Department of Sustainability and Environment

Criteria and Indicators for Sustainable Forest Management in Victoria

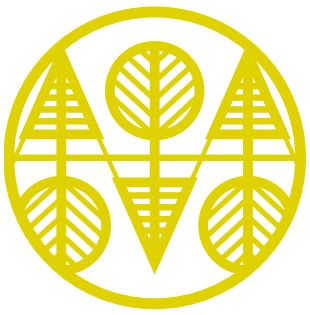
Guidance Document

A Victorian Government initiative

Victoria The Place To Be

Criteria and Indicators for Sustainable Forest Management in Victoria

Guidance Document



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Foreword

Victoria's State forests are an important part of our environment. They are the origin of many of our creeks and rivers, and are some of our favourite places to explore, learn and enjoy. State forests contain diverse and outstanding natural values. They contribute to scenic landscapes and provide habitat for a wide range of plants and animals. State forests are important contributors to regional employment and provide the Victorian community with a wide range of products, including timber, firewood and honey.

The policy initiatives *Growing Victoria Together* (2005), *Our Forests, Our Future* (2002) and *Our Environment, Our Future – Victoria's Environmental Sustainability Framework* (2005), combined with the *Sustainable Forests (Timber) Act 2004* and the *Sustainability Charter for Victoria's State forests* (2006), demonstrate and strengthen the Victorian Government's commitment to regional communities and the sustainable management of Victoria's State forests.

To meet the requirements of the *Sustainable Forests (Timber) Act 2004*, criteria and indicators for the sustainable management of Victoria's State forests have been developed by the Department of Sustainability and Environment with the assistance of key experts, Government partners, and in consultation with the community.

The community and industry are entitled to scientifically robust and transparent information about Victoria's State forests. Victoria's sustainable forest management indicators will provide a framework for the State forest monitoring and information reporting activities undertaken by the Department of Sustainability and Environment. The outcomes will complement and inform other sustainability initiatives currently operating at various scales within Victoria and Australia.

Hon. John Thwaites
Minister for Water, Environment and Climate Change

Contents

Introduction

The Victorian Government is committed to being a world leader in environmental sustainability. Victoria's forests are of major importance at a local, regional, State, national and international level. They hold many values, benefits and products for the community. They provide habitat for a wide variety of plants and animals, and play a vital role in conserving habitat and biodiversity values. Forests also make an important contribution to Victoria's economy, providing wood and other forest products, employment for local communities, regional development, recreation and tourism. The social, cultural, Indigenous, educational and aesthetic values associated with Victoria's forests are highly prized in the community and more people visit our State forests for recreation and amenity than for any other purpose. Victorians expect that forest ecosystems will be protected for current and future generations to enjoy, while continuing to satisfy the need for products derived from sustainably managed forests.

The Department of Sustainability and Environment (DSE) has primary responsibility for the sustainable management of Victoria's State forests. This includes the conservation of flora and fauna, protection of water catchments and water quality, the provision of timber and other forest products on a sustainable basis, the protection of landscape, archaeological and historic values, and the provision of recreational and educational opportunities.

Sustainable Forest Management

At the 1992 United Nations Conference on the Environment and Development held in Rio de Janeiro, Australia endorsed the Global Statement of Principles on Forests. Based on this endorsement, the Commonwealth, State and Territory governments developed a strategy for the ecologically sustainable management of Australia's forests. This strategy was embodied in the *National Forest Policy Statement*, signed by all participating governments in 1992, with the exception of Tasmania, which became a signatory in 1995.

After the United Nations Conference on the Environment and Development, Canada convened the International Seminar of Experts on the Sustainable Development of Boreal and Temperate Forests in 1993. This led to the signing of the Santiago Declaration in 1995, which included a criteria and indicator framework – known as the Montreal Process criteria and indicators. Australia is one of 12 member countries in the Montreal Process, which spans five continents and accounts for 60 percent of the world's forests. Similar frameworks have been developed for other forests of the world (for example the Helsinki Process for the forests of Europe (1993) and the International Tropical Timber Organisation Process (1992) for the world's tropical forests).

The Montreal Process criteria and indicators are designed to reflect the ecological, economic and social components of sustainable forest management. They provide a common understanding of what is meant by sustainable forest management. They also provide a common framework for describing, assessing and evaluating progress towards sustainable forest management at the national level. The Montreal Process criteria are:

1. Conservation of biological diversity;
2. Maintenance of productive capacity of forest ecosystems;
3. Maintenance of ecosystem health and vitality;
4. Conservation and maintenance of soil and water resources;
5. Maintenance of forest contribution to global carbon cycles;
6. Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies; and
7. Legal, institutional and economic framework for forest conservation and sustainable management.

Within these criteria, regional indicators have been developed for use in Australia under the *Framework of Regional (Sub-National) Level Criteria and Indicators of Sustainable Forest Management in Australia* (Commonwealth of Australia, 1998). These form the basis for measuring and reporting on sustainable forest management in Australia.

Victoria's Criteria and Indicators for Sustainable Forest Management

To demonstrate that Victoria is committed to sustainable forest management, it is important for our public reporting processes to reflect the work done by the Montreal Process (1995). Victoria's criteria and indicators for sustainable forest management are consistent with the Montreal Process. The Victorian criteria and indicators are also well aligned with Australia's regional indicators of sustainable forest management (Commonwealth of Australia, 1998) and will meet Victoria's national reporting obligations.

Under the *Sustainable Forests (Timber) Act 2004*, DSE has the responsibility to collate information against each of the Victorian indicators. This is done through *Victoria's State of the Forests Report* – a five-yearly report to the Minister for Water, Environment and Climate Change from the Secretary, DSE. VicForests is also required to provide information on relevant indicators to support this reporting process. Victoria's criteria and indicators will be used for a range of management and reporting processes and will complement other sustainability initiatives currently operating at various scales within Victoria and Australia. For example, the criteria and indicators provide a means to monitor and report on progress towards the objectives set out in the *Sustainability Charter for Victoria's State forests* (2006).

Specifically, it is anticipated that monitoring and reporting against the criteria and indicators will:

- Improve information about the current state of publicly owned native forests and trends over time;
- Define sustainable forest management on public land in the Victorian context;
- Allow credible performance reporting to the community;
- Facilitate inter/intra-agency communication and data exchange;
- Improve stakeholder/community/Indigenous consultation and participation in sustainable forest management;
- Draw on DSE's extensive data resources and identify where other relevant data may exist;
- Influence research directions to ensure knowledge gaps are identified and addressed;
- Highlight the forest sector's contribution to sustainable development in Victoria; and
- Improve the efficacy of management systems, policies and procedures (including elements of the *Code of Practice for Timber Production 2007*).

Process for developing Victoria's Criteria and Indicators for Sustainable Forest Management

The development of Victoria's criteria and indicators has included government, stakeholder and community consultation (see Figure 1), demonstrating the Victorian Government's commitment to greater community engagement in forest management.

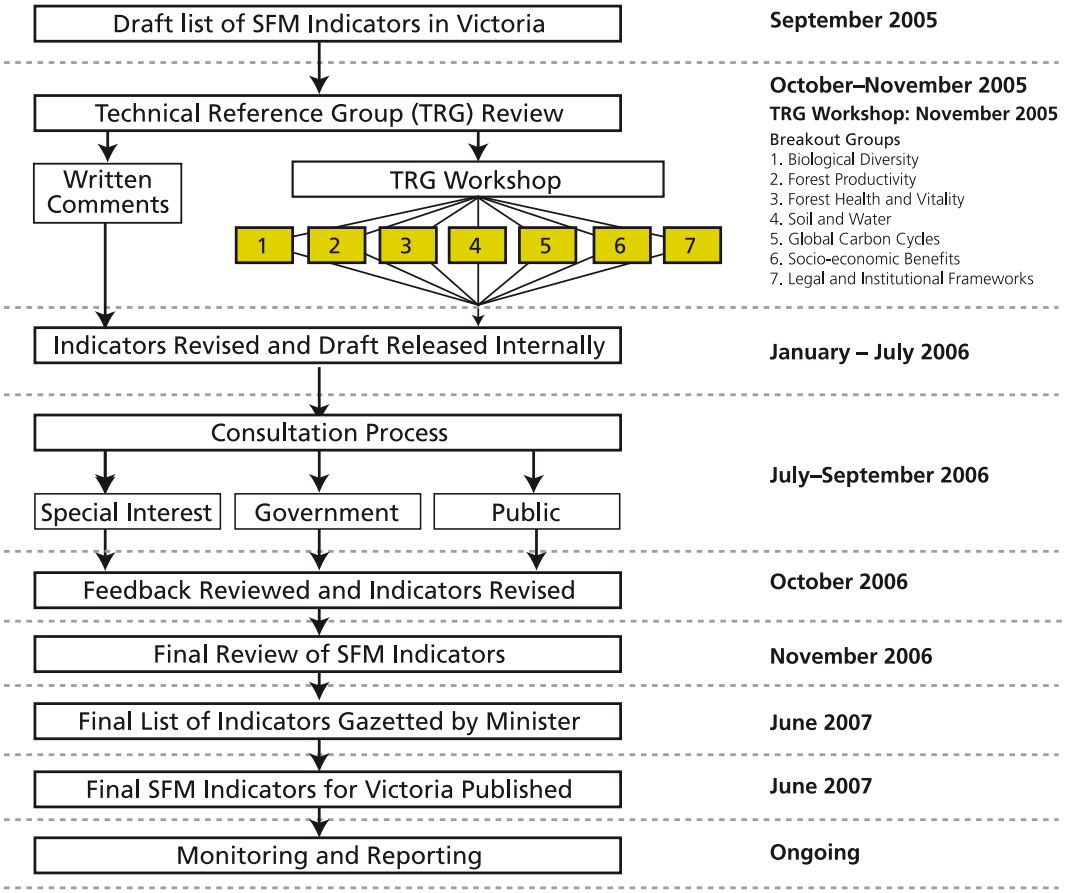
Victoria's criteria and indicators for sustainable forest management have been subjected to a process of expert review through a series of Technical Reference Group workshops held in November 2005. The Technical Reference Group was comprised of DSE and external people with high-level expertise in at least one of the seven Montreal Process criteria subject areas. The Technical Reference Group workshops identified a number of issues associated with the proposed indicators. These issues were addressed, where possible, and new indicators subsequently included.

The draft criteria and indicators were then distributed across Government for comment and released for statewide consultation between July and September 2006. Further opportunity for comment by government bodies was also provided during this consultation period.

Public information sessions were held at Ballarat, Bairnsdale, Benalla, Bendigo and Melbourne. These sessions aimed to provide interested stakeholders and members of the public with an understanding of how the indicators were developed and how they would be used in forest management. The sessions also provided an opportunity for questions and concerns to be raised. Forty written submissions were subsequently received from interested parties. All feedback was addressed, where feasible.

It is expected that the criteria and indicators will be periodically reviewed to ensure the continued supply of accurate and relevant information for sustainable forest management.

Figure 1: Process for developing the *Criteria and Indicators for Sustainable Forest Management (SFM) in Victoria*



Structure of Victoria's Criteria and Indicators for Sustainable Forest Management

Forty-five indicators are proposed under the seven broad criteria of the Montreal Process and *Framework of Regional (Sub-National) Level Criteria and Indicators of Sustainable Forest Management in Australia* (Commonwealth of Australia, 1998). The reporting unit for each criteria and indicator is State forest. While the criteria and indicators can be applied to all forest land tenures in Victoria, the *Sustainable Forests (Timber) Act 2004* only requires DSE to monitor and report on the indicators in the context of Victoria's State forests. Nevertheless, where data is available, a broader 'all forests, all tenure' approach to reporting will be adopted. It is recognised that no single criteria or indicator is an indication of sustainability, therefore, each must be considered in the context of other criteria and indicators.

Associated with the indicators are a number of potential sub-indicator reporting areas. These potential sub-indicators are practical, yet aspirational, and will rely on data availability at the time of reporting. Reporting on these potential sub-indicators is not considered compulsory, however, the extent to which DSE can monitor and report on these areas needs to be considered in the evaluation of sustainable forest management and will play an important role in demonstrating continual improvement over time.

To facilitate a statewide approach to reporting, the following three categories have been applied to each indicator (see Appendix 1):

A *Category A:* Indicators that can be reported against immediately for many areas of Victoria's forest. In these cases, information is already available and/or being collected;

B *Category B:* Indicators that can be measured for some areas of forest, but where there remains a methodological or resourcing issue; and

C *Category C:* Indicators where significant research and development is required to assess if there is a practical, sensitive and cost-effective means of implementation.

These categories will be used to determine the availability and completeness of the data, and to set information priorities.

The *Criteria and Indicators for Sustainable Forest Management in Victoria* is structured as follows:

Montreal Process Criterion

Indicator name and category

Potential sub-indicator reporting areas

- **Rationale** – why the indicator is used and what information it provides;
- **Issues** – outlines specific issues that may affect DSE's ability to report accurately on the indicator;
- **Possible data sources** – lists the government and non-government agencies/groups that may provide data related to the indicator;
- **Potential methods** – lists the various methods that can be used to obtain and assess the data related to the indicator; and
- **Interpretation** – outlines the factors that need to be considered when interpreting the data and assessing the indicator.

Criterion

1

Conservation of biological diversity

"Biodiversity refers to the different plants, animals, micro-organisms, their genes and the ecosystems they form. The conservation of biodiversity is a key element of ecologically sustainable development. Managing native forests to protect biodiversity and maintain ecosystem processes via the conservation of habitats and ecosystems is essential to the ongoing survival of all species."

Sustainability Charter for Victoria's State forests (2006)

Element:	**1.1 Ecosystem diversity**
Indicator:	**1.1a Area of forest by type and tenure** A
Potential sub-indicator reporting areas	*i) Percentage of tree species (Ecological Vegetation Class and species group) by age class and site quality*

Rationale

Indicator:

Measures the current level of forest cover by broad forest type and demonstrates whether/how the forested area is changing over time. This knowledge is fundamental for the effective management of our forests.

Potential sub-indicator reporting areas:

This sub-indicator aims to incorporate the concept of Comprehensive, Adequate and Representative with respect to tree species.

Issues

- Ecological Vegetation Class is not synonymous with forest type. Consequently, vegetation classification could be reported as either Ecological Vegetation Class or forest type, or both;
- The Statewide Forest Resource Inventory program considers site quality by measuring the height of forests at 20 years and their growth potential. Sites < 20 years at the time of the inventory have not been assessed; and
- In some Ecological Vegetation Classes the understorey age and composition may differ from that of the overstorey.

Possible data sources

- Department of Sustainability and Environment.

Potential methods

- Initially this indicator should use Statewide Forest Resource Inventory databases, however, the use of the Ecological Vegetation Class benchmarking process needs to be considered; and
- National Forest Inventory classes may also be used, see National Forest Inventory (2003).

Interpretation

This information will allow the identification of changes in vegetation cover and condition over time. The data should be reviewed with respect to forest management objectives including seral stage distributions, forest condition and areas in reserve.

Element:	**1.1 Ecosystem diversity**
Indicator:	**1.1b Area of forest type by growth stage** B
Potential sub-indicator reporting areas	*i) Area of old growth forest, by type, distributed across the Forest Management Area* *ii) Area and percentage of old growth harvested annually* *iii) Area and percentage of old growth impacted by natural processes annually (e.g. wildfire, insect attack)* *iv) Area recruited for future old growth (areas of regrowth protected from anthropogenic disturbances – age distribution)*

Rationale

Indicator:

Within any forest ecosystem or forest type, ecological processes and the species associated with those processes are related to vegetation structure (age and strata), successional stages (varies between species) and their configuration in the landscape.

Potential sub-indicator reporting areas:

These sub-indicators aim to incorporate issues related to the representativeness and future availability of old growth forest.

Issues

- In some Ecological Vegetation Classes the understorey age and composition may differ from that of the overstorey. This can be difficult to analyse and could cause difficulties in reporting.

Possible data sources

- Department of Sustainability and Environment.

Potential methods

- Standard forest measurement procedures, including aerial photograph interpretation, inventory data, disturbance history, logging history and fire maps can be used for determining growth stage.

Interpretation

This information will identify changes in growth stages within forest types related to forest management objectives, and by tenure. Implications for flora and fauna that favour particular growth stages should be discussed.

Element:	**1.1 Ecosystem diversity**
Indicator:	**1.1c Area of forest type by growth stage distribution in protected zones** A
Potential sub-indicator reporting areas	*i) Area of forest, by type and age class in Comprehensive, Adequate and Representative (CAR) reserve areas* *ii) Range of sizes and average size of CAR reserve areas for each forest type* *iii) Number of outstanding or unique biological, zoological, geological, or paleontological features in protected areas* *iv) Area of forest available for timber harvesting in relation to area of forest in CAR reserve areas* *v) Area of forest types with significantly reduced area*

Rationale

Indicator:

Strategies for nature conservation should include a system of reserves that are Comprehensive, Adequate and Representative.

Potential sub-indicator reporting areas:

These sub-indicators aim to incorporate issues related to representativeness, connectivity and habitat availability.

Issues

- Some areas of forest still require measurement. This includes combinations of protected areas, mature forest and regrowth;
- The effects of wildfire on forest age class and structure needs to be considered and incorporated;
- Measurement unit types and regions may vary (for example Catchment Management Area, Forest Management Area and Bioregions); and
- In some Ecological Vegetation Classes the understorey age may differ from the overstorey.

Possible data sources

- Department of Sustainability and Environment.

Potential methods

- Fire severity mapping case studies.

Interpretation

Generally, as the area of protected forest increases the indicator will show a corresponding rise in the area of forest type by growth stage distribution in protected zones, thereby increasing representativeness. However, it may also be possible for representativeness to increase, even when the area protected remains unchanged, because of reductions in the total forest estate.

Element:	**1.1 Ecosystem diversity**
Indicator:	**1.1d Fragmentation of native forest cover** B
Potential sub-indicator reporting areas	*i) Connectivity between areas with similar habitat types* *ii) Area of forest permanently converted to non-forest*

Rationale

Indicator:

Provides information on the state of forests impacted by the loss of forest cover and determines the spatial configuration of that loss within a region. Because large stretches of continuous forest are often necessary for maintaining viable populations of species, fragmentation (for example from roads, pipelines) can cause populations (especially small populations) to become vulnerable, and can reduce gene pools through loss of biodiversity.

Potential sub-indicator reporting areas:

These sub-indicators aim to quantify habitat fragmentation at the landscape level.

Issues

- There needs to be a focus on the representation of growth stages in each Ecological Vegetation Class;
- Fragmentation already exists in some Ecological Vegetation Classes – change through time is important;
- Pest and wildfire (fire severity) effects need to be considered with respect to this indicator; and
- Fragmentation is often an issue where a forest area adjoins private property, or is divided by private property across a forest type.

Possible data sources

- Department of Sustainability and Environment;
- Arthur Rylah Institute; and
- Birds Australia Atlas.

Potential methods

- *FragStats*: A computer software program designed to compute a wide variety of landscape metrics for categorical map patterns, and to explore some issues regarding the use of landscape metrics to describe landscape structure;
- For measuring Connectivity Indices see Hanski (1999); and
- For methods to assess fragmentation of parks see University of Ballarat (1998).

Interpretation

Broadly speaking, less fragmentation of forest by other land uses is considered to be more favourable to the conservation of biodiversity. Assessment of this indicator should be interpreted within the context of natural fragmentation patterns. It should also incorporate both temporary and permanent fragmentation in the landscape and consider their effects over time.

Element:	1.2 Species diversity
Indicator:	**1.2a The status of forest dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment** A
Potential sub-indicator reporting areas	*i) Percentage of high priority actions at high priority locations successfully implemented annually for threatened species and communities* *ii) Percentage of high priority threatened species populations with positive trends for a) population, b) habitat and c) risk* *iii) Percentage of high priority occurrences of threatened communities with positive trends for a) extent and condition, b) physical environment and c) risk* *iv) Percentage change in the number of forest dependent species classified as vulnerable, threatened or endangered*

Rationale

Indicator:

Describes the status of known threatened species in Victoria's forests and provides information to improve their conservation status and formal designation.

Potential sub-indicator reporting areas:

These sub-indicators aim to provide a measure of change in both the status of species at risk and the processes threatening their survival.

Issues

- The mobility of faunal species requires measurement and monitoring across land tenures;
- The capacity of the system to absorb change requires consideration when reporting on this indicator; and
- There is a time lag between the assessment of species at risk and implementation of appropriate interventions.

Possible data sources

- Department of Sustainability and Environment;
- Victoria's Catchment Management Authorities;
- Arthur Rylah Institute;
- School of Forest and Ecosystem Science (The University of Melbourne); and
- Birds Australia Atlas.

Potential methods

- For ecological risk assessment and defining attributes required to meet the needs of species see Lambeck (1997) and Carey *et al*. (2004);
- Actions for Biodiversity Conservation – measuring and reporting on the conservation of species through the three categories of population size, habitat extent and condition, and future risk; and
- Reporting on the implementation of activities contained in *Flora and Fauna Guarantee Act 1988:* Action Statements.

Interpretation

A decline in the total number of species at risk is desirable. It will also be important to note changes between the categories over time and any improvements in the number of species in lower risk categories.

Element:	1.2 Species diversity
Indicator:	**1.2b Area of habitat available for forest dependent indicator species** B
Potential sub-indicator reporting areas	*i) Areas of high, medium and low habitat (quality) for indicator species* • Percentage change in area of feeding habitat over time • Percentage change in area of breeding habitat over time • Percentage change in sites suitable for germination/regeneration *ii) Distribution of selected habitat elements by catchment over time* • Percentage change in stems by large live tree diameter class • Percentage of total area retained in Habitat Tree Patches • Dead and dying trees: volume (m^3, ha) of dead potential • Stags per hectare • Volume (m^3, ha) of coarse woody debris (logs) by size class and catchment

Rationale

Indicator:

Provides information on the amount of habitat available for indicator species. While the existence of habitat does not necessarily indicate the presence of a particular species, habitat information can inform decision making for forest management and protection.

Potential sub-indicator reporting areas:

These sub-indicators aim to provide a measure of habitat quality through time. They also consider the life-cycle requirements of certain species.

Issues

- Thresholds for habitat requirements need to be set for the indicator species being measured;
- The species richness of an area needs to be considered with respect to the amount of habitat available;
- The process of identifying species requirements needs to incorporate a risk assessment approach; and
- There is uncertainty about the methodology for the selection and monitoring of indicator species. Furthermore, this selection is often dependent on location and management objectives.

Possible data sources

- Department of Sustainability and Environment;
- Arthur Rylah Institute;
- School of Forest and Ecosystem Science (The University of Melbourne); and
- Parks Victoria.

Potential methods

- For adaptive management see Holling (1978), Parma *et al.* (1998), Shea *et al.* (2002) and Nitschke *et al*. (2007);
- For selection and ongoing monitoring of appropriate indicator species see Lambeck (1997), Lindenmayer *et al.* (2000), and Kavanagh *et al.* (2004);
- High level approaches outlined in *Victoria's Native Vegetation Management Framework for Action*;
- Improved application of remote sensing technology; and
- Actions for Biodiversity Conservation – database queries on habitat requirements and availability for a given species.

Interpretation

The availability of suitable habitat is fundamental to the survival of species and the maintenance of species diversity. It is generally accepted that species diversity will increase with habitat availability, however, this is also dependent on factors such as habitat connectivity, disease, disturbance, and competition and predation from other species.

Element:	1.2 Species diversity
Indicator:	**1.2c Representative indicator species from a range of habitats monitored at scales relevant to regional forest management** B
Potential sub-indicator reporting areas	*i) Population levels of selected forest dependent species* *ii) Number of forest dependent species that occupy a small portion of their former range* *iii) Percentage of original range occupied by selected rare, threatened, endangered, or indicator species*

Rationale

Indicator:

Provides a broad measure of the conservation status of representative indicator species across a range of forest habitats. The intention is to provide an early warning of changes in conditions that may impact negatively on biodiversity. This indicator reflects elements of ecosystem diversity.

Potential sub-indicator reporting areas:

These sub-indicators aim to further quantify the extent of species monitoring conducted in Victoria's State forests.

Issues

- There is uncertainty regarding satisfactory sampling methods to accurately estimate species distributions across different types of land tenure;
- In order to understand changes, results for individual species need to be assessed relative to groups of species with similar life histories;
- Identifying the former ranges of species may be difficult and, in some cases, not possible;
- The monitoring framework must have the capacity to include new indicator species;
- Species migration in response to habitat maturation needs to be determined;
- Biodiversity Action Plans are influenced by land tenure, therefore different regulations apply and management strategies may vary; and
- There is uncertainty about the methodology for the selection and monitoring of indicator species.

Possible data sources

- Department of Sustainability and Environment;
- Arthur Rylah Institute;
- School of Forest and Ecosystem Science (The University of Melbourne); and
- Birds Australia Atlas.

Potential methods

- Actions for Biodiversity Conservation – database queries on habitat availability and population attributes for given species;
- Aspects of monitoring program design and ecological modelling for sustainable forest management are discussed in relevant scientific literature including Lindenmayer (1999), Lindenmayer *et al.* (2000), Kavanagh *et al.* (2004), Loyn (2004) and Wintle *et al.* (2005);
- For survey design for monitoring the abundance of arboreal marsupials see Lindenmayer *et al.* (2003); and
- For selection and ongoing monitoring of appropriate indicator species see Lambeck (1997), Lindenmayer *et al.* (2000) and Kavanagh *et al.* (2004).

Interpretation

Interpretation of the potential consequences of changes in a species population size should be carried out by the appropriate scientific authority. Population numbers fluctuate up and down for many reasons, including natural cycles and stochastic variation.

Species whose ranges are decreasing over time, particularly for those species at risk, indicate the need to implement or revise conservation strategies. Likewise, changes in the range of species of economic importance may indicate reduced or increased economic opportunities.

Element:	**1.2 Species diversity**
Indicator:	**1.2d Degree of disturbance to native forest species caused by invasive species** B
Potential sub-indicator reporting areas:	*i) Number of invasive, exotic forest-associated species* *ii) Location and dispersal of introduced species* *iii) Changes in abundance and distribution of native species known to be susceptible to such disturbance*

Rationale

Indicator:

Invasive species can affect ecological processes in forests. Information on the degree of disturbance caused by invasive species can be used to inform rehabilitation and pest control programs.

Potential sub-indicator reporting areas:

These sub-indicators aim to further quantify the characteristics of invasive species present in Victoria's State forests.

Issues

- Monitoring results may only provide an indication for future management requirements, rather than show impacts on biodiversity values;
- Priority listing of pest plant and animals may determine which invasive species are reported;
- Pest plant and animals do not include pathogens and insects, however, these are monitored through other programs;
- Focal species monitoring may not be adequate to address the full extent of pest plant and animal impacts;
- Some invasive species may exist outside their normal range;
- The propensity for insect attacks on native vegetation may be affected by climate change; and
- Catchment Management Authority weed priorities may not include high threat weeds to forest and woodland ecosystems.

Possible data sources

- Department of Sustainability Environment;
- Parks Victoria; and
- Department of Primary Industries.

Potential methods

- Glenelg Ark and Southern Ark programs – monitoring of fox numbers and distribution;
- Parks Victoria indicators for invasive species; and
- Quantitative monitoring to determine pest plant and animal impacts on biodiversity.

Interpretation

Increases in the number of invasive species will usually be detrimental. However, knowledge of the number of invasive species will only provide limited assistance to management decision-making. Also see Indicator 3.1.

Element:	1.3 Genetic diversity
Indicator:	**1.3a The number of forest dependent species at risk from isolation that may lead to loss of genetic variation** C
Potential sub-indicator reporting areas	*i) The number of seed-lot provenances used in regeneration, reforestation, roading and stabilisation works that meet Code requirements*

Rationale

Indicator:

Provides a measure of the number of species identified as at risk of decreased genetic variation that may prevent long term survival and adaptation.

Potential sub-indicator reporting areas:

This sub-indicator provides an indication of the genetic diversity of trees used for regeneration and reforestation in Victoria.

Issues

- The effect of fragmentation in reducing genetic variation in non-commercial native flora and fauna species needs to be considered.

Possible data sources

- Department of Sustainability and Environment;
- Arthur Rylah Institute;
- School of Forest and Ecosystem Science (The University of Melbourne);
- Cooperative Research Centre for Forestry; and
- Forest and Wood Products Research and Development Corporation.

Potential methods

- Predictive modelling of genetic variation.

Interpretation

Increases in the mean or median value of genetic diversity are generally desirable. Native flora and fauna species may suffer reduced genetic variation if their populations are greatly reduced or fragmented.

Element:	**1.3 Genetic diversity**
Indicator:	**1.3b Number of *in situ* and *ex situ* conservation efforts for forest dependent species**
Potential sub-indicator reporting areas	*i) Change in the area of gene protection forests* *ii) Changes in genetic diversity and structure within populations, and gene flow, for selected species*

Rationale

Indicator:

Sustainable forest management requires a commitment by forest agencies to conserve locally or regionally adapted populations of native species using a combination of *in situ* and *ex situ* approaches. *In situ* (on site) conservation of genetic diversity is provided by parks and other protected areas, genetic and ecological conservation areas, reserved stands and areas of State forest that comply with the *Code of Practice for Timber Production 2007*. *Ex situ* (off-site) conservation measures include seed banks, seed orchards and clonal archives. This indicator describes the extent of *in situ* and *ex situ* conservation efforts for native species.

Potential sub-indicator reporting areas:

These sub-indicators aim to provide more specific information relating to the genetic diversity of forest dependent species.

Issues

- *Ex situ* studies are difficult;
- Australian Commonwealth Scientific and Industrial Research Organisation seed banks are not guaranteed for long term storage; and
- Similar issues can apply to many flora and fauna species that are rarely investigated.

Possible data sources

- Department of Sustainability and Environment;
- Arthur Rylah Institute; and
- School of Forest and Ecosystem Science (The University of Melbourne).

Potential methods

- Monitoring the transfer of seeds in the landscape.

Interpretation

The discussion should include a description of the major genetic conservation programs in Victoria's forests.

Criterion

2

Maintenance of productive capacity of forest ecosystems

*"The Victorian Government, through **Our Forests, Our Future**, has recognised that the use of Victoria's State forests must be at a level that can be sustained without impairing the ability of the forest to regenerate and to continue to provide employment, products and services for future generations."*

Sustainability Charter for Victoria's State forests (2006)

Maintenance of productive capacity of forest ecosystems

2

Indicator:	**2.1 Area and percentage of forest and net area of forest available and suitable for timber production** A
Potential sub-indicator reporting areas	*i) Additions and deletions of forest area, by cause and by forest type* *ii) Forest area (ha) reserved by special management regime (e.g. for conservation of powerful owls, baw baw frog or water quality)* *iii) Loss of forest area to roads and other developments (e.g. quarries)* *iv) Area (ha) removed due to site being inoperable or uneconomical (e.g. due to slope and other Code exclusions)*

Rationale

Indicator:

Reflects the area available for timber harvesting over time. This indicator provides important information on forest zoning and the capacity of forests to meet society's demand for wood products.

Sub-indicators:

These sub-indicators aim to provide information on forest zoning and how much of the forested area has been affected by land use changes.

Issues

- Data on private native forest and plantations will be required for *Victoria's State of the Forests Report*; and
- Plantation resources must be represented to address sustainability concerns if there is a reduced area of native forest available for timber production.

Possible data sources

- Department of Sustainability and Environment;
- VicForests; and
- Department of Primary Industries.

Potential methods

- This indicator is best represented in a table that shows gross and net area of forest available and suitable for timber producction, and change over time;
- Use Statewide Forest Resource Inventory definition of 'forest land'; and
- Soil surveys, radiometric surveys and terrain models.

Interpretation

An increase or decline in area may affect productive capacity. Care must be taken in the interpretation of this indicator to distinguish between a number of factors that can change the value of the indicator, for example, reclassification of land tenure or changes in forest area.

Indicator:	**2.2 Volume of wood by forest type in State forest that is available and suitable for timber production**	A
Potential sub-indicator reporting areas	*i) Total volume of wood and area of non-merchantable forest* *ii) Total volume of wood and area of merchantable forest* *iii) Area (ha) of available forest that is managed intensively*	

Rationale

Indicator:

The total volume of wood available and suitable for timber production is a basic indicator of forest sustainability in terms of the area potentially available for timber harvest. Results can be compared to the volume harvested each year, with increases or decreases in the total stock tracked over time.

Potential sub-indicator reporting areas:

These sub-indicators aim to provide quantitative data to determine changes in forest characteristics such as growth, age, species and volume.

Issues

- The type of forest classification used is a key consideration;
- The indicator needs to be flexible around the definition of 'merchantability';
- The Statewide Forest Resource Inventory has mapped all State forest. However, only stands with an average height of greater than 28 metres have been field validated;
- Data on non-merchantable volume and area is limited; and
- Information on non-merchantable forest types may be limited.

Possible data sources

- Department of Sustainability and Environment; and
- VicForests.

Potential methods

- A variety of field inventory techniques including post-harvesting assessment.

Interpretation

Maintenance of, or an increase in, the growing stock is considered desirable. Sharp declines in the growing stock need to be interpreted in relation to the amount lost to natural and anthropogenic disturbances to understand why the decline has occurred. Consistent declines over time may indicate that the current harvest regime is not sustainable. This may be due to a range of reasons including changes in area designation from timber production to other purposes. However, it is also important to understand that maximising timber productivity may compromise the maintenance of ecosystem condition. Both desired levels of productivity and the broader ecosystem condition are important considerations with respect to timber production.

Indicator:	**2.3 Annual production of wood products from State forest compared to sustainable harvest levels** A
Potential sub-indicator reporting areas	*i) Annual volume (cubic metres) harvested from State forest by broad forest type* • Sawlogs/pulpwood *ii) Area harvested compared to sustainable harvest level (ha) by broad forest type* • Sawlogs/pulpwood *iii) Actual annual harvest of minor wood products compared to sustainable harvest level* • Firewood • Other (e.g. sleepers, stakes and props, burls, etc.) *iv) Area and volume by silvicultural treatment type (clearfell, thinning, salvage, selective)* *v) Volume of wood removed by ecological processes*

Rationale

Indicator:

Measures the actual harvest to meet society's demand for wood products, against the sustainable level of production.

Potential sub-indicator reporting areas:

These sub-indicators specify the total volumes and sustainable yields by major wood product group.

Issues

- Loss of timber resulting from illegal removal (for example firewood) needs to be considered;
- Mean Annual Increment is based on sawlog and total merchantable volumes, and does not include firewood;
- Case studies may be required to respond to some sub-indicator reporting areas; and
- The STANDSIM model was developed specifically for the growth and yield prediction of Ash and Silvertop regrowth. A growth model (simulator) has not been developed for the growth and yield prediction of mixed species and/or uneven-aged regrowth forests.

Possible data sources

- Department of Sustainability and Environment; and
- VicForests.

Potential methods

- Use of growth functions;
- Where appropriate, area statements can be used to report on this indicator because such statements outline how timber is allocated to VicForests under the Timber Allocation Order; and
- STANDSIM model for predicting growth and yield for the ash-type forests in Victoria.

Interpretation

This indicator allows a comparison between the determined harvest levels and sustainable levels, and complements growing stock information (see Indicator 2.1).

Indicator:	**2.4 Annual production of non-wood forest products** A
Potential sub-indicator reporting areas	*i) Carrying capacity of the system for economically important species/products* • Records of assessment of the productive capacity for existing non-wood products • Sample plots and records of regrowth *ii) Non-wood products produced annually from State forests* • Sand/gravel • Salt • Eucalyptus oil • Tea-tree/broom bush • Tree ferns • Xanthorrhoea fronds • Bee sites • Grazing licences • Water • Seed • Mining and prospecting • Game (e.g. deer, duck) • Wildflower licences • Agistment licences

Rationale

Indicator:

Provides an indication of the production of non-wood forest products and services supplied annually.

Potential sub-indicator reporting areas:

These sub-indicators aim to provide more detail on the management of non-wood forest products in Victoria's State forests.

Issues

- Forest age class, forest type and fire history will affect the carrying capacity and sustainable level of many minor forest products (for example honey production);
- It is difficult to determine sustainable supply levels for many minor forest products; and
- Illegal removal of non-wood forest products needs to be considered.

Possible data sources

- Department of Sustainability and Environment;
- Department of Primary Industries; and
- VicForests.

Potential methods

- Records of use for licensed activities;
- Consult with Indigenous communities in relation to traditional uses and level of removal to ascertain sustainable levels; and
- The 'quantity' of grazing should be recorded by size of area and location, by forest type, Ecological Vegetation Class, and the number of cattle per hectare.

Interpretation

Compare harvest trends to known sustainable levels. See also Indicators 4.1, 4.2 and 6.1c.

Indicator:	**2.5 Proportion of timber harvest area successfully regenerated by forest type**	A
Potential sub-indicator reporting areas	*i) Area not meeting stocking standards* • First attempt stocking survey results over time • Area retreated • Area regenerated where stocking surveys are overdue • Area and percentage of area meeting stocking standards	

Rationale

Indicator:

To maintain the productive capacity of the forest ecosystem, all forest areas where timber harvesting has been undertaken need to be regenerated. This indicator assesses the effectiveness of regeneration in timber harvest areas.

Potential sub-indicator reporting areas:

This sub-indicator aims to provide specific information regarding the area of the forest estate not meeting stocking standards and efforts to ensure adequate stocking.

Issues

- There will be a time lag in the area regenerated versus the area harvested. Successful regeneration usually indicates that the stand is fully stocked.

Possible data sources

- Department of Sustainability and Environment; and
- VicForests.

Potential methods

- Remote sensing – Quickbird and Multispectral imagery; and
- Stocking and regeneration surveys.

Interpretation

This indicator will assess the proportion of the timber harvest area that has been successfully regenerated. 'Successfully regenerated' is in accordance with the *Code of Practice for Timber Production 2007*.

Criterion

3

Maintenance of ecosystem health and vitality

"A range of natural and human induced disturbances, such as fire, pest plants and animals, disease, pollution and drought can impact on the health and vitality of forest ecosystems. These disturbances need to be identified, monitored and managed to ensure that the natural assets of State forests are restored and maintained."

Sustainability Charter for Victoria's State forests (2006)

Indicator:	3.1 Scale and impact of agents and processes affecting forest health and vitality B
Potential sub-indicator reporting areas	*i) Area of forest damage, by age class and forest type, caused by extreme weather including wind, rainfall, snow, drought and frost* *ii) Area of State forest burnt, by forest type and age class annually* • Planned/Unplanned • Source of ignition (e.g. lightning strikes, deliberate) *iii) Area of forest burnt for ecological management purposes on an annual basis* *iv) Area and percentage of regenerated coupes affected by browsing or other damage processes (e.g. drought, frost, etc.)* *v) Annual quantity (tonnes) of pesticide or herbicide used to control damage agents* *vi) Area and percentage of forested land subject to levels of specific air pollutants (e.g. ozone, nitrates) that may cause negative impacts on forest ecosystems* *vii) Area of forest damage, by age class and forest type, caused by insects and pathogens*

Rationale

Indicator:

Victoria's State forests are impacted by a range of disturbances, both natural and human-induced. It is important that we monitor major disturbance processes that may impact on the maintenance of ecosystem health and vitality.

Potential sub-indicator reporting areas:

These sub-indicators aim to provide an overview of the major disturbances potentially affecting ecological processes in Victoria's State forests. Measurement of these indicators will also enable researchers to develop links between aspects of the fire regime and the response of plants and animals, impacts on soil health and hydrology. This information will inform on the impacts of fire management practices and enable Victorians to engage in discussions on topics as diverse as fire suppression, pesticide usage, or wood supply.

Issues

- There are various scales at which disturbances can be reported (for example by forest, landscape or Catchment Management Authority region);
- Defining a threshold for ecosystem health needs to be considered with respect to the natural extent of the damaging process;
- Human disturbances require consideration when reporting on this indicator;
- Cross-border considerations need to be made; and
- Consideration of factors related to fires such as season, severity, patchiness, type and intent, should be incorporated into this indicator – refer to the *Code of Practice for Fire Management on Public Land* (2006).

Possible data sources

- Department of Sustainability and Environment;
- Department of Primary Industries;
- Arthur Rylah Institute;
- School of Forest and Ecosystem Science (The University of Melbourne);
- Environment Protection Authority Victoria;
- Department of Agriculture, Fisheries and Forestry (Australian Government);
- Australian Quarantine and Inspection Service;
- Parks Victoria; and
- Australian Bureau of Meteorology.

Potential methods

- Remote sensing;
- Establish a network of forest health plots across the state – monitor with inventory plots;
- Pest risk analysis;
- State forests Environmental Management System;
- Liaison with external agencies such as Australian Quarantine and Inspection Service, Department of Agriculture, Fisheries and Forestry (Australian Government), Department of Primary Industries, Parks Victoria, Catchment Management Authorities and other State equivalents;
- Case studies for particular events relating to early detection/threat;
- For a review of methods used to collect fire data see Chatto and Tolhurst (2004); and
- Case studies on flooding (for example River Redgum forests).

Interpretation

Disturbance can contribute to a healthy forest ecosystem, however, large changes in the frequency of some types of disturbance may be undesirable. Consequently, the frequency of disturbance needs to be managed (where possible) to maintain ecosystem health. The type and extent of disturbance, the level of damage and its impact on ecosystems will also need to be considered. In the past decade, there has been considerable scientific debate about defining a 'natural' range of variation in ecosystem health. There can be a number of positive impacts (for example ecosystem renewal) associated with storm and fire damage. These impacts will depend on the timing and intensity of the event.

Indicator:	3.2 Area and type of human-induced disturbance A
Potential sub-indicator reporting areas	*i) Harvested area by silvicultural system and forest type, and percentage of total forest area* *ii) Regeneration area and percentage change in the composition of the disturbed area* *iii) Area of forest and percentage of total forest area covered by grazing licences by forest type* *iv) Area of prescribed burning (e.g. fuel reduction, regeneration, ecological) undertaken on State forest and percentage of total forest area* *v) Area and percentage of forest thinned by age and forest type* *vi) Impact of other human induced disturbances (e.g. mining, infrastructure and recreation)*

Rationale

Indicator:

Human-induced disturbance, whether intentional or unintentional, has the potential to significantly affect forest ecosystem health. Some human induced disturbance is undertaken for management purposes (for example prescribed burning) to achieve particular outcomes or objectives. Monitoring of this indicator is essential to assess the impact of human induced disturbances and the effectiveness of forest resource management.

Potential sub-indicator reporting areas:

These sub-indicators aim to track the nature of the human-induced disturbance in Victoria's State forests.

Issues

- To assess changes in forest condition, a comparative benchmark needs to be determined such as pre-European settlement or pre-harvesting.

Possible data sources

- Department of Sustainability and Environment; and
- VicForests.

Potential methods

- Remote sensing; and
- Field survey.

Interpretation

The boundary between natural phenomena and direct human-induced activities is difficult to define, for example when significant forest losses occur as a result of natural or human-induced fires, or for disturbances such as pest and pathogen outbreaks. Consequently, distinguishing between the natural and anthropogenic factors that influence forest vulnerability to disturbance will be difficult.

Disturbance from human land-use and management activities differ from natural disturbance processes and may elicit different biotic responses and disrupt ecological relationships. The widespread prevalence of human land-use requires that human activity be addressed as a fundamental ecological process and that lessons from investigations of land-use history be applied to the conservation and management of forested landscapes (Foster *et al*., 2003).

Criterion

4

Conservation and maintenance of soil and water resources

"Soil and water are two of the most fundamental resources associated with our State forests. We need to ensure that we have clean water coming from our forests and that terrestrial and aquatic processes in forests are maintained."

Sustainability Charter for Victoria's State forests (2006)

Criterion 4

Conservation and maintenance of soil and water resources

Indicator:	**4.1 Area and percentage of forest by activity type systematically assessed for risk to soil attributes**	**B**
Potential sub-indicator reporting areas	*i) Soil erosion* *ii) Change in nutrient status* *iii) Biological composition/activity* *iv) Structural decline (compaction)*	

Rationale

Indicator:

Soil sustains plant production and other ecological and hydrological functions of the forest through its ability to hold and supply water and nutrients, to store organic matter, and to provide suitable habitat for plant roots and a wide range of organisms. Forest management can remove and redistribute soil nutrients and organic matter, and can alter the physical properties of the soil to the extent that productivity and other ecosystem functions are impaired. This indicator aims to assess changes in key soil properties.

Potential sub-indicator reporting areas:

These sub-indicators aim to evaluate soil properties, compliance with soil disturbance standards, and the extent to which soil disturbance exceeds acceptable thresholds.

Issues

- The methodologies to cost-effectively monitor the potential sub-indicators are still being developed for statewide application by Department of Sustainability and Environment.

Possible data sources

- Department of Sustainability and Environment;
- Arthur Rylah Institute;
- School of Forest and Ecosystem Science (The University of Melbourne);
- Australian and New Zealand Environment Conservation Council;
- eWater Cooperative Research Centre; and
- VicForests.

Potential methods

- To determine appropriate methodologies relevant to this indicator, there is a need to address ongoing issues regarding appropriate techniques for the broad-scale measurement of soil physical, chemical and biological attributes and the need to evaluate the relationships between those attributes.

Interpretation

Some soil disturbance is expected during forestry activities and is considered to be acceptable if there is no impact on forest productivity. In some cases, disturbance may also be desirable, such as for regeneration purposes. This indicator aims to assess undesirable soil disturbance. A map of the area assessed, including areas with no data, could be useful for reporting.

In the future, it is hoped that a common approach to soil disturbance monitoring will be developed to statistically indicate the areas with significant soil damage. See also Indicators 3.1 and 3.2.

Indicator: **4.2 Change in forested catchment water yield characteristics through time** **B**

Rationale

Indicator:

This indicator aims to measure the effects of forest management and other factors on water yield. This is important for stream health and for water supply for human use. Activities throughout a catchment strongly influence water resources. This is due to the strong influence land use has on the quantity of runoff, and consequently, the amount of water reaching watercourses. Within forested catchments natural characteristics such as vegetation cover and type, presence of impermeable surfaces, catchment topography and geomorphology, and groundwater levels all influence surface runoff.

Forestry activities can influence water yield as well as the timing and peak flows in rivers and streams. For example, harvesting can increase catchment water yield as a result of higher runoff, whereas regrowth areas can decrease water yield due to increased water uptake for tree growth. In addition, disturbances such as fire can also affect water yields in forested catchments. Considering this indicator at a catchment scale may help inform landscape-level planning to ensure that catchments deliver a sustainable supply of water into the future.

Issues

- Characteristics other than water yield may need consideration, including groundwater flows;
- A risk assessment approach is required;
- This indicator should be reported against a theoretical maximum yield (percentage); and
- Sampling must be comprehensive enough to adequately capture statewide trends.

Possible data sources

- Department of Sustainability and Environment;
- Australian Bureau of Meteorology; and
- Melbourne Water.

Potential methods

- Measurement against Forest Management Area prescriptions relating to catchments (for example in the Thompson Reservoir, Midlands and Otways); and
- Analysis will incorporate the age of the forest (linked with Criterion 1).

Interpretation

Water yield varies dramatically according to season and these variations must be accounted for. The amount of change within a forested catchment (for example loss of cover, growth stage changes) before significant impacts to water yield characteristics are observed will vary with topography, underlying surficial material, forest type, and regional weather patterns. This indicator can be used as a 'coarse filter' highlighting catchments where water yield issues need to be addressed. The causes of disturbance in forested catchments, whether natural or anthropogenic, as well as the potential effects of climate change should be considered in the interpretation of this indicator.

Conservation and maintenance of soil and water resources

Indicator:	**4.3 Change in forested catchment river health characteristics through time** B
Potential sub-indicator reporting areas	**Reach scale impacts** i) *Percentage compliance with locally applicable road construction, stream crossing and riparian zone management standards* • Road density for entire catchment (km/km²) • Number of stream crossings (no./km²) • Level of road use • Failed culvert by culvert type ii) *Percentage to which forest operations have been systematically assessed for risk to water quality* iii) *Percentage to which the application of chemicals has been systematically assessed for risk to water quality* **Ecological scale impacts** iv) *Index of Stream Condition* • Hydrology • Streamside zone • Physical form • Water quality • Aquatic life v) *Water quality attainment ratings in each Catchment Management Authority region*

Rationale

Indicator:

Activities throughout a forested catchment can have adverse effects on river health. Without good baseline information we can not set realistic long-term management objectives for our rivers or determine priorities for action. This indicator allows the development of river-related management objectives and to measure the effectiveness of long-term programs for the health of rivers in State forests.

Potential sub-indicator reporting areas:

i) Poorly constructed road and stream crossings and inappropriate activity in riparian zones can lead to increased sedimentation, water quality degradation, and changes in the flow and timing of water courses. These changes can have significant impacts on aquatic ecosystem health, as well as on human populations that depend on healthy river systems.

iv) The Index of Stream Condition is an indicator of environmental condition. It uses information on river flow, water quality, channel and riparian zone condition, and macroinvertebrate communities, to provide an overall assessment of riverine health.

Issues

- Water quality is typically assessed according to chemical, physical and microbiological parameters. These parameters need to be considered with regard to the range of forest management activities;
- For many of the sub-indicators, the different scales at which data is measured within catchments needs to be considered;
- Interpretation of Index of Stream Condition data from 'reach' scale to 'ecological' scale may be difficult;
- Adequate reporting requires sufficient survey stands and Index of Stream Condition sites within forest catchments;
- Point source impacts (for example roads, harvesting areas) require consideration; and
- Areas associated with changes in water quality may contain a range of land tenures.

Possible data sources

- Department of Sustainability and Environment;
- Water Data Warehouse;
- Australian and New Zealand Environment Conservation Council;
- eWater Cooperative Research Centre;
- School of Forest and Ecosystem Science (The University of Melbourne);
- Environment Protection Authority Victoria;
- Department of Primary Industries; and
- Melbourne Water.

Potential methods

- Consult with relevant water supply authorities and agencies for forests, or parts of forests, located in a water supply catchment designated under schedule 5 of the *Catchment and Land Protection Act 1994*; and
- Index of Stream Condition – overall assessment of riverine health.

Interpretation

An improvement in the Index of Stream Condition rating for streams located in forests may be equated with improvements in management.

Criterion

5

Maintenance of forest contribution to global carbon cycles

"Forests in our landscape have an important role to play in the global carbon cycle. Growing forests harness carbon found in the atmosphere, while timber products store carbon. However, we need to better understand and report on how forests, their biomass and forest products contribute to managing carbon in the atmosphere."

Sustainability Charter for Victoria's State forests (2006)

Criterion 5

Maintenance of forest contribution to global carbon cycles

Indicator:	**5.1 Total forest ecosystem biomass and carbon pool by forest type, age class and successional stages**	B
Potential sub-indicator reporting areas	*i) Mean Annual Increment by forest type and age class* *ii) Tree biomass volumes* *iii) Non-tree biomass volumes* *iv) Soil carbon pools* *v) Removals (fire and harvesting)* *vi) Net change in forest products carbon*	

Rationale

Indicator:

Estimates of total forest biomass allow changes in the total carbon pool to be assessed. Estimation by forest type and age class improves understanding of these changes. This indicator provides valuable information to Victorians, helping to inform the debate on actions designed to mitigate human-induced climate change.

Potential sub-indicator reporting areas:

Victoria's forests store a considerable amount of carbon, and the ability of the forest to take up carbon may factor in future attempts to mitigate climate change at the international level. These sub-indicators measure the rate of change in the total forest ecosystem carbon pool over time. They indicate whether Victoria's forests are a sink for, or a source of, atmospheric carbon. While the total amount of carbon stored in forest products is tiny relative to that stored in forests or in the atmosphere, it is an important component of the overall carbon cycle.

Issues

- Mean Annual Increment is dependent upon age and not necessarily indicative of total changes in carbon stock across the entire forest estate;
- Clarification of the difference between non-tree biomass and soil carbon pools; and
- Changes in carbon stock due to fire are difficult to estimate.

Possible data sources

- Department of Sustainability and Environment;
- Australian Greenhouse Office;
- School of Forest and Ecosystem Science (The University of Melbourne); and
- Australian Commonwealth Scientific and Industrial Research Organisation.

Potential methods

- Use data from other indicators, such as Indicator 2.3 (Annual removal of growing stock);
- FullCAM (Carbon accounting model from the National Carbon Accounting System);
- Modelling of Statewide Forest Resource Inventory program data;
- Australian Greenhouse Office – Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks; and
- Australian Commonwealth Scientific and Industrial Research Organisation – Life Cycle Analysis database.

Interpretation

This indicator assesses the relative size of the forest carbon pool. Any interpretation will have to take into account factors such as the age class distribution of the forest, fire history, disease or insect disturbance. It is also important to note that carbon budget (storage) results depend on the scale of model used.

The decay of forest products, and the subsequent release of carbon into the atmosphere, generally depends on the type of product.

Soil carbon pools comprise a significant proportion of the total forest ecosystem carbon pool, and as such, are a very important contributor to changes in carbon stocks. The soil carbon pool is sensitive to changes in forest management practices.

Indicator:	**5.2 Contribution of forest ecosystems to the global greenhouse gas balance** **B**
Potential sub-indicator reporting areas	*i) Estimated tonnes of greenhouse gas uptake or release by forest type and age class (report separate subtotals for CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6 in tonnes)* *ii) Fuel consumption for timber harvesting (per m^3 of product) compared with average fuel consumption for agricultural, manufacturing and retail sectors* *iii) Use and emissions of ozone-depleting substances (in tonnes of CFC –11 equivalents)*

Rationale

Indicator:

Human activities are increasing the concentrations of greenhouse gases that cause climate change. Forest ecosystems play an important role in the global greenhouse gas balance. This indicator provides information on emissions and removals of greenhouse gases (including carbon) from forest ecosystems over time for comparison with other land cover types or other sectors of the economy.

Potential sub-indicator reporting areas:

Forest management can have a positive or negative impact on greenhouse gas emissions. These sub-indicators aim to quantify these impacts.

Issues

- The significance of emissions other than CO_2 from forests is yet to be determined;
- Measurements of fuel consumption are difficult and may vary depending on factors such as machinery used, the type of slope, and type of road surface; and
- There may be some limitations in the practical measuring of the sub-indicators.

Possible data sources

- Department of Sustainability and the Environment;
- Australian Greenhouse Office;
- School of Forest and Ecosystem Science (The University of Melbourne);
- Forest and Wood Products Research and Development Corporation;
- Department of the Environment and Water Resources (Australian Government); and
- National Land and Water Resources Audit (Australian Government).

Potential methods

- FullCAM (carbon accounting model from the National Carbon Accounting System) can report changes in carbon due to nitrogen cycling and provides outputs in terms of CO_2 equivalents; and
- Upgrade existing permanent plot data to assess changes in forest structure and carbon pools. A system for monitoring change in the carbon pools also needs to be established.

Interpretation

The greenhouse consequences of forest management are best interpreted at larger scales because it is the net effect across the landscape, rather than local changes, that influence the global atmosphere. Site level greenhouse gas emissions should not be interpreted as a measure of sustainability.

Both temporal patterns and longer-term trends in greenhouse gas emissions from forests can be of interest. Annual estimates of net greenhouse gas emissions are useful for increasing our understanding of fluxes to and from the atmosphere, even though natural variation due to factors such as climate and wildfire can often be far greater than the effects of management. Trends over longer periods (10–20 years) reflect the integrated effect of significant land use change and forest management decisions as well as the effects of climate change.

Criterion

6

Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies

"Victorian communities have strong social, spiritual and cultural links to their State forests. These links are often related to traditional forest uses, recreation and the provision of jobs. Recognising and using the valuable experience and knowledge that resides in the community will greatly contribute to the sustainable management of Victoria's State forests."

Sustainability Charter for Victoria's State forests (2006)

Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies

Element:	**6.1 Production and consumption**
Indicator:	**6.1a Value ($) of wood and wood products** B
Potential sub-indicator reporting areas	*i) Value of primary timber products to the Gross State Product* • Sawlog – hardwood/softwood • Residual wood • Pulpwood • Specialty timbers *ii) Value of secondary timber products per volume/unit harvested* • Poles • Posts • Sleepers • Hewn timber • Bush sawn/split timbers • Firewood • Stakes • Burls *iii) Production, consumption, imports, and exports of timber products* *iv) Timber price trend* *v) Victoria's share in all forest products markets (percentage)*

Rationale

Indicator:

Enables socio-economic benefits to be monitored by ascertaining trends in the value and volume of wood production. Marketed timber products, including primary and secondary manufacturing, provide livelihoods, government revenues for public services, profits to businesses and incomes for landowners. This indicator shows the relative contribution of wood and wood products to the Victorian economy.

Potential sub-indicator reporting areas:

These sub-indicators provide supporting information to aid in interpreting Indicator 6.1a. The ability of timber product producers to compete in domestic and international markets is partly dependent on their ability to develop secondary manufacturing products, commonly called 'value-added' products, for specialty markets. The balance of volumes of production, consumption, imports and exports indicates the relative development pressure on forest resources, both domestically and internationally. The sustainability of domestic forests to produce the quantity of wood and wood products required by Victorians may become threatened if consumption exceeds domestic supply, and foreign supplies become limited.

Issues

- Forest certification will play an increasing role in assessing buyer identification by product.

Possible data sources

- Department of Sustainability and Environment;
- VicForests;
- Department of Primary Industries;
- Australian Bureau of Statistics;
- Australian Bureau of Agriculture and Resource Economics; and
- National Land and Water Resources Audit (Australian Government).

Potential methods

- Analysis of data from industry sources and Australian Bureau of Agriculture and Resource Economics; and
- Analysis of the markets into which Victorian timber is sold.

Interpretation

Increases in the contribution of the sector are open to several interpretations. They may signal unsustainable pressures on timber and non-timber resources, or they may signal desirable increases in manufactured value from a sustainably managed resource base.

An increase of net export earnings could indicate the competitiveness of the Victorian timber products industry. A decrease in net export earnings could indicate a loss of competitiveness or greater domestic consumption.

Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies

Element:	**6.1 Production and consumption**
Indicator:	**6.1b Value ($) and yield of non-wood forest products** B
Potential sub-indicator reporting areas	*i) Contribution of non-timber forest products to the Gross State Product* *ii) Production, consumption, imports and exports of non-timber forest products* *iii) Value by type of non-wood forest products (m^3, kg)*

Rationale

Indicator:

Enables socio-economic benefits to be monitored by ascertaining trends in values and yields of non-timber forest products against management objectives.

Potential sub-indicator reporting areas:

Non-timber forest products provide livelihoods, government revenues for public services, profits to business, and incomes for landowners. These sub-indicators show the relative importance of non-forest timber products to the forest sector. Individually, non-timber forest products (for example, honey) are important on a regional scale. Collectively, non-timber forest products are important to the State economy.

Similarly, marketed forest-based services (for example, tourism, recreation, and carbon credits) also provide livelihoods, government revenues for public services, profits to business, and incomes for landowners. Although their contribution to the national economy is relatively small compared with timber products, they are wide-spread and involve many people. Some forest-based services, such as wilderness tourism, are currently relatively small but are growing in social and economic importance. In addition, carbon credits may significantly contribute to Victoria's economy in the future.

Issues

- Databases for non-wood forest products do not distinguish between the areas where products have been sourced; and
- Game data is supplied voluntarily and may not be accurate. Dollar value will only be for licences issued.

Possible data sources

- Department of Sustainability and Environment;
- Australian Bureau of Agricultural and Resource Economics; and
- National Land and Water Resources Audit (Australian Government).

Potential methods

- Licence databases.

Interpretation

A positive trend in dollar value is generally considered desirable, but in itself provides no indication of sustainability. A sharp decrease might be a sign of mismanagement, but could also result from dramatic changes in market demand (consumer tastes) or seasonal variations.

Element:	**6.1 Production and consumption**
Indicator:	**6.1c Value ($) of forest derived ecosystem services** C
Potential sub-indicator reporting areas	*i) Cost ($) per megalitre of water from forested catchments*

Rationale

Indicator:

Forest derived ecosystem services include environmental processes that enhance our quality of life. These range from the maintenance of water and soil quality, to protecting biodiversity and mitigating global warming. This indicator recognises the important role that State forests play in providing these and other invaluable ecosystem services to the broader community. Assigning an economic value to these services will better reflect the contribution that State forests make to the Victorian economy. Values can be estimated from the similar goods and services that are exchanged in a market.

Whilst this indicator is not limited to the assessment of water resources, such assessment currently provides a clear, measurable indication of the value of forest derived ecosystem services.

Potential sub-indicator reporting areas:

This sub-indicator assesses the value of an important ecosystem service offered by forests in Victoria.

Issues

- There is a limit to the accuracy with which ecosystem services can be valued at this stage;
- Water is harvested from most catchments in Victoria and the cost of production is aligned to the cost of provision and delivery; and
- Development and change in the theory and methodologies of valuing ecosystem services may cause difficulties in deriving long term comparative trends.

Possible data sources

- Department of Sustainability and Environment; and
- Victorian water retailers.

Potential methods

- Department of Sustainability and Environment – Ecotender; Bush broker; Carbon tender and other projects.

Interpretation

Increases in this indicator demonstrate the increased value that society gains from ecosystem services. This indicator is linked to indicator 4.2.

Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies

Element:	**6.1 Production and consumption**
Indicator:	**6.1d Degree of reuse and recycling of wood products** B

Rationale

This indicator identifies the extent to which forest-derived products are reused and recycled. Reuse and recycling of forest products conserves Victoria's forest resource base, reduces the volume of solid waste to land-fill, and can reduce greenhouse gas emissions.

Issues

- There are difficulties in quantifying the capacity of Victoria's recycling facilities to recycle timber.

Possible data sources

- Department of Sustainability and Environment;
- Australian Paper Industry Council;
- Victorian Greenhouse Office; and
- Sustainability Victoria.

Potential methods

- To obtain an indication of the degree of recycling, the volume of products recycled may be reported as a proportion of annual consumption or production.

Interpretation

An increase in the recycling of forest products indicates more efficient use of forest resources and, consequently, a move toward more sustainable forest use.

Element:	**6.2 Investment in the forest sector**
Indicator:	**6.2a Investment and expenditure in forest management** A
Potential sub-indicator reporting areas	*i) Investment by Government in forest management as a percentage of Gross State Product* *ii) Average expenditure in forest asset protection (e.g. prescribed fire)* *iii) Expenditure on forest infrastructure (e.g. roads, bridges, fire towers)*

Rationale

Indicator:

Provides an indication of the long-term and short-term commitment to forest management, further processing and other forest uses. Business viability is essential for a competitive and dynamic timber products industry that can support sustainable communities. Business viability is dependent on adequate investment to maintain efficiency and competitiveness.

Potential sub-indicator reporting areas:

These sub-indicators aim to provide different perspectives on the level of investment in forest management.

Issues

None identified.

Possible data sources

- Department of Sustainability and Environment;
- Australian Bureau of Agricultural and Resource Economics;
- Parks Victoria;
- Australian Bureau of Statistics; and
- VicForests.

Potential methods

- Analysis of data from State agencies.

Interpretation

Trends in investment need to be considered in relation to the forest management objectives for Victoria's State forests.

Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies

Element:	**6.2 Investment in the forest sector**
Indicator:	**6.2b Investment in research and development, and education** A
Potential sub-indicator reporting areas	*i) Number of forestry professionals with recognised qualifications in natural resource management or forest science working in forest management* *ii) Investment ($) in forest management research and development by government, and percentage of forest management funding over time* *iii) Investment ($) in forest-related community and public education programs by government, and the number of programs initiated annually*

Rationale

Indicator:

Socio-economic benefits over time depend on investments in knowledge to ensure ongoing productivity of both the forest resource base and timber products industry. Ongoing forest research, typically funded by governments, is required to support or update existing guidelines and standards, or to support the creation of new guidelines and standards. Industry competitiveness requires ongoing innovation in timber production, products, processing technologies and forest-based research. Investment in forest-based education builds the capacity of the population to contribute innovative ideas to the workplace and to participate in effective decision-making. This indicator describes Victoria's long-term commitment to forest research, timber products research, and community development and education.

Potential sub-indicator reporting areas:

These sub-indicators aim to further quantify the level of commitment to research and development, and education by government and industry.

Issues

None identified.

Possible data sources

- Department of Sustainability and Environment;
- School of Forest and Ecosystem Science (The University of Melbourne);
- Arthur Rylah Institute;
- Australian Bureau of Agricultural and Resource Economics;
- Australian Bureau of Statistics;
- Forest and Wood Products Research and Development Corporation; and
- VicForests.

Potential methods

- Analysis of data from State agencies.

Interpretation

As a general rule, declining expenditures on research and development, and education indicate a reduced capacity to respond to a changing economic climate. Increasing expenditure on forest related education is likely to lead to more effective public participation.

Element:	**6.2 Investment in the forest sector**
Indicator:	**6.2c Extension and use of new and improved technologies** B

Rationale

This is an indicator of continuous improvement in forest management and in forest-based industries relevant to the sustainability of forest use.

Issues

- There are issues interpreting, and major practical difficulties obtaining, meaningful data for this indicator. These difficulties include:
  - Defining what constitutes a new or improved technology;
  - Research and development effort is commonly measured by funds invested, rather than rate of adoption; and
  - While it would be desirable for this indicator to cover forest on all land tenures managed for all uses, it is impractical to obtain meaningful data or information for all forests and uses, especially for non-commercial uses.
- With the possible exception of technologies that only apply in particular regions, assessing this indicator is unlikely to be relevant or practical at a regional level.

Possible data sources

- Department of Sustainability and Environment;
- Arthur Rylah Institute;
- School of Forest and Ecosystem Science (The University of Melbourne);
- VicForests;
- Australian Bureau of Agricultural and Resource Economics;
- Bureau of Rural Sciences (Australian Government);
- Australian Bureau of Statistics; and
- Forest and Wood Products Research and Development Corporation.

Potential methods

- This indicator will be reported in narrative format only, outlining relevant trends and information.

Interpretation

Adoption of new technologies will lead to more efficient resource use and improved management of forests. Forest management guidelines and standards should be supported or updated by ongoing research. New standards should be put forward and old ones updated as new knowledge becomes available.

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Element:	**6.3 Recreation and Tourism**
Indicator:	**6.3a Area and quality of forest actively utilised for recreation and tourism** A
Potential sub-indicator reporting areas	*i) Economic contribution of forests to the tourism sector (local and State)* *ii) Cost of maintenance activities in recreation and tourism areas* *iii) Level of visitor satisfaction*

Rationale

Indicator:

This indicator provides information on the utilisation of forests for the purpose of recreation and tourism. It recognises the role that forests play in the provision of nature-based tourism experiences and the contribution this has to both the regional and State economy.

This indicator also provides a measure of the extent to which forest management is providing for the recreational needs of the community, and the contribution of forests to the tourism sector.

Potential sub-indicator reporting areas:

These sub-indicators aim to quantify the economic costs and benefits of tourism and recreation related opportunities in forests, and the level of visitor satisfaction with such opportunities.

Issues

- Recreation and tourism sites need to be classified according to site quality and level of service provision;
- The meaning of economy in this context needs to be defined;
- Determining the most appropriate measures for calculating the economic benefits of forests to recreation/tourism, and the optimum area and quality of forest required for sustainable recreation and tourism use; and
- Reporting mechanisms for visitor numbers needs to be refined.

Possible data sources

- Department of Sustainability and Environment;
- Parks Victoria;
- Tourism Alliance Victoria;
- Tourism Victoria; and
- Sport and Recreation Victoria (Department for Victorian Communities).

Potential methods

- Standard multipliers will need to be applied to visitor numbers to determine economic contribution; and
- Parks Victoria – community surveys for visitor satisfaction and customer perception.

Interpretation

The data will show the supply and availability of forest for recreation and tourism. Trends would need to be interpreted in the context of management intent and public demand.

Element:	**6.3 Recreation and Tourism**
Indicator:	**6.3b Range and use of recreation and tourism opportunities that are available within forests** A

Rationale

This indicator provides information on the diversity of recreation and tourism opportunities available in State forest in Victoria.

Issues

- Increases in the number of activities could be attributed to changes in State forest provisions or community activity;
- Visitation of European and Indigenous cultural sites needs to be included in this indicator; and
- Maintenance costs will vary between regions depending on recreation and tourism facilities available and the number of visitors.

Possible data sources

- Department of Sustainability and Environment;
- Parks Victoria;
- Tourism Victoria;
- Tourism Alliance Victoria; and
- Sustainable Tourism Services Cooperative Research Centre.

Potential methods

- Annual statewide surveys of community forest awareness and the recreation/tourism activities undertaken in forests (for example Parks Victoria surveys).

Interpretation

Data to be interpreted in terms of the variety and the number of activities per site. It would be useful to compare provisions available for activities with community demands.

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Element:	**6.3 Recreation and Tourism**
Indicator:	**6.3c Number of visits per annum** B

Rationale

Provides an indication of overall visitor use and demand. It is a key variable in determining the sustainability of recreation and tourism.

Issues

- The number of visitor access points into a forest limits the accuracy of visitor estimates; and
- Data from Tourism Research Australia can not be subdivided to particular areas.

Possible data sources

- Department of Sustainability and Environment;
- Parks Victoria;
- Tourism Alliance Victoria;
- Tourism Victoria;
- Tourism Research Australia;
- Local Councils;
- Australian Bureau of Statistics; and
- Sustainable Tourism Cooperative Research Centre.

Potential methods

- Analysis of data from State agencies.

Interpretation

When compared with 6.3a, this indicator highlights trends in annual recreation and tourism over time with respect to the area actively available for use. This indicator also provides data on the rates of visitation and relative locations of visits. This can be used to determine where potential impacts may occur, or where facilities are required for planning initiatives.

Element:	**6.4 Indigenous and non-Indigenous cultural, social, and spiritual needs and values**
Indicator:	**6.4a Area of forest to which Indigenous people have access and rights that protect their cultural heritage and are recognised through formal and informal management regimes** A

Rationale

This indicator is aimed at identifying whether adequate land is placed mutually and appropriately under the range of tenure classifications and/or dedicated management regimes to protect Indigenous peoples' values associated with forests. These values include formal access and custodial rights, cultural maintenance and ceremony, education and Aboriginal cultural heritage places. This indicator also monitors whether an acceptable level of accountability for the protection of Indigenous peoples' cultural, social and spiritual needs and values is being maintained.

Issues

- Level of awareness of Aboriginal cultural heritage management practices by forest managers;
- Resourcing of Aboriginal cultural heritage surveys in partnership with traditional owners and any other relevant Indigenous groups;
- Indigenous ownership of data and intellectual property rights;
- The benefits to Indigenous communities through appreciation of Country can not be measured in dollar terms;
- Indigenous peoples' connection to Country including ceremonial, spiritual affiliation, sense of place and custodial obligations is included in this indicator;
- Opportunities by which Indigenous people can obtain education and training in natural and cultural resource management; and
- Illegal destruction of Aboriginal sites and places.

Possible data sources

- Department of Sustainability and Environment;
- Aboriginal Affairs Victoria;
- Traditional owners; and
- Parks Victoria.

Potential methods

- Identification and protection of Aboriginal cultural heritage places;
- Involvement of local Indigenous communities and traditional owners in interpretation at all levels;
- Education of children in Indigenous communities to maintain cultural continuity through:
  - Oral histories, customs and traditions, dreamings;
  - Aboriginal sites and places; and
  - Reconciliation themes.
- Active protection and management for appropriate protective mechanisms in partnership with traditional owners and any other relevant Indigenous groups;
- Ascertaining numbers of cultural sites legally destroyed (data collected under appropriate legislation);
- The development of cultural heritage management plans, cultural heritage agreements, or forest management plans in partnership with traditional owners and any other relevant Indigenous organisation;
- Funding and active management for the protection of Aboriginal cultural heritage places;
- Prosecutions under relevant legislation where infringements are identified;
- Monitor Aboriginal sites and places against inventory; and
- Consult with appropriate traditional owners and any other relevant Indigenous groups.

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Interpretation

This indicator aims to assess whether measures are adequate to protect Indigenous peoples' cultural, social and spiritual needs and values, and Aboriginal cultural heritage places. This indicator is also linked to legislation requirements for the protection of Indigenous and non-Indigenous values (see Indicator 7.2).

Element:	**6.4 Indigenous and non-Indigenous cultural, social, and spiritual needs and values**
Indicator:	**6.4b Proportion of places of Indigenous and non-Indigenous cultural values in forests formally managed to protect those values** A
Potential sub-indicator reporting areas	*i) Number of Indigenous and non-Indigenous staff with specialist cultural heritage management skills* *ii) Proportion of Aboriginal cultural heritage places and historic places with agreed conservation management plans* *iii) Proportion of Aboriginal cultural heritage places and historic places presented or interpreted to the public* *iv) Proportion of Aboriginal cultural heritage places and historic places disturbed as a result of forest or fire management operations* *v) Proportion of Aboriginal cultural heritage places and historic places where active conservation works have been completed* *vi) Number of new places added to the Victorian Aboriginal Heritage Register and the Historic Places database; or number of existing records that have been updated or reviewed* *vii) Proportion of Aboriginal cultural heritage places and historic places with an active monitoring program*

Rationale

Indicator:

This indicator measures and monitors management regimes for Indigenous and non-Indigenous cultural heritage values such as Aboriginal cultural heritage places, historical sites, research and education programs, social heritage and aesthetic values.

Potential sub-indicator reporting areas:

Improved management of Aboriginal cultural heritage places and historic places depends on the involvement of traditional owners, other relevant Indigenous groups, and the general public. It is important that known sites of cultural, social and spiritual values are actively managed and monitored, and that potential sites are examined when required.

Issues

- Indigenous communities have not always been consulted in the assessment of non-Indigenous sites. However, such sites may have importance to Indigenous communities (for example displacement from the area by Europeans);
- Because inter-relationships exist between many Indigenous and non-Indigenous heritage sites, distinctions between Indigenous, European and natural history are not always clear;
- The general public is often reluctant to supply information on sites for fear that land may be lost or permanently reserved; and
- Intrinsic benefits to the community can not be measured in dollar terms.

Possible data sources

- Department of Sustainability and Environment;
- Aboriginal Affairs Victoria;
- Heritage Victoria;
- National Trust;
- Department of Environment and Water Resources (Australian Government);
- Parks Victoria; and
- Indigenous groups.

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Potential methods

- Analysis of data from State agencies.

Interpretation

This indicator assesses whether forest management prescriptions are adequate to protect community sites of cultural heritage, and historical and spiritual values.

Element:	6.5 Employment and community needs
Indicator:	**6.5a Direct and indirect employment in the forest sector and forest sector employment as a proportion of total employment** B
Potential sub-indicator reporting areas	*i) Total Full Time Equivalent and number of jobs indirectly and directly employed in the forest sector* *ii) Age and gender profile of employment in the forestry sector* *iii) Age and gender related indices for staff involved in forest management (Victorian Government forest management agencies)* *iv) Percentage of Aboriginal people employed in forest management (Victorian Government forest management agencies) in comparison to non-Indigenous people*

Rationale

Indicator:

Employment rates in forest dependent communities indicate extent of participation in the workforce and the degree to which forest dependent communities derive benefits from economic activity in forests. Employment is an important measure of the contribution of forests in meeting community needs.

Direct employment is defined as employment in the wood and wood product industries, and forest contact industries (for example beekeeping, eco-tourism operations, grazing, and forest reserve management).

Indirect employment is 'other' employment generated by direct forest employment. That is, the potential multiplier effect of direct forest employment (Commonwealth of Australia, 1998).

Potential sub-indicator reporting areas:

These sub-indicators aim to provide information on the nature of forest-related employment in State forests.

Issues

- All categories need to consider full time/part time and casual/seasonal employment; and
- Numbers will depend on the response rate to the Australian Bureau of Statistics surveys, however, not all industries may respond to these.

Possible data sources

- Department of Sustainability and Environment;
- Australian Bureau of Statistics;
- Australian Bureau of Agricultural and Resource Economics;
- Local government;
- Timber Communities Australia;
- Koori Business Network; and
- VicForests.

Potential methods

- Australian Bureau of Statistics census data; and
- Analysis of data from State agencies.

Interpretation

Employment trends need to be considered in the context of community expectations and industry developments in and around State forests. Changes in the number of people employed in the forest sector should be interpreted in relation to any changes to employment in other industry sectors, technology and economic policies.

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Element:	**6.5 Employment and community needs**
Indicator:	**6.5b Average wage rates and injury rates in major employment categories within the forest sector** **B**
Potential sub-indicator reporting areas	*i) Number of accidents and injury rates by forest sector category* *ii) Standard injury, days lost, absentee rates and numbers of work-related fatalities (including subcontracted workers)*

Rationale

Indicator:

A sustainable forest industry will ensure high levels of workforce health and welfare, and wage rates comparable with other rural industries.

Potential sub-indicator reporting areas:

These sub-indicators aim to further describe the nature of the wage and injury rates for workers in State forests.

Issues

- Reporting on this indicator will require cooperation between government and industry.

Possible data sources

- Department of Sustainability and Environment;
- VicForests;
- Australian Bureau of Statistics;
- Australian Bureau of Agricultural and Resource Economics; and
- Work Cover – annual statistics.

Potential methods

- Australian Bureau of Statistics census data on average wage rates and employment within forest sectors.

Interpretation

Wages in wood and wood product industries, compared to wages for similar occupations in the region, give an indication of the economic benefits of income security to forest dependent communities.

Decreasing injury rates in the forest sector gives an indication of improved occupational health and safety and employment quality, providing a social benefit for communities.

Element:	**6.5 Employment and community needs**
Indicator:	**6.5c Resilience of forest dependent communities to changing social and economic conditions** **B**
Potential sub-indicator reporting areas	*i) Contracts ($ total) paid to local enterprise (including Department of Sustainability and Environment contracts)* *ii) Migration history, likelihood of future migration*

Rationale

Indicator:

Communities with a high economic and cultural dependence on forest and forest-related industries should be sustainable. This indicator provides a measure of the extent to which communities are able to respond and adapt to change successfully.

Potential sub-indicator reporting areas:

These sub-indicators aim to capture issues related to community health and stability, and community resilience to social and economic changes within specific sectors.

Issues

- 'Forest dependent community' will require definition;
- Timber may be moved between regions for processing; and
- Government employees in forest management should be included.

Possible data sources

- Department of Sustainability and Environment;
- Australian Bureau of Statistics;
- VicForests;
- Forest and Wood Products Research and Development Corporation;
- Victorian Department of Human Services;
- Department of Innovation, Industry and Regional Development (Victoria);
- Timber Communities Australia;
- Shires/Local Councils; and
- Parks Victoria.

Potential methods

- Continue to utilise case studies; and
- Utilize same 'communities' over time.

Interpretation

In most cases, more economic diversity creates a more resilient community.

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Element:	**6.5 Employment and community needs**
Indicator:	**6.5d Resilience of forest dependent Indigenous communities to changing social and economic conditions** **B**
Potential sub-indicator reporting areas	*i) Number and type of tenures offered to Indigenous peoples* *ii) Aboriginal employment*

Rationale

Indicator:

It is important to understand the extent that Indigenous communities are dependent on forest resources for their viability and for the maintenance of their traditional values and cultural use.

Potential sub-indicator reporting areas:

These sub-indicators provide a measure of the relationship between State forests and Indigenous communities.

Issues

- Recognition of customs, traditions, laws/lores and values of Indigenous communities; and
- For Indigenous communities, gender issues require specific interpretation by men or women only.

Possible data sources

- Department of Sustainability and Environment;
- Koori Business Network;
- Aboriginal Affairs Victoria; and
- VicForests.

Potential methods

- Speak to custodians and other Indigenous land managers where appropriate;
- Continue to utilise case studies; and
- Utilise same 'communities' over time.

Interpretation

Indigenous communities need to be involved in any form of social or economic community transitions.

Element:	6.5 Employment and community needs	
Indicator:	**6.5e Area of forest available and accessible for Indigenous people to exercise their inherent rights to meet subsistence or individual and family cultural and spiritual needs**	B
Potential sub-indicator reporting areas	*i) Area available for subsistence purposes* *ii) Area available for continued cultural use* *iii) Area available for continued resource use* *iv) Areas where Indigenous partnerships are being practiced*	

Rationale

Indicator:

Measures the opportunities for cultural and traditional lifestyles, and access to forests in accordance with any native title or other rights. Indigenous access to forests is vital for the maintenance of traditional values, lifestyles, cultural heritage and economic development.

Potential sub-indicator reporting areas:

These sub-indicators aim to provide information on forest use by Indigenous people to better inform decision-makers.

Issues

- Recognition of customs, traditions, laws/lores and values of Indigenous communities; and
- For Indigenous communities, gender issues require specific interpretation by men or women only.

Possible data sources

- Department of Sustainability and Environment;
- Aboriginal Affairs Victoria;
- The Department of Justice and Native Title Services;
- Department of Agriculture, Fisheries and Forestry (Australian Government);
- Parks Victoria; and
- Local communities.

Potential methods

- Speak to appropriate custodians and other Indigenous land managers where appropriate; and
- Continue to utilise case studies.

Interpretation

Sustainable forest management requires Indigenous input at all levels of Government.

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Element:	**6.6 Indigenous participation**
Indicator:	**6.6a Extent to which the management framework includes the exercise of customary, custodial, traditional and native title rights as an essential component in achieving sustainable forest management** A
Potential sub-indicator reporting areas	*i) Research partnerships* *ii) Extent of incorporation of Indigenous knowledge in cultural inventories* *iii) Level of Indigenous participation and/or consultation* *iv) Indigenous information sharing and referrals program*

Rationale

Indicator:

This indicator measures the extent to which Indigenous people are able to actively participate in forest management.

Potential sub-indicator reporting areas:

These sub-indicators aim to quantify various aspects of Indigenous participation in forest management.

Issues

- Native title rights and coexisting rights;
- Access, residents' rights, and protection of cultural sites and values;
- Recognition of the spiritual character of the environment and of commercial and subsistence activities by Indigenous people; and
- Indigenous involvement in decision-making mechanisms and representation at all levels of management.

Possible data sources

- Department of Sustainability and Environment;
- Aboriginal Affairs Victoria;
- Department of Families, Community Services and Indigenous Affairs (Australian Government);
- The Department of Justice and Native Title Services; and
- Parks Victoria.

Potential methods

- Data need to be collected in a culturally appropriate manner in accordance with local protocols.

Interpretation

Indigenous satisfaction levels with participation and/or consultation in forest management should be used to assess performance against this indicator.

Criterion

7

Legal, institutional and economic framework for forest conservation and sustainable management[1]

"A key component of ecologically sustainable development relates to the legal, institutional and economic frameworks that support the conservation and sustainable management of Victoria's State forests. This includes community involvement in decision-making."

Sustainability Charter for Victoria's State forests (2006)

1 This Criterion relates to the governance mechanisms that are in place to support sustainable forest management. As a result, most of the associated indicators are qualitative in nature and require narrative-style reporting.

Legal, institutional and economic framework for forest conservation and sustainable management

Indicator:	**7.1 Extent to which the legal framework (laws, regulations, guidelines) supports the conservation and sustainable management of forests** A
Potential sub-indicator reporting areas	7.1.1 Clarifies Indigenous and non-Indigenous property rights *i) Provides for appropriate land tenure arrangements* *ii) Recognises and protects the inherent cultural heritage rights of Indigenous peoples including:* *(a) The right to self determination;* *(b) Native title rights of Indigenous peoples; and* *(c) Customary and traditional rights (including intellectual and cultural heritage rights) of Indigenous peoples.* *iii) Level of Aboriginal satisfaction with involvement in developing policy, legislation, and agreements related to forest management* *iv) Extent or proportion of forest practices that incorporate Traditional Ecological Knowledge* 7.1.2 Provides for periodic forest-related planning, assessment, and policy review that recognise the range of forest values, including coordination with relevant sectors 7.1.3 Provides opportunities for public participation in public policy and decision-making related to forests and public access to information 7.1.4 Encourages the development and application of best practice codes and systems for forest management

Indicator:

A legal framework is essential for the sustainable management of forests and for maintaining Victoria's position as an international leader in sustainable forest management.

Potential sub-indicator reporting areas:

7.1.1 This sub-indicator assesses:

- The legal system and frameworks for land ownership and management, including self management;
- The legal system and frameworks for Indigenous land management; and
- Ownership and other inherent rights relating to land, particularly the rights and interests of Indigenous peoples.

7.1.2 Periodic assessment, review, policy, planning and management are important components of a legal framework for achieving sustainable forest management. This sub-indicator shows how the legal framework demonstrates the Department of Sustainability and Environment's commitment to achieving sustainable forest management.

7.1.3 This sub-indicator assesses whether the legal framework ensures transparency and participation in public policy and decision making in Victoria's State forests.

7.1.4 Best practice codes indicate a commitment to compliance with environmental management systems and demonstrate continuous improvement in forest management practices.

Issues

7.1.1

- Native title and other land rights mechanisms need to be reported;
- The degree to which the legal framework provides for the management of co-existing rights, including the rights of Indigenous peoples and non-indigenous individuals and groups;
- Issues relating to cultural property will need to be addressed once relevant policies are developed;
- The conservation and sustainable management of forests must comply with the requirements of any native title/land rights legislation;
- The continuation of compatible Indigenous activities within the context of forest management;
- Mechanisms (including effective resourcing) for involvement of Indigenous peoples in the management of natural and cultural resources; and
- The responsibility of the Commonwealth Government for implementing the current native title legislation needs to be recognised in the context of this indicator.

7.1.2

- Appropriate assessment periods will vary depending on jurisdiction and task.

7.1.3

- Perceptions regarding the effectiveness of public participation processes will differ; and
- Some commercial and traditional Indigenous information may be of a sensitive or exclusive nature.

7.1.4

- Environmental audit arrangements and compliance with the Environmental Management System for Victoria's State forests need to be reported.

Possible data sources

- Department of Sustainability and Environment;
- Department of Primary Industries; and
- Koori Business Network.

Potential methods

- Narrative reporting, including at the regional level, on the content and coverage of codes and compliance with the codes; and
- Evaluation of legislation and management plans.

Interpretation

7.1.1 Narrative. This indicator assesses the adequacy of the legal framework in providing mechanisms for clarifying Indigenous and non-Indigenous property rights and establishing appropriate land tenure arrangements.

7.1.2 Narrative. Demonstrates a commitment to sustainable forest management. This sub-indicator should be considered in conjunction with other indicators under Criterion 7.

7.1.3 Narrative. Indicates whether public participation and information processes involving all parts of the community have been effective.

7.1.4 Narrative. High level of application indicates a commitment to best practice.

Legal, institutional and economic framework for forest conservation and sustainable management

Indicator:	**7.2 Extent to which the institutional framework supports the conservation and sustainable management of forests** A
Potential sub-indicator reporting areas	7.2.1 Provide for public involvement activities and public education, awareness and extension programs, and make available forest-related information 7.2.2 Undertake and implement periodic forest-related planning, assessment, and policy review, including cross-sectoral planning and coordination 7.2.3 Develop and maintain human resource skills across relevant disciplines 7.2.4 Develop and maintain efficient physical infrastructure to facilitate the supply of forest products and services, and support forest management 7.2.5 Enforce laws, regulations and guidelines *i) Rate of compliance with sustainable forest management laws, regulations, and best management practices* *ii) Incidents of, and fines for, non-compliance with all applicable international declarations/conventions/treaties and national, sub-national, regional, and local regulations associated with environmental regulations*

Rationale

Indicator:

A commitment to building community awareness, regional assessment and planning, and policy review is essential for continuous improvement. The maintenance of appropriate levels of human resource skills, the enforcement of laws, regulations and guidelines, and the adoption of forest certification are mechanisms that can be utilised in demonstrating commitment to sustainable forest management.

Potential sub-indicator reporting areas:

7.2.1 An institutional commitment to building community awareness and support is essential for the sustainable management of forests.

7.2.2 Periodic regional planning, assessment, and policy review by the responsible institutions provide the basis for continuous improvement in forest management.

7.2.3 Appropriate levels of human resource skills are required to implement sustainable forest management.

7.2.4 The development and maintenance of physical infrastructure underpins efficient forest management and use. The main physical infrastructure in forests is the road network. Its development and maintenance provides a critical role in the provision of recreation, wood products, non wood products, fire prevention, fire response and management.

7.2.5 Enforcement of laws ensures that plans are implemented effectively. The sub-indicators aim to provide quantitative information related to enforcement.

Issues

7.2.1

- Public concern regarding forest management varies and some communities/regions have a greater ownership of forest management than others.

7.2.3

- There is difficulty in identifying the full range of human resource skills required and available in particular regions; and
- Further development of successional planning is required.

7.2.5

- Low levels of breach and prosecution may mean high levels of compliance, or a low level of enforcement.

Possible data sources

- Department of Sustainability and Environment;
- Department of Primary Industries;
- Arthur Rylah Institute;
- Forest and Wood Products Research and Development Corporation;
- School of Forest and Ecosystem Science (The University of Melbourne); and
- Environment Protection Authority Victoria.

Potential methods

- A narrative report addressing monitoring and enforcement effort; and
- Report compliance against monitoring and the amount of monitoring undertaken.

Interpretation

7.2.5 Number of breaches can reflect both enforcement effort and compliance with the law.

Legal, institutional and economic framework for forest conservation and sustainable management

Indicator:	**7.3 Extent to which the economic framework supports the conservation and sustainable management of forests**	B
Potential sub-indicator reporting areas	7.3.1 Investment and taxation policies and a regulatory environment which recognise the long-term nature of investments and permit the flow of capital in and out of the forest sector in response to market signals, non-market economic valuations, and public policy decisions in order to meet long-term demands for forest products and services	

Rationale

Government investment and taxation policies can affect investment in forest conservation, forest growing and timber processing industries. This indicator examines the ways in which economic policies maintain and develop forest capital.

Issues

- Accounting for environmental services in economic frameworks is important for the sustainable management of forests (see also Indicator 6.1c).

Possible data sources

- Department of Sustainability and Environment;
- Department of Primary Industries;
- VicForests;
- Forest and Wood Products Research and Development Corporation;
- Australian Bureau of Agricultural and Resource Economics; and
- Department of Agriculture, Fisheries and Forestry (Australian Government).

Potential methods

- Compilation of existing laws and policies that provide incentives for investment in forest capital;
- Compilation of both national and state programs for investment in the forest sector; and
- Identification of polices designed to promote access to forest product markets.

Interpretation

Discriminatory trade policies that distort market signals can affect sustainable forest management. Alternatively, trade liberalisation can have both positive and negative impacts.

Indicator:	**7.4 Capacity to measure and monitor changes in the conservation and sustainable management of forests**	A
Potential sub-indicator reporting areas	7.4.1 Coverage, currency and frequency of data and other information that is important for measuring or describing indicators associated with Criteria 1 to 7	

Rationale

The conservation and sustainable management of forests depends on the capacity to measure and monitor social, economic and environmental conditions. This indicator will assess the data available to report against Victoria's sustainable forest management indicators.

Issues

- Access to private sector forestry data and assessing the frequency, coverage and currency of that data; and
- Assessing statistical confidence in a broad range of data sources.

Possible data sources

- Department of Sustainability and Environment;
- Department of Primary Industries;
- VicForests;
- Bureau of Rural Sciences (Australian Government); and
- Department of Agriculture, Fisheries and Forestry (Australian Government).

Potential methods

- Narrative summarising the frequency, coverage and currency of data and assessments.

Interpretation

Data collected under this indicator should demonstrate the timeliness and completeness of the information available for the sustainable management of forests. Results will indicate whether there is an improvement in reporting capacity.

Legal, institutional and economic framework for forest conservation and sustainable management

Indicator:	**7.5 Capacity to conduct and apply research and development aimed at improving forest management, including development of scientific understanding of forest ecosystem characteristics and functions** **A**
Potential sub-indicator reporting areas	*i) Number of sustainable forest management related research projects underway and/or completed on forest management or ecosystem processes* *ii) Number of applied social and natural science research projects which address issues of local and regional significance*

Rationale

Indicator:

A scientific understanding of forest ecosystem characteristics and functions is needed to underpin sustainable forest management. There is also a need to develop methods that enable the full range of forest values to be considered in forest management.

Potential sub-indicator reporting areas:

These sub-indicators aim to provide a more detailed description of research and development capacity.

Issues

- Research often requires long-term studies which are dependent on adequate funding; and
- Research funding must be specific to sustainable forest management requirements, consequently, accountability and progress reporting needs to be ensured.

Possible data sources

- Department of Sustainability and Environment;
- Arthur Rylah Institute; and
- School of Forest and Ecosystem Science (The University of Melbourne).

Potential methods

- Narrative report on initiatives undertaken to address regional research needs;
- Number of research papers published relevant to sustainable forest management, by Criteria 1 to 6;
- Number of people employed in research and development; and
- Annual expenditure on research and development (see also Indicator 6.2b).

Interpretation

Research contributes significantly to improvements in sustainable forest management.

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Glossary

Aerial photograph interpretation	Visual analysis, classification and mapping of forest, using photographs taken from an aircraft.
Aesthetic value	The response derived from an experience of the environment or particular natural and cultural attributes within it. This can be either to visual or non-visual elements and can embrace emotional response, sense of place, sound, smell and any other factors having a strong impact on human thoughts and feelings.
Biodiversity	The natural diversity of all life: the sum of all our native species of flora and fauna, the genetic variation within them, their habitats, and the ecosystems of which they are an integral part.
Biomass	The total mass of all plant and other material of biological origin in an area.
Browsing	Eating (grazing) of vegetation by livestock or wild animals.
Burl	A hardened, woody outgrowth on a tree.
Catchment	The natural boundary of the area where all surface water drains to a common point.
Code of Practices for Timber Production	Set of principles, procedures, guidelines and standards that specify minimum acceptable practices in harvesting and associated forest management operations.
Comprehensive, Adequate and Representative (CAR) Reserve System	A reserve system to conserve all native forest types as well as the plants and animals that depend on them. Comprehensive – the full range of forest communities recognised by an agreed national scientific classification at appropriate hierarchical levels; Adequate – the maintenance of the ecological viability and integrity of populations and communities; Representative - areas of forest that reflect the biological diversity of the communities.
Coupe	A single area of native forest or plantation of variable size, shape and orientation from which timber is harvested in one operation.
Criteria and indicators	Hierarchical framework used to monitor, assess, and report on the status of sustainable forest management at local, country or regional level. A criterion is a characteristic feature, a set of conditions, or a process, based on which sustainable forest practices may be assessed. An indicator is a quantitative or qualitative parameter which can be assessed in relation to a criterion.
Disturbance	Any range of factors affecting the condition of natural areas. Disturbance may be natural or human-induced. Natural disturbances include wildfires and rainstorms, and are part of the natural ecological processes. Human-induced disturbance includes timber harvesting, agricultural clearing, mining or livestock grazing. Important factors when considering disturbance are the origin, duration, and intensity of the disturbance, and its impact on the environment.
Diversity	A measure of the physical or biological complexity of a system.
Ecological Vegetation Class (EVC)	Vegetation classification system - groupings of vegetation communities based on floristic, structural and ecological features.
Ecosystem	All the organisms (including plants and animals) present in a particular area together with the physical environment with which they interact.

Endangered species and communities	Species and communities at risk of extinction if factors causing their decline continue. This includes species and communities whose numbers have been reduced to a critical level or whose habitats have been drastically reduced. Status elsewhere in Australia is not considered when assessing Victorian species and communities in this category.
Environmental Management System (EMS)	Provides a systematic framework and process to assist an organisation in identifying and managing significant environmental impacts that may occur as a result of its activities. Also see *State forest Environmental Management System*.
Erosion hazard	The likelihood of soil erosion occurring because of soil erodibility, rainfall erosivity, slope and soil disturbance.
Exotic	Introduced to Australia, not native.
Fauna	A general term for animals (including reptiles, birds, marsupials, and fish).
Flora	A general term for plants.
Forest	An area, incorporating all living and non-living components, that is dominated by trees with an existing or potential stand height exceeding 5 metres, and with existing or potential projective foliage cover of overstorey strata of at least 30 per cent. This definition includes Australia's diverse native forests and plantations, regardless of age. It is also sufficiently broad to encompass areas of trees that are sometimes described as woodlands.
Forest certification	The voluntary independent assessment of an organisation's forest management activities and operations for a particular area of forest.
Forest estate	All forests growing on public or private lands.
Forest Management Area	The basic units for forest planning and management in Victoria. Currently Victoria is divided into 15 Forest Management Areas as defined in the *Forests Act 1958*.
Forest management plan	A plan for public land applying to one or several Forest Management Areas, that is approved by the Secretary of the Department of Sustainability and Environment, which addresses the full range of values and uses in the Area.
Forest Resource Inventory	The classification and measurement of the forest estate to provide information on sustainable yield, forest land-use, and resource allocation.
Forest stand	See *Stand*.
Forest type	A classification of forests according to their life form and height of the tallest stratum, and the projected foliage cover of the tallest stratum.
Game	Wildlife species declared as game under the *Wildlife Act 1975* to enable them to be hunted.
Grade	The designation of the quality of a sawlog, a piece of timber or other manufactured wood product in accordance with standard grading rules.
Greenhouse gases	Gases that affect the temperature of the Earth's surface and climate. They include water vapour, ozone, chlorofluorocarbons, carbon dioxide, methane and nitrous oxide.
Groundwater	All subsurface water occupying the pores and crevices of rock and soil.
Growth stages	The different forms exhibited by trees at various stages in their development e.g. regeneration, regrowth, pole, mature and senescent.

Guidelines	The directing principles adopted to establish decisions (zoning, actions or prescriptions) for the protection and management of forest values. They are not necessarily mandatory, and are to be interpreted and applied on the basis of information available, and in the context of the protection and management of other values in the forest.
Habitat	The natural home of a plant or animal.
Hardwood	Timber from flowering trees (botanically classified as Angiosperm), such as eucalypts, irrespective of the physical hardness of the timber, also used to refer to trees that have such timber.
Harvesting	As part of forest management, the cutting (felling) of trees to produce timber products.
Hazard class (land degradation)	Classification of similar land types on the basis of susceptibility to damage, such as soil erosion, from disturbances resulting from timber harvesting and related operations.
Herbicide	A chemical used to poison plants.
Heritage	All those things we have inherited from previous generations and which we value, including places, objects and folklore.
Intensive management	Silvicultural intervention in a forest or stand beyond the minimum required to ensure re-stocking. It can include some or all of site preparation, planting, fertilising, weed control, spacing and thinning.
Management prescriptions	Details specific conditions or standards which apply to forest operations in the vicinity of certain threatened flora or fauna.
Mature forest	Forest stands and/or individual trees where the tree crowns are well foliated and rounded. The height and crown development of the trees has effectively ceased (compared with regrowth) but decline of the crown (loss of limbs) has not yet significantly begun (as in the senescent or over mature growth stage).
Mean Annual Increment (MAI)	The average annual increase in the volume of individual trees or stands up to a given age. The MAI changes with different tree growth phases. MAI is commonly used to identify the biological maturity of the tree, and its readiness for harvesting.
Merchantable	Used to describe trees, or parts of trees, suitable for processing into forest produce and for which a market exists.
Minor forest produce	Forest produce other than sawlogs or residual logs.
National Forest Inventory	A joint Commonwealth and State / Territory program responsible for collating comprehensive information about the location and diversity of Australia's forest estate.
National Forest Policy Statement	A joint Commonwealth and State / Territory Government response which outlines agreed objectives and policies for Australia's public and private forests.
National Park	Land described as a national park on Schedule Two of the *National Parks Act 1975*. These are generally extensive areas of land of nationwide significance because of their outstanding natural features.
Native	A species of plant or animal that occurs naturally in a region.
Non-merchantable	Used to describe trees, or parts of trees, unsuitable for processing into forest produce.

Old-growth forest	Ecologically mature forest where the effects of disturbances are now negligible.
Overstorey	Trees (or vegetation in general) in the upper stratum of the forest.
Plantation	Managed stands of trees of either native or exotic species, planted or sown primarily for timber production purposes.
Population	A group of interacting organisms of the same species that occupy a definable area.
Private land (including private forest)	1. Land alienated from the Crown. 2. Unalienated land of the Crown managed and controlled by other than the Minister for Water, Environment and Climate Change, the Minister for Agriculture, or the Secretary of Sustainability and Environment. 3. Unalienated land of the Crown occupied under a lease from the Crown. 4. Land licensed under the *Victorian Plantations Corporation Act 1993*.
Provenance (of seed)	The original geographic source or place from which that seed was obtained.
Public forest	Any forest on Crown land for which government has management responsibility.
Public land	Unalienated land of the Crown managed and controlled by the Minister for Water, Environment and Climate Change, the Minister for Agriculture, or the Secretary of Sustainability and Environment, whether or not occupied under a licence or other right (but not including land occupied under a licence under the *Victorian Plantations Corporation Act 1993*).
Pulpwood	Timber cut and prepared primarily for the manufacture of wood pulp and for further processing to make paper or reconstituted wood product such as fibreboard.
Reference areas	An area of public land of ecological interest and significance preserved in its natural state.
Reforestation	The re-establishment of forest cover by planting or sowing species native to the locality on previously cleared or poorly forested land.
Regeneration	The renewal or re-establishment of native forest flora by natural or artificial means following disturbance such as timber harvesting or fire.
Regional Forest Agreement (RFA)	An agreement between the Commonwealth and a State Government about the long term management and use of forests in a region.
Rehabilitation	The restoration and revegetation of a site following disturbance such as timber harvesting or fire.
Reserves	Areas such as national parks and nature conservation areas which are subject to an established degree of protection from disturbance.
Residual log	Logs, not of sawlog quality, produced as a consequence of a sawlog harvesting operation. Unlike pulpwood the end-use of a residual log is not specified.
Richness	A measure of the abundance of individual elements within a particular place. For instance, the species richness of an ecological vegetation class (EVC) is the number of species which typically occur within that EVC.
Riparian	Of, or located on, the banks of rivers.
Royalty	A payment made for the value of timber harvested.

Runoff	The proportion of rain falling in a catchment which flows across the surface rather than infiltrating the soil. Runoff is a major agent of water erosion.
Salvage harvesting	Harvesting of forest produce to recover a resource that would otherwise be lost as result of damage such as fire, pests or disease.
Sawlog	A log considered suitable in size and quality for producing sawn timber.
Sedimentation	The pollution of streams and water bodies by sedimentary runoff.
Senescent	Old-growth stage of a forest stand or individual tree that is characterised by declining crown leaf area and irregular crown shape e.g. due to the loss of branches.
Seral stage	A plant community that occurs at a particular stage of succession.
Silviculture	The science and practice of managing harvesting, forest establishment, composition, and growth, to achieve specified objectives.
Softwood	Timber from cone-bearing trees (botanically classified as Gymnosperm), such as coniferous trees including pines and cypresses, irrespective of the physical softness of the timber. Also used to refer to trees that have such timber.
Species	A group of organisms that are biologically capable of breeding and producing fertile offspring. It is the lowest normal taxonomic classification in use.
Stand	A group of trees in a forest that can be distinguished from other groups on the basis of age, species composition, condition etc.
STANDSIM	A software program for predicting forest growth and timber yields, often used for *E. regnans*, *E. delegatensis* and *E. sieberi* forests in Victoria.
State forest	As defined in section 3 of the *Forests Act 1958*, State forest comprises publicly owned land which is managed for the conservation of flora and fauna; for the protection of water catchments and water quality; for the provision of timber and other forest products on a sustainable basis; for the protection of landscape, archaeological, historical and other cultural values; and to provide recreational and educational opportunities.
State forest Environmental Management System	Based on ISO 14001, ensures that an organisation understands and manages environmental risks associated with its activities, it is often used as the foundation for forest certification. Also see *Environmental Management System*.
Stocking	A measure of density of any given forest stand, which can be expressed in a variety of terms, such as the number of trees per hectare, the basal area per hectare, and the percentage of stocked plots.
Stumpage	The value of forest produce available in a forest.
Succession (of forest ecosystems)	The progressive change of species composition within a stand over time. If left undisturbed this succession will continue to a climax where the species composition will remain largely unchanged.
Sustainable forest management (SFM)	The stewardship and use of forests and forest land in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil relevant ecological, economic and social functions. This is to be achieved at local, national, and global levels, both now and in the future, and in a way that does not cause damage to other ecosystems.
Sustainable yield	Yield of forest products that can be maintained for a given period, based on the capacity of the forest to produce that product whilst maintaining the functioning of the forest ecosystem.

Thinning	The removal of part of a forest stand or crop, with the aims of increasing the growth rate and/or health of retained trees and, in commercial thinning, obtaining timber from trees that would otherwise eventually die before final harvest.
Threatened	A collective term used to denote species that are extinct, critically endangered, endangered, vulnerable, near threatened, data deficient, or conservation dependent.
Timber	A general term used to describe standing trees or felled logs before their processing into wood products. This includes timber from trees or parts of trees which are specified as available for timber harvesting, but does not include firewood collected for domestic use.
Timber Release Plan	Timber Release Plans are produced by VicForests in accordance with part 5 of the *Sustainable Forests (Timber) Act 2004*. The plans are publicly available and define the location and timing of timber harvesting operations, stand type, and roading activities over a five year period.
Total merchantable volume	The total amount of available merchantable wood.
Tree	A perennial plant having a self-supporting woody stem or trunk which has the potential to grow to over 5 metres in height.
Value	A principle, standard, or quality considered worthwhile or desirable. In sustainable forest management, values relate to the ecological, economic, and social aspects of forests and their uses.
VicForests	A state owned enterprise responsible for the sustainable harvest and commercial sale of forest produce in eastern Victoria.
Vulnerable species and communities	A species or community is considered to be vulnerable when likely to become endangered in the near future if the factors causing their decline continue e.g. through changes in land use. Status elsewhere in Australia is not considered when assessing Victorian species and communities in this category.
Water supply catchment	A catchment from which water is used for domestic water supply purposes.
Weed	Any plant that survives in an area where it is harmful or troublesome to land uses or values.
Wilderness	Land that, together with its plant and animal communities, is in a state that has not been substantially modified by, and is remote from, the influences of European settlement or is capable of being restored to such a state, is of sufficient size to make its maintenance in such a state feasible, and is capable of providing opportunities for solitude and self-reliant recreation.
Wood	The hard, fibrous inner part of tree trunks, branches and stems. A source of timber.

Appendix 1: Summary of indicators

		Category[1]
1.	**Conservation of biological diversity**	
1.1	**Ecosystem diversity**	
1.1a	**Area of forest by type and tenure**	**A**
	i) Percentage of tree species (Ecological Vegetation Class and species group) by age class and site quality	A
1.1b	**Area of forest type by growth stage**	**B**
	i) Area of old growth forest, by type, distributed across the Forest Management Area	A
	ii) Area and percentage of old growth harvested annually	A
	iii) Area and percentage of old growth impacted by natural processes annually (e.g. wildfire, insect attack)	A
	iv) Area recruited for future old growth (areas of regrowth protected from anthropogenic disturbances – age distribution)	A
1.1c	**Area of forest type by growth stage distribution in protected zones**	**A**
	i) Area of forest, by type and age class in Comprehensive, Adequate and Representative (CAR) reserve areas	A
	ii) Range of sizes and average size of CAR reserve areas for each forest type	A
	iii) Number of outstanding or unique biological, zoological, geological, and paleontological features in protected areas	A
	iv) Area of forest available for timber harvesting in relation to area of forest in CAR reserve areas	A
	v) Area of forest types with significantly reduced area	B
1.1d	**Fragmentation of native forest cover**	**B**
	i) Connectivity between areas with similar habitat types	C
	ii) Area of forest permanently converted to non-forest	A
1.2	**Species diversity**	
1.2a	**The status of forest dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment**	**A**
	i) Percentage of high priority actions at high priority locations successfully implemented annually for threatened species and communities	A
	ii) Percentage of high priority threatened species populations with positive trends for a) population, b) habitat and c) risk	B
	iii) Percentage of high priority occurrences of threatened communities with positive trends for a) extent and condition, b) physical environment and c) risk	B
	iv) Percentage change in the number of forest dependent species classified as vulnerable, threatened or endangered	A
1.2b	**Area of habitat available for forest dependent indicator species**	**A**
	i) Areas of high, medium, and low habitat (quality) for indicator species	B
	ii) Distribution of selected habitat elements by catchment over time	B
1.2c	**Representative indicator species from a range of habitats monitored at scales relevant to regional forest management**	**B**
	i) Population levels of selected forest dependent species	B
	ii) Number of forest dependent species that occupy a small portion of their former range	A
	iii) Percentage of original range occupied by selected rare, threatened, endangered, or indicator species	B
1.2d	**Degree of disturbance to native forest species caused by invasive species**	**B**
	i) Number of invasive, exotic forest-associated species	A
	ii) Location and dispersal of introduced species	B
	iii) Changes in abundance and distribution of native species known to be susceptible to such disturbance	B
1.3	**Genetic diversity**	
1.3a	**The number of forest dependent species at risk from isolation that may lead to loss of genetic variation**	**C**
	i) The number of seed-lot provenances used in regeneration, reforestation, roading and stabilisation works that meet Code requirements	A
1.3b	**Number of *in situ* and *ex situ* conservation efforts for forest dependent species**	**C**
	i) Change in the area of gene protection forests	B
	ii) Changes in genetic diversity and structure within populations, and gene flow, for selected species	C

		Category[1]
2.	**Maintenance of productive capacity of forest ecosystems**	
2.1	**Area and percentage of forest and net area of forest available and suitable for timber production**	**A**
	i) Additions and deletions of forest area, by cause and by forest type	B
	ii) Forest area (ha) reserved by special management regime (e.g. for conservation of powerful owls, baw baw frog, or water quality)	A
	iii) Loss of forest area to roads and other developments (e.g. quarries)	A
	iv) Area (ha) removed due to site being inoperable or uneconomical (e.g. due to slope and other Code exclusions)	A
2.2	**Volume of wood by forest type in State forest that is available and suitable for timber production**	**A**
	i) Total volume of wood and area of non-merchantable forest	B
	ii) Total volume of wood and area of merchantable forest	A
	iii) Area (ha) of available forest that is managed intensively	A
2.3	**Annual production of wood products from State forest compared to sustainable harvest levels**	**A**
	i) Annual volume (cubic metres) harvested from State forest by broad forest type	A
	ii) Area harvested compared to sustainable harvest level (ha) by broad forest type	A
	iii) Actual annual harvest of minor wood products compared to sustainable harvest level	B
	iv) Area and volume by silvicultural treatment type (clearfell, thinning, salvage, selective)	A
	v) Volume of wood removed by ecological processes	B
2.4	**Annual production of non-wood forest products**	**A**
	i) Carrying capacity of the system for economically important species/products	C
	ii) Non-wood products produced annually from State forests	A
2.5	**Proportion of timber harvest area successfully regenerated by forest type**	**A**
	i) Area not meeting stocking standards	A
3.	**Maintenance of ecosystem health and vitality**	**Category[1]**
3.1	**Scale and impact of agents and processes affecting forest health and vitality**	**B**
	i) Area of forest damage, by age class and forest type, caused by extreme weather including wind, rainfall, snow, drought and frost	B
	ii) Area of State forest burnt, by forest type and age class annually	A
	iii) Area of forest burnt for ecological management purposes on an annual basis	A
	iv) Area and percentage of regenerated coupes affected by browsing or other damage processes (e.g. drought, frost, etc.)	B
	v) Annual quantity (tonnes) of pesticide or herbicide used to control damage agents	A
	vi) Area and percentage of forested land subject to levels of specific air pollutants (e.g. ozone, nitrates) that may cause negative impacts on forest ecosystems	B
	vii) Area of forest damage, by age class and forest type, caused by insects and pathogens	B
3.2	**Area and type of human-induced disturbance**	**A**
	i) Harvested area by silvicultural system and forest type, and percentage of total forest area	A
	ii) Regeneration area and percentage change in the composition of the disturbed area	B
	iii) Area of forest and percentage of total forest area covered by grazing licences by forest type	B
	iv) Area of prescribed burning (e.g. fuel reduction, regeneration, ecological) undertaken on State forest and percentage of total forest area	A
	v) Area and percentage of forest thinned by age and forest type	A
	vi) Impact of other human induced disturbances (e.g. mining, infrastructure and recreation)	B
4.	**Conservation and maintenance of soil and water resources**	**Category[1]**
4.1	**Area and percentage of forest by activity type systematically assessed for risk to soil attributes**	**B**
	i) Soil erosion	B
	ii) Change in nutrient status	C
	iii) Biological composition/activity	C
	iv) Structural decline (compaction)	B
4.2	**Change in forested catchment water yield characteristics through time**	**B**
4.3	**Change in forested catchment river health characteristics through time**	**B**
	i) Percentage compliance with locally applicable road construction, stream crossing and riparian zone management standards	A
	ii) Percentage to which forest operations have been systematically assessed for risk to water quality	B
	iii) Percentage to which the application of chemicals has been systematically assessed for risk to water quality	A
	iv) Index of Stream Condition	A
	v) Water quality attainment ratings in each Catchment Management Authority region	A

5.	**Maintenance of forest contribution to global carbon cycles**	**Category[1]**
5.1	**Total forest ecosystem biomass and carbon pool by forest type, age class, and successional stages**	**B**
	i) Mean Annual Increment by forest type and age class	A
	ii) Tree biomass volumes	B
	iii) Non-tree biomass volumes	C
	iv) Soil carbon pools	C
	v) Removals (fire and harvesting)	A
	vi) Net change in forest products carbon	C
5.2	**Contribution of forest ecosystems to the global greenhouse gas balance**	**B**
	i) Estimated tonnes of greenhouse gas uptake or release by forest type and age class (report separate subtotals for CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 in tonnes)	B
	ii) Fuel consumption for timber harvesting (per m^3 of product) compared with average fuel consumption for agricultural, manufacturing and retail sectors	B
	iii) Use and emissions of ozone-depleting substances (in tonnes of CFC –11 equivalents)	C
6.	**Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies**	**Category[1]**
6.1	**Production and consumption**	
6.1a	**Value ($) of wood and wood products**	**B**
	i) Value of primary timber products to the Gross State Product	A
	ii) Value of secondary timber products per volume/unit harvested	B
	iii) Production, consumption, imports, and exports of timber products	B
	iv) Timber price trend	A
	v) Victoria's share in all forest products markets (percentage)	B
6.1b	**Value ($) and yield of non-wood forest products**	**B**
	i) Contribution of non-timber forest products to the Gross State Product	B
	ii) Production, consumption, imports and exports of non-timber forest products	C
	iii) Value by type of non-wood forest products (m^3, kg)	A
6.1c	**Value ($) of forest derived ecosystem services**	**C**
	i) Cost ($) per megalitre of water from forested catchments	C
6.1d	**Degree of reuse and recycling of wood products**	**B**
6.2	**Investment in the forest sector**	
6.2a	**Investment and expenditure in forest management**	**A**
	i) Investment by Government in forest management as a percentage of Gross State Product	B
	ii) Average expenditure in forest asset protection (e.g. prescribed fire)	A
	iii) Expenditure on forest infrastructure (e.g. roads, bridges, fire towers)	A
6.2b	**Investment in research and development, and education**	**A**
	i) Number of forestry professionals with recognised qualifications in natural resource management or forest science working in forest management	B
	ii) Investment ($) in forest management research and development by government and percentage of forest management funding over time	A
	iii) Investment ($) in forest-related community and public education programs by government, and the number of programs initiated annually	A
6.2c	**Extension and use of new and improved technologies**	**A**
6.3	**Recreation and tourism**	
6.3a	**Area and quality of forest actively utilised for recreation and tourism**	**A**
	i) Economic contribution of forests to the tourism sector (local and State)	B
	ii) Cost of maintenance activities in recreation and tourism areas	B
	iii) Level of visitor satisfaction	C
6.3b	**Range and use of recreation and tourism opportunities that are available within forests**	**A**
6.3c	**Number of visits per annum**	**B**
6.4	**Indigenous and non-Indigenous cultural, social, and spiritual needs and values**	
6.4a	**Area of forest to which Indigenous people have access and rights that protect their cultural heritage and are recognised through formal and informal management regimes**	**A**

6.4b	**Proportion of places of Indigenous and non-Indigenous cultural values in forests formally managed to protect those values**	**A**
	i) Number of Indigenous and non-Indigenous staff with specialist cultural heritage management skills	A
	ii) Proportion of Aboriginal cultural heritage places and historic places with agreed conservation management plans	A
	iii) Proportion of Aboriginal cultural heritage places and historic places presented or interpreted to the public	A
	iv) Proportion of Aboriginal cultural heritage places and historic places disturbed as a result of forest or fire management operations	B
	v) Proportion of Aboriginal cultural heritage places and historic places where active conservation works have been completed	A
	vi) Number of new places added to the Victorian Aboriginal Heritage Register and the Historic Places database; or number of existing records that have been updated or reviewed	A
	vii) Proportion of Aboriginal cultural heritage places and historic places with an active monitoring program	A
6.5	**Employment and community needs**	
6.5a	**Direct and indirect employment in the forest sector and forest sector employment as a proportion of total employment**	**B**
	i) Total Full Time Equivalent and number of jobs indirectly and directly employed in the forest sector	B
	ii) Age and gender profile of employment in the forestry sector	C
	iii) Gender and age related indices for staff involved in forest management (Victorian Government forest management agencies)	A
	iv) Percentage of Aboriginal people employed in forest management (Victorian Government forest management agencies) in comparison to non-Indigenous people	A
6.5b	**Average wage rates and injury rates in major employment categories within the forest sector**	**B**
	i) Number of accidents and injury rates by forest sector category	A
	ii) Standard injury, days lost, absentee rates and numbers of work-related fatalities (including subcontracted workers)	A
6.5c	**Resilience of forest dependent communities to changing social and economic conditions**	**B**
	i) Contracts ($ total) paid to local enterprise (including Department of Sustainability and Environment contracts)	B
	ii) Migration history, likelihood of future migration	B
6.5d	**Resilience of forest dependent Indigenous communities to changing social and economic conditions**	**B**
	i) Number and type of tenures offered to Indigenous peoples	A
	ii) Aboriginal employment	A
6.5e	**Area of forest available and accessible for Indigenous people to exercise their inherent rights to meet subsistence or individual and family cultural and spiritual needs**	**B**
	i) Area available for subsistence purposes	A
	ii) Area available for continued cultural use	B
	iii) Area available for continued resource use	B
	iv) Areas where Indigenous partnerships are being practiced	A
6.6	**Indigenous participation**	
6.6a	**Extent to which the management framework includes the exercise of customary, custodial, traditional and native title rights as an essential component in achieving sustainable forest management**	**A**
	i) Research partnerships	B
	ii) Extent of incorporation of Indigenous knowledge in cultural inventories	B
	iii) Level of Indigenous participation and/or consultation	A
	iv) Indigenous information sharing and referrals program	B

	7. Legal, institutional and economic framework for forest conservation and sustainable management	Category[1]
7.1	**Extent to which the legal framework (laws, regulations, guidelines) supports the conservation and sustainable management of forests**	**A**
	7.1.1 Clarifies Indigenous and non-Indigenous property rights	A
	i) Provides for appropriate land tenure arrangements	A
	ii) Recognises and protects the inherent cultural heritage rights of Indigenous peoples	B
	iii) Level of Aboriginal satisfaction with involvement in developing policy, legislation, and agreements related to forest management	C
	iv) Extent or proportion of forest practices that incorporate Traditional Ecological Knowledge	C
	7.1.2 Provides for periodic forest-related planning, assessment, and policy review that recognise the range of forest values, including coordination with relevant sectors	A
	7.1.3 Provides opportunities for public participation in public policy and decision-making related to forests and public access to information	A
	7.1.4 Encourages the development and application of best practice codes and systems for forest management	A
7.2	**Extent to which the institutional framework supports the conservation and sustainable management of forests**	**A**
	7.2.1 Provide for public involvement activities and public education, awareness and extension programs, and make available forest-related information	A
	7.2.2 Undertake and implement periodic forest-related planning, assessment, and policy review, including cross-sectoral planning and coordination	A
	7.2.3 Develop and maintain human resource skills across relevant disciplines	B
	7.2.4 Develop and maintain efficient physical infrastructure to facilitate the supply of forest products and services, and support forest management	A
	7.2.5 Enforce laws, regulations and guidelines	A
	i) Rate of compliance with sustainable forest management laws, regulations, and best management practices	A
	ii) Incidents of, and fines for, non-compliance with all applicable international declarations/ conventions/treaties and national, sub-national, regional, and local regulations associated with environmental regulations	A
7.3	**Extent to which the economic framework supports the conservation and sustainable management of forests**	**B**
	7.3.1 Investment and taxation policies and a regulatory environment which recognise the long-term nature of investments and permit the flow of capital in and out of the forest sector in response to market signals, non-market economic valuations, and public policy decisions in order to meet long-term demands for forest products and services	B
7.4	**Capacity to measure and monitor changes in the conservation and sustainable management of forests**	**A**
	7.4.1 Coverage, currency and frequency of data and other information that is important for measuring or describing indicators associated with Criteria 1 to 7	A
7.5	**Capacity to conduct and apply research and development aimed at improving forest management, including development of scientific understanding of forest ecosystem characteristics and functions**	**A**
	i) Number of sustainable forest management related research projects underway and/or completed on forest management or ecosystem processes	A
	ii) Number of applied social and natural science research projects which address issues of local and regional significance	B

[1] *Category A:* Indicators that can be reported against immediately for many areas of Victoria's forest. In these cases, information is already available and/or being collected;
Category B: Indicators that can be measured for some areas of forest, but where there remains a methodological or resourcing issue; and
Category C: Indicators where significant research and development is required to assess if there is a practical, sensitive and cost-effective means of implementation.

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