Building a 'whole of soil' policy framework

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Abstract
This paper describes an approach taken in Victoria, Australia, to describe the role for policy for comprehensive aspects of soil use and management. Political changes in governments and the structure of government departments generate redundancy in policies. An enduring policy framework for soil health should be adaptable to these political changes whilst maintaining a core of principles to guide new policy and investment by government. Soil serves multiple uses that may cut across responsibilities of different government departments. Negotiating shared policy across departments and creation of a 'whole of government' policy for soil health may be seen as a solution, however the path to that solution has the potential to be protracted and without complete resolution. An alternative to this is to develop a soil health policy framework that is a 'whole of soil' framework to which the changing roles of government departments can be fitted. A simple conceptual model that relates soil ecosystem services, threats to soil, and governance for soil protection is described. An example of how this may be applied in the Victorian Department of Primary Industries is outlined.

Key Words
Soil health, ecosystem services, soil degradation, soil protection.

Introduction

Policies and practices that have an impact on soil are diverse and need a framework through which integrity of soil resources can be maintained. There is a diversity of codes, strategies and legislation that affect soil. Planning legislation may or may not have provision for zoning to protect prime agricultural land. Codes of practice may be prescribed for removal, storage and rehabilitation of soil associated with mining and extractive industries. The success of policies concerned with water management have a direct dependence on land use practices within catchments but, except in the case of proclaimed or protected catchments, do not usually exercise any governance over soil use and management within land uses.

Soil conservation developed as the first focus in Victoria for government intervention following the Soil Conservation Act of 1940 and the Soil Conservation and Land Utilisation Act of 1949. Changes in attitude to land management during Australia's 'Decade of Landcare' led to a devolvement of some responsibility for soil and land condition from the State to 10 Victorian Regional Catchment Management Authorities formed under the Catchment and Land Protection Act of 1994. This Act incorporated earlier soil conservation legislation as well as some other acts and is administered by the Department of Sustainability and Environment. Many of the regional authorities have independently developed soil health strategies.

Crawford *et al* (2006) described an initiative to develop a soil health policy framework in Victoria, largely in response to a government committee inquiry into soil acidity. They reported on the need for better partnerships between soil scientists and policy-makers to support evidence-based policy making and proposed a framework in which the onus would be on for government to achieve soil health outcomes of wide benefit through providing land managers with the knowledge, tools and choices to improve soil health, rather than by legislation or directive. This draft policy framework resulted in major investment into a 'Healthy Soils' project to deliver better information to farmers and their advisers in partnership with cropping groups in western Victoria from 2007-2010.

Subsequently, other issues including land use change, climate impacts, the role for soil Carbon sequestration in greenhouse gas mitigation, questions concerning protection of prime agricultural land from peri-urban development, and a growing interest in 'biological farming', have become more prominent. All of these issues have a bearing on soil and its health.

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Methods

The Department of Primary Industries (DPI) is taking leadership in addressing the need for a policy framework that has the potential to be inclusive of diverse issues that may lie within the jurisdiction of other government departments but without dictating the policies that those departments might develop. A four project team comprising policy and technical specialists is charged with writing a framework.

Definitions

Agreement concerning terminology, definitions and scope for the framework was achieved through consultation with a broader reference group and DPI executive. There is a substantial body of international literature on soil health and soil quality and this was reviewed previously (DPI 2007). There are several definitions but all have common ground in affirming the importance of soil functions. The performance of these functions depends on biological, chemical and physical soil properties and processes. However, much of the published material on this subject is highly technical and not suitable for explaining policy, particularly when trying to determine societal benefits whether they are private or public.

Ecosystem Services versus threats

Past policies have largely focussed on threats or hazards but the language and objectives in natural resource management (NRM) have recently become more holistically focussed. The notion of 'ecosystem service' provision now has currency as the major criterion for assessing the functional worth or capacity of the natural and the managed environment. This is in contrast to the more reactionary alternative approach in NRM that has been more focussed on negative aspects associated with environmental degradation. There are many programs and initiatives that have been, and are being, implemented to address these issues e.g. the National Soil Conservation Program was developed to progress management improvements to prevent or ameliorate erosion, salinity, acidification, soil structure decline. However, the underlying reasons for dealing with them have always been positive, for example, that by addressing these issues, land management will be more productive and sustainable and water quality will be improved. The ecosystem service concept provides an integrated positive driver for NRM just as the soil health concept provides an integrated (albeit symbolic) paradigm for managing the diverse issues that arise in soil management.

Governance

Soil health can be viewed in terms of its functional capacity to deliver ecosystem services and it can also be considered in relation to the threatening processes that would impair that capacity. Governance is required wherever serious threats to sustained service provision exist. This governance may include: accepted 'best management practices', documented Codes of Practice (e.g. forestry), government strategies, polices and Acts of Parliament. The degree to which legislation is required, including penalties and enforcement, depends on the judgements exercised at a policy level. Determinations for government investment to support practices for improving or maintaining soil health require a balancing of private and public benefit, and an economic assessment of 'market failure'.

Results

Definitions

For the purposes of the soil health policy framework, the following definition was agreed:
Soil health is the condition of the soil in relation to its potential to provide ecosystem services and resist degradation.

The Millennium Ecosystem Assessment (MA) defined ecosystem services as:
'the benefits people obtain from ecosystems'. 'These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth' (MA 2003).

The MA framework can be used to describe ecosystem services from soil. However, although the majority of literature concerned with soil health refers to functions of soil in a similar way the emphasis is specific to soil. In this report we have adopted the terminology used in key literature concerning soil quality and soil health. A summary of the functions and services expected from healthy soils (illustrated in Figure 1) in relation to the MA (2003) ecosystem services (provisioning, regulating, cultural and supporting) follows. The importance of particular aspects of these services to some government departments and authorities is noted.

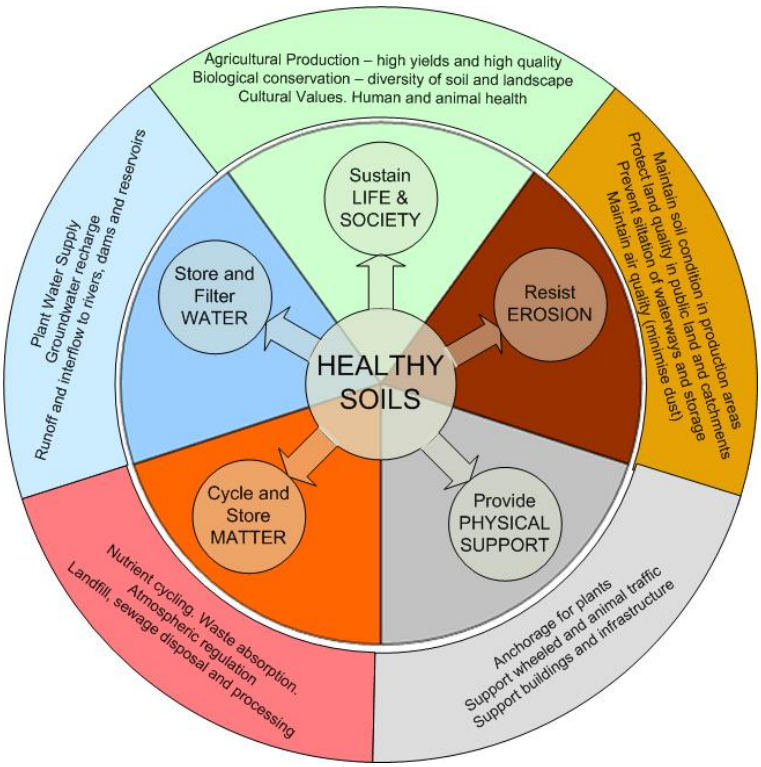

Figure 1. A summary of the functions and services expected from healthy soils.

Sustain life and society
Essentially, the provisioning services (primary industries) for food, fuel, fibre and other genetic resources, discovered or undiscovered, associated with global biodiversity, are encompassed here. Also included are cultural services — the recreational, aesthetic and spiritual values invested in significant sites and landscapes (sports turf, gardens and sacred sites). Multiple agencies share an interest in, or accountability for, soil issues in this sector: DPI (agricultural productivity and animal health); DSE (biological conservation); DPCD (sports, heritage, community development); DoH (human health).

Store and filter water
Soil performs regulatory services in the hydrologic cycle. It is the interface between rainfall and terrestrial flows, regulating recharge to groundwater, runoff and stream flow. The storage of plant available water in soil is a vital supporting service required for provisioning plant growth. Filtering water on its path to groundwater, rivers and storages is an important supporting service influencing water quality. All of these hydrologic services are highly dependent on soil conditions that are sensitive to management. Consequently, this is an important area for soil health policies. Principal agencies concerned with soil issues in this sector are: DPI (understanding and managing soil water use in farming systems); DSE (surface and groundwater management, catchment management) and water authorities (land use, water supply and quality, catchment management).

Cycle and store matter
The suite of processes that regulate the cycling of matter through and within soil influence services that support plant growth via nutrient cycling, and those that have a role regulating atmosphere. The dynamics of carbon storage, release of greenhouse gases and relation to soil type, soil health and management are critical to the development of relevant soil health policies. Soil is also expected to perform regulatory and supporting services related to waste disposal, management and absorption. These services may be site specific as in the use of soil for containing and capping landfill, and for land application of wastes as fertilizers. Waste absorption services are also linked to hydrologic functions in which soil serves as an environmental buffer between land-based water-borne pollution sources and receiving surface and ground water resources. These latter services are diffuse, extensive and catchment based. The DPI (nutrient cycling, atmospheric regulation / greenhouse abatement), DSE (atmospheric regulation / greenhouse abatement) and EPA (waste management) are key government agencies with interest or jurisdiction within this sector.

Provide physical support

In natural and agro-ecosystems, soil provides anchorage for plant roots and physical support for machinery and animals. These functions support services that are cultural (e.g. sports turf, parks and gardens) and provisioning (agricultural production systems). Soil that is strong enough to support heavy machinery is too compacted to support plant growth, and soil that has optimal physical conditions for roots is easily degraded (compacted) by foot and wheel traffic. This example demonstrates that fitness of soil conditions depends on use — controlled traffic cropping practices solve this dilemma by consistently restricting wheels to specific tracks. In the built environment, soil provides a source of building material as well as the underlying support for buildings and protection for buried infrastructure and utilities. There are significant hazards to infrastructure associated with certain soil types and soil degradation processes. For example: acid sulfate soils , if allowed to oxidise, generate large volumes of corrosive sulfuric acid; shrinkage of reactive clay soils can damage building foundations; landslides can cause destruction of buildings, roads and buried utilities (e.g. water and gas pipes). Maintaining the supporting services of soil in the built environment requires a combination of hazard avoidance (appropriate planning and development) and hazard management (e.g. drainage for landslides, saturation of potential acid sulfate soils). The DPI (tillage, traffic and soil health), DPCD (land use planning and assessment, local authorities (planning, development) and utility managers (underground distribution networks) all have responsibilities in this sector.

Resist erosion

This is a supporting service. Provision of ecosystem services requires that soil is resistant or resilient to the pressures that are imposed on it. Healthy soils are more resilient and able to sustain functions and resist degradation than soils in poor condition. Loss of soil through erosion obviously reduces the capacity to provide those services. Soil erosion is a natural process, but accelerated, or management-induced, erosion is a significant global phenomenon. Well-managed soil has qualities that make it more resistant to erosion by wind and water. Surface ground cover as a protecting layer is extremely important here but healthy soils, high in organic matter and with stable structural units can resist detachment and erosion. The DPI (soil management to minimise erosion from agricultural land) CMAs (monitoring and reporting land condition under the CaLP act), DoH and EPA (air quality and human health), DSE (water quality, catchment condition, monitoring), DPCD (land use planning and assessment), local government authorities and VicRoads all have accountabilities within this sector.

Conclusion

We are developing a soil health policy framework that has a strong technical base in the literature on soil health, soil quality and ecosystem services. This can be used to map out areas where governance exists or is needed to manage threats to services. In this way it can serve the changing needs of governments and different accountabilities of departments. It doesn't necessarily provide an instant means of reconciling differences but, by collecting all the issues into one conceptual space, it provides a framework for debate.

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