Discussion Paper on Ecosystem Services for the Department of Agriculture, Fisheries and Forestry

Final Report



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Table of Contents

| 10 | An example framework for the ecosystem services associated with Australian rural lands | | | |
|----|---|--|-----|--|
| | 10.1 | What are rural lands? | 62 | |
| | 10.2 | Applying ecosystem services typologies to rural lands | 63 | |
| | 10.3 | Relating ecosystem services to land management practices | 63 | |
| | 10.4 | Helping rural land managers to find innovative ways to manage ecosystem services | 70 | |
| 11 | Issue in Au | s associated with implementation of an ecosystem services approach stralia | 73 | |
| | 11.1 | Attitudes towards the concept of ecosystem services | 74 | |
| | | 11.1.1 Data from our interviews | 74 | |
| | | 11.1.2 A view from industry | 79 | |
| | | 11.1.3 Insights from the UK National Ecosystem Assessment | 80 | |
| | 11.2 | A system-level view of enablers and blockers of ecosystem services approaches | 80 | |
| | 11.3 | Perceptions from the literature | 92 | |
| | 11.4 | What value might be added to policy by an ecosystem services approach? | 93 | |
| | | 11.4.1 Identifying issues | 97 | |
| | | 11.4.2 Policy analysis | 97 | |
| | | 11.4.3 Policy instruments | 97 | |
| | | 11.4.4 Consultation | 98 | |
| | | 11.4.5 Coordination | 98 | |
| | | 11.4.6 Decision | 98 | |
| | | 11.4.7 Implementation | 98 | |
| | | 11.4.8 Evaluation | 99 | |
| | | 11.4.9 Contributions to other dimensions of policy analysis | 99 | |
| | | 11.4.10 Potential costs | 100 | |
| | 11.5 | Key issues and recommended actions | 101 | |
| | 11.6 | Achieving strategic, holistic environmental-social thinking and planning across interest groups, sectors, government departments, and levels of government and society | 104 | |
| | 11.7 | Application of an ecosystem services approach in food, environment, agriculture and population policy | 106 | |

Tables

| Table 11: An example of a typology of ecosystem services provided by agricultural lands. ¹³⁶ | 63 |
|--|----|
| Table 12: Soil-based ecosystem services appropriate to Australia illustrating the distinction between intermediate (supporting) services and final services (which lead directly to benefits) (from Bennett <i>et al.</i> 2010). ³⁰ | 65 |
| Table 13: Public benefits potentially impacted by changes in soil management (fromBennett et al. 2010).30 Codes for services relate to Table 12. | 66 |
| Table 14: Estimated change in public and private net benefits produced by a change in soil management of light-textured Calcarosols in the Murray Mallee Bioregion from conventional tillage to either conservation tillage or restored native vegetation (from Bennett <i>et al.</i> 2010). ³⁰ | 67 |
| Table 15: Five-year outcomes and strategies for Sustainable Farm Practices under Caring for Our Country. ¹² | 69 |
| Table 16: Example of mapping land management practices to ecological processes | 69 |
| Table 17: Summary of interview responses | 74 |
| Table 18: Australian Government departments whose policies and programs affects the delivery of ecosystem services to Australians and/or might benefits from a strategic consideration of ecosystem services | 84 |
| Table 19: Summary of the enablers and blockers of ecosystem services approaches identified in Figure 23 | 88 |
| Table 20: Ways in which ecosystem services approaches can add value to policy and decision-support cycles | 95 |
| Table 21: Potential contributions of an ecosystem services approach to social, technological, economic, environmental and political/legal dimensions of decision-making | 99 |

Figures

| Figure 19: Distribution of population and area across predominantly urban, intermediate and predominantly rural regions in the OECD in 2005. ¹⁷¹ | 62 |
|--|----|
| Figure 20: Spatial scales of metrics that relate to ecosystem services from rural land management. ⁷⁶ | 64 |
| Figure 21: Conceptual relationship between land management practices, ecosystem services and benefits from ecosystems to people. | 65 |
| Figure 22: Ecosystem services as a foundation for resilience and sustainability (Dixon Landers, US EPA, personal communication 2011) | 76 |

| Figure 23: System map (depiction of key relationships, processes and issues that interviewees considered to affect Australia's ability to consider the full range of benefits from the environment strategically and to translate this into | |
|---|----|
| human wellbeing). | 82 |
| Figure 24: Framework proposed by Turner and Daily (2008) ²²² for integrating ecosystem services analysis with policy and other decision-making cycles | 94 |
| Figure 25: An operational model proposed by Cowling <i>et al.</i> (2008) ⁷⁰ for making assessment and management of ecosystem services part of mainstream | |
| decision-making | 94 |

Boxes

| Box 6: The Communities in Landscape Project. ⁵⁷ | 1 |
|---|---|
| Box 7: Key points of difference in opinions about ecosystem services | 7 |
| Box 8: Key pathways helpful to the adoption of the sort of holistic, strategic environmental-social thinking and planning that an ecosystem services approach encourages, together with key factors working again those helpful | |
| cycles8 | 3 |

10 An example framework for the ecosystem services associated with Australian rural lands

Key conclusions from this chapter:

- A framework for ecosystem services associated with rural lands should have the following characteristics:
 - A clear definition that is relevant to, and can be understood by, all stakeholders and is sufficiently broad to allow adaptation by different stakeholders to different situations but provides sufficient principles to avoid misinterpretation or miscommunication
 - A typology that, as far as is possible, aligns ecosystem services and the ecological processes that underpin them with theory and practice in ecology and economics
 - Acknowledges policy imperatives of government land management agencies as well as imperatives of businesses and communities living and working in and rural and regional Australia
- Existing typologies for ecosystem services need no modification for application to Australia's rural lands (i.e., lands outside major urban centres), as rural lands represent over 99% of the area of Australia and therefore potentially deliver the full range of ecosystem services identified in existing typologies
- Rural land other than those in protected tenures represent over 60% of Australia's land area and are managed for purposes such as agriculture, forestry, fisheries and mining
- Managers of rural lands play a role in the delivery of benefits from ecosystem services in two ways: (1) they provide input of human and other capital to turn some ecosystem services into benefits (e.g., ecosystems provide the conditions for growing food and inputs from farmers allow food to be produced); and (2) they influence ecosystem processes (e.g., the role of native vegetation in soil retention or the role of soil organisms in maintaining soil fertility), which produce ecosystem services
- Strategies for achieving sustainable farm practices under Caring for Our Country already focus implicitly on improving delivery of ecosystem services
- Data being collected on land management practices under Caring for Our Country can be used to draw inferences about impacts of improved land management on ecosystem processes, ecosystem services and benefits to Australians, and steps are already being taken to establish these links.

Drawing on previous chapters of this report, a framework for ecosystem services associated with rural lands should have the following characteristics:

- A clear definition that is relevant to, and can be understood by, all stakeholders and is sufficiently broad to allow adaptation by different stakeholders to different situations but provides sufficient principles to avoid misinterpretation or miscommunication
- A typology that, as far as is possible, aligns ecosystem services and the ecological processes that underpin them with theory and practice in ecology and economics

• Acknowledges policy imperatives of government land management agencies as well as imperatives of businesses and communities living and working in and rural and regional Australia

Below, we consider how existing typologies of ecosystem services can be adapted and aligned with current and future policy and management initiatives for improving the delivery of benefits to Australians from rural lands.

10.1 What are rural lands?

Rural lands are all lands outside major urban settlements. By the Organisation for Economic Cooperation and Development (OECD) definition (Figure 1), around 85% of Australia's area is predominantly rural and most of the rest is rural with large urban centres embedded in it.



Figure 1: Distribution of population and area across predominantly urban, intermediate and predominantly rural regions in the OECD in 2005.¹⁷¹

Regions are classified as 'Rural' if more than 50% of its population lives in rural local units (less than 150 inhabitants per square kilometre), except where there is an urban centre larger than 200,000 inhabitants that contains more than 25% of the regional population (in which case the region is classified as 'Intermediate').

Less than 0.2% of Australia's land area is taken up by built environments and around 37% is protected or used only minimally.⁴⁵ This means that a large proportion of the ecosystem services that provide benefits to Australia's human population come from over 60% of Australia's land area that is managed for purposes such as grazing of natural vegetation, grazing of modified pastures, production forestry, plantation forestry, dryland cropping, dryland horticulture, irrigated pastures and cropping, irrigated horticulture, and mining. ⁴⁵

10.2 Applying ecosystem services typologies to rural lands

The typologies for ecosystem services reviewed in Section **Error! Reference source not found.** require little modification to be applied to rural lands in total (i.e., including protected tenures) as these typologies have been developed for most of the types of ecosystems occurring in rural lands, both in Australia and globally. Lands outside protected tenures, including land managed for agriculture, forestry and fisheries, also provide ecosystem services (Table 1). Considerable attention is being given to identifying and paying for ecosystem services from various land tenures, but particularly forests, in China.²⁴⁶

| Benefit | Ecosystem services |
|--|--|
| Harvests | |
| Managed commercial | Pollinator populations, soil quality, shade and shelter, water availability |
| Subsistence | Target fish, animal, and plant populations |
| Pharmaceutical | Biodiversity |
| Amenities and fulfillment | |
| Aesthetic | Natural land cover in viewsheds; rural landscapes |
| Bequest, stewardship, spiritual, emotional | Wilderness, biodiversity, varied natural land cover and rural agri-landscapes |
| Existence | Relevant species populations; relevant rural agri- landscapes |
| Damage avoidance | |
| Health | Air quality, drinking water quality, land uses or species |
| | populations hostile to disease transmission |
| Property | Wetlands, forests, natural land cover |
| Waste assimilation | |
| Avoided disposal cost | Surface and groundwater, open land |
| Drinking water provision | |
| Avoided treatment cost | Aquifer, surface water quality |
| Avoided pumping/ transport cost | Aquifer availability |
| Recreation | |
| Birding/wildlife watching | Relevant species populations |
| Hiking, biking, pleasure driving | Natural land cover, rural agri- landscapes, vistas, surface waters |
| Angling | Surface waters, target species populations, natural land cover |
| Hunting | Natural land cover, target species populations |
| Swimming | Surface waters, river banks, lake shores |

| Table 1: An exam | nle of a typology | of ecosystem services | nrovided by agri | cultural lands ¹³⁶ |
|-------------------|--------------------|--------------------------|--------------------|-------------------------------|
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10.3 Relating ecosystem services to land management practices

The literature contains many analyses of changes in ecosystem services over the past century and attributes many of these changes to the expansion of agriculture and associated land management practices.¹⁴⁴ Agriculture generally increases provisioning ecosystem services at the

expense of regulating and cultural ecosystem services that are often higher in less humandominated ecosystems.¹¹⁰ Increasingly, there are analyses of how these declines can be addressed through management of soils, water, vegetation and other landscape components at landscape scales using an understanding of the relationships between ecosystem processes `and how they relate to the maintenance of functional ecosystems and benefits to humans.^{30, 108, 110} Examples are given later in this sub-section.

To allow the impacts of rural land management on ecosystem services to be considered in developing policies and programmes, suites of indicators are required that are pertinent at different spatial resolutions.¹⁸⁴ ⁷⁶ Figure 2 illustrates the different types of indicators required to assess ecosystem service implications of international and national policies and programs, such as Caring for Our Country or programs for addressing Australia's obligations under international conventions such as RAMSAR, compared with individual programmes, such as component programmes of Caring for Our Country or the Murray Darling Basin Plan, and interventions at farm-scale or finer.



Spatial Scale

Figure 2: Spatial scales of metrics that relate to ecosystem services from rural land management.⁷⁶

The term 'program' in the top axis refers to the scale of individual land management programmes, such as soil conservation programmes or market-based incentives for habitat protection.

By focusing on the effects of land management practices on ecological processes, land management regimes can be understood in terms of how they affect ecosystem services and, therefore, how they affect private and public benefits to a range of beneficiaries (Figure 3).



Figure 3: Conceptual relationship between land management practices, ecosystem services and benefits from ecosystems to people.

Land managers influence benefits from ecosystems to people in two ways: (1) they provide input of human and other capital to turn some ecosystem services into benefits (e.g., ecosystems provide the conditions for growing food and inputs from farmers allow food to be produced); and (2) they influence ecosystem processes (e.g., the role of native vegetation in soil retention or the role of soil organisms in maintaining soil fertility), which produce ecosystem services. Note that some commentators would argue that services provided *because* of intervention by land managers (e.g., services created by planting exotic vegetation) are not truly *ecosystem* services but this does not change the fact that benefits are provided nevertheless.

Table 2 and Table 3 show an example of this approach being applied to considering the ecosystem services and benefits related to soil and soil management in Australia.³⁰ This example illustrates how an ecosystem services approach separates the processes that provide intermediate or supporting services from those that directly provide a benefit to people. Such an analysis then provides a basis for dialogue about when, how and why steps should be taken to improve soil management and who might benefit. This particular example was developed because of concern that debate about the values of soil and the benefits of better management were being under-recognised in decision-making because of a focus on soil health. The authors argued that soil health was not clearly related to ecosystem function or the benefits to people and so there was little incentive for action to address declines in soil health.

Table 2: Soil-based ecosystem services appropriate to Australia illustrating the distinction betweenintermediate (supporting) services and final services (which lead directly to benefits) (from Bennett *et al.*2010).³⁰

Codes in the first column link final services to public benefits in the following table. Intermediate service abbreviations: 'SSM' soil structure maintenance; 'OC' organic matter cycling; 'NC' nutrient cycling; 'IE' ion retention and exchange; 'WC' water cycling; 'GC' gas cycling; 'BC' soil biological life cycles.

| Code | Final services (lead to benefits) | Description | Intermediate services (support final services) |
|------------|--------------------------------------|--|--|
| S1 | Provision of marketable goods | Provision of, e.g. food, fibre, timber | SSM, OC, NC, IE, WC, GC, BC |
| S2 | Soil structure stabilization | Retention of soil (prevention of loss by wind and water) | SSM, OC, BC |
| S 3 | Gas regulation | Consumption/emission of atmospheric gases | SSM, OC, NC, IE, GC, |

| Code | Final services (lead to benefits) | Description | Intermediate services (support final services) |
|------------|--------------------------------------|---|--|
| | | | BC |
| S4 | Carbon sequestration | Net carbon stored in soil | SSM, OC, NC, GC, |
| | | | BC |
| S5 | Water quality regulation | Water filtration/purification | SSM, OC, NC, IE, |
| | | | WC, BC |
| <i>S6</i> | Water yield | Water storage and availability | SSM, OC, WC |
| S7 | Water flow regulation | Mitigation of, e.g. runoff, flooding | SSM, WC |
| S8 | Weather regulation | Ameliorate daily extremes in air temperature and moisture | OC, WC |
| S9 | Remediation of wastes and | Breakdown, immobilization, or detoxification of | OC, NC, IE, BC |
| | pollutants | excess or harmful organic and inorganic materials | |
| S10 | Disease and pest regulation | Control of potential pests and pathogens | BC |
| S11 | Habitat provision/genetic | Habitat for and maintenance of soil biodiversity | SSM, OC, NC, WC, |
| | resource maintenance | (genes, species, phyla, functional groups) | GC |

Table 3: Public benefits potentially impacted by changes in soil management (from Bennett *et al.* 2010).³⁰ Codes for services relate to Table 2.

| Public benefit | Description | Service |
|----------------------------|---|------------------|
| Rural economic activity | Decreased vulnerability of rural societies | S1 |
| Future choices | Sustained soil capital to accommodate future land uses or | S2, S9, S10, S11 |
| | expectations | |
| Clean air | Healthy air quality (e.g. low dust load, low pollutants) | S2, S3, S9 |
| Favorable climate | Climate change mitigation, and local climate amelioration | S3, S4, S8 |
| Water quality | Water quality meets or exceeds standards for required uses | S2, S5, S9, S10 |
| Water volume | Sufficient quantity of water available for required uses | S6, S7 |
| Protection of physical | Protection of buildings, machinery, etc. against, e.g. excess | S2, S5, S7 |
| assets | windborne soil, landslide, flood damage | |
| Novel products | Discovery/development of new public good products for, e.g. | S11 |
| | pharmaceuticals, material development | |
| Pollution control | Containment of wastes, pollutants, toxins | S9 |
| Disease and pest control | Containment of soil-based diseases and pests | S10 |
| Reduced pesticide use | Reduced exposure to potentially harmful chemicals | S10, S11 |
| Soil inoculation potential | Increased potential for inoculation by useful biota (e.g. root | S11 |
| | symbionts in revegetation) | |
| Ecosystem resilience | 'Insurance' (and associated avoided cost) for disturbance | S2, S4, S6, S11 |
| | recovery in the form of, e.g. stored water, functional | |
| | diversity of biota | |
| Aesthetics | Expectations of soil-based aesthetics, sense of place, cultural | S2 |
| | heritage | |

The authors of the research reported in Table 2 and Table 3 also identified 'ecosystem disservices', such as salinisation, acidification, wind erosion and organic matter decline. Others

in the literature have also referred to disservices, but we suggest it is better to consider these as the results of declines in services. For example, salinisation is the result of reductions in deeprooted plants in a landscape and therefore a reduction in the service of watertable regulation. We suggest that it is inconsistent with the concept of ecosystem services to argue that ecosystems are causing salinisation or the other disservices listed above. Water and wind erosion are, indeed, caused by non-living elements of the environment but they have their effect because of reductions in the living components (plants).

This research illustrates another important aspect of ecosystem services approaches that has been mentioned several times elsewhere in this report — assessing the likely relative consequences of alternative decisions in terms of human wellbeing often can be done from expert judgement based on existing ecological knowledge sometimes does not require economic valuation or even a monetary analysis at all. Table 4 shows the qualitative assessment done by Bennett *et al.*³⁰ based on their judgement about the impacts of management on the services and benefits identified in Table 2 and Table 3. This is an example of how strategic exploration of decisions with an environmental component could be carried out at a range of scales. In some cases more research and/or analysis might be needed to support strategic decisions but often the qualitative assessment will reveal the best option or at least the major risks and uncertainties.

Table 4: Estimated change in public and private net benefits produced by a change in soil management of light-textured Calcarosols in the Murray Mallee Bioregion from conventional tillage to either conservation tillage or restored native vegetation (from Bennett *et al.* 2010).³⁰

Assessments were qualitative (expert judgement). Anticipated change of '+3' indicates considerable increase in net benefit, '0' indicates no change, and '-3' indicates considerable decrease in net benefit relative to conventional tillage. 'ND' indicates not determined due to insufficient information.

| Net benefit type | Anticipated change (-3 to +3) | |
|-------------------------------|-------------------------------|----------|
| | Conservation tillage | Restored |
| Public | | |
| Rural economic activity | 0 | -2 |
| Future choices | +1 | +2 |
| Clean air | +2 | +3 |
| Favorable climate | 0 | ND |
| Water quality | -1 | +1 |
| Water volume | +1 | -1 |
| Protection of physical assets | 0 | +2 |
| Novel products | ND | ND |
| Pollution control | ND | ND |
| Disease and pest control | ND | ND |
| Reduced pesticide use | ND | ND |
| Soil inoculation potential | ND | ND |
| Ecosystem resilience | +1 | +1 |
| Aesthetics | +1 | +1 |
| Balance | +5 | +6 |
| | | |
| Private | | |
| Short-term profit | 0 | -2 |

| Net benefit type | Anticipated change (-3 to +3) | |
|-------------------------------|-------------------------------|----------|
| | Conservation tillage | Restored |
| Financial certainty | 0 | -1 |
| Ease of implementation | 0 | -1 |
| Future choices | +1 | +1 |
| Clean air | +2 | +3 |
| Protection of physical assets | +2 | +3 |
| Reduced pesticide use | ND | ND |
| Aesthetics | +1 | +1 |
| Balance | +6 | +4 |

More refined estimates of overall net benefit can be obtained by weighting individual net benefits in terms of such factors as their likelihood, degree, consequence, scale, direction, and time lag.³⁰

Other approaches to classifying soil ecosystem services have been proposed (Appendix VI). These differ in detail from that of Bennett *et al.*³⁰ (e.g., there are differences in how ecosystem function, processes, services and benefits are distinguished and distinctions between intermediate and final services differ slightly) but the broad philosophy is similar across approaches. Rather than endorse one or the other, we recommend that anyone wanting to apply a typology consider their objectives and then match those to the reasons for which different typologies have been developed.

A beginning towards applying this sort of approach in national environmental policy is being made through the Sustainable Farm Practice strategies and targets in Caring for Our Country (Table 5).

| Table 5: F | ive-vear outcomes a | nd strategies for | Sustainable Fa | rm Practices under | r Caring for Our | Country. ¹² |
|------------|---------------------|-------------------|----------------|--------------------|------------------|------------------------|
| | | | | | | |

| Five-year Outcomes: By 2013, Caring for our Country will: | Strategies To Achieve The Five-Year Outcomes: |
|---|---|
| Assist at least 30 per cent of farmers to increase their uptake of sustainable farm and land management practices that deliver improved ecosystem services | Improve the environmental outcomes from farm management while maintaining or improving productivity: Support on-farm actions and investments that improve natural assets (including soil, water and biodiversity) and reduce the impact of invasive species Support the use of flexible, innovative and cost-effective approaches, including market-based incentives, to deliver sustainable on-farm natural resources management and improve our natural assets |
| Increase the number of farmers who adopt stewardship, covenanting, property management plans or other arrangements to improve the environment both on- farm and off-farm | Provide information to allow farmers to make better decisions in a changing climate: Support the uptake of sustainable farming techniques and technology by providing information and advice on: new technologies, sustainable farm practices, and ecosystems services the management of emerging threats to sustainable food and fibre production, including weeds, salinisation and pest animals. |
| Improve the knowledge, skills and engagement of at least 30 per cent of land managers and farmers in managing our natural resources and the environment | Work with community and industry organisations, including landcare, to accelerate the adoption of more sustainable farm management Support the work of voluntary groups, including landcare groups, to build the skills and capacity of land managers and farmers to deal with emerging threats and opportunities relating to sustainable production and land management. Encourage effective partnerships between key stakeholders, including industry, regional, community and landcare groups, research and teaching organisations and governments which will drive on-ground practice change. |

To assess progress towards these outcomes, Caring for Our Country commissioned the Australian Bureau of Statistics (ABS) to establish the Agricultural Resource Management Survey to report every two years on land management practices being used by Australian farmers.¹⁶ This survey reports on the extent of different categories of rural land and the types of land (including soil) and biodiversity management being applied to those lands.¹⁶

From these types of data, it should be possible to adopt the approach illustrated in Figure 3. Table 6 is an example of how this can be done (it refers to soils but the approach could be applied to all aspects of land management in rural lands).

Table 6: Example of mapping land management practices to ecological processes.

This table draws on the results of the 2008-08 ARMS relating to practices expected to improve soil condition (Michele Barson, personal communication, August 2011). From this information inferences can be made

about how management practices might affect delivery of ecosystem services and benefits to humans as described in Figure 3.

| Practice | Type of agriculture | Increases Carbon content | Reduces risk of wind erosion | Reduces risk of water erosion | Reduces risk of soil acid- ification (low pH) |
|---|--|--------------------------------|---------------------------------------|--|---|
| No cultivation/ tillage apart from sowing | Broadacre cropping | Indirectly | Y | Y | |
| Crop residue left intact | Broadacre cropping | Υ | Y | Y | |
| Reduce fallow | Broadacre cropping | Y | Y | Y | |
| Soil pH testing | Broadacre cropping Horticulture Dairying Grazing (beef cattle/ sheep meat)^ | Indirectly | Indirectly | Indirectly | Y |
| Soil nutrient testing | Broadacre cropping Horticulture Dairying Grazing (beef cattle/ sheep meat)^ | | | | Y |
| Lime or dolomite applied to reduce soil acidity | Broadacre cropping Horticulture Dairying | Indirectly | Indirectly | Indirectly | Y |
| | Grazing (beef cattle/ sheep meat)^ | | | | |
| Monitoring of ground cover | Grazing (beef cattle/ sheep meat) | Y | Υ | Y | |
| Use of ground cover management targets* | Grazing (beef cattle/ sheep meat) | Y | Y | Y | |
| Pasture phase in crop rotations | Broadacre cropping | Y | Indirectly | Indirectly | |
| Increasing perennial pastures | Grazing (beef cattle/ sheep meat) | Y | Y | Y | |
| | Dairying | | | | |

* Ground cover management target is the desired percentage of the soil surface covered by living or dead vegetation.

^For grazing (beef cattle/ sheep meat) businesses in natural resource management regions outside the rangelands.

10.4 Helping rural land managers to find innovative ways to manage ecosystem services

Peter Ampt (Australia21 and Sydney University) has provided some commentary on the Communities in Landscapes Project,^{5, 6, 58} a partnership that is funded by Caring for Our Country

under the Landcare component. This project aims to work with communities to improve the extent and quality of Box Gum Grassy Woodlands across their range through strategies that integrate conservation and production. The project focuses on the Murrumbidgee, Lachlan and Central West Catchments and demonstrates how a collaborative approach among stakeholders is helping rural land managers find novel solutions to managing ecosystem services ().

Box 1: The Communities in Landscape Project.⁵⁷

There is an emerging community of practice around grazing management that attempts to regenerate perennial native grasslands while maintaining profitability. Participants enunciate values that are strongly consistent with an ecosystem services approach. Broadly they are aiming to 'get nature to do more of the work' by managing to increase perennial native grass and litter cover which they claim leads to improved 'soil health' with little or no applied fertilizers or herbicides.

They focus on maintaining 100% groundcover and increased litter and report improved soil structure, reduced runoff and erosion, more soil moisture, increased soil organic matter and higher fertility. They are using rotational, time control or cell grazing strategies which involve consolidating their livestock into large mobs, grazing small areas for short periods of time (2-7 days) then allowing for long periods for rest and recovery (120-180 days). They regularly adjust their rotation and stocking rate, based primarily on the amount of plant material and litter. Some have opted for ultimate flexibility by trading in livestock, while others maintain studs and have periods of the year when the grazing rotation schedule is modified to accommodate animal husbandry needs, such as lambing.

Any crops (for fodder and or for grain) are direct drilled into the emerging grassland with or without the use of herbicides to suppress pasture growth for establishment. Practitioners report that this is an ideal strategy for transition between previous cropping paddocks and the system based on maintaining permanent perennial soil cover.

A key feature of this community of practice is that it is adaptive. People are generally not following a strict protocol, but have a range of strategies for monitoring the impact of their management. For example, most are looking ahead to assess the amount of plant growth and litter in the paddocks ahead of the stock, as well as observing the recovery of the recently grazed paddocks. Many keep track of the species present and can track the return of desirable native grasses back into their paddocks. They use the information generated to adjust their stocking rate, intensity, duration and time of grazing and length of rest and recovery.

The 'Communities in Landscapes' project has focused on these practices and conducted a benchmark study to describe them and to determine the extent to which 10 innovators are succeeding in integrating conservation with production.⁶ The results show that these practices have resulted in an increase in the basal cover of perennial native grasses and litter, which has significantly improved soil stability, water infiltration and nutrient cycling as measured by Landscape Function Analysis (LFA). Soil fertility is higher (increased P, N, C and pH and decreased soil bulk density), and soil microbiological communities are more abundant, active and diverse. From this we were able to conclude that these strategies are resulting in a transition towards a more highly functioning native grassland that provides a larger range and quantity of ecosystem services than the system that it replaces. Services enhanced include nutrient cycling, soil formation, plant production leading to food and fibre production, climate regulation through increase soil C, flood mitigation and water purification through increased water infiltration, and greater levels of motivation and optimism through the recognition that management is leading to regeneration and greater degree of personal control and reduction of risk.

In terms of supportive policy, some CMAs have provided incentives for training and for 'water and wire' to support implementation of improved grazing management. However state government agencies are yet to advocate these practices due to lack of published peer-reviewed papers that support it. The adaptive nature of

this management is a challenge to traditional agronomic research practices. Instead it lends itself to ecological research methods. Practitioners also have multiple objectives in mind and are actively involved in negotiating the trade-offs between services. Rather than focus solely on optimizing production, they are taking a more holistic approach that aims for clear expression of their values and aims and regular monitoring of the happiness of family members. Rather than feeling 'caught on a treadmill', they are taking a longer term view that minimizes their exposure to climatic and economic risk. This often means reducing expenditure on expensive purchased inputs in favour of strategies that cost less. This may mean less production but often means higher profit with greater peace-of-mind and a greater sense of control over their destiny. Interwoven with this is confidence that their practices are leading to a regenerating landscape. As more evidence is collected on these practices it would be ideal if policies would support this innovation, especially in enhancing the monitoring already being done and scaling it up from farm to district or region. This should ideally be in the form of ongoing documentation of the enhanced ecosystem services resulting from the regenerating grasslands.

Another initiative of the Communities in Landscapes project was to support the development of cross property collaboration in environmental management. This involved support in the form of farm visits, mapping, meetings, courses and field days with \$75k grant to groups of landholders who develop individual property biodiversity plans that contribute to a cross property plan. At the time of writing 6 groups of about 10 members each were in various stages of plan development through to funding and initial implementation. Several groups are keen to document the collective impact of their plans. There are opportunities to gain economies of scale in terms of valuing the benefits of a group's collective approach. For example one group covers more than 80% of a small sub-catchment and their approach to land management appears to be having a beneficial impact on the riparian zone with resulting improvement in the delivery of clean water to a major regional water storage.

The particular relevance of ecosystem services to this cross property approach is that the groups have grasped the importance of scaling up from an individual property to support a broader ecosystem. It supports the use of ES approach to generate understanding and to provide a framework that facilitates collaboration to achieve environmental objectives in production landscapes. There is potential for the development of opportunities for philanthropic and even commercial support of groups that generate public goods such as has been achieved through this project. Critical to the apparent success of the approach was the grant and the active on-ground facilitation. The project funded Community Woodlands Officers and the deployment of a NSW Department of Primary Industries officer to develop property plans that contributed to a cross property plan. This practical support was enhanced by the 'carrot' of the \$75k grant, which resourced the initial stages of implementing the landscape scale plan.

A possible policy initiative emerging from this discussion is for DAFF to drive and support the development of an integrated resource condition monitoring process not unlike what is being achieved through Waterwatch using Landscape Function Analysis (LFA). Training of community members in could facilitate widespread community monitoring of soil stability, water infiltration and nutrient cycling – all supporting services. Community data complemented by expert LFA data could build a picture of a transition to greater ES provision, and provide individual landholders with a standard with which they could assess their individual contribution. They key to this is that strategies that improve landscape function will also improve their production potential so should also impact positively on profitability.

11 Issues associated with implementation of an ecosystem services approach in Australia

Key conclusions from this chapter:

- Among people involved in natural resource management policy, the concept of ecosystem services is familiar and generally thought to be useful as a communication device; opinions differ about how easily it can be applied
- Among the broader community it appears that familiarity with the term 'ecosystem services' is patchy but that people are generally familiar with the idea that nature provides benefits (although understanding of the range of these benefits is very limited)
- An ecosystem services approach potentially makes significant contributions to most components of policy and decision cycles, especially in terms of better identification of the nature of social-ecological issues and the range of stakeholders potentially affected, and in strategic consideration of policy options and their implications across different government portfolios
- There was wide agreement among those interviewed that a strategic approach to considering human dependence on ecosystems is needed that:
 - Considers the full range of benefits and costs of environmental management
 - Engages decision makers across government departments, levels of government and governance, and sectors of society
 - Considers factors affecting possible future needs for, and impacts on, benefits from the environment, including population size and distribution, lifestyles and the nature of economic activity.
- Factors considered to be important for application of an ecosystem services include:
 - Clarification, communication and education about the benefits from the environment
 - Refinement of the concept so that barriers between scientific disciplines are removed and the ability to measure relevant aspects of ecosystem service delivery is improved
 - Research & development to improve understanding of how ecosystem services are delivered and anticipation of the effects of interventions on service delivery
 - Collection and sharing of data that supports strategic thinking and planning around ecosystem services and allows monitoring and improvement of ecosystem service management
 - Governance regimes that support recognition of ecosystem services at appropriate scales in space and time and allow innovative and flexible approaches to adjusting flow of benefits between beneficiaries for enhanced human well being
 - Leadership to encourage new thinking and approaches
 - Processes for strategic, holistic environmental-social thinking and planning across interest groups, sectors, government departments, and levels of government and society.
- It appears that most agencies, organisations and groups of people engaged in natural resources policy and management in Australia contribute to these enabling factors, but that

- achievement of strategic, holistic environmental-social thinking and planning across interest groups, sectors, government departments, and levels of government and society has so far been elusive.
- We recommend actions to improve the application of an ecosystem services approach in Australia

This Chapter draws heavily on our interviews with a range of people who have been involved in development and implementation of environmental and landuse policy at Australian, state, natural resource management region, or local government levels, research and development on ecosystem services or related topics, public or private investment in the environment, agricultural and other landuse industries, advocacy for landuse industries and/or environmental conservation, and regional community-level governance of environmental, social and economic issues. These interviews are supplemented by our literature review.

This chapter, therefore, contains many opinions. Although readers might question the factual basis and underlying assumptions for these opinions, they represent the interpretations of interviewees who have had involvement in interpreting and applying the concept of ecosystem services. As such, they provide important information about the perceived strengths and weaknesses of an ecosystem services approach and the factors enabling or blocking the application of this concept.

11.1 Attitudes towards the concept of ecosystem services

11.1.1 Data from our interviews

Table 7 summarises the main attitudes towards the concept of ecosystem services emerging from the direct interviews conducted for the project and the additional information drawn from other interview processes.

| Question | Summary of responses |
|--|---|
| Understanding about the concept of ecosystem services | Those interviewed were mostly people considered to understand the challenges associated with human dependence on the environment, although we also drew on broader surveys of people not directly involved in natural resource management. It was not surprising, therefore, that most of those directly interviewed had heard of the term 'ecosystem services'. All interviewees understood that ecosystem services are the benefits to people from nature and that these include the full range of use and non-use, market and non-market, tangible and intangible benefits. |
| <i>Opinions about usefulness of the concept</i> | All interviewees considered that the concept is useful as a high-level strategic thinking tool. Opinions differed in terms of the practicality of the concept. Most interviewees considered that there are significant challenges in measuring ecosystem services and, therefore, in assessing the ecosystem services implications of different decision choices. Several interviewees with extensive experience working with environmental benefits pointed out that it is vitally important to be clear what question is being asked in any situation, rather than assuming that application of an ecosystem services approach is |

Table 7: Summary of interview responses.

| Question | Summary of responses |
|---|--|
| | necessarily about economic valuation of the services. One interviewee, which had been involved in a survey of regional bodies and communities told us that many of those people were previously familiar with the idea that ecosystem provide benefits to people but started using the term 'ecosystem services' mostly because that was the term used by state and Australian Governments and they thought using it would improve their connection with government processes. |
| The degree to which the concept meets particular needs of decision makers at some or all levels of government and/or non- government decision-making in Australia | All interviewees considered that there is a strong need for approaches to considering the full range of social and economic benefits and costs associated with environmental policies and management, and particularly ways to facilitate dialogue and decisions in relation to tradeoffs between competing values and objectives among stakeholders. There was a considerable range of opinions about how well an ecosystem services approach might meet these needs. Some interviewees thought an ecosystem services approach provides a useful framework for strategic conversations at various levels of government, because if makes clear what the benefits of environmental management might be and potentially provides tools for exploring tradeoffs. Others said that such conversations rarely, if ever, happen so there is little opportunity to use an ecosystem services expect government departments to contemplate the range of issues encompassed by ecosystem services. Some scientists (economists, ecologists and social scientists) felt that ecosystem services a useful framework for interdisciplinary conversations, but others thought that many frameworks for ecosystem services inhibit, rather than facilitate, interdisciplinary conversations and research. |
| Whether there are alternative and/or better ways to address those needs | Most interviewees considered that the concept of ecosystem services brings a different perspective to dialogue about human interactions with nature to the ones promoted by ecology and economics and embodied in concepts like sustainability, ecological footprint, resilience and the like. Not all interviewees were clear about how these concepts interrelate. Some still understood that ecosystem services was being promoted as an alternative to these other concepts but most understood that it is intended to be complementary. |
| How those needs are currently being met and could be met better | Discussed in the following sub-sections. |

One interviewee provided an illustration of how he sees ecosystem services providing the basis for considering resilience and sustainability (Figure 4).



Figure 4: Ecosystem services as a foundation for resilience and sustainability (Dixon Landers, US EPA, personal communication 2011).

The high level of common understanding about ecosystem services among those interviewed for this project contrasts with our own experience working with community members, and the results of several surveys of communities that indicate that many people struggle to be able to fit the concept of ecosystem services within their current ways of thinking about their relationship with the environment.¹⁷⁹ The selection of interviewees in this project was biased towards people who understand the issues surrounding relationships between people and the environment, but even among these people there have been diverse understandings and misunderstanding about ecosystem services over the past decade.⁶³ It appears that there is now a much higher degree of understanding of the general intend and scope of ecosystem services approaches than there was even 5 years ago.

This is not to say there is no longer misrepresentation of the concept, or at least the suspicion by some interest groups that the concept will be misused by others (we are aware of such suspicion being expressed frequently, publically and privately, in a range of forums).

Most interviewees argued that the concept of ecosystem services is useful for prompting decision makers to consider the full range of benefits from the environment. They thought it is useful and important to identify what those benefits are. In particular there was very strong agreement among stakeholders that current challenges facing Australia and the world require rigorous methods for addressing both the nature of benefits from the environment and who benefits (i.e., the types of questions identified in Section **Error! Reference source not found.** as being integral to an ecosystem services approach).

Seven interviewees who have all had first-hand experience with using the concept of ecosystem services to engage in dialogue and planning with community, industry and government stakeholders all said that most stakeholders were at first unfamiliar with the concept but that

they quickly understood is and found it easy to apply it to their particular situation. These interviewees all considered that the concept improved understanding of complex social, economic and environmental issues, and generated productive and focussed dialogue that enable the exploration of decision trade-offs and the seeking of agreed ways forward among participants.

The main areas of difference among interviewees related to: whether there are alternative ways to address the issues that ecosystem services approaches have been developed to address (this was discussed in Chapter **Error! Reference source not found.**); the ways in which ecosystem services are defined and characterised (discussed in Chapters **Error! Reference source not found.**); and the challenges that arise in implementing ecosystem services classifications in practical environmental policy and management decisions (discussed in Section **Error! Reference source not found.**). These differences of viewpoint can be reduced to the key issues highlighted in . As mentioned in and Table 7, and discussed further at the end of this subsection, most of these points of difference can be dealt with if there is careful thought about the aims of employing an ecosystem services approach and the questions being asked.

Box 2: Key points of difference in opinions about ecosystem services.

Several stakeholders interviewed were unclear about whether the concept of ecosystem services is intended to replace concepts like 'sustainability' or 'resilience' or disciplines like economics (and this raises concerns about whether advances that have been made in these other areas over many years might be lost or abandoned). The interrelationships among ecosystem services, sustainability, resilience and similar concepts were dealt with in Section 4.3. In short, an ecosystem services approach complements and adds richness to the other concepts by identifying what the elements of a sustainable environment might need to be and what aspects of life support for humans might need to be resilient.

Some, especially in the discipline of environmental economics, argue that many ecosystem services classifications do not differentiate between processes, functions, and services in consistent ways, and that this not only prevents robust economic valuations, but also can lead to biased conclusions in non-quantitative deliberative approaches (note that recent advances in ecosystems services typologies address this issue – see Chapter **Error! Reference source not found.**).

Some stakeholders interviewed thought that lack of detailed knowledge about ecological processes and likely responses to policy and management interventions means that an ecosystem services approach cannot be implemented across Australia, while others considered that there is sufficient understanding the generate the type of strategic conversations that are required to get better planning for multiple ecosystem benefits. These differences of opinion were probably influenced by different levels of understanding about what knowledge is available and different experiences with access to, and use of, scientific information and so the balance of opinion in our surveys is unlikely to reflect either the true situation or the balance of opinion among stakeholders generally. The level of understanding required will vary with the issues being addressed and the services involved. Often, available understanding will be more than adequate because the benefits versus costs will be obviously greater for one scenario than another.

Some stakeholders interviewed thought that it is important to clarify land managers' duty of care responsibilities and property rights so that a wider range of market-based approaches to managing ecosystem services can be developed, while others thought that it is not necessary, or desirable, to get into this very difficult area as there are likely to be other ways than payment schemes to manage non-market ecosystem services (and that some of these ways have yet to be discovered by encouraging stakeholders to explore their own innovative solutions).

The challenges posed by lack of clarity in duty of care and property rights are real, but probably less significant than often thought. They only become a problem if government seeks to intervene directly in markets using regulations and/or incentives, including payments for ecosystem services. This creates moral hazards, including paying land managers for services that they should provide as part of their duty to society to maintain the productive capacity of the land. The Australian Government and various state governments have avoided this problem so far by encouraging markets around values that are well above duty of care. For example, stewardship programs¹⁴ have paid landowners for protection and/or management of habitat for native species of high conservation significance that is above and beyond management that provides private benefit. Several interviewees, including some involved in representing agricultural industries and some involved in nature-conservation policy, told us that attempts to define duty of care and property rights in more detail could be unproductive as it would discourage many land managers from providing public benefits above duty of care.

Another way for governments to avoid moral hazards is to facilitate mechanisms that allow providers and beneficiaries of ecosystem services to develop their own formal and informal

agreements. One interviewee recounted how he had been involved in an international program to use economic valuation to aid planning of natural resource use in the Philippines. The program struggled to cope with the complexities of the real-world situation, but it also revealed that land managers had established many effective informal arrangements that acknowledged and exchanged ecosystem services benefits. For example, in one sub-catchment, people from the upper catchment were given preferential hunting rights in the lower catchment in exchange for restraint in land development in the upper catchment. Recent reforms to encourage trading in water and to allow the use of offsets to compensate for impacts on biodiversity in land development are examples of mechanisms that allow stakeholders to find their own solutions to managing ecosystem benefits, and the devolution of responsibilities for natural resources policies and management to catchment management bodies under NHT also allowed a degree of self-organisation among stakeholders. Numerous contributors to research on societal resilience argue that greater sharing of responsibility, authority and resourcing across society, especially in regional Australia, is required to encourage exploration of innovative solutions by stakeholders.⁵⁹

As mentioned above, most of these points of difference can be addressed by careful thought about the aim of using an ecosystem services approach and the questions being asked in any situation. For example, if the aim is to encourage dialogue then tradeoffs might need to be made between being rigid about multiple counting of benefits and allowing stakeholders to develop their own thinking. The process adopted in southeast Queensland,¹⁵⁰ which engaged 140 individuals from government, universities and non-government organizations, is a good example of how this sort of dialogue was allowed, but was channelled into a framework that minimises the chances of multiple counting (see Sections 4.3 and 4.4). Although most published research on ecosystem services includes some form of economic valuation, this is not an essential part of applying and ecosystem services approach. Several interviewees who are experienced economists pointed out that it is critical at the beginning of any project to ask: 'Do we need to make detailed assessments of ecosystem services and their economic values to establish which decision-alternatives are likely to be best?' Examples of questions that might be asked that do not necessarily require detailed economic valuation include:

- Have we considered the full range of potential interactions among ecological, social and economic systems that might have implications for our decision-making?
- What are the likely magnitudes of economic and other benefits and costs of alternative decision-possibilities?
- Is it likely that the economic and/or social benefits of making detailed analyses will be greater than the transaction costs involved? (For example, detailed analyses might be required to support complex regulatory approaches, but this might not be warranted if the social benefits are less than the cost of the regulatory mechanisms. Alternatively, broad measurements and estimates might be sufficient to encourage decisions by private sector investors or land managers that might have both private and public benefits).
- What sorts of ecosystem services might be required, and where, under alternative scenarios for Australia's population, and where and how people live in the future and what decision rules should be applied to minimise the risk of failing to meet demand for ecosystem services?

Although addressing these sorts of questions might not require detailed economic valuations, it is important that the logic and theory of economics be included. This is a point often overlooked

in discussion of the interactions among economists, ecologists and policy makers. The thinking around how humans value the future versus the present (discounting) and how real or perceived rarity affects perceptions of worth is often not considered in dialogue about ecosystem services. An example is the often-repeated mistake of thinking that what people are willing to pay for an outcome on a small piece of land can be expected to apply over much larger scales. The amount that people might be prepared to pay for protection of threatened species in a particular wetland will be influenced by their perceptions about how unique that wetland is, and how rare the opportunity is to protect the species. Once one such wetland is protected, people's willingness to pay for additional ones is likely to decrease. This is why the practice of multiplying marginal values from small-scale studies of environmental assets over the total areas of such assets to estimate, for example, the total value of a nation's or the world's environmental assets has been criticised.⁶⁸ This same thinking mistake can be made in general dialogue about environmental management.

11.1.2 A view from industry

Those who have applied ecosystem services approaches consistently report that understanding of the relationships between humans and the environment is patchy, ranging from very sophisticated among some people and very rudimentary among others. Despite this, all practitioners that have worked with interested stakeholders in rural or urban communities have reported that the ideas conveyed by an ecosystem services approach are readily understood in workshops and generate lively and productive debate. This evidence is largely anecdotal and does not establish that an ecosystem services approach is better than general communication about ecological issues, although the suggestion is that an ecosystem services focus transcends multiple interests and backgrounds among stakeholders.^{100, 111, 150}

Dewar⁸³ surveyed Australian businesses to assess the level of knowledge about ecosystem services. She found that understanding the underlying concepts among senior executives was relatively high and that many had heard of the term 'ecosystem services'. However, most were reluctant to use the term because of the connotations that it had among staff and stakeholders. The greatest reported barrier to addressing ecosystem services issues was lack of understanding of the issues among staff and stakeholders. Dewar concluded that many of the perceptions that these business people had about the meaning of the term were incorrect and that if the term was fully understood by businesses and their stakeholders it would meet their needs. This parallels the findings from our interviews and raises two key issues: (1) The importance of clarifying the concept; and (2) the question of how much any ecological concept will always be vulnerable to misunderstanding and misinterpretation.

Dewar's research also confirmed previous surveys that suggest the approach of most businesses towards environmental issues relates to compliance and minimisation of detrimental impacts rather than taking a system-level view that includes how the environment supports the business. Like governments, businesses were reluctant to address ecosystem services unless they could be measured and there was a clear imperative related to core business.

11.1.3 Insights from the UK National Ecosystem Assessment

A component of the recent UK National ecosystem assessment²²⁸ was a survey to establish the level of understanding about ecosystems and the benefits they provide among the public. The

results revealed that the terms 'ecosystem' and 'ecosystem services' were very poorly known among the general public although they are increasingly used by academics and in government. The public identified more with more general concepts like 'nature', 'place' and 'landscape'. Despite this, the majority of people had a high appreciation of nature and understood that it provides benefits, including provisioning, regulating and cultural benefits.

These findings are consistent with what our limited set of interviews revealed for a group of Australians, most of whom are likely better informed than the average about natural resource management issues.

11.2 A system-level view of enablers and blockers of ecosystem services approaches

Ecosystem services approaches are about encouraging holistic (interdisciplinary), strategic thinking and planning about the relationships between humans and the natural environment (see Chapter **Error! Reference source not found.**). In this sub-section, we consider the factors that might be helping (enabling) or hindering (blocking) this sort of high-level strategic environmental-social thinking in policy making and land management. These factors are depicted in Figure 5, which is a simplified system map. This map is based on the opinions of people who we interviewed and other opinions from the literature (as explained in Chapter **Error! Reference source not found.**). It is intended as a way to stimulate productive dialogue about if, and how, better outcomes might be achieved.

At the right of Figure 5, depicted as green-shaded boxes, are what we assume to be the ultimate goals of holistic, strategic think and planning of the sort encouraged by ecosystem services approaches (i.e., societies and economies that are better adapted to their resource base so that they achieve higher levels of human wellbeing and they are better able to meet their accepted ethical and moral responsibilities to humans and other species).

The major risks of not achieving this holistic, strategic thinking and planning are shown as redshaded boxes (i.e., overlooking of important processes that support economies and/or social wellbeing, leading to perverse outcomes that work against human wellbeing).

At the left of Figure 5 and into the centre are some of the organisations and groups of people that we think play key roles and enablers, blockers, or both, of holistic, strategic thinking about relationships between humans and the environment (grey-outlined boxes). Details of ways in which the policies and programmes of Australian Government Departments might benefit from and/or influence ecosystem services approaches are given in Table 8. Australia21's discussion paper on a national ecosystem services strategy contains detailed consideration of the roles of other parts of Australian society.⁹

Enabling factors are shown in Figure 5 with green outlines and seven key enabling factors are shown with bold green outlines. These are discussed in more detail in Table 9. Key blocking factors are shown as red-bordered boxes. In general, blocking factors are those that work against the enabling factors.

Three factors (two are actually groups of factors) are highlighted with a yellow border. Theses were seen to be particularly influential components of the system. Two are enablers and one is a

blocker. The two key enablers are 'clarification communication and education' and a group of factors related to 'open, cooperative cross-sector dialogue about human needs and environmental processes' (the green and yellow-highlighted boxes). The factors most widely thought by interviewees to inhibit achievement of such dialogue were those related to the adversarial nature of environmental debates in Australia, together with processes and cultures that encourage competition for resources and attention, and compartmentalisation of functions within government and across society (the red and yellow-highlighted box).



Figure 5: System map (depiction of key relationships, processes and issues that interviewees considered to affect Australia's ability to consider the full range of benefits from the environment strategically and to translate this into human wellbeing).

Broken lines indicate relationships considered to have weak influence over outcomes of the system and bold lines indicate especially strong influence.

The red and green, broken and solid, arrows in Figure 5 indicate how different factors encourage one another (ordinary arrows) or counteract one another (arrows with a line through them). Green arrows indicate that the result is helpful for application of an ecosystem services approach, while red arrows indicate an unhelpful outcome. These arrows show that most groups of people considered in the system map contribute to both the processes helpful to strategic, cross-sector dialogue and to processes that are unhelpful (Table 9).

Some especially strong helpful linkages are emphasised as bold green arrows in the system map and especially strong unhelpful linkages are shown as bold red arrows (note that some of these unhelpful relationships result from encouragement of something undesirable — red ordinary arrows — and some result from the discouragement of something that would otherwise have been helpful — red arrows with lines through them).

Taking the dynamics of this system into account, we suggest there are several key influence cycles encouraging the sort of holistic, strategic environmental-social thinking and planning that an ecosystem services approach encourages, and each of these has a blocking factor that, if addressed, could see the rate of progress accelerate ().

Box 3: Key pathways helpful to the adoption of the sort of holistic, strategic environmental-social thinking and planning that an ecosystem services approach encourages, together with key factors working again those helpful cycles (these cycles are shown by the bold arrows in Figure 5 – see text for further explanation).

Helpful Pathway 1: Open, cooperative cross-sector dialogue about human needs and environmental processes -(helps)—> Strategic, holistic environmental-social thinking and planning -(helps)—> Balanced management of ecosystem services -(helps)—> Societies and economies adapted to their resource base -(helps)—> Human wellbeing. Key factors unhelpful to this pathway: Adversarialism, competition for attention and resources, pursuit of individual interests, compartmentalisation of functions and approaches -(hinders)—> Open, cooperative cross-sector dialogue etc.

Helpful Pathway 2:Research and development -(helps)—> Information collection and sharing —(helps)—> Strategic, holistic, environmental-social thinking and planning -(leads to)—>—> Human wellbeing(as in Pathway 1, above). Key factors unhelpful to this cycle: Reduced emphasis on research and developmentby governments -(hinders)—> Research and development etc.

Helpful Pathway 3: Adaptive governance —(*helps*)—> Experimentation to find new solutions (to land management and governance) —(*helps*)—> Innovative agreements among beneficiaries of environmental benefits —(*helps*)—> Balanced management of ecosystem services —(*leads to*)—>—> Human wellbeing (as in Pathway 1, above). **Key factors unhelpful to this pathway:** Over-reliance on governments to solve environmental and social problems —(*hinders*)—> Experimentation to find new solutions etc.

Helpful Pathway 4: Clarification, communication and education —(*helps*)—> Strategic, holistic environmentalsocial thinking and planning —(*leads to*)—>—> Human wellbeing (as in Pathway 1, above). **Key factors unhelpful to this pathway:** Adversarialism, competition for attention and resources etc. —(*helps*)—> Real or perceived use of ecosystem services for narrow interests —(*hinders*)—> Clarification, communication and

educations etc.

The need for open, cross-sectoral dialogue is obvious as this is the pathway by which an ecosystem services approach seeks to achieve holistic, strategic environmental-social thinking and planning. Most of those interviewed gave examples of factors that create obstacles to cross-sectoral dialogue by creating boundaries to issues that different disciplines, agencies and groups of people can become involved in and by creating a sense of competition and adversarialism. As Professor Stephen Dovers (Australian National University) put it: interdisciplinarity is not rewarded in academia or consulting and is discouraged in agencies. Soloism and adversarialism are major problems for many approaches to transdisciplinarity, not just ecosystem services, but, ironically, different approaches to transdisciplinarity can be adversaries with one another as well.

All of those interviewed emphasised the importance of achieving clarity and understanding about ecosystem services (noting that these are not yet widely available) and of having good and accessible information on the state of environmental assets and processes. These requirements are emphasised in the literature as well. The current processes to develop a national plan for environmental information¹⁹ and for that to feed into a set of national accounts, was seen as promising by many interviewees.

It was suggested by several interviewees that there has been on over-reliance on governments to address imbalances in environmental management, and production and consumption of natural resources, and that a critical requirement for making progress is incentives for individuals and groups outside government to become involved in finding innovative approaches to managing and sharing ecosystem services.

Although it has become fashionable to dismiss calls from scientists for more research funding, there was a very strong agreement among those interviewed that reduced emphasis on research and development by governments in recent years has gone too far and that vital research to understand ecological responses to policy and management options is being inhibited critically.

In the following sub-sections, we discuss how perceptions in the literature align with those from our interviewees and then we consider what value an ecosystem services approach might add to policy and decision-making processes, before making some recommendations for better application of an ecosystem services approach in Australia.

 Table 8: Australian Government departments whose policies and programs affects the delivery of ecosystem services to Australians and/or might benefits from a strategic consideration of ecosystem services.

| Department | Nature of policies and programs | Ecosystem services categories |
|-----------------|--|-------------------------------------|
| Broadband, | Communication policies affect many aspects of life and lifestyles, | All services to |
| Communications | including the ability of people to live and work remotely from major | some degree |
| and the Digital | urban centres. This has implications for water supply and other | |

| Department | Nature of policies and programs | Ecosystem |
|---|---|---|
| | | services |
| | | categories |
| Economy | aspects of natural resource management in and around urban centres. | |
| Climate Change and Energy Efficiency | Carbon emission policies affect investment in environmental interventions and thus affect a range of ecosystem services. Consideration should be given to the possible unintended consequences of stimulating markets for environmental carbon sequestration at the development stage. The recent coupling of a biodiversity fund with the carbon tax policy is a promising development. | All services to some extent, especially those associated with native vegetation |
| Defence | The Department of Defence manages large areas of natural ecosystems for conservation and other purposes. As Defence lands are often in places that provide ecosystem services to nearby settlements, these should be considered in management plans. In a sense, Defence receives some important ecosystem services as much of the land it holds is used to help military personnel learn about operating in natural environments. | Regulatory and Cultural services in particular |
| Education, Employment and Workplace Relations | Ecosystems contribute importantly to environmental education at a range of levels (primary and secondary schools, tertiary education and research). This department can also contribute to increasing understanding and research about ecosystem services and, therefore, to better decisions in the future. Location of businesses in areas with scenic beauty and places that offer recreational opportunities has been shown to affect productivity. These factors should be considered at some level in whole of government thinking about environmental management. | All services but especially cultural services |
| Families, Housing, Community Services and Indigenous Affairs | Ecosystems play a key role in indigenous culture. Ecosystems also provide protection from extreme weather, which can be a factor in survival of homeless people in cities. The value of houses in affected by ecosystem services and people on low income often are deprived of some cultural and psychological aspects of ecosystem services and they often are exposed to areas in which effects of extreme weather are greater than in more expensive areas. These might seem like minor points but their importance is often high and they should be at least considered at some scale in strategic thinking within this department. Similarly, other departments should consider the possible impacts if their policies on the policies of this department | Cultural and regulatory services |
| Finance and Deregulation | Finance should be aware of the true costs and benefits of interactions between people and the environment, so that budgets relating to managing ecosystems services can be assessed in an informed way. | All services |
| Foreign Affairs | Securing access to foreign markets is often contingent on how Australian businesses manage their interactions with the | All services |

| Department | Nature of policies and programs | Ecosystem services categories |
|---------------------------------|--|--|
| and Trade | environment. There is likely to be an advantage in being able to show that Australian Government departments take a whole of government strategic view of policy interactions with ecosystems. In addition, many of the potential beneficiaries of Australian ecosystem services reside outside Australia (e.g., foreign tourists, foreign investors, those who influence trade and foreign policy in other countries who are influenced by their impressions of environmental management in Australia) | |
| Health and Ageing | Evidence is emerging that many aspects of ecosystems affect the physical and mental health of people. This is often considered in some way in health and aging policy how well can the Australian government currently anticipate or manage the way that policies implemented by other departments affect health outcomes and/or impacts on the aging? | Mostly cultural services |
| Human Services | The relationships between people and the environment affect many aspects of the works of Human Services. There would be benefit in these effects being considered at a strategic level across all government departments | Mostly cultural services |
| Immigration and Citizenship | Where immigrants settle and in what numbers has major implications for the mental and physical well being of those immigrants, the social processes in their new home areas, and the demands that communities place on ecosystem services associated with productive use of land, regulation of ecological processes and cultural values. The nature of the natural environment can have major importance for immigrants, especially when they have previously had close relationships with ecosystems. Similarly, immigrants can bring innovative new approaches to land management and it is important to consider whether the areas in which they are encouraged to settle can provide the ecosystem services suitable for these approaches. Policy decisions by other departments that relate to infrastructure, population, water use and conservation, for example, should consider their impacts on immigration policies and vice versa. | All services, especially cultural ones |
| Infrastructure and Transport | Development of infrastructure can have positive or negative impacts on delivery of provisioning, regulatory and cultural ecosystem services. General environmental impacts are considered in impact assessments but rarely is the full range of ecosystem services considered. There are many indirect effects of infrastructure developments that can be overlooked (e.g., changes in use of land as a result of new roads). Many major challenges facing Australia involve interactions between infrastructure, environment and other departments that are often difficult to deal with due to lack of mechanisms for cross-department strategic thinking. For example, coastal development pressures arise from a mixture of employment, | All services but especially regulatory and cultural |

| Department | Nature of policies and programs | Ecosystem services categories |
|--|---|-------------------------------------|
| | social pressures, demands on infrastructure, environmental impacts and needs for ecosystem services, and economic development pressures. | |
| Innovation, Industry, Science and Research | Nowhere is encouragement of innovative research needed more than in relation to understanding the processes generating ecosystem services and assessing future needs for these services. There is a tendency for governments to see investment in industries that produce tangible produces as more desirable than investments in intangibles like ecosystem services, but such investments may be the most effective ways to support economic and social wellbeing of Australians. | All services |
| Prime Minister and Cabinet | The Department of Prime Minister and Cabinet is the driver of whole of government approaches. It has been championing such approaches for some years but a lot more is needed to facilitate whole of government strategic thinking about ecosystem services. Most government departments still operate within clearly demarcated boundaries and leave thinking about the environment to the environment department, which we argue leads to inefficient and ineffective environmental policies and outcomes for society and the economy that are less favourable than could be achieved with a more holistic strategic approach. | All services |
| Regional Australia, Regional Development and Local Government | Most leading thinking about ecosystem services and ecosystem stewardship approaches conclude that it is important for Australia to develop new approaches to governance that empower and engage regional communities in anticipating, preparing for, detecting and acting on environmental and social change. This is the core of thinking about maintaining resilience ecosystems and communities. This department should be engaged at the heart of whole of government strategic thinking about managing production of ecosystem services and their use by Australians. | All services |
| Resources, Energy and Tourism | Ecosystem services are at the heart of tourism and many resource extraction industries. Both of these sorts of industries also affect the capacity of ecosystems to deliver a range of services to other beneficiaries. There are ever increasing calls for a strategic approach to balancing the various dependencies and impacts on ecosystems services by extractive and productive industries and the public. | |
| Sustainability, Environment, Water, Population and Communities | This is the 'natural' home of ecosystems services. Protection of biodiversity, including ecosystem diversity, is core business. However, some aspects of ecosystem services are considered to be outside the remit of this department and there are concerns that an ecosystem services approach can work against traditional approaches to conservation. This department has pioneered the application of | |

Department

Nature of policies and programs

Ecosystem services categories

| | market-based instruments, including stewardship schemes, to achieving conservation objectives. However, it has been difficult for it to address issues of property rights and land managers' duty of care, so payments for ecosystem services has been limited to matters of national environmental significance, which are seen to be above and beyond any duty of care considerations. While it is important to have a home for thinking about ecosystem services, we argue that there is a need to other departments to think strategically and routinely about their own interactions with ecosystem services and for there to be a process for considering strategically about the whole of government's interactions. This would not necessarily be an expensive or large-scale process but we argue that it is important to at least consider at a broad qualitative level what the needs of Australians are for ecosystem services, how individual departments' actions affect those demands and the ability of ecosystems to meet them, and how policies of different departments might help or hinder those of others. |
|-------------------|--|
| The Treasury | Decisions by Treasury affect the operations of most other departments. Often the focus on market-based assessments of return on investments means that non-market benefits of ecosystem services to society are overlooked. There should be a process by which the potential importance of ecosystem services to all departments is considered and, especially, the potential for unintended negative impacts of some departments on others via ecosystems services. The Australian Bureau of Statistics, which is responsible for the Set of National Accounts and is currently developing an approach to environmental-economic accounts, ¹⁰ is part of the Treasury. |
| Veterans' Affairs | Policies of this department probably have limited impacts on ecosystem services but many ecosystem services are important to veterans — as they are to the public in general. Investing in building awareness of what ecosystem services are and how they might be important to this department's clients could be useful in representing the interests of those clients in inter-departmental strategic discussions. |

Table 9: Summary of the enablers and blockers of ecosystem services approaches identified in Figure 5.

| Factor | Enablers |
|--------|-----------------------|
| | Blockers (in italics) |
| | |

| Factor | Enablers | |
|--|---|--|
| | Blockers (in italics) | |
| Clarification, | Reports and workshops by government and non-government organisations | |
| communicatio n and education | Communication around stewardship programmes by both state and federal governments | |
| culculon | Despite the consistency of understanding among those interviewed in this study, there remain misunderstandings and suspicions among interest groups about one another's interpretations and motives. Such tensions would likely subside if widely agreed principles and frameworks for dialogue about ecosystem services were developed. | |
| | The confusion of different frameworks in the literature and the sense that this is a concept that is still evolving discourages government agencies from committing to a framework or approach. | |
| | While levels of understanding and agreement are low, there remains a low willingness of consumers to pay a premium for products coming from environmentally sustainable and ethical land management. | |
| Research & development | Research and development funding through a range of government programmes (e.g. CERF, NERP, R&D Corporations, ARC, investment by DIISR at the national scale and various R&D programmes within states) | |
| | Support for R&D by philanthropic institutions | |
| | Adaptive management and innovation by land managers | |
| | Investment in R&D by industries outside the R&D Corporations (e.g., mining, energy) | |
| | Inadequate action to address declining agricultural productivity | |
| | Limited ability to scale up (e.g., paddock to landscape or region) or down (to paddock) because of an historical lack of attention to scale issues in many biophysical disciplines (e.g., soil science) (this deficiency is being addressed but there is some way to go) | |
| | Poor understanding of links between management actions, ecosystem function and delivery of services | |
| | Reduced focus and support for R&D to address system-level environmental issues (e.g., closure of Land & Water Australia) | |
| Information collection and sharing | Research and development funding through a range of government programmes (e.g. CERF, NERP, R&D Corporations, ARC, investment by DIISR at the national scale and various R&D programmes within states) | |
| | Support for R&D by philanthropic institutions | |
| | Adaptive management and innovation by land managers | |
| | Investment in R&D by industries outside the R&D Corporations (e.g., mining, energy) | |
| | Limited resources have been allocated in the past by all levels of government for data collection and analysis and integration of ecosystem services in planning | |
| | Having information on the state of environmental assets is a key first step towards an ecosystem services approach. | |
| | In the view of some interviewees, current thinking about national environmental accounts | |

| Factor | Enablers |
|--|--|
| | Blockers (in italics) |
| | (both in Australia and elsewhere and spreading across academia and government) appears to be focused strongly on measuring assets and only weakly on ecological functionality and service delivery, which might limit its ability to support an ecosystem services approach |
| Adaptive governance | Improved approaches to assessing return on investments in environmental programs (e.g., Caring for Our Country) |
| | Research on governance options, fitting governance models to the nature of environmental and social challenges, and defining and assessing adaptive capacity, resilience and social wellbeing |
| | Related to the above, development of 'pathways to implementation' (links through and across decision-making chains – also called 'vertical and horizontal integration') |
| | Support for application of ecosystem services approaches by regional bodies and communities as concern grows about the sustainability of regional economies and settlements |
| | Establishment and testing of 'regional models' under recent government programmes (e.g., NHT, Caring for Our Country) |
| | Reform of planning process in regional Australia to include thinking about ecosystem services, resilience, adaptive capacity and social wellbeing (e.g., Victorian Government Biodiversity White Paper, resilience-based planning in NSW encouraged by NRC) |
| | Governments in the past have placed strong reliance on market-based economic valuation to assess return on investment and allocation of government funding. Investment in non- market environmental issues has been disadvantaged by this approach, which is one reason why the concept of ecosystem services has emerged |
| | When governments focus on reducing budgets, cutting all but core functions, optimising productivity they risk reducing resilience and the capacity to innovate and adapt with respect to environmental, social and economic issues (i.e., by reducing diversity, spare capacity, overlapping institutions, networking, social capital etc.) |
| | It is argued, by a number of recent reviews of natural resource management in Australia, that governments have been reluctant to allow movement towards polycentric governance (governance in which responsibility, authority and resourcing is spread across society so that the people in the best place to detect and deal with issues are in a position to do so. It is argued that many of the social-environmental issues faced in Australia at present require greater engagement of people at regional scales than is currently encouraged. Many stakeholders in regional areas complain that they cannot engage productively in dialogue of the sort encouraged by ecosystem services approaches due to over-centralized governance structures. |
| | Among farmers, there has been a high level of innovation, which some interviewees think is under-recognised and under-supported. On the other hand, some farmers have expressed the view that incremental adaptation (i.e., coping by making a few adjustments to management) is not necessarily sustainable in the long term. |
| Leadership to encourage new thinking | Role of governments in developing and testing new approaches to governance and coupled environmental-social-economic management |

| Factor | Enablers |
|--|---|
| | Blockers (in italics) |
| and | Advocacy of new approaches by NGOs (environment and industry) |
| approaches | Degree to which members of civil society are prepared and able to show leadership (versus reliance on governments to identify and solve environmental and social problems) |
| | There is a cultural expectation that governments will deal with environmental and social issues |
| | There is a poorly developed culture of philanthropy and private investment in environmental and social issues in Australia |
| Mechanisms for allowing and encouraging innovative agreements among beneficiaries of environmental benefits | Incentives for developing markets for ecosystem services (e.g., land stewardship and other approaches to creating markets for biodiversity, linking carbon-emissions trading and markets with broader environmental objectives) |
| | Strategic use of regulation and legislation to drive a focus on ecosystem services (e.g., the Murray Darling Basin Plan, planning reforms in Victoria, Queensland and NSW, review of the EPBC Act) |
| | Community-driven assessments of benefits and beneficiaries and exploration of new mechanisms for harmonization (e.g., several regional bodies and other community coalitions in all state and territories) |
| | Industry-driven initiatives (especially around carbon markets, biodiversity offsets and maintenance of cultural values) |
| | Some interviewees suggested that there is insufficient attention given to ecosystem services in legislation. It was pointed out that issues like human resources and discrimination became mainstream in public and private organizations only after legislation was introduced to require attention to them. |
| Processes for strategic, | Encouragement of whole-of-government approaches from within government (e.g., blueprint for reform of the Australian public service) |
| holistic | Support for inter-jurisdictional decision-making forums (e.g., MDBA, COAG) |
| environmental -social thinking and planning across interest groups, sectors, government departments, and levels of government and society. | Review of the Environment Protection and Biodiversity Conservation Act 1999, probably leading to more strategic application with a focus on ecosystems |
| | Anticipating future demands on ecosystem services in relation to population, food production, water use, infrastructure and conservation objectives (e.g., 2020 Summit, Australian Government's 2010 Sustainable Population discussion paper, discussion papers by the Australian Academy of Sciences Australia21, Australia Institute, Climate Institute, Grattan Institute and the Strategic Policy Institute, and various scenario planning exercise by regional bodies throughout Australia) |
| and society | Despite official encouragement of whole-of-government approaches from within government, issues are compartmentalized between departments at all levels of government and environmental issues are the primary, and often sole, provenance of one department. This means that the implications of environmental benefits and impacts are not routinely considered in most other departments. |
| | There are limits to cooperation and aareement amona jurisdictions in inter-jurisdictional |

| Factor | Enablers |
|--------|--|
| | Blockers (in italics) |
| | decision-making forums due to competition for resources and concerns about the transactions costs of changing to more compatible approaches. |
| | There are limited incentives for environment and industry NGOs to cooperate in addressing environmental-social issues (several interviewees referred to the 1990s collaboration between the NFF and ACF to address land degradation in rural Australia as a model for what is needed again now) |
| | Related to the above, the level of adversarialism in environmental debates in Australia was considered to be higher than in the past and a powerful blocker of ecosystem services approaches. |
| | One consequence of adversarialism appears to be a suspicion of ecosystem services approaches among some conservation agencies and interest groups (for example some have expressed concern that a focus on utilitarian aspects of biodiversity will result in the ethical and moral dimensions of conservation being marginalised) |
| | Several interviewees expressed the opinion that agriculture has decreased in importance on policy agendas of both state and federal governments, and that this makes effective dialogue about natural resource management in regional Australia difficult. Declines in the absolute contributions of agriculture to the Australian economy are considered as partly to blame but also the rising contributions from mining to both regional and national economies has made agriculture seem relatively less important. |

11.3 Perceptions from the literature

Appendix VII summarises some conclusions and insights from work that has critically analysed the development of ecosystems services approaches and considered what is required to develop and apply an ecosystem services approach at a range of spatial scales.

Several common themes arise, most of which are consistent with what we found in our interviews:

- There are clear roles for government in creating the conditions under which private individuals and businesses can find innovative ways to recognise the benefits from good ecosystem management and incorporate them into the transactions that are part of everyday life for businesses and communities (in the language of government this is 'addressing market failure')
- There is a need to recognise that governments cannot, and in the views of many should not attempt to, address all of the challenges associated with recognising benefits to humans from the environment (in general, government should intervene to manage benefits that accrue to the general population, and which are unlikely to be protected by current market and non-market mechanisms, and where the benefits of the intervention outweigh the transaction and other costs)
- The state of functionality of ecosystems should be considered in a country's national accounts (although there is ongoing debate worldwide about how this should be done)

- While arguments for an ecosystem services/ management/ stewardship approach are now well documented (see Chapter **Error! Reference source not found.**), implementation is often based on a range of untested assumptions that should be a priority for research and development (details of research priorities were given in Section **Error! Reference source not found.**)
- Progress is particularly needed on three fronts: 'the science of ecosystem production functions and service mapping; the design of appropriate finance, policy, and governance systems; and the art of implementing these in diverse biophysical and social contexts'⁷³
- Applying an ecosystem services approach in many cases requires new approaches to environmental and social aspects of policy and governance, especially to establish 'pathways to implementation' that stretch throughout society, and this will require testing and learning from new approaches which can be best done by embedding research and its evaluation as an interactive part of policy and management processes
- Much of the thinking about how to develop and apply lessons from research on ecosystem services approaches has been done by individual groups or small networks that have had limited interactions with one another. Although there are examples of regular 'gatherings' of ecosystem services researchers at meetings, there is a need for a more formal mechanisms to encourage the sharing of insights and the development of commonly agreed definitions and principles to give policy makers and land managers confidence to put the lessons into practice. Such a network would allow an ongoing dialogue that could, over time, arrive at a robust set of conclusions that have broad agreement. Such agreements are rarely, if ever, achieved at irregular meetings or symposia.
- There remains a key role for ecosystem services frameworks as communication tools for bringing new understanding to the value of natural capital, especially at local and regional levels

Progress towards addressing these issues has, in the past, been impeded by resistance from disciplines, functional units within bureaucracies, and/or sectors of society that require convincing about the merits of taking new, and potentially ill-defined, approaches. Many of the reasons for this resistance have been removed by improved typologies that align ecosystem services approaches with theory in economics and ecology but some of the most fundamental barriers have little to do with the ecosystem services approach itself (for example, reluctance of government departments to expose themselves to risks by engaging in strategic analyses that cut across departmental boundaries, or the lack of professional or other incentives for researchers to engage in inter-disciplinary or transdisciplinary approaches that go beyond the bounds of their skills and experience). Addressing the latter, requires creation of new incentives and reward structures, within both government and a range of scientific and other disciplines.

11.4 What value might be added to policy by an ecosystem services approach?

Several recent reviews have considered how an ecosystem services approach can add value to decision-making by governments and other sectors of society. Turner & Daily (Figure 6) and Cowling *et al.* (Figure 7) have proposed frameworks for aligning ecosystem services approaches

with policy and decision-support cycles. Cork *et al.*⁶³ and Maher & Thackway¹⁴⁶ considered how ecosystem services approaches can contribute to these cycles.



Figure 6: Framework proposed by Turner and Daily (2008)²²² for integrating ecosystem services analysis with policy and other decision-making cycles.





Figure 7: An operational model proposed by Cowling *et al.* (2008)⁷⁰ for making assessment and management of ecosystem services part of mainstream decision-making.

In Australia in 2007, it appeared that ecosystem services assessments (and similar approaches under different names) made substantial contributions to only two steps in a typical decision-support cycle: Step 1, 'Characterising the Resource or Asset' (mostly through frameworks and tools for describing and assessing ecosystem services), and Step 3, 'Designing and Implementing a Programme' (mostly through incentive-based approaches such as market-based instruments).¹⁴⁶ Contributions to other phases of decision cycles — Step 2, 'Influencing Priority Settings', Step 4, 'Tracking On-Ground Progress Toward Desired Goals/ Objectives, and Step 5, 'Complete Resource Assessments Following Action — were considered to be relatively insignificant at the time. This situation has improved slightly in Australia since 2007. The term 'ecosystem services' is now found throughout most key environmental policy documents at all levels of government and in programs developed by non-government organisations, and markets for some ecosystem services are far from being central in environmental decision-making, are only moderately considered in food and other agricultural policy and are almost unconsidered in other policy, such as population policy (see Chapter 11).

In contrast, the recent review by deGroot *et al.*⁷⁷ concluded that ecosystem services approaches now contribute strongly to all phases of policy and decision-support cycles in Europe and the USA. As a result of the UK's National Ecosystem Assessment, natural capital is being placed 'at the centre of economic thinking and at the heart of the way the way we measure economic progress nationally'.²²⁷ The elements of state of the art approaches to ecosystem services analysis are discussed more fully in Chapter **Error! Reference source not found.** In summary, the literature suggests that an ecosystem services approach should include the following elements:

- Social analysis (including consideration of beliefs, norms, needs, values, owners and beneficiaries of ecosystem services, and institutional and governance arrangements)
- Biophysical analysis (including analysis of the state of ecosystem assets, flows and impacts over a range of spatio-temporal scales as well as mapping, modelling and other visualisation techniques to engage stakeholders)
- Valuation (in both monetary and other terms)
- Scenario analysis and other approaches to considering alternative policy and management options over a range of spatio-temporal scales
- Effective engagement with stakeholders

The ways in which and ecosystem services approach can add value to policy and decisionsupport cycles is considered in Table 10. Most of the above elements play roles at one or more phases of these cycles.

| Policy phase ^a | Nature of value added |
|---------------------------|--|
| Identify issues | More comprehensive and systems-based assessment of the issues, including interactions |
| | between social, economic and environmental processes. |
| | Greater insights into where to look further to understand the issues and devise effective |
| | interventions. |
| | A focus on multiple benefits and beneficiaries provides a way to approach complex, |
| | multi-stakeholder issues that have an environmental component, such as population and |
| | food security policies. |
| | Collection and sharing of information to support ecosystem services analyses, by |
| | government and non-government organisations, plays a key role in identifying emerging |
| | issues and allowing them to be addressed early. |
| Policy analysis | The conceptual framework relating ecological processes to human wellbeing is likely to |
| r ency unurysis | give a more complete understanding of the context of the issues that other approaches |
| | that do not explicitly aim to identify all benefits and beneficiaries. |
| | |
| Policy | Supports a rich dialogue about possible future implications of alternative instruments and |
| instruments | opens up possibilities for greater use of tools such as information, promotion, grants and |
| | other suasive approaches targeted at improving service delivery and human well being, |
| | market based instruments, regulation, and certification or labelling programs. 21 |
| Consultation | Ideally stakeholder engagement would be involved in all steps of this process |
| consultation | The great value that an ecosystem services approach offers is that it enables diverse |
| | stakeholders to rapidly understand the issues and take part in dialogue about options and |
| | their implications. This makes for stakeholder engagement that is more informed than in |
| | many other processes in which stakeholders might struggle to understand the technical |
| | information and the issues. |
| | |
| Coordination | An ecosystem services framework can provide common understanding and language to |
| | enhance coordination among government agencies and between government and |
| | nongovernment organisations so long as the effort is made to explain the concept and |
| | seek agreement on terms. |
| | |

Table 10: Ways in which ecosystem services approaches can add value to policy and decision-support cycles.

| Policy phase ^a | Nature of value added |
|---------------------------|--|
| Decision | Decision-making is enhanced if there is a clear analysis of who is affected, how and when. |
| | An ecosystem services analysis aims to do this through a focus on all costs, benefits and |
| | beneficiaries from ecosystems and of policies that influence ecosystem function. |
| Implementation | The comprehensive analysis of benefits, beneficiaries and current and future expected |
| | demands for ecosystem services provides a framework for monitoring and adaptive |
| | management to both assess whether plans are working and incorporation lessons |
| | learned into revision of policies and plans. |
| | The focus on the links between ecosystems and human wellbeing is a strong basis for |
| | developing visions and objectives in the planning process. |
| | The conceptual and quantitative models of ecological and social process developed in an |
| | ecosystem services analysis support scenario planning to consider the possible paths |
| | forward and their implications in clear and concrete terms. |
| | Ecosystem services processes have been shown to engage and encourage stakeholders to |
| | take responsibility for developing and implementing plans and so have the potential to |
| | increase the effectiveness of government investments. |
| Evaluation | Defining the issues and policy and planning objectives at least partly in terms of |
| | ecosystem services and human wellbeing facilitates evaluation of whether objectives |
| | have been met (although setting inflexible targets is unwise as it is likely to work against |
| | resilience and adaptability of both ecosystems and societies). |

11.4.1 Identifying issues

An ecosystem services approach starts with a framework that prompts those assessing the issues to consider the full range of potential benefits and beneficiaries of ecosystem processes, the needs of people in the system, and the capacity of the ecological systems to meet those needs. This approach defines the issues more fully than approaches that do not start with such a comprehensive framework. Experience of many studies has shown that the process of considering exactly what benefits people get from ecosystems, what processes provide them and what the alternatives are is highly enlightening and can fundamentally change stakeholder's understanding of the issues and ideas about solutions.^{1, 64, 150, 178} The UK Department for Environment Food and Rural Affairs has adopted an ecosystem services framework as a high proportion of environmental impact assessments failed to consider impacts comprehensively.²²⁵ Combining ecosystem services analysis with an analysis of social and ecological resilience, adaptability and transformability allows analysts to identify whether the real issues are environmental, social or both and to identify where to look further to understand the issues and devise effective interventions. Collection and sharing of information to support ecosystem services analyses, by government and non-government organisations, plays a key role in identifying emerging issues and allowing them to be addressed early. While economic valuation might often be required to clarify the nature of the issues and those affected, is has been argued that the biophysical information is the key as this is the basis for people's value judgements.¹¹⁶

11.4.2 Policy analysis

An ecosystem services approach draws on the tools of ecology, economics, social sciences, engineering and mathematics to consider the nature of the coupled social-ecological system in

question, including understanding factors determining people's needs, where those needs are found spatially, and what ecological processes are operating to provide ecosystem services.^{70, 77, 222} The conceptual framework relating ecological processes to human wellbeing is likely to give a more complete understanding of the context of the issues that other approaches that do not explicitly aim to identify all benefits and beneficiaries. Ideally, an ecosystem services approach would include a robust analysis of institutions, governance and other social factors contributing to the issues.

11.4.3 Policy instruments

An ecosystem services approach does not create new policy instruments but it supports a rich dialogue about possible future implications of alternative instruments and opens up possibilities for greater use of tools such as information, promotion, grants and other suasive approaches targeted at improving service delivery and human well being, market based instruments, regulation, and certification or labelling programs.²¹

Recent summaries of studies around the world have concluded that application of an ecosystem services approach has allowed market forces to bring about major landuse and industrial change in several Latin American Countries and in the USA and has allowed China to launch the most far-reaching payments for ecosystem services program yet seen globally.^{44, 205, 222} In Australia, the power of markets for water have become apparent in the Murray Darling Basin⁶² and programs nationally and in Victoria and South Australia that involvement payments for management of habitat for biodiversity have begun to have impact.^{21, 64}

11.4.4 Consultation

Ideally stakeholder engagement would be involved in al steps of this process. The great value that an ecosystem services approach offers is that it enables diverse stakeholders to rapidly understand the issues and take part in dialogue about options and their implications. This makes for stakeholder engagement that is more informed than in many other processes in which stakeholders might struggle to understand the technical information and the issues. In an ideal ecosystem services approach, stakeholders will contribute to all phases of identifying and assessing ecosystem services, giving them ownership of the process and understanding of the different viewpoints among their fellow stakeholders. Stakeholder engagement under these circumstances is likely to be more productive, less adversarial and, therefore, more efficient and effective that in processes where governments attempt to convey complex information and decisions to audiences that feel unengaged with the decision process.^{1, 100, 178, 227}

11.4.5 Coordination

With respect to coordination among government departments, and ecosystem services framework can provide common understanding of the issues and reasons for policy interventions. Coordination will also be enhanced by an analysis that shows how different departments are affected by ecosystem services and therefore how the policy decisions under consideration could influence other policies in other departments.

11.4.6 Decision

Decision-making is enhanced if there is a clear analysis of who is affected, how and when. An ecosystem services analysis aims to do this through a focus on all costs, benefits and beneficiaries from ecosystems and of policies that influence ecosystem function. An ecosystem services analysis would normally be accompanied by an analysis of non-ecosystem costs and benefits.

11.4.7 Implementation

An ecosystem services approach potentially adds value to implementation of policies in a number of ways. The comprehensive analysis of benefits, beneficiaries and current and future expected demands for ecosystem services provides a framework for monitoring and adaptive management to both assess whether plans are working and incorporation lessons learned into revision of policies and plans. The focus on the links between ecosystems and human wellbeing is a string basis for developing visions and objectives in the planning process. The conceptual and, where possible, quantitative models of ecological and social process developed in an ecosystem services analysis support scenario planning to consider the possible paths forward and their implications.¹⁴⁵ Many plans in the past sought a 'sustainable future' without a clear of idea of what that meant. An ecosystem services approach, however imperfect, provides a basis for considering what the nature of sustainability might be. Ecosystem services processes have been shown to engage and encourage stakeholders to take responsibility for developing and implementing plans and so have the potential to increase the effectiveness of government investments.^{1, 64, 150}

11.4.8 Evaluation

Defining the issues and policy and planning objectives at least partly in terms of ecosystem services and human wellbeing facilitates evaluation of whether objectives have been met. The combined literature of ecosystems services and resilience, however, warns against setting inflexible objectives as there must be room for adaptation and learning, especially about the nature of human well being and the processes by which ecosystems function. In any case, current understanding and technologies will not support the setting or measurement of precise targets with respect to ecosystem services.

11.4.9 Contributions to other dimensions of policy analysis

It is easy for the misconception that ecosystem services is synonymous with economic valuation to arise as so many ecosystem services projects involve economic valuation and the approach was developed in part to get benefits from ecosystems considered along with issues that have clear monetary value. Proponents of an ecosystem services approach emphasise that it addresses a much wider range of aspects of environment-social policy (Table 11) and that it goes beyond the scope of most other approaches to measuring demand and impacts of humans, such as ecosystem health.³⁰

Table 11: Potential contributions of an ecosystem services approach to social, technological, economic, environmental and political/ legal dimensions of decision-making.

| Aspect | Potential contributions |
|------------------|---|
| Social | At the heart of an ecosystem services framework is explicit links between ecosystems and human wellbeing. A focus on benefits and beneficiaries is a basis for considering ethical and justice dimensions of environmental decision-making. |
| Technological | A fundamental part of an ecosystem services approach is considering the nature and cost-effectiveness of technological (e.g., engineering) alternatives to ecosystem services. The focus on relationships between ecosystem processes and how they lead to services and benefits is a basis for considering what functions would need to be provided in engineering solutions. An ecosystem services approach does not assume that an ecosystem is necessarily superior to a technological solution but it does aim to provide stakeholders with relevant information on which to base value judgements and decisions. |
| Economic | As discussed in several places in the report and throughout the literature, one major aspect of the development of ecosystem services approaches over the past decade has been closer alignment with ecology and economics. Recent frameworks allow diverse stakeholders to take part in dialogue about 'worth' of ecosystems and to understand the basis for benefit-cost analyses and other economic analyses. The improvements that have been made in economic approaches to non-market valuation over this same time period have meant that an ecosystem services valuations are being used frequently in decision-making in the USA and Europe and even in courts of law in the USA. |
| Environmental | An ecosystem services approach provides a framework that can be used to organise the complex information about states and trends in ecological systems. It provides language and concepts that relate to everyday transactions (the giving and receiving services between producers and consumers) and allow non-ecologists to engage in productive dialogue about what trends in biodiversity and ecosystem function might mean, and it therefore provides bridges between scientists, communities, businesses and policy makers. |
| Political/ legal | The language and concepts of ecosystem services allow politicians to couch explanations of environmental decisions in terms that relate to human wellbeing. As explained throughout this report, the concept does not only deal with tangible uses of biodiversity and its services but also the intangible values, including existence and bequest values, that make sense to most people when included within a framework that considers the full range of values. Although the concept is still not quite at the stage where all services can be defined and measured precisely, the evidence is that once such definitions and measurements become possible, as they have for habitat, water quality and carbon sequestration, regulations, markets and, eventually, codification of rights and responsibilities in law become possible. Legal practitioners have said for some time that one factor holding back the mainstreaming of 'sustainability' has been the difficulty of defining it in ways that hold up in courts. There is promise that the concept of ecosystem services will evolve to the point where it becomes part of legislation. ^{198, 199} |

11.4.10 Potential costs

Appendix VIII reports an assessment of strengths, weaknesses, opportunities and threats associated with applying an ecosystem services approach in Australia. The most obvious costs of

applying an ecosystem services approach are transaction costs and costs of research and data collection. These costs are not likely, however, to be greater than applying alternative approaches and are likely to be lower in many cases. The Australian Government is committed to whole of government approaches for addressing major public issues and to stakeholder engagement in policy development. Developing a framework for classifying and discussing benefits from ecosystems is likely to improve communication between government departments and with stakeholders. Just as importantly, it is likely to increase the quality and relevance of stakeholder input and allow government departments to develop strategic approaches to dealing with environmental issues that have relevance to multiple departments.

The costs of research to improve ability to measure ecosystem processes and anticipate demand and supply of ecosystem services spatially and temporarily might be high, but these costs would need to be incurred anyway as it becomes more clear that Australia's ability to report on environmental change and its implications is inadequate. Applying an ecosystem services approach as one component of a national approach to environmental information collection is likely to enhance the use of the data in strategic thinking and planning. It is highly likely that the type and level of information that is required for an ecosystem services approach will be the same as that called for by most academics and non-government organisations that have expressed informed opinions about what data are needed to assess the state of Australia's environments. The types of information needed include data on ecosystem processes in soil, plant and animal systems, including natural and human managed systems, at a range of spatial and temporal scales. This information is vital even if an ecosystem services approach is not applied — the difference is that an ecosystem services approach will give an additional way to interpret the information and relate it to big policy issues related to human wellbeing.

11.5 Key issues and recommended actions

Taking the results of our interviews (Section 11.2) and conclusions from the literature (Section 11.3), we have identified a consolidated set of issues that we think, if addressed, would greatly improve the Australian Government's ability to consider, strategically, the alignment between environmental policy and management and human wellbeing and increase the effectiveness of investments in environmental management by engaging a wider range of society in dialogue and action. In the following subsections we briefly outline our key recommendations, and the issues that underpin them, and suggest actions for implementing the recommendations

Recommendation 1: Develop a process for strategic dialogue and planning within the Australian Government that considers the full range of potential benefits from ecosystems along with other information relevant to strategic decisions.

This recommendation is based on the feedback from our interviews, and from our literature analyses, which suggests that not only are the potential environmental impacts of policies developed in many government departments (at all levels of government) being poorly considered but that there are also potential benefits from ecosystems that are not being taken into account and opportunities for synergism between environmental and other policies that are being overlooked. Later in the chapter we highlight population and food policies as two such areas but there are potentially many others (as indicated in Table 8). Furthermore, the experience of several governments around the world, including the UK, USA and China, and also

Australia to a degree, has shown that an ecosystem services framework can lead to both productive strategic dialogue and major new opportunities for aligning economic development with improved environmental management and human wellbeing.

Fundamental to achieving this recommendation is a need to develop a common understanding, language and framework to support strategic dialogue about environmental issues across government departments and with stakeholders outside of government. This understanding needs to be at a systems level, going beyond minimisation of undesirable environmental impacts and including understanding of how suites of species interacting with one another and the non-living world support activities that are important to all governments departments and all sectors of society. The language and framework should not be overly specific and should be sufficiently flexible to incorporate different perspectives and different disciplines as well as new knowledge as it emerges.

These processes for strategic dialogue should be capable of engaging with and drawing on expert and public opinion and should include steps to build the capacity of all stakeholders to understand the concepts and language used in this dialogue; examples of cross-departmental issues that should be considered by such processes include populations policy, food security policy, coastal policy and conservation policy.

Recommended actions:

- 1.1 Build on lessons learned in the review of Caring for Our Country about how to present and communicate ideas about benefits from ecosystems and human wellbeing within government and with other stakeholders and especially how the high-level rhetoric has influenced delivery of programmes
- 1.2 Convene a multi-departmental working group (preferably linked to a National Ecosystem Services Network see Action 2.1) to work towards a conceptual framework that would facilitate productive dialogue about ecosystem services across Australian Government departments and with the Australian Government's stakeholders. Available evidence suggests that this would need to be a high-level, guiding framework. It should avoid trying to be specific about categorising ecosystems and ecosystem services as this is likely to get bogged down in debate between ecologists, economists and communities with little benefit. This is better achieved on a case study basis.
- 1.3 Establish a high-level strategic forum but make sure it is supported by an advisory panel of lower-level technical experts and policy developers who are wrestling with the implementation issues and are able to make recommendations for consideration (this is based on the experience in the USA where a high-level forum exists but is not supported by those dealing with the day to day issues)
- 1.3 As a mechanism for achieving Action 1.3, consider establishment of an "Office of Ecosystem Services", which is responsible for achieving strategic thinking and action across departments (this has been done in the USA and an equivalent mechanisms now exists in the UK arising from the National Ecosystem Assessment)

1.4 As a mechanism to support Action 1.3, seek agreement that all government programs include a strategic assessment against an ecosystem services framework

Recommendation 2: Explore improvements to governance arrangements to encourage appropriate sharing of responsibility for strategic alignment of human wellbeing and ecosystem management across society

Recommendation 1 is a contribution to these improvements in governance, but there is a need to recognise that government cannot solve all ecosystem services issues. There is need for understanding, capacity and authority to be spread through the decision-making chain so that there are 'pathways to implementation' for government policies, 'pathways for feedback' from stakeholders to policy makers, and all sectors of society understand and can play their part on strategic management of ecosystem and human wellbeing.

Recommended actions:

- 2.1 Encourage and, at least initially finance, development of a national ecosystem services network of researchers, policy makers and policy implementers from all sectors and levels of society to encourage dialogue about what the key issues are and how to addressed them (this might also be seen as a 'community of practice'). This network should be hosted by a non-government entity NGO (such as a University) but supported by government. Australia 21 has previously produced a report suggesting how this could be done,⁹ which could serve as a starting point. Feedback from similar networks, such as the Ecosystem Services Partnership in the USA,⁸⁸ suggests that active government involvement is critical but that organisation and leadership should be independent of government.
- 2.2 Convene a multi-stakeholder working party to consider the different roles and responsibilities of different parts of society for identifying and managing ecosystem services and how governance arrangements can be modified to facilitate those roles and responsibilities (this should involve an Office of Ecosystem Services, if established, but also representatives from all organisations and institutions that contribute to environmental governance).

Recommendation 3: To support all of the above, continue and enhance initiatives to establish an appropriate and accessible set of information capable of supporting strategic dialogue about ecosystem management and human wellbeing

To support constructive strategic dialogue that adds, rather than detracts from, efforts to align environmental policy and management with human wellbeing, there is a need for information that tracks changes in the state and capacity of ecosystems to produce benefits to people as well as assessments of likely demands for these benefits spatially and temporarily. We recognise that development of a national set of environmental-economic accounts is underway in Australia and that a National Plan for Environmental Information is under development and that ecosystems services approaches are being considered as one input to those processes. We suggest that demands for ecosystem services analyses will grow rapidly in the next decade and that people performing these analyses will be major clients for national data sets. State of the environment reports over the past decade have highlighted the dearth of information for tracking change in ecosystem function. Another major gap in Australia's ability to align environmental management and human wellbeing is the scarcity of information on current, and possible future, human demands on ecosystems.

Recommended actions:

- 3.1 In the design of national environmental data collection and analysis, consider information required for assessing the capacity of ecosystems generate benefits in relation to when and where humans need them (e.g., collect data on not only the state of ecosystem assets but also functionality and also collect information that will allow assessments of current, and possible future, human needs).
- 3.2 Use the above to identify key research gaps and develop a program to address them
- 3.3 Consider a national ecosystem assessment, grounded in action by regional bodies and building on the UK's National Ecosystem Assessment and the lessons learned from that process, which includes not only assessment of the state of the assets but also scenarios for future human demands on ecosystems this assessment should be seen as a whole of government and whole of nation project designed to support multiple sectors and policies across society.
- 3.4 Encourage integration of ecosystem services assessments into key cross-departmental policies and programs, such as population, immigration and food security policies and programs (e.g., include strategic thinking about future demands on ecosystems services, where those demands might occur and how policy settings might affect the size and nature of the demands)
- 3.5 Consider how centralised data collection and distribution can facilitate multistakeholder dialogue about ecosystem service tradeoffs

Recommendation 4: Build on and enhance Australia's investments in innovative ways to link ecological and economic research with business to drive desirable environmental change

Australia is already investing productively in this area and producing examples that have been emulated elsewhere in the world. This process should built on and encouraged to develop further. Harnessing the force of markets has become a major component of environmental policy but there is a need to be more innovative so that the outcomes achieved are consistent with well-informed strategic dialogue about the implications of multiple ecosystem benefits to current and future Australians.

4.1 Convene a working group (linked with a National Ecosystem Services Network and Australian Government working groups established in response to the recommendations above) to consider whether a set of environmental assets can be identified that satisfy the needs of economic (especially benefit-cost) analysis (the indications are that this is close to being possible as a result of recent advances in

ecosystem services classifications and typologies) and to consider how an ecosystem services framework for Australia can better support development of market-based approaches to achieving balanced wellbeing outcomes from ecosystems for Australians.

4.2 Linked with Recommendation 2.2, invest in building capacity and opportunities for beneficiaries of ecosystem services to explore mutually beneficial solutions to sharing benefits. This might require new consideration of the roles of government in encouraging or discouraging innovation in institutional design and governance.

11.6 Achieving strategic, holistic environmental-social thinking and planning across interest groups, sectors, government departments, and levels of government and society

Perhaps one of the greatest challenges in this list is that of improving strategic dialogue across government departments and between governments and the rest of society.

There was broad agreement among interviewees that there have been serious efforts at both state and federal levels to encourage whole-of-government approaches to major challenges in recent years but that departments still tend to function somewhat independently of one another and often in competition for recognition and resources. In the past, responsibility for environmental issues was often not considered or taken by most departments as it was expected that the environment department would do that. This meant that there was little routine consideration of how decisions within departments, other than the environment department, either affected ecosystems services or could benefit from consideration of them. This worked strongly against a strategic or integrated approach to considering ecological, social and economic benefits, risks and tradeoffs at any level of government. In recent years, DSEWPaC has been directed to take the lead in considering environmental issues in relation to challenges like the development and implementation of the Murray Darling Basin Plan and, more recently, integrating environmental management with carbon-emissions policies and programs. While this makes sense from an efficiency point of view, there is a risk that inadequate thinking about links with ecosystem services will occur in other departments. Several interviewees associated with agricultural industries expressed concern that DAFF has had a limited profile in environmental discussions in the past few years and expressed concern that this has reduced the ability of agriculture, forestry and fisheries industries to engage in strategic dialogue about ecosystem services.

On the other hand, it was emphasised to us that Caring for Our Country is a genuine and productive partnership between DAFF and DSEWPaC, and that DAFF had important inputs into the review of the *Environment Protection and Biodiversity Conservation Act 1999*.

The observation has been made several times recently that the environment has not been mentioned often in debates about population policy in Australia. ^{53, 60, 104, 208} In the opinion of at least some interviewees, this is partly a reflection of the separation of immigration, industry, infrastructure and environmental thinking with governments (at all levels) and the limited mechanisms for strategic conversations about ecosystem services across these functionalities.

Several emerging developments offer possibilities for greater strategic dialogue about ecosystem services among Ministers and government departments at state and federal levels and between government and other sectors:

- 1 The finalisation and implementation of the Murray Darling Basin Plan has attracted both positive and negative feedback from stakeholders but it, and the ongoing activities of the Murray Darling Basin Authority (MDBA), have considerable potential to facilitate the sort of dialogue required to identify and deal with tradeoffs between environmental, social and economic values (and a major study of potential ecosystem services benefits from the Plan is underway, as mentioned in Chapter **Error! Reference source not found.**);
- 2 The recent review of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), which included recommendations to apply the act more strategically with an ecosystem-scale focus, was seen as an important opportunity for a more strategic approach to considering society's current and future needs for ecosystem services and the impacts of decisions by a wide range of government departments on those need and on the ability of ecosystems to meet them. Although decisions under the EPBC Act are ultimately taken by the DSEWPC Minister, there is a requirement for that Minister to consult other Ministers and this could be a mechanisms for inter-departmental strategic dialogue about ecosystem services.
- 3 The development of a national approach to collecting and sharing environmental information¹⁹ has the potential to support informed dialogue about the relationships between people and the natural environment at a level previously not possible in Australia, and Australia's involvement in the development of the System of Environmental-Economic Accounts²³¹ and the associated Wealth Accounting and Valuation of Ecosystem Services programme¹³⁷ will provide mechanisms for accessing leading international thinking in this area.
- 4 Ongoing implementation of Caring for Our Country, which has a strong focus on ecosystem services from both protected and production lands, should provide a vehicle for developing an ecosystem services approach further, as might any future developments following from this programme.
- 5 Finally, the Australian Government's involvement in the development of the Intergovernmental Platform on Biodiversity and Ecosystem Services²⁰ could provide a mechanism to refine thinking about the strategic application of an ecosystem services approach, including improving alignment between research and policy, and to play an international leadership role as Australia's approach develops.

11.7 Application of an ecosystem services approach in food, environment, agriculture and population policy

Around 60% of Australia's land area is used for agricultural activities such as grazing, cropping and horticulture.¹⁸⁰ The largest use by area is extensive grazing of mainly natural vegetation, but most farm profit is derived from intensive industries (especially irrigated cropping and horticulture).

We know of no national-scale strategic thinking integrating future trajectories for these extensive and intensive land uses with areas of national policy that are likely to influence the

needs of Australians for ecosystem services and the ability of ecosystems to meet those needs. Such policies include those relating to population, immigration, infrastructure development, food security, water, and biodiversity.

The recent PMSEIC report¹⁸⁰ acknowledged the central importance of food and food production to human wellbeing and environmental health. The report discussed a range of ways in which the food production chain might interact with aspects of environmental management and the development of Australia society, including through competition for arable land from alternative land uses like urban development. It noted that landuse conflicts are likely to become more acute in the future. Competition for arable land will be strongly influenced by population, immigration and settlement policies as where and how people live influences spatial patterns of land value. And yet, PMSEIC observed: '…food is not currently dealt with in an integrated way which brings together the policy and regulatory agencies involved with food'.

PMSEIC further observed that:

The development of a consistent and whole-of-government approach to food will encourage understanding, communication and innovation in the food sector. Such an approach will be vital to respond to global and domestic food security challenges. A holistic approach to the food value chain could also result in the creation of new international markets for food and food technologies developed in Australia, as well as opportunities to export technologies and innovations to help address global food security issues.

A recent review by the Australian Bureau of Agricultural and Resource Economics (ABARE)²⁰⁶ concluded that there is no immediate threat to Australia's domestic food supply but that Australia will increasingly be called on to play a role in ensuring global food security. The report observed that: 'Australia has an opportunity to share its technologies, institutional knowledge, agricultural policy and rural development capability with poorer nations through extension initiatives and aid programs. Collaborative agricultural research, particularly in the areas of tropical and dryland agriculture, would benefit multiple stakeholders from a range of countries'. Development, testing and communicating an ecosystem services approach could be one important aspect of this global contribution.

It has been noted by some stakeholders in our interviews that DAFF has very little substantive engagement with core government policy beyond quarantine and customs, biosecurity and food security policies. This view overlooks DAFF's considerable role in Caring for Our Country.¹³ Even within its core policy areas, there remain some significant mechanisms through which DAFF could influence application of an ecosystem services approach nationally. The recent discussion paper on a National Food Plan⁷² points out that decisions on land-use planning and zoning, especially in relation to factor affecting access to arable land (e.g., the granting of mining licences and or urban development decisions) are primarily a state, territory and local government responsibility, but that the Australian Government has a role, through the *Environment Protection and Biodiversity Conservation Act 1999*, when proposed developments are likely to have an impact on matters of national environmental significance. Application of the *Environment Protection and Biodiversity Conservation Act 1999* requires the responsible minister to consult with other relevant ministers, including DAFF's minister. The recent review of the *Environment Protection and Biodiversity Conservation Act 1999* recommended a more strategic application using an ecosystem approach (see Chapter **Error! Reference source not found.**).

This is an opportunity for DAFF to link its areas of policy interest into a broader ecosystem management agenda. A third opportunity comes from the current exploration of a national approach to collecting environmental information and inclusion of such information into a set of national accounts.^{19, 235} The potential contributions of an ecosystem services approach to that process are being investigated and key people involved in that process have been interviewed as part of this project.

Perhaps the most substantial opportunity for DAFF to influence application of an ecosystem services approach in Australia is via food security policy. It was suggested by some interviewees that the current discussion paper for a National Food Plan⁷² contains little reference to environmental issues. We note, however, that the discussion paper invites input from respondents on several aspects of environmental management: environmental sustainability and safety of food production; the capacity of natural resources, including fresh water, clean air and biodiversity, the influence of food production on the capacity of the environment to provide food and other ecosystem services; the influence of ecosystem services on development of the food industry over the short and long-term; implications of climatic factors for ongoing agricultural productivity growth; contributions by farmers, fishers, industries and the community to maintenance and improvement of natural resources; cost-effectiveness and prevention of environmental degradation; and helping farming and fishing enterprises improve their knowledge and skills and management practices to promote sustainable resource management. If these areas are developed in the ensuing National Food Plan it will provide a strong basis for integrating agriculture into national strategic thinking and planning about ecosystem-service based relationships between people and the environment.