regions being affected. It is a significant issue of concern (≥25% of sites) in eight of the 11 LLS regions.

Table 11.1: Percentage of soil monitoring units in each local land services region where land management within capability is rated as poor or very poor for any land degradation hazard

Local land services region	Sheet erosion*	Gully erosion	Wind erosion	Acidification	Organic carbon decline	Structure decline	Salinity and waterlogging	SMUs with at least one process rated poor or very poor**
Central Tablelands	20	20	10	40	10	10	20	**60**
Central West	6	6	25	25	19	13	25	**56**
Greater Sydney	14	14	29	71	43	43	29	**71**
Hunter	15	15	8	23	15	15	8	**54**
Murray	17	17	0	50	33	33	50	**100**
North Coast	40	40	10	30	10	10	20	**60**
North West	5	0	19	24	14	5	19	**48**
Northern Tablelands	27	27	18	45	0	0	9	**73**
Riverina	17	17	17	33	50	50	33	**92**
South East	6	6	41	53	0	0	12	**76**
Western	0	0	50	6	6	6	19	**63**
NSW (percentage of all SMUs surveyed)	**11**	**10**	**28**	**35**	**20**	**16**	**21**	**69**
Ranking by severity of issue	**6**	**7**	**2**	**1**	**4**	**5**	**3**	

Source: OEH 2014a
Notes: * Indicates, for example, in Central Tablelands Local Land Service (LLS), 20% of soil monitoring units (SMUs) have sheet erosion rated as poor or very poor.
** Indicates, for example, in Central Tablelands LLS, 60% of SMUs have one or more hazards rated poor or very poor.

Wind erosion

Twenty-eight per cent of all sites have ratings in the poor or very poor range. Locations where this issue is managed poorly are found across much of the state. It is a significant issue of concern (≥25% of sites) in four LLS regions.

Salinity and waterlogging

Twenty-one per cent of all sites have ratings in the poor or very poor range. Locations where this issue is managed poorly are found in many parts of NSW. It is a significant issue of concern (≥25% of sites) in four LLS regions.

Organic carbon decline

Twenty per cent of all sites have ratings in the poor or very poor range. Locations where this issue is managed poorly are found in many parts of the state. It is a significant issue of concern (≥25% of sites) in three LLS regions.

Soil structure decline

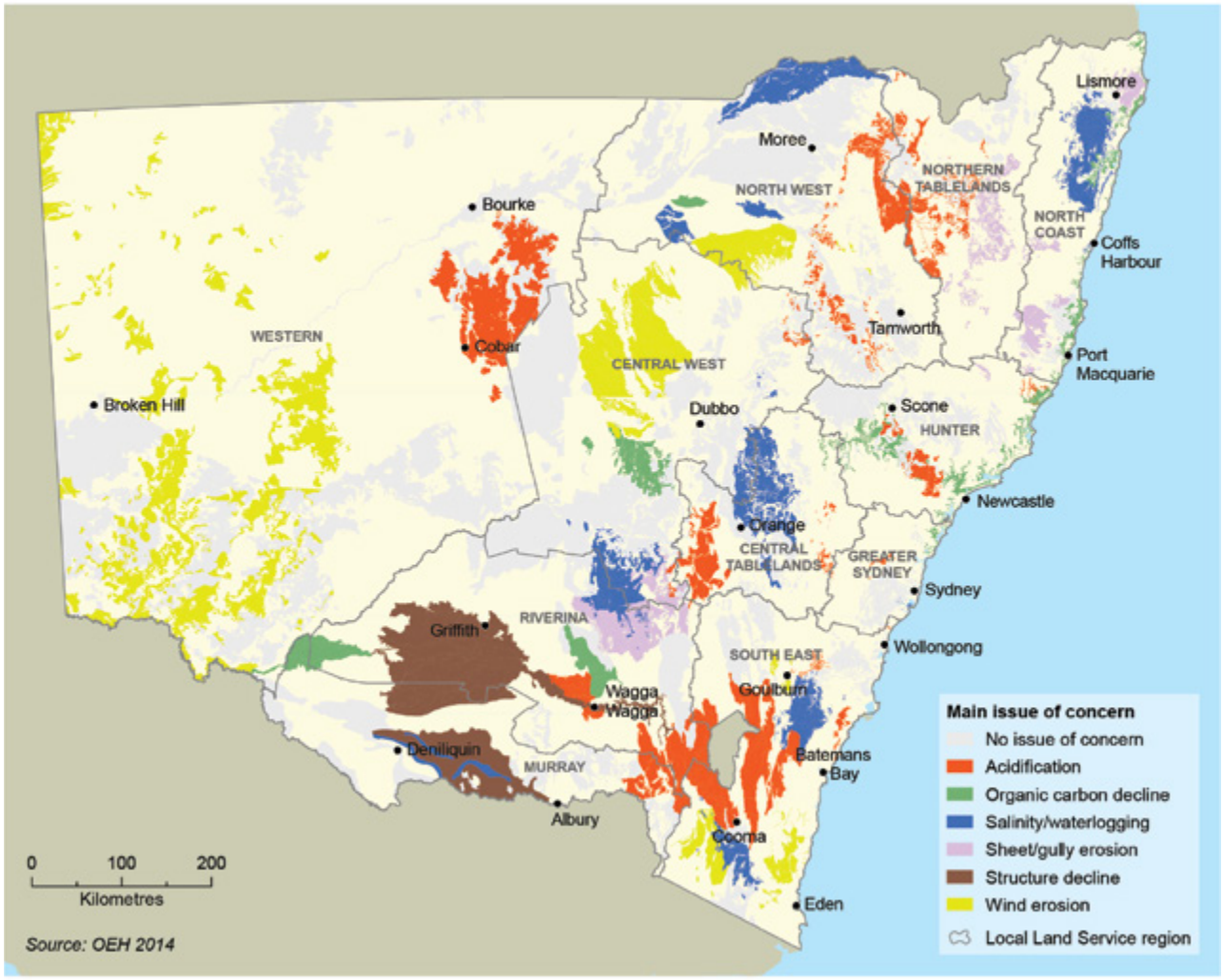
Sixteen per cent of all sites have ratings in the poor or very poor range. The locations where this issue is managed poorly are relatively regionalised within the state. It is a significant issue of concern (≥25% of sites) in three LLS regions.

Management of sheet erosion and of gully erosion are issues confined to localised areas of NSW, and are significant matters of concern in two LLS regions.

The results suggest that on a statewide basis, acidification and wind erosion are the two land degradation issues that are being managed least sustainably. Salinity and waterlogging, organic carbon decline and loss of soil structure are also issues of some concern.

The areas assessed as being at significant risk of ongoing or future degradation as a result of present land management practices are not large. Generally, they tend to occur in clusters of locations where a particular land use is marginal for the district. Map 11.1 shows the main issues of concern for individual SMUs at the present

Map 11.1: Main issue of concern by soil monitoring unit for land management within capability



time, in regard to managing land within its capability across NSW; however, this does not mean that the whole of the SMU is affected by the issue (further details based on the former CMAs are available in OEH 2014a).

Pressures

The pressures that influence land use and land management are numerous. They involve a complex interplay of economic, social and environmental factors.

Intensifying land use

To manage soil sustainably, changes to land use and land management that involve greater levels of soil disturbance demand a higher level of soil capability. As land management practices intensify there is a higher risk of reducing soil condition.

In many parts of NSW, land use is changing to more intense types as the population increases, particularly along the coast and near major urban settlements. These areas have growing populations, which lead to intensification of soil disturbance on all types of land.

Climate variability

Decisions about land use or land management practices can be affected by seasonal weather conditions, increasing the risk of land degradation or a decline in soil condition.

While a soil type may be capable of supporting certain uses or management practices during normal weather patterns, major climatic patterns or events, such as prolonged droughts, severe storms or high intensity rainfall events, can exacerbate land degradation processes and cause extensive damage.

These pressures will be coupled with the expected effects of climate change which are likely to include drying and more extreme weather events for much of NSW (DECCW 2010; Baldock et al. 2012; OEH 2014b). Changes in climate are expected to lead to changes in land use and land management over the longer term.

Economic factors

Land management decisions are often made with imperfect knowledge of future weather patterns and market fluctuations. Declining farm profitability or poor terms of trade can lead to intensified production activities (see 'Appendix 2: Private landholder capacity to manage natural resources' of SoE 2009 (DECCW 2009)).

As fuel becomes more expensive and competition for essential resources like water and fertilisers increases, significant challenges for managing the land sustainably will arise (Cribb 2010). These will be exacerbated in the future by increased population pressures and greater demand for food resources.

Responses

These responses are the same as those described for the related Theme 10: Soil condition.

Legislation and policy framework

Important legislation providing for the protection and management of soil and lands in NSW includes the following.

The *Soil Conservation Act 1938* provides for the conservation of soil and farm water resources and the mitigation of erosion. It establishes the Soil Conservation Service, a state-owned soil conservation and environmental consulting business.

The *Native Vegetation Act 2003* regulates the clearing of native vegetation in NSW by outlining requirements for landowners when they clear native vegetation. Proposals for broadscale clearing of native vegetation must be assessed to determine whether this will improve or maintain environmental outcomes using the Environmental Outcomes Assessment Methodology (EOAM). This methodology establishes specific criteria for the assessment of impacts on land and soils when clearing is being considered.

Policy instruments supporting soil management include:

- the State Environmental Planning Policy (Rural Lands) 2008
- the Policy for Sustainable Agriculture in NSW (NSW Agriculture 1998).

Programs

The performance monitoring system of the Soil Health Evidence Based Assessment (SHEBA) program (formerly SoilWatch) is used in many regions of NSW. It complements and supplements surveillance monitoring throughout the state.

Locally, the Landcare network contributes to integrated natural resource management at a grass-roots level. Nationally there are over 4000 Landcare groups and almost 2000 of these are registered in NSW. Groups are involved with a wide variety of land and water management issues, which can include soil erosion, streambank erosion, weed control, revegetation, degradation of the riparian zone, and farmland improvements. The projects and issues addressed by Landcare groups often assist in effective soil conservation by promoting the sustainable use of soils through education and community awareness programs.

The Soils Unit of NSW Department of Primary Industries (DPI Agriculture) has a large research and development program that develops technologies and management systems to maintain and enhance the physical, chemical and biological productivity of soils, protect the soils resource, build resilience and reduce environmental impacts. DPI Agriculture partners with local land services and private stakeholders to ensure research and development findings are delivered to industry.

The National Committee on Soil and Terrain coordinates and provides advice on soil and land assessment standards and policy. National protocols for monitoring soil acidification and soil carbon have been developed and published (Grealish et al. 2011).

The National Soil Research, Development and Extension Strategy (CofA 2014) will ensure soils research is targeted and collaborative and that research meets the needs of farmers and primary producers. There will also be better information and tools available on soil use and management.

The national strategy:

- provides an overview of soil research, development and extension (RD&E) in Australia, including challenges and drivers for soil RD&E
- considers current investment and capability in soil RD&E
- presents a future RD&E plan, including goals and strategic directions
- considers roles and responsibilities and co-investment
- provides a set of implementation actions.

The Carbon Farming Initiative (CFI) was replaced by the Emissions Reduction Fund (ERF) under the *Carbon Farming Initiative Amendment Act 2014*. The ERF has a number of elements that support sustainable management of soils. The CFI co-funded research under the 'Filling the Research Gap' program with the objective of identifying strategies to increase soil carbon and reduce nitrogenous greenhouse gases, increase productivity and potentially reduce soil acidification. The CFI also co-funded the 'Action on the Ground' program which focused on demonstrations by land managers to boost adoption of management techniques to increase carbon.

The ERF provides funding through a reverse auction mechanism that allows land managers proposing to sequester carbon to be financially rewarded for doing so. The first round of auctions in early 2015 resulted in 47 million tonnes of CO_2-e abatement (28 million tonnes of CO_2-e being contracted for sequestration and 19 million by other means).

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