

# Living in the Landscape



## The Lockyer Valley

A guide to  
property and landscape  
management



We would like to acknowledge the valuable contribution of the Lockyer Catchment Association, the Gatton and Laidley Shire Councils (now the Lockyer Valley Regional Council), who were responsible for the production of the document 'Living in the Lockyer' that primarily inspired the production of this latest publication. The format, layout and content have changed but the overall intent to improve the way in which we manage the catchment in which we live and work remains the same.

ISBN 978-0-9807088-0-6

South East Queensland Catchments Limited

This publication may be used for research, individual study and educational purposes. Properly acknowledged quotations may be made. This document has been prepared from the best available information at the time of publication. Information has been collated from a number of sources and is presented in a non-technical format. Any decisions made by other parties based on this document are solely the responsibility of those parties.

#### Disclaimer

*This information or data is provided on a general basis only. You should seek specific or appropriate advice in relation to this information or data before taking any action based on its contents. So far as permitted by law, SEQ Catchments Limited makes no warranty in relation to this information or data.*

SEQ Catchments

PO Box 13204

George St QLD 4003

www.seqcatchments.com.au

Citation details:

Galbraith, R (Ed) 2009. Living in the Landscape: the Lockyer Valley. A guide to property and landscape management. South East Queensland Catchments Limited, Brisbane 115p.



REGIONAL COUNCIL



Australian Government

Department of Agriculture, Fisheries and Forestry  
National Landcare Programme



Ph: 0407 622 995

Email: rick@aquilanrm.com.au

www.aquilanrm.com.au

Graphics by:



Ph: 0419 788 465

Email: tabitha@wrappd.com.au

www.wrappd.com.au



Figure 1: Lockyer Valley locality map

**Introduction** ..... 6

**Catchments**..... 6

    Lockyer Catchment Facts ..... 7

    Climate ..... 8

    Land Resources ..... 8

    Water .....11

    Vegetation.....12

    Nrmplans & Regional Bodies..... 14

**Property Planning And Management** ..... 16

    Managing my Land -why Manage Natural Resources ..... 16

    I Can Make A Difference.....18

    Where Do I Start .....18

    What Am I Allowed To Do With My Property?.....20

    What Is The Best Use For My Property?.....20

    Regional, State and Commonwealth laws and legislation .....21

**Resource** ..... 22

    Ecosystem Services .....22

    Land.....24

    Soils .....25

    Pasture.....28

    Water .....32

    Riparian Areas .....33

    Native Vegetation.....35

    Vegetation Maps.....38

    Nature Conservation.....40

    Three principals of habitat management .....42

**Planning For Action** ..... 48

    Taking Stock Of Our Resources .....49

    Action - The Moment We've Been Waiting For .....51

    Prioritising Actions .....52

    Monitoring.....53

    Reviewing - How Did We Go? .....53

**Practical Consideration Formanaging Your Property** ..... 54

    Land & Soils.....54

    Erosion Control .....54

    Salinity.....58

    Pasture Management .....60

    Horsemanagement .....64

    Water Supply & farm Dams .....67

    Vegetation.....69

    Riparian Management .....70

    Nature Conservation.....72

    Natural Regeneration.....74

    Revegetation.....75

    Tree Planting And Selection .....75

    Fire .....81

    Suggested Burning Regimes..... ??

    Pest Management .....84

    Biological Calendars .....86

    Weeds.....87

    Ferals Taking Over .....91

    Fish - The Good, The Bad And The Ugly .....93

    Escaping Garden Plants And Native Alternatives.....94

    Domestic Animals - Pets.....98

**Monitoring - Measuring Success** ..... 100

**Indigenous Cultural Heritage** ..... 102

**Appendix 1: Local, State & Commonwealth Government Laws And Legislation** ..... 104

    Lockyer Valley Regional Council Local And Planning Laws..... 104

    State Law..... 104

    Commonwealth Law ..... 110

**Appendix 2: Endangered, Vulnerable And Rare Native Species Of The Lockyer Valley Region** ..... 112

**Appendix 3: Sources of Additional Information**..... 116





## Introduction

Living in the Landscape:- the Lockyer Valley provides basic advice on land, water, wildlife and vegetation management for people owning land or residing in the Lockyer Valley. This publication is laid out in such a way that it operates at a number of scales, at an individual property, local area (sub-catchment, working with neighbours), the Lockyer Valley (catchment) and then at a broader scale such as south east Queensland or whole of State. Guidance on management is provided for application at an individual property level and cover a range of relevant topics for landholders. This publication is intended to give landholders an overview of relevant land management topics and direction for seeking additional information.



## Catchments

The Lockyer Valley is a catchment in which the land is bounded by natural features such as hills or mountains (for example, the Great Dividing Range), from which all run-off water flows to a low point (the Lockyer Creek) which ultimately flows into the Brisbane River. Catchments can be further subdivided into sub-catchments, again based on creeks and waterways including Laidley, Tenthill, Ma Ma and Atkinson Buaraba Creeks.

The Lockyer Valley comprises almost one quarter of the entire Brisbane River catchment and includes some of Queensland's most productive alluvial soils. Clearing and settlement of the region began in the 1840s with most of the productive floodplains of Lockyer Creek and its tributaries being cleared for agriculture before 1940. Agricultural production has become steadily more intensive and is now heavily reliant on irrigation.

Due to a combination of intensification of rural industries and population expansion, the Lockyer Valley is experiencing widespread land management issues

## Lockyer Valley Facts:

The Lockyer Valley and its catchments have the following characteristics:

- Cover a total area of almost 3000 square kilometres,
- Contain a stream network of over 2,000 kilometres,
- Has a population of approximately 30,000 which is expected to grow to approximately 47,000 by 2026 (SEQ Regional Plan),
- Dominant land uses include grazing, intensive agriculture, native bush and rural residential areas,
- 50% of the catchment is covered by native vegetation,
- Upper catchment remain largely forested,
- The mid and lower catchment has been largely cleared,
- Has the highest proportion of land used for intensive agriculture in SEQ,
- Numerous water storages are present in the catchment, major ones being Atkinsons Dam, Lake Clarendon, Lake Dyer and Bill Gunn Dam and
- Instability of stream banks and gully erosion due to degradation of the riparian vegetation.

The Lockyer Valley has steep ranges in the north, south and west forming major escarpments of the Great Dividing Range in the south and west. The central and eastern parts fall to undulating low hills which surround the wide alluvial plains of the lower Lockyer Creek and its major tributaries. The rich alluvial plains, which occupy 8% of the area, support an intensive vegetable, grain and fruit industry and the region is described as the salad bowl of south east Queensland.





### Climate

The Lockyer Valley experiences a sub-humid and subtropical climate with relatively long hot summers, and short, mild winters with occasional frosts.

Rainfall is summer dominant with 65-70% of the total rainfall occurring in the October to March period. The average annual rainfall in the valley centre is about 780 mm making this the driest part of the South East Queensland region. Typically, the mountain ranges in the upper catchment receive annual rainfall of about 900-1,200 mm. Most of the annual runoff occurs in a few large events (Olley et al., 2006). Evaporation rates are in the order of 1,800 mm per year.

Rainfall is a highly variable feature of the Australian landscape and drought is a regular occurrence in the region. The duration of the dry period determines the severity of the drought and is often defined as severe rainfall deficiencies over a period of at least 12 months.

Thunderstorms are an important source of rainfall and are most frequent during the summer months; however, they have a high degree of variability for location and intensities. High intensity thunderstorms can generate high rates of runoff resulting in erosion and flooding. Hail associated with storms can severely damage crops, plants and buildings.

Stream flow for many of the creeks is ephemeral (short lasting, transitory) in nature, and related to summer storms which mostly occur from November to March. Over the last 15 or so years, there has been a trend to both lower rainfall, and a less regular seasonal rainfall distribution.

### Land Resources

#### Land Use

The Lockyer Valley is one of the most important agricultural production areas in South East Queensland. Agricultural enterprises include intensive horticulture, cropping and grazing. The majority of crops are grown on the rich alluvial soils of most of the creek systems. Major crops grown in the district include grains, vegetables and lucerne. Much of the land in the valley has been cleared for cattle grazing, which is still an important industry and is produced on the uplands. Large areas of remnant forest remain in upland areas of the Helidon Hills to the north west of the district, Mt Mistake in the south, and the D'Aguilar Range in the east.

### Land zones

Land zones are geomorphic (geological characteristics) categories that describe the major geologies and associated landforms of an area. They have had a major determining influence on the vegetation communities present and their structure in Lockyer Valley. There are three broad land types or land zones in the Lockyer Valley; upland areas that are volcanic in origin comprising basalt plains and hills, undulating to steep landscapes of sedimentary origin and alluvial plains made up of river and creek flats that contain highly fertile soils. These areas are illustrated below in Figure 2.

Descriptions of the major land zones are listed below.

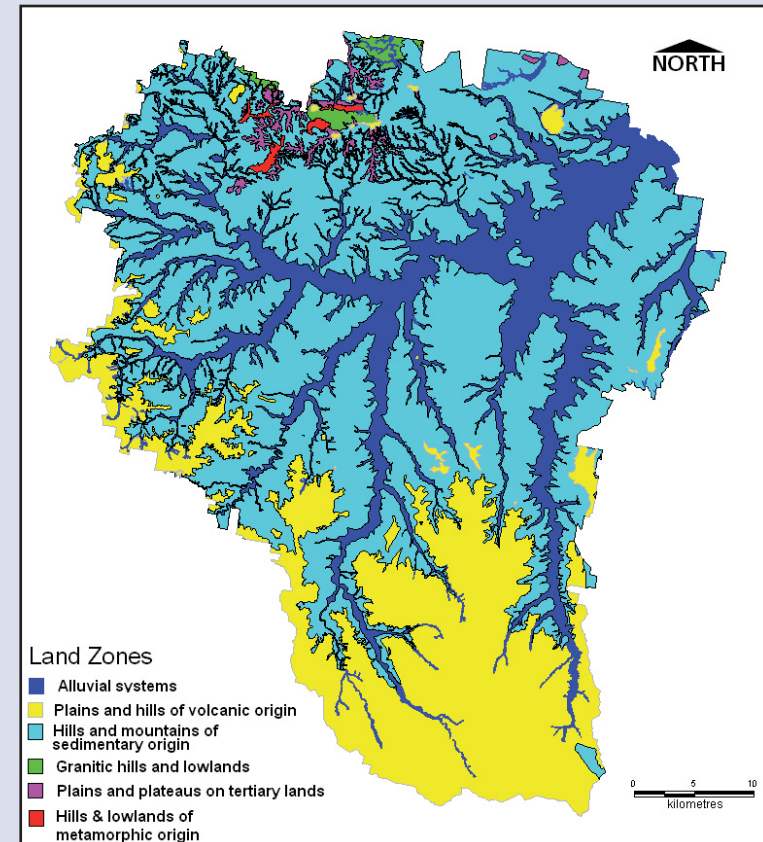


Figure 2: Land zones of the Lockyer Valley



### Alluvial systems

Broad alluvial plains along rivers and creeks are derived mainly from basalt, but also other volcanic and metamorphic rocks. These are the most intensively used soils in the Lockyer Valley and a variety of crops are grown, often with irrigation from surface and groundwater sources. Typical landforms include levees, terraces, back plains and alluvial plains. Blue gum woodland was the original vegetation, but has largely been cleared. Local examples of alluvial systems are the Forest Hill and College View areas.

### Plains and hills of volcanic origin

Sometimes referred to as Basaltic Uplands, this land zone is of volcanic origin and contains a variety of landforms, ranging from plains to steep hills and mountain. Native vegetation is typically open eucalypt forest with some mixed rainforest. Factors which may limit land use include slope, erodibility, shallow soil depth and surface rockiness. Glen Rock National Park, Tent Hill and Mount Sylvia are all examples plains and hills of volcanic origin.

### Hills and mountains of sedimentary origin

This land zone consists of undulating hills and rises to steep hills and mountains of sedimentary origin. The native vegetation is commonly narrow leaved ironbark, silver-leaved ironbark and spotted gum open forest with some softwood scrub. Agricultural land use may be limited by slope, water availability, low fertility, soil depth and susceptibility to erosion. Grazing is the main enterprise in this land zone. A local example is the Helidon Hills area.

### Land types

Another way of describing land is by Land Type. This provides a more detailed description of the land and its use and suitability for a range of management activities. Land type descriptions include elements such as Land Resource Areas, landform and broad vegetation communities.

These land types have individual characteristics which influence native vegetation, pasture types and composition, stocking rates and in some situations, limit landuse. Conservation features are also been identified. Twelve land types have been identified for the Lockyer Valley. A publication on land types for the Lockyer Valley has been prepared by SEQ Catchments and is available in hard or electronic copy.

## Water

Water is a critical resource for the environmental and economic viability of the Lockyer Valley. In the past ground and surface water resources have become stressed as the demand on them exceeds supply. This has resulted in lower levels of production and reduced or non existent environmental flows for waterways. Ground and surface water resources are predominantly driven by variable rainfall.

### Surface water

The main stream system central to the Lockyer Valley is Lockyer Creek. The headwaters of the larger tributaries of the catchment about the ranges in the south and west. In the north the drainage divide is less well defined and streams flowing south to Lockyer Creek are smaller and more irregular in nature.

### Groundwater

The Lockyer Valley is a very important agricultural area, which is mainly based on groundwater supply. The valley supplies the State with 35% of its irrigated vegetables, as winter and spring crops, plus fodder and small crops. Less than 8% of the area of the Lockyer Valley provides over 80% of all agricultural production for the area. This demand for high productivity has the potential to put underground water supplies under significant stress.





## Vegetation

There is a great diversity of native plant species to be found in the Lockyer Valley, ranging from grasses and herbs to shrubs, trees and rainforest plants. A unique feature of the flora of the Lockyer Valley and neighbouring areas is the occurrence of many plant species that do not occur elsewhere in the State, for example, the Splendid Boronia (*Boronia splendida*). Additionally, there are many species present that are classified as rare or endangered and hence are of special significance to the area.

Within the Lockyer Valley, there are a number of distinct vegetation types or communities, ranging from fringing forests to blue gum woodlands on the alluvial plains, brigalow and dry scrub communities on elevated alluvial terraces, ironbark and Moreton Bay Ash grassy woodlands on hill slopes and upland areas to patches of rainforest and semi evergreen vine thickets in escarpment areas.

### Grassy woodlands

Grassy woodlands can be thought of as grasslands with trees on them with many native grasses and forbs being found in both grasslands and grassy woodlands. Typically, woodlands occur on those areas above the alluvial plains and consist of a number of vegetation communities including Queensland Blue Gum (*Eucalyptus tereticornis*) and Moreton Bay Ash (*Corymbia tessellaris*) with a canopy cover in the range of 10% to 30%. Often the shrub layer is sparse or absent and the ground layer is often dominated by Queensland Bluegrass (*Dichanthium sericeum*) or Kangaroo Grass (*Themeda triandra*).

### Forests and shrubby woodlands

Extensive areas of forests and woodlands remain on the undulating to steep hilly or mountainous areas of the Lockyer Valley. A range of eucalypt and corymbia species occur in these areas varying according to soil types and rainfall. Ironbarks (*Eucalyptus crebra*) and spotted gums (*Corymbia citriodora*) are present on the poorer soils and lower rainfall areas. In the wetter areas a number of eucalypts are present including Rose gum (*E. grandis*), Sydney (*E. saligna*) and grey gums (*E. biturbinata*, *E. propinqua*, *E. major*), tallowwood (*E. microcorys*) and stringybarks (*E. eugenioides*, *E. acmenoides*) are present. These areas have outstanding habitat values, especially for arboreal (tree dwelling) species of wildlife.

## Rainforests and Semi Evergreen Vine Thickets

Small areas of microphyll rainforest and semi-evergreen vine thickets occur in the escarpment areas of the Lockyer Valley. These vegetation communities form dense thickets often less than ten metres high that contain a rich diversity of plant species, some of which are quite rare. These remnants have high nature conservation values and provide habitat for a range of wildlife species that are distinct from those found in other vegetation communities in the Lockyer Valley.

Semi-evergreen vine thickets are prone to invasion by lantana and pasture grasses which provide a fuel layer that is otherwise absent and can contribute to severe damage by fire. Unrestricted grazing by cattle can cause damage to remaining vegetation and contribute to weed invasion.

### Brigalow

Small pockets of brigalow remain scattered through the Lockyer Valley, fragments of the eastern most extremities of this community. These areas have been extensively cleared in the past for agricultural purposes due to their high fertility soils. Remaining patches are threatened by ongoing loss and fragmentation, invasion by the exotic pasture grasses such as green panic, woody weeds including lantana, fire and inappropriate grazing practices.

### Vegetation mapping

Native vegetation has been mapped across Queensland by the Queensland Herbarium (part of the Department of Environment and Resource Management). A number of means are used to identify remnant vegetation in the landscape, including satellite imagery, aerial photographs, field surveys (ground truthing) and current and historical records. Maps are then compiled on the basis of the vegetation present and its intactness.

In general the remnant vegetation cover mapping (that Department of Environment and Resource Management uses) in the Lockyer Valley is at a scale of 1:25,000. To give an idea of scale, 1 mm on a map produced at a scale of 1:25,000 equates to 25 metres on the ground. It is important to remember the scale at which maps are produced, as although they may be accurate at a landscape scale, they may not be accurate at a property scale.

Appendix 4 provides additional information on obtaining and understanding vegetation maps.



### NRM Plans & Regional Bodies

SEQ Catchments is the regional Natural Resource Management group covering the south-east corner of Queensland. The SEQ Region includes Brisbane, Moreton Bay and Islands, Ipswich, the Sunshine Coast, Gold Coast and hinterland and the Upper Brisbane and Lockyer Valleys. The diversity of this geographical region supports many land uses which also can place pressures on our natural resources.

SEQ Catchments seeks a sustainable future for South East Queensland's natural resources through community involvement, government and industry partnerships, and innovative on-ground delivery. SEQ Catchments is a community-based business that sources and coordinates investment in activities that help South East Queensland to a sustainable future and restores natural resources for the benefit of future generations. They act as an intermediary between all levels of government, community and industry in order to make the connections, secure financial support, coordinate activities, provide technical and scientific advice and administrative support to deliver measurable, long-term outcomes for our natural resources.







### Managing My Land - Why manage natural resources

“Why should I care about managing the natural resources of my property, things like native vegetation, soils and encouraging wildlife on my property?” and, “What benefits can I expect from incorporating nature conservation into my land management practices?” are questions that are often asked.

There are a wide range of benefits for landholders who choose to sustainably manage the natural resources of their properties. For example, retaining native vegetation helps to:

- Provide habitat for wildlife,
- Stabilise the soil surface,
- Reduce the risk of salinity and erosion,
- Stabilise stream banks,
- Provide shelter for crops and livestock,
- Supply pasture for livestock,
- Contribute to pollination of crops,
- Control pests (e.g. mice, insects and grubs) by providing habitat for predators,
- Recycle nutrients, and
- Provide personal satisfaction

Some native vegetation types are found almost exclusively on private property and are not well represented in national parks and reserves. Conserving these vegetation types and the animals associated with them depends very much on the sympathetic management of these lands.

The plants and animals that comprise our wildlife form part of our natural heritage, create a sense of place or identification with the landscape, and for many people on the land contribute to the quality of rural life.

Almost 50% of the catchment still retains some form of original or native vegetation. Most of this original vegetation is located on the upland slopes to the north in the region of the Helidon Hills and in the south of the catchment near the Mistake and Main ranges. Some small remnant patches still remain on the central lowland areas.

Within the catchment more than 500 plant species and over 500 fauna species (with birds accounting for 318 of these species alone) have been identified through various studies undertaken over the years. These species are contained in a diverse range of communities.



Much of the area on the alluvial plains and associated landscapes has been extensively modified, however many smaller remnants exist on road reserves or on private property. These areas are important as they provide flora and fauna with corridors, refuges and areas to re-colonise from.

Many activities in the Lockyer Valley are putting pressure on our native animals and plants. Some of these pressures are:

- Habitat clearance and fragmentation,
- Invasion by exotic species,
- Altered and inappropriate fire regimes,
- Inappropriate grazing regimes,
- Understorey modification,
- Quarrying and mining,
- Lack of conservation awareness, and
- Population growth pressures.

### I can make a difference

Often individuals believe that their actions will not make a difference. However, if enough individuals start doing something, then together, their collective actions can make a big difference. There is much that landholders can do to make a difference by conserving native vegetation on their properties. Actions could include developing a long-term vision for the property and where it fits within the landscape, learning about the plants and animals that occur on the property - their requirements for survival and developing a property plan that takes into consideration production and conservation issues. On-ground actions can be implemented such as fencing off areas of remnant vegetation and stream banks to manage stock access, retaining or re-creating shelterbelts and wildlife corridors, conservatively grazing native pastures and planting suitable vegetation for a diversity of wildlife such as skinks, rosellas, fairy wrens, finches and tree frogs. The section "Planning for Action" has more detail on how to prepare a property plan and develop a plan of action.

#### Where do I start

Often it is daunting to try and work out how to manage the natural resources on your property. Where do I start? What should I take into consideration? What information do I need? Where can I get it? How much is it going to cost? These are questions that are frequently asked. Figure 3 can help you work through the steps from having some thoughts or ideas to actually implementing them on the ground. It's useful to think about our property and how it has been managed before starting. For example:

##### Past

- What has our property been used in for the past?
- If we have owned the property for some time, what did we achieve?
- Would we do anything differently?

##### Present

- What are we using our property for now?
- Are we happy with our property management?
- Are there things that we would like to change?

##### Future

- What are my objectives?
- What do I want to achieve?
- What is realistic and feasible?

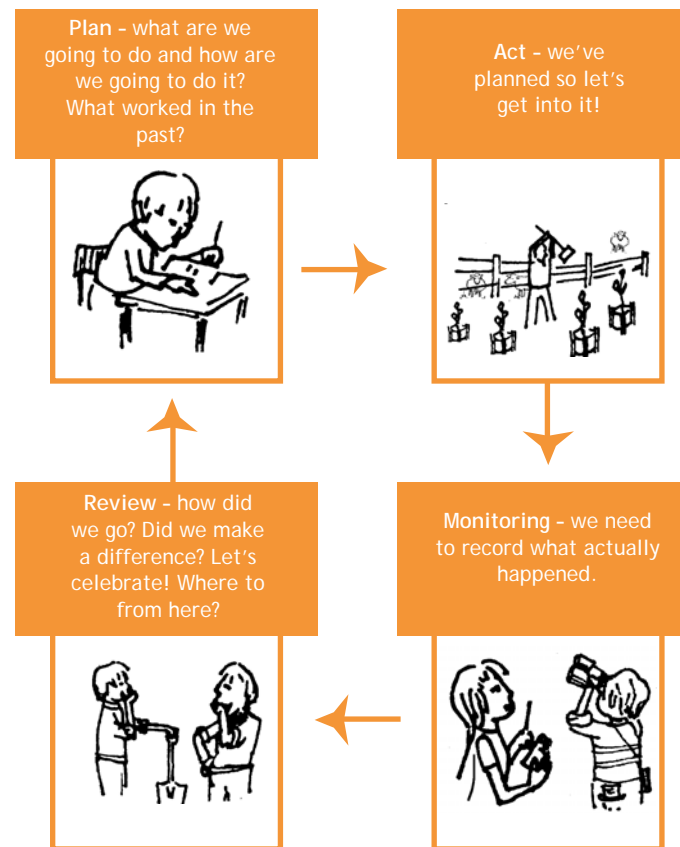


Figure 3: The cyclical nature of planning, acting, monitoring and reviewing in a work program.

The best place to start is with some planning to guide your actions. Think about what your vision or mental picture is for your property in the future. Follow this with a stock-take or assessment of your property and its values, then plan and prioritise your actions. Once the planning is done, then it's time for work. When the action or doing part is under way, it is important to record or monitor your actions so that you can assess how you are going. It's possible then to review your progress to see whether the changes are happening in the right direction or whether a different approach is needed. This whole process can then continue through additional cycles indefinitely.





### What am I allowed to do with my property?

Owning a property entitles you too many freedoms and rights, but with it also comes many responsibilities. These responsibilities are designed to ensure that all people can live in a community that is a healthy, nuisance-free environment. Landholders have a 'duty of care' to the land under their management as well as any livestock and domestic animals.

Regional Councils and the State Government administer a number of laws that relate to rural-residential living. It is important that you seek information if you think these laws may impact on your activities and where possible, it is also advisable to seek advice from the relevant department of Regional Council or State Government prior to purchasing a block of land. Appendix 1 contains more information on legislation and laws relevant to landholders in the Lockyer Valley from a natural resource management perspective.

### What is the best use for my property?

The most suitable activities for you to pursue on your property will be determined to a large extent by the physical characteristics of your land. It is important for you to get to know your property and what it is capable of. Some of the important characteristics that will determine your land's capability are:

- The topography of your block (i.e. the angle of the slope, aspect and drainage patterns),
- The type of soils (texture, fertility, structure and depth), and
- The climate (average rainfall and weather patterns).

If you do not manage your property according to its capability you will see negative responses such as the development of soil erosion, salinity, declining fertility and reduced production.



### Regional, State and Commonwealth laws and legislation

The three levels of government - Regional, State and Commonwealth all have laws and legislation that govern what one can do on their property.

Regional Councils have laws that operate at a local level. They can include; planning, the keeping of domestic animals and pets, pest management, construction of buildings, vegetation management and the storage of chemicals and flammable liquids above minor amounts.

The State Government has legislation that covers many activities such as environmental protection, vegetation management, management of waterways and construction of dams, pest management and cultural heritage.

At a national level, the Federal Government has enacted legislation to deal with issues of national significance. Examples of this are climate change and the environment.





The natural resources of our property determine to a large extent what it is capable of being used for. Natural resources include the land and its underlying geology, soils, vegetation - both native and exotic, and water. Closely related to natural resources is climate, which can have a major impact on property management practices.

### Ecosystem services

Ecosystems are the complex system of plant, animal, fungal, and microorganism communities and their associated non-living environment interacting as an ecological unit. Ecosystem services can be defined as: - *“the fundamental life-support services provided by natural ecosystems, without which human civilization would cease to thrive”*. It is this link between natural assets and human benefit that distinguishes the ecosystem services approach. If natural assets are not maintained, then the benefits derived from these services decline. Figure 4 below illustrates a conceptual framework that identifies the assets, products and the maintenance role in providing ecosystem services.

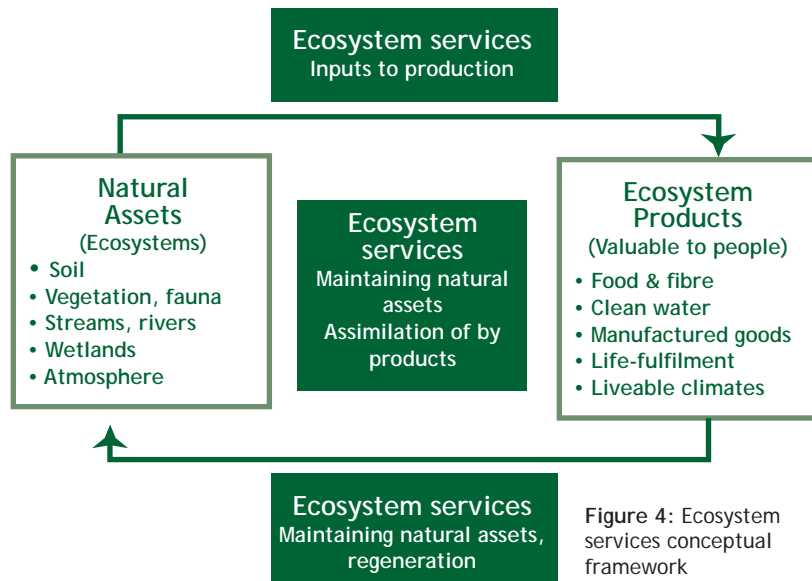


Figure 4: Ecosystem services conceptual framework



### Why should we bother about ecosystems?

The decline of various native species (plants and animals) can be a sign that an ecosystem is out of balance. Diverse ecosystems are healthy and self sustaining. When many animal and plant species are living together, there are in-built checks and balances to keep the system operating effectively. This means that if the population of one species increases for some reason, this produces more food for another species, so the first species is pulled back into balance.

Many properties have a simplified vegetation structure - scattered trees, no shrubs and reduced numbers of grass species. These landscapes lack a diversity of species - both plants and animals - and have a limited ability to self regulate. This means that individual species may rapidly increase to the detriment of others.

Remember: Every place, no matter how small or how modified, has some value, because it can support the life of some native animal, plant or microbe.



## Land

### Land Classification

When managing your property, one of the first things that you should do is to identify the various land classes present on your property. This will influence how your property is managed and what it is capable of producing. Table 1 is a summary of the eight broad land classifications used in Queensland.

Table 1: Land class for Queensland

LAND USE	CLASS	MANAGEMENT OPTIONS
Mainly cropping	I	Wide variety of uses - vegetables and fruit production, grain crops, energy crops and fodder, sugar cane. No special soil conservation works or practices necessary
	II	Soil conservation practices such as strip cropping, conservation tillage and adequate crop rotations
	III	Structural soil conservation works such as graded banks and waterways are necessary, together with soil conservation practices as in Class II
Mainly grazing	IV	Occasional cultivation, better grazing land. Soil conservation practices such as pasture improvement, stock control, application of fertiliser and minimal cultivation for the establishment or re-establishment of permanent pasture, maintenance of ground cover
	V	Similar to IV, structural soil conservation works such as diversion banks and contour ripping, together with the practices in Class IV, like the maintenance of good ground cover
Grazing	VI	Not capable of cultivation, less productive grazing, can have saline areas. Soil conservation measures including the limitation of stock, broadcasting of seed and fertiliser, promotion of native pasture regeneration, prevention of fire and destruction of vermin. This may require some structural works and maintenance of good ground cover
Tree cover	VII	Land best protected by trees. Very important habitat areas for protecting biodiversity
Unsuitable for agriculture	VIII	Cliffs, lakes or swamps and other lands where it is impractical to grow crops or graze pastures

## Slope

Steeper slopes require careful management as there is an increase in runoff, decreased infiltration and subsequent reduction in soil water storage potential. Many soils on steep slopes just wash away if cultivated, overgrazed or disturbed in some other way. The greater the slope the greater the velocity of water that can run off which increases the likelihood of erosion if soil surfaces are left unprotected by vegetation. In general, hills are more suited to grazing and tree planting, whereas valleys are more suited to crops except in flood prone areas.

### Aspect - which way do you face?

The direction your block faces influences soil erosion and vegetation characteristics of your property. Northern slopes generally provide better winter growth due to direct exposure to the sun, while southern slopes produce better summer growth due to less exposure to the sun which extends the growing season.

If your property is exposed to winter westerly winds, you may be prone to soil erosion and other damage due to wind. Windbreaks and adequate vegetation cover on the soil is important.

## Soils

The soils on your property can be your greatest asset. It is important to understand the characteristics of your soils in order to know what they are capable of doing for you.

There is a wide variety of soil characteristics in the Lockyer Valley and, therefore, a diversity of what you are able to do with your block of land. Be aware that soil types and therefore associated properties can change abruptly to a point where they can differ significantly from one side of the road to the other. Depending on what you plan to do with your property, it may be useful to have a soil test done to determine the nutrient status of the soil, which can also assist in matching the use of the land to the soil type. If we do not use our soil appropriately, we could expect soil erosion, nutrient loss and structural damage which will limit the productivity of the soil.

### Soil structure

The structure of soil determines the amount of air and water a soil can hold. Clay, silt and sand minerals in soils join together to form aggregates called peds. These peds give soil its structure. The rate of infiltration of water into a soil depends on the structural stability of the surface soils. Soils with weak or no structure can reduce water intake and increase water runoff resulting in erosion.

### Soil texture

The texture of a soil refers to the size of the soil particles and the ratios of sand, silt and clay within a soil. It can be used to determine the plant available water holding capacity. Clay textured soils have higher water holding capacity when compared with soils of a sandy texture. Large changes in texture between the topsoils and the subsoil can lead to water drainage problems.

### Soil depth

Soil depth is a major determining factor (along with soil texture and structure) on the quality of water and nutrients that can be stored for plant growth. Plant growth on shallow soils is limited by sufficient water storage. Shallow soils are often not viable for agriculture or can erode quickly when disturbed.

### Organic matter

Good soil organic matter makes for healthy soil and healthy plants. Organic matter is made up of dead and decaying plant materials, animals and animal products. It provides food for the beneficial microorganisms and creatures that live in the soil and it also binds the soil together. Organic matter influences the ease of water to enter the soil, the ability of the soil to store water, to facilitate air flow and to increase nutrient availability.

Organic matter on the soil surface (such as wheat stubble residues) protects the surface from the action of raindrops, reducing surface compaction and hardsetting. Continuous cropping and cultivation can diminish organic matter in the soil very quickly, leading to soil structural decline.

### Plant nutrients

In general, most plants grow by absorbing nutrients from the soil. Their ability to do this depends on the nature of the soil. Depending on its location, a soil contains some combination of sand, silt, clay, and organic matter. The makeup of a soil (soil texture) and its acidity (pH) determine the extent to which nutrients are available to plants.

Nitrogen is the soil nutrient required in the largest quantities by growing plants and can be supplied by growing legumes (includes clover, wattles and pea plants) which are plants that take nitrogen from the air and channel it through the roots into the soil where it can be used by other plants.

The majority of Australian soils are relatively infertile with nitrogen and phosphate deficiency very common. Our native vegetation has adapted to these soils and is therefore, happier under these conditions than introduced species.

Nutrients can be added to the soil using chemical fertilisers (e.g. urea), natural fertilisers (e.g. manures, seaweed or compost). Care should be taken when using any fertilisers to ensure that they don't get washed into our waterways and cause environmental harm and health concerns.

### Soil pH

Soil pH is one of the most important soil properties that affects the availability of nutrients. It is measured on a scale of one to fourteen with seven being neutral, less than seven, acid and greater than seven, alkaline. A pH of around six to seven is considered ideal for the majority of plants with nutrients being more readily available to plants.

It is a good idea to have your soil tested if you plan on growing crops or pasture. Doing so will enable you to get a report that explains how much lime and fertiliser will be needed for optimum plant growth. Nutrient availability to plants is influenced by soil pH. This is illustrated in Figure 5 which shows the level of nutrient availability compared to pH.

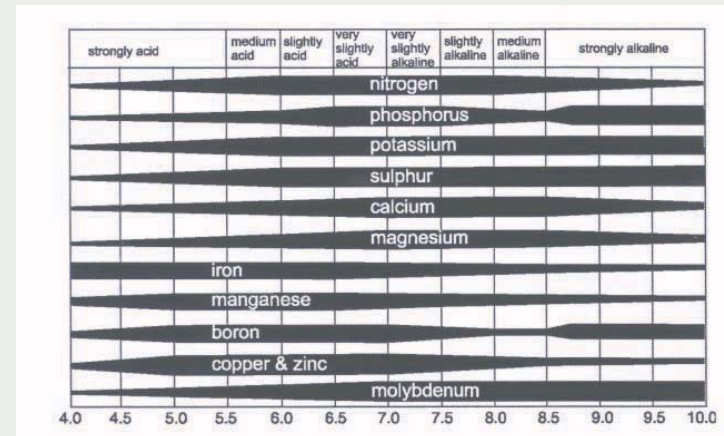


Figure 5: Nutrient availability and soil pH.





## Pasture

Pastures are the 'engines' that drive animal production systems and are the major source of nutrients for livestock. Productivity depends on this production base being maintained and involves keeping both the pastures and the soils in a healthy state. A diversity of pasture species helps to optimise production.

There are three key processes at work in a grazing ecosystem:

1. Energy flows and capture
2. Nutrient cycles, and
3. Water flows.

### Energy capture and flow

Photosynthesis is the process where plants convert solar energy, nutrients and water into carbohydrate. A healthy pasture photosynthesises efficiently to produce useful feed for livestock. Plant leaves are effectively solar panels that capture energy from the sun and convert it into carbohydrates. Managing pastures so that plants have a high proportion of leaf allows a high level of photosynthesis to take place which optimises productivity.

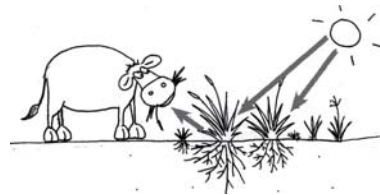


Figure 6: Energy flow and capture in pastures

### Nutrient cycle

Nutrients must be recycled for pastures to maintain their productive capacity. Plants extract nutrients from the soil, animals eat the plants and the nutrients move through the food chain. As the animal or original plant dies, the organic matter is returned to the soil surface where insects and microbes break it down into basic nutrient forms that are once again accessible to plants. Living plants and animals also cycle nutrients, for example dung and urine. When the system is functioning well, only very small amounts of nutrients leave the system in the form of grazing animals.



Figure 7: Nutrient cycles in pastures

### Water cycle

Water cycles through the land system and atmosphere. Any disturbance that reduces the availability of moisture to growing plants reduces the productive potential and sustainability of grazing enterprises. Poor ground cover, soil compaction and erosion can all accelerate the decline in soil structure and interrupt the water cycle.

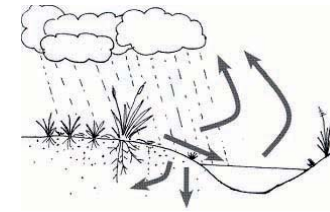


Figure 8: Water cycling in the environment.

Land in good condition can sustainably grow forage if these three processes (i.e. energy capture and flow, nutrient and water cycling) are working effectively and efficiently. Degradation of grazing land is the loss of land condition and production.

### Pasture and land condition

Pasture condition is really the state of health of the pasture at a particular time. It indicates how the pasture paddock has been treated and how effectively it can be used, for example to grow or fatten beef cattle.

In specific terms a pasture in good condition has

- A high proportion of desirable grasses or plants which have the four P's - productive, perennial, palatable and persistent,
- Good ground cover,
- Few if any woody weeds, other weeds or regrowth problems, and
- Little, if any, sign of soil erosion or degradation including salinity

Pastures in fair or declining condition tend to have relatively more weeds, soil erosion and bare ground. As such they are becoming less and less productive and need more intensive management and remedial action to get them back to good condition and productivity.

Different pasture species have different levels of resilience to stocking rates and unfavourable seasons. However, they all need and respond to good treatment at the appropriate time.

### Indicator species

In grazed pastures, there are some grass species that are desired above others. Good pasture management is required to maintain these desirable pasture species because they are favoured by livestock and reduce in frequency with continued grazing.

**Desirable species** are selected first by livestock and tend to decrease if grazing pressure is not managed. Native desirable grasses include black spear grass, Queensland blue grass, forest blue grass and kangaroo grass.

Introduced species in this category in the Lockyer Valley include green panic, Rhodes grass, purple pigeon grass and creeping blue grass. It should be noted that some grasses, for example green panic, may become weeds and increase the incidence of fire in ecosystems susceptible to altered fire regimes such as semi-evergreen vine thicket. There are also some legumes that are highly desirable, including Lucerne and medics.

**Undesirable species** are the less palatable species that remain after the more palatable species have been taken. They will increase in frequency if continued unsustainable grazing pressure persists.

Increaser species include many *Aristida* species (e.g. wire grass, white spear grass), blady grass and lovegrass. Pitted blue grass (a native grass) is also regarded as an increaser species, indicating that grazing pressure has been too high. It is also a good pioneering species.

All annual grass species are regarded as increasers and are less desirable in pasture systems. Annuals take advantage of bare spaces which have been created by over grazing, however they leave the soil bare once their life cycle is complete (3 to 6 months).

A large proportion of increaser species in a paddock reflects poor pasture condition. Where undesirable species dominate, intervention is necessary to return to a productive and sustainable system. Wet weather spelling and reduced stocking rates are essential. More radical work may be required, for example, replanting with better species, control measures, stocking at a lower rate or stock exclusion. The pasture management section (page 60) has more information on pasture species.

### Pasture condition

By putting a 'condition tag' on a paddock, a landholder will be able to answer several questions

1. Will it be suitable for feeding livestock?
2. What treatment/management will it need to do the job I want it to do?
3. Will it need spelling to build up seed reserves or build up desirable plant species?

4. Is a weed control programme required?
5. Is soil erosion a problem and if so, how can it be fixed?
6. Is salinity a problem and what action needs to be taken to manage it?

Land condition should be monitored using the ABCD framework as a bare minimum:

- A. Grazing land in A condition has a dominance of desirable species, few if any weeds, controlled woody regrowth, few, if any, annual species, fully covered soil surface, and no signs of soil erosion.
- B. Land in B condition has fewer desirable species, more weeds, some woody regrowth, some soil not covered by plants or plant litter and a little sign of soil movement. Grazing land in B condition should be managed to return it to A condition to make the most of its potential.
- C. Land in C condition has a general decline in desirable pasture species, more than half the soil surface uncovered by litter or vegetation and obvious signs of past soil erosion. Land in C condition will require intervention to restore it to productive use.
- D. Land in D condition has a dominance of undesirable species or bare ground, a large proportion of weeds, a fairly substantial woody weed or sucker problem and obvious signs of soil erosion and possibly signs of salinity. Land in D condition will require radical intervention to return it to productive use.

Information in this pasture section is based on 'Stocktake - balancing supply and demand' developed by Queensland Primary Industries and Fisheries.





## Water

Water is a critical resource for the environmental and economic well being of the Lockyer Valley. It is classified as either **ground** (which means that it is contained within the ground) or **surface** (which means that it is on the surface of the ground - for example in streams or dams). The resource of water - both ground and surface - is dependant on rainfall, which is quite variable.

**Groundwater** The main groundwater resources of the Lockyer Valley are contained within the alluvial deposits of the drainage system. This alluvium directly overlies sedimentary formations that form the bedrock. The majority of the Lockyer's irrigated crops are irrigated with groundwater drawn from aquifers located in the alluvial deposits of many of the valleys

**Surface water** is provided by episodic rainfall events. The major water storages in the Lockyer Valley are Bill Gunn Dam, Lake Clarendon and Atkinson's Dam. In addition there are numerous farm dams of varying size, and a series of weirs along the Lockyer Creek and its tributaries.

**Recharge** is the process whereby groundwater in aquifers is replenished. This recharge can be from direct rainfall or indirect means. Most of the recharge in the Lockyer Valley to the alluvial aquifers is indirect and is stream flow from the upper catchment and surrounding ranges. This water is largely from rainfall in those areas that directly run off into streams, or infiltrates through the soils into the basalt aquifers on the ranges and then seeps out into the streams.

Landholders need to be aware that the State Government has placed restrictions on the construction of new dams on properties in the region. This means that if you are planning to construct a new dam; you will need to check with the Department of Environment and Resource Management. Other permits may also be required from the Lockyer Valley Regional Council and the Department of Employment, Economic Development and Innovation Queensland Primary Industries and Fisheries.



## The Role of Nature in Providing Clean Water

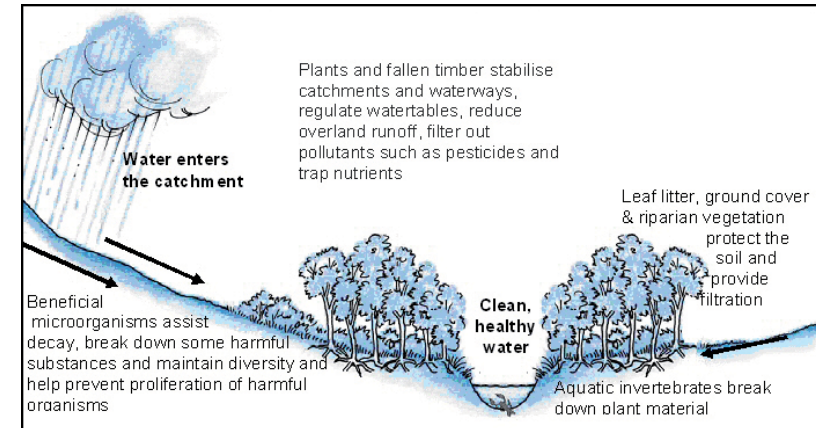


Figure 9:  
The role of nature in providing clean water.  
(Redrawn from Land and Water Australia 2001)

## Riparian areas

The edges of wetlands, creeks and drainage lines are commonly referred to as riparian zones. These riparian areas are important components of the landscape that require careful management to maintain and improve their condition. They occur whether the water bodies are permanent or temporary (for example many wetlands experience natural drying out periods). Healthy vegetation consisting of a mixture of trees, shrubs, tussocks, grasses and rushes can help to prevent flood damage and maintain the integrity of stream banks. These riparian areas provide important habitat for a broad range of plant and animal species. It is important to note that on floodplains, trees and shrubs may be sparse or absent from riparian areas and creek banks are stabilised with tussocks (*Phragmites* and *Juncus*), rushes and grasses.





Figure 10: The value of vegetation in maintaining riparian areas

Many of these vegetation communities are sensitive to disturbance, vulnerable to weed invasion and are not well adapted to fire. Forming a link between land and water ecosystems, riparian lands are very important in slowing water velocity, stabilising streambanks, and reducing erosion. Riparian vegetation acts as a water filter and is important in maintaining water quality, and nutrient and algal growth. Special attention should be given to the protection and management of riparian zones to prevent soil erosion and to protect and improve water quality.

Large woody debris is an important component of many streams that assists in the healthy functioning of streams and waterways. It includes masses of vegetation such as full trees, shrubs, trunks, branches, tree heads or root masses, which have been washed into rivers, streams, or onto the floodplain. Large woody debris is very important in slowing the velocity of streams, reducing overall erosion and improving structural stability. The localised erosion that can occur around large woody debris is important for the ecology and structural diversity of streams and rivers, and forms essential habitat and breeding areas for aquatic animals such as fish and terrestrial animals such as birds.

### Thirteen good reasons to manage your riparian lands with care

1. Reduced erosion,
2. Improved water quality,
3. Healthy ecosystems,
4. Maintaining river courses,
5. Better stock management,
6. Decrease in insect pests,
7. Increase in capital values,
8. Opportunities for diversification,
9. Climate protection,
10. Retention of nutrients,
11. Lowered water tables,
12. Increased fish stocks, and
13. Decreased algal growth.

### Native Vegetation

There is more to a patch of remnant vegetation than just trees. A healthy patch of remnant vegetation is made up of a number of components or elements. These can vary according to the type of vegetation community, whether it is grassland, woodland or rainforest.

#### The essential ground-layer

Leaf litter, lichens and mosses, patchy low vegetation, rocks and logs together comprise the ground-layer which provides habitat for a great diversity of birds, animals, reptiles and invertebrates (spiders, ants, centipedes, beetles, etc). All of these creatures aid in the decomposition of litter (leaves, twigs, branches, etc), which in turn releases nutrients essential for plant growth.

Many of the litter layer dwellers are an important food source for larger animals, reptiles and birds. It is estimated that twenty percent of Australian mammals depend directly on the litter layer for food and shelter. Many of these predators require rocks and crevices, hollow logs or thick vegetation for refuge and breeding sites. If the ground layer is sparse or lacking, it can be enhanced by allowing woody debris to accumulate or adding it to the site, along with planting suitable vegetation.

#### The all important understorey layer

A healthy understorey layer is made up of plants that grow in the 20 centimetre to 1.5 metre height range. Numerous 'beneficial' insects along with many frogs, reptiles, birds and small mammals depend on this layer to provide to provide essential habitat resources of food and shelter.

### Did You Know That?

The Black-breasted button quail is a large, plump, pale-eyed ground dwelling bird. It has a grey bill and pale yellow legs and distinguishable from true quails by having three forward facing toes and no hind toe. They are territorial, well-camouflaged, elusive birds commonly seen in pairs and relying on stealth to avoid danger. The breeding season extends mainly from October to December and 3-4 eggs are incubated in



*Black-breasted button quail*  
*Turnix melanogaster*  
(Listed vulnerable under EPBC Act & NCA)

ground nests and cared for solely by males. They are most commonly found in fragments of vine forest and thickets that are periodically water-stressed and coastal scrubs. The species is threatened by habitat loss from timber harvesting, agriculture, infrastructure construction and urban development, habitat degradation from domestic stock and feral pigs predation by wild dogs, cats and foxes.

Ground dwelling and foraging birds, animals, reptiles and amphibians are particularly sensitive to changes or modification to their habitat. Trampling and destruction of the litter layer, frequent fires, removal of bush rocks and other disturbances reduce food and habitat resources of these creatures and increase the risk of predation.

#### Ground cover

Maintaining good ground cover is vital for conserving and protecting the essential resources of soil and water. Living plants (grasses, shrubs and trees) together with ground litter play a key role in slowing and intercepting surface runoff associated with rainfall events. In the absence of adequate and effective ground cover and surface protection, rapid runoff of water can occur, taking with it soil and organic matter. This contributes to erosion, siltation of waterways and declining water quality. Figure 11 illustrates the positive benefits of good ground cover contrasted with poor grass and ground cover and the impacts on soil loss and water quality.

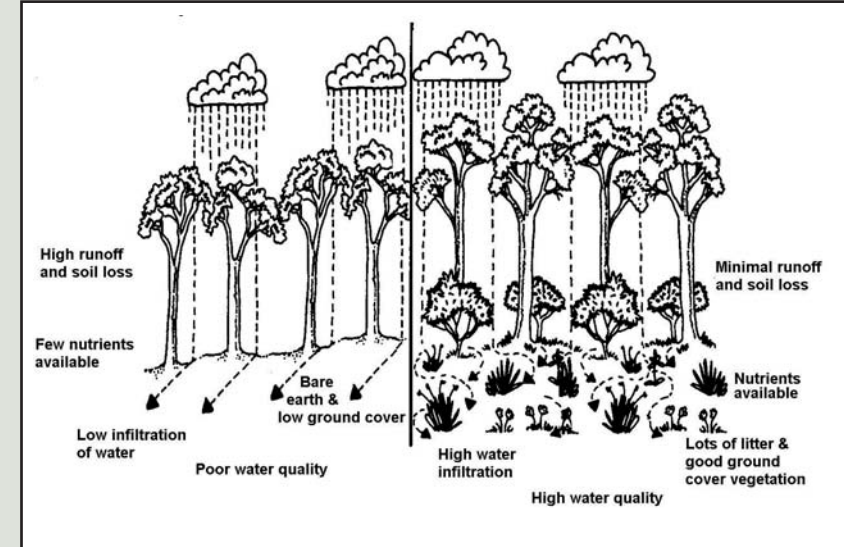


Figure 11: The positive benefits of maintaining high levels of groundcover contrasted with the negative results of low groundcover and bare earth. (Redrawn from Bennett et al. 2000).

The maintenance of good levels of ground cover - both living and dead (eg. grass and litter layers) in conjunction with adequate soil organic matter contributes to an increase in biological activity in the soil. This results in improved soil structure and fertility, provides for better plant growth, infiltration of rain and higher productivity.

#### The benefits of vegetation at a property scale

Native vegetation can make a significant contribution to land productivity, sustainable land use, and ultimately the profitability of properties. Benefits of retaining areas of native vegetation or replanting them include the following ecosystem services; shelter for stock and crops, protection from wind and weather, pest control by birds and insects, primary and secondary products from native vegetation, pollination by insects, health, recreation and amenity benefits as well as helping to address erosion, water logging and salinity management.





## Vegetation maps and what they mean - Deciphering a vegetation map

### Regional Ecosystems

Vegetation communities within Queensland are categorised and mapped by a system known as 'regional ecosystems'. Each regional ecosystem has been assigned a conservation status according to the *Queensland Vegetation Management Act 1999*, based on its current remnant extent, that is, how much of it remains since European settlement in 1788.

**Conservation Status** - Regional ecosystems are classified as:

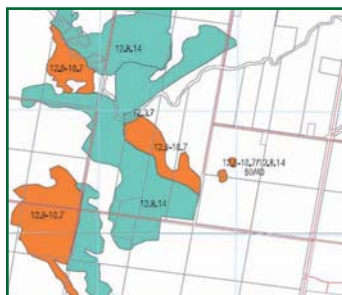


Figure 12: Regional Ecosystem map

#### Endangered if:

- Less than 10% of the pre-clearing extent remains, or
- 10-30% of the pre-clearing extent remains and the area of remnant vegetation is less than 10,000 ha.

#### Of concern if:

- 10-30% of the pre-clearing extent remains, or
- More than 30% of the pre-clearing extent remains and the area of remnant vegetation is less than 10,000 ha.

#### Not of concern if:

- More than 30% of the pre-clearing extent remains, and the area of remnant vegetation is greater than 10,000 ha.

Remnant vegetation maps can be purchased from the Department of Environment and Resource Management or downloaded off their website ([www.epa.qld.gov.au/REMAPs](http://www.epa.qld.gov.au/REMAPs)). You can either put in the Lot on Plan for your property (it's on your rate notice) or a GPS point and a map will be emailed to you at no cost. You will end up with a coloured map like the one below, but what does it mean?

### What the regional ecosystem number means

Based on broad landscape patterns that reflect the major underlying geology, climate patterns and broad groupings of plants and animals, each regional ecosystem is given a number rather than a name. Each part of the number represents these different elements and, like a puzzle when all the pieces come together, a story is told.

12	3	7
<p>The first number shows the particular bioregion that you are in. Of the 13 bioregions in Queensland, the Darling Downs falls in the Southern Brigalow Belt Bioregion</p> <ol style="list-style-type: none"> <li>1. Northwest Highlands</li> <li>2. Gulf Plains</li> <li>3. Cape York Peninsula</li> <li>4. Mitchell Grass Downs</li> <li>5. Channel Country</li> <li>6. Mulga Lands</li> <li>7. Wet Tropics</li> <li>8. Central Queensland Coast</li> <li>9. Einasleigh Uplands</li> <li>10. Desert Uplands</li> <li>11. Brigalow Belt</li> <li>12. Southeast Queensland</li> <li>13. New England Tablelands</li> </ol>	<p>The second number stands for the land zone which is based on the underlying geology. There are 12 land zones in Queensland.</p> <ol style="list-style-type: none"> <li>1. Marine tidal clay plains</li> <li>2. Coastal sand dunes</li> <li>3. Alluvial plains</li> <li>4. Gently undulating clay downs</li> <li>5. Sand plains</li> <li>6. Inland dunefields</li> <li>7. Duricrusts &amp; associated slopes</li> <li>8. Igneous rocks (volcanics)</li> <li>9. Fine-grained sediments</li> <li>10. Coarse-grained sediments</li> <li>11. Metamorphosed sediments &amp; interbedded sediments - hills &amp; slopes</li> <li>12. Granite &amp; quartz hills &amp; ranges</li> </ol>	<p>The third number is for the dominant vegetation that is associated with the particular bioregion and land zone. This can be complicated as there are many combinations of native plants in Australia. However, determining the vegetation structure is extremely useful when identifying the vegetation type. There are many types of vegetation. A few examples are shown below.</p>

Regional ecosystem:	12.3.7	Conservation status	Not of Concern
Biodiversity status	No concern at present		
Estimated extent	In September 2003, remnant extent was > 10,000 ha and >30% of the pre-clearing area remained.		
Structure	Riverine wetland or fringing riverine wetland		
Short description	<i>Eucalyptus tereticornis</i> , <i>Melaleuca viminalis</i> , <i>Casuarina cunninghamiana</i> fringing forest		
Description	Narrow fringing community of <i>Eucalyptus tereticornis</i> , <i>Melaleuca viminalis</i> , <i>Casuarina cunninghamiana</i> ± <i>Waterhousea floribunda</i> . Other species associated with this RE include <i>Melaleuca bracteata</i> , <i>M. trichostachya</i> and <i>M. fluviatilis</i> in north of bioregion. <i>Lomandra hystrix</i> often present in stream beds. Occurs on Quaternary alluvial plains along watercourses.		
Comment	Prone to invasions by weeds such as Chinese elm <i>Celtis sinensis</i> , broad leaved pepper tree <i>Schinus terebinthifolius</i> and cat's claw creeper <i>Macfadyena unguiscati</i> .		

Table 2: Regional Ecosystem description (Source - REDD Ver 5.2 November 2007)





Windbreaks and shelter belts provide shelter from wind and weather and help to improve stock productivity and crop yields. Experience on the Darling Downs has shown that windbreaks and shelterbelts can contribute to increased crop yields. They also act as wildlife corridors and assist wildlife to move across the landscape. To be effective, they need to be a minimum of 20 to 30 metres wide and are most effective when they are at least 100 metres wide.

Creeks and gullies can provide diverse and important habitat for wildlife, especially if native grasses, tussocks, shrubs and trees are retained for at least 50 metres either side of them.

Farm dams and their associated vegetation are important habitats for frogs, yabbies, fish, birds, invertebrates and reptiles. Trees that have fallen into the water are often used by fresh water turtles and water dragons as basking sites. Emergent vegetation such as reeds provides shelter and nesting sites for birds like the clamorous reed warbler and habitat for frogs.

Vegetation retained on ridges or in clumps on the property can assist in pest control by providing habitat for birds, bats, insects and small native marsupials and rodents that prey on pest insects. It can also assist in lowering water tables, filtering and slowing rainfall runoff and prevent erosion from occurring.

Native grasslands contain a diversity of grasses, herbs and forbs (including several rare and threatened species) that support a host of wildlife species ranging from birds to reptiles, mammal and frogs and a myriad of insects.

Gardens around homes, if planted with a range of suitable native plant species, can attract and support a number of wildlife species. This provides interest and pleasure for residents and food and shelter resources for wildlife.

## Nature conservation

### Building Blocks for Habitat

Habitat is the environment in which a species can occur, survive and reproduce. It consists of the various components of the environment that native flora and fauna require for different parts of their life cycle. Native fauna require areas for feeding, roosting, migration and the rearing of young.

Components that contribute to healthy habitat include:

- Plant structure - trees, shrubs, ground covers,
- A range of vegetation age classes,
- Tree hollows and fallen logs and branches,
- Leaf litter, mosses and lichen,
- Native grasses, rushes and sedges,

- Watercourses, streams, rivers and damp or swampy areas,
- Plants flowering and seeding throughout the year,
- Rocks - small and large, and
- Seasonal cracks in the soil.

Different plant and animal species have individual habitat requirements. The more habitat structural components that are available to wildlife, the greater the potential range of species that will be present. Even if only one or two of these elements are present, they may still provide important habitat for a range of species.

The concept of '*Habitat Building Blocks*' demonstrates how a number of components can combine to form a healthy environment or habitat. The more building blocks present, the greater the habitat quality and complexity. This in turn enables a greater range of species to potentially utilise a particular habitat. Figure 13 illustrates the concept of '*Habitat Building Blocks*'.

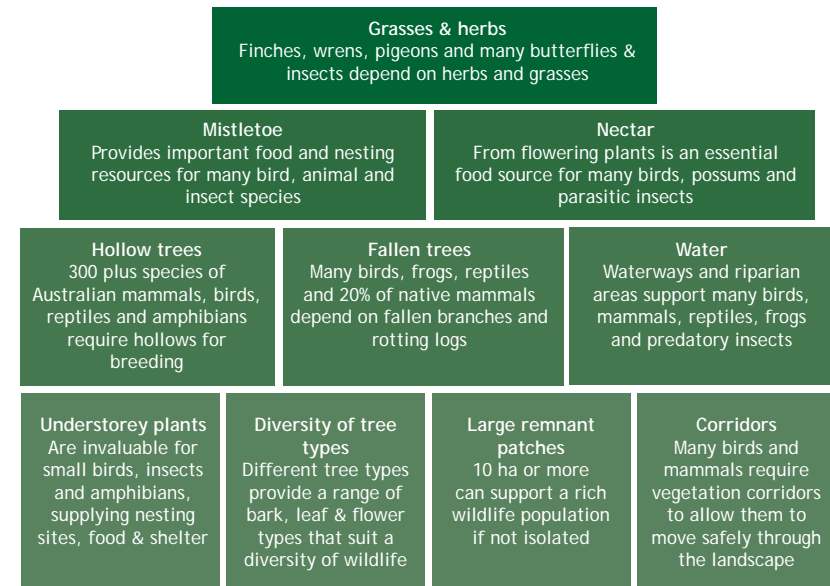


Figure 13: Habitat building blocks  
(Reproduced from 'Re-leafing New England: A farmer's guide to trees on farms')



### Three Principles of Habitat Management

Every place, no matter how small or how modified, has some value, because it can support the life of some native animal, plant or microbe.

#### 1. Retain larger areas for large animal populations and long-term conservation

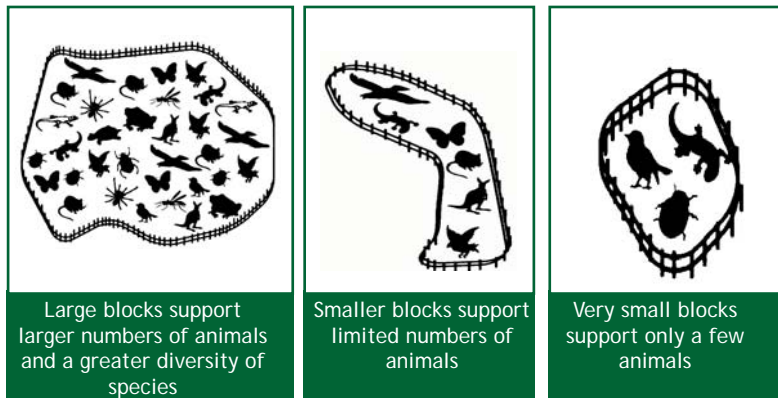
Large areas of habitat generally support greater numbers of individuals and species than small areas of similar habitat. Small wildlife populations are more prone to local extinction whereas larger populations are much more resistant to variation in numbers and are more likely to persist over time. This is most important for those species that have limited means or ways of re-establishing in the event that a local population disappears (such as geckoes, small mammals, ground-dwelling invertebrates).

#### 2. Make sure that habitats meet the requirements of particular species

The size of a habitat influences the type of species that make up the animal community. Small blocks usually favour animals with small home ranges and generalist habitat requirements, or highly mobile species that move between multiple habitats. Species that need large areas of habitat or require specialised types of habitat are less likely to occur in small blocks.

#### 3. Retain large blocks for more diverse animal communities

There is usually a direct relationship between the size of a remnant patch of vegetation and the number of wildlife species present. For this reason, larger areas of vegetation (or areas of revegetation combined with other vegetation) are required to support rich and diverse animal communities, while in contrast; small blocks may support only a few species.



Large blocks support larger numbers of animals and a greater diversity of species

Smaller blocks support limited numbers of animals

Very small blocks support only a few animals

Figure 14: Habitat potential of varying sizes of vegetation remnants. (Redrawn from Bennett et al. 2000).

### Size does matter - large old trees

Large old trees - both living and dead are a unique and irreplaceable feature of our landscapes that are invaluable for our wildlife. They are a valuable resource for both wildlife and farming systems providing both food and shelter.

As trees age, they often develop hollows that are used by wildlife for nesting and roosting. They are usually at least 100 years old before they begin to develop hollows that can be utilised by wildlife. It is estimated that over 300 species of native wildlife in Australia utilise tree hollows, including frogs, reptiles, birds and mammals.

### The living dead

If all the trees are the same age with little or no regeneration occurring, then the remnant is likely to be doomed in the long term (although this process may take many years).

The health of isolated trees is often at risk from a number of factors including compaction and increased nutrient loads caused by cattle camping under them, defoliation by insects, greater exposure to the elements and use of herbicides.

Fencing off to allow regeneration to occur and planting more shrubs and trees are options for landholders to consider.



Figure 15: The living dead

### The value of large trees to landholders

Large trees provide more shade, and in groups provide better protection from severe weather conditions than small trees. They provide a more stable microclimate, the area beneath large trees being relatively cooler in summer and warmer in winter.

#### Trees & insectivorous bats

Insectivorous bats can provide a unique ecosystem service in maintaining the health of the rural environment by consuming up to one and a half times their body weight in insects each night. Of all the species of insectivorous bats that potentially occur in the Lockyer Catchment, the majority prefer to roost in tree hollows.

Bats usually select tree hollows that have entrances not much larger than their own body size -about 3 cm or less in diameter. Larger colonies, especially those formed when females congregate to give birth, require a large internal hollow with a small entrance. These types of hollows are usually found only in large old trees.

#### Dead trees

Dead trees and branches in paddocks and amongst bushland have more value than many people realise. Often viewed as a source of firewood, their removal from some areas of the landscape has had a significant impact on wildlife. Before removing dead wood from your property, consider its values. Dead wood provides:

- Perching sites for birds of prey,
- Important roosting sites for bats,
- Large nesting hollows used by cockatoos, owls, gliders and other species,
- Important sources of food for insectivorous birds, and
- Logs, branches and twigs that provide important habitat for ground-dwelling wildlife.

Old trees are a vital resource for wildlife. Almost 400 of Australia's vertebrates (creatures with backbones such as birds, mammals, reptiles and frogs) use tree hollows. This means that if suitable hollows are not available for them to shelter inside, or to construct a nest, they may not survive in that area.

Eleven of Australia's 15 species of possums and gliders depend on hollows, while one in five bird species nests in hollows. Many bats and reptiles use tree hollows during winter, when cold conditions cause them to enter a state of reduced activity called torpor. Table 3 lists a range of wildlife species that utilise hollows.

Table 3: Animals that use hollows and the reasons they need them

Fauna species	Purpose		
	Shelter	Breeding	Torpor sites
brush-tailed possum	✓	✓	
all gliders	✓	✓	
yellow-footed antechinus	✓	✓	
insect-eating bats	✓	✓	✓
most owls eg powerful owl, southern boobook	✓	✓	
owlet-nightjar	✓	✓	
white-throated treecreeper	✓	✓	
waterfowl eg wood duck, Pacific black duck		✓	
striated pardalote		✓	
some kingfishers eg sacred kingfisher		✓	
most parrots and cockatoos		✓	
some raptors e.g. brown falcon, nankeen kestrel		✓	
dollarbird		✓	
reptiles eg many geckoes	✓	✓	✓
some frogs e.g. peron's tree frog	✓		

Note: Torpor sites are places where an animal slows its metabolism and becomes inactive during cold periods (Source: Dorricott, Voller and Lawrie, 1998).

#### Hollow havens - *Eucalyptus tereticornis*

*Eucalyptus tereticornis* (also known as Queensland Blue Gum) is a common tree of riparian areas and alluvial flats in the Lockyer Valley landscape. While still common, once extensive areas of Blue Gum flats have now become fragmented and degraded through clearing and property management practices. Blue Gum fringing forests (RE 12.3.7) have been significantly reduced from their historical distribution, while Blue Gum woodlands on alluvial flats (RE12.3.3) have suffered a much greater reduction, contributing to their "endangered" ecosystem classification.

The Queensland Blue Gum is a large, fast growing, hollow forming tree that has special significance for many fauna species. The habit or form of individual trees is highly variable, and is usually a tall forest tree up to 40m with upward sweeping branches although it sometimes occurs as a shorter, stout trunked form with a heavily branched, weeping crown. These Forest Red Gums provide valuable habitat and food resources to a broad range of species.





Figure 16: *Eucalyptus tereticornis* - a hollow haven that provides important habitat for wildlife



**Fruits, flowers and seeds:** Food source for a variety of honeyeaters, parrots, pigeons, rosellas and galahs



**Leaves:** are a major food source for Koalas and arboreal mammals including greater gliders and brushtail possums



**Mistletoe:** Is an important source of food and nesting sites for many birds and animals. Foliage and flowers provide a rich supply of nutrients



**Hollows:** Hollows in old trees provide nest sites and shelter for many birds and animals including ducks, parrots, owls, treecreepers, frogs, possums, gliders and bats.



**Bark:** Shedding bark and larger gaps provide important habitat for invertebrates, geckos, frogs, micro-bats and other small mammals

### Misunderstood mistletoe

Mistletoe is a much-maligned and misunderstood plant parasite but one that has important ecological functions. Mistletoes are spread mainly by the mistletoe bird. These and many other birds including silvereyes, olive-backed orioles, honeyeaters and some parrots eat mistletoe fruit or feed from the flowers. Gliders feed on mistletoe flowers, and brush-tail possums feed on the leaves, fruit and flowers. Possums might play a role in controlling mistletoe growth. At least 30 species of butterflies and moths in southern Queensland feed on mistletoe. Many of these have a complex relationship with various ants.

As heavy mistletoe infestations can lead to tree decline and death, landholders are often inclined to remove the offending plants or the affected trees. However, tree failure is seldom due to a single factor. The cause can be a combination of several factors including activities that have upset the natural ecological balance such as soil compaction, the addition of excess fertilizer and/or the removal of understorey.

Mistletoes are very light dependent and in a natural bushland area, are mostly found on the edges and in taller trees. If the area is cleared or thinned, more light can then enter the canopy of remaining trees making better habitat for mistletoe. This is why mistletoe infestation is generally more severe on isolated trees in paddocks, or in partially cleared areas or edges of forests and woodlands. In a healthy unmodified environment mistletoe is not normally a problem and is an important part of most vegetation communities.

*(Source: Dorricott, Voller and Lawrie, 1998)*

### Land for Wildlife

Land for Wildlife is a voluntary, non-binding conservation program offers landholders with advice and support to improve wildlife habitat on their properties. Land for Wildlife extension officers make on site visits and guide landholders on weed and pest animal control plus strategies to protect and enhance habitat through bushland regeneration, fencing, tree planting, provision of nest boxes and other tips and tricks. Participants receive a regular newsletter full of information and advice and can attend training and education sessions.





Property Management Planning (PMP) is a process for outlining what resources are on your property and how you are going to manage these resources. The end result of the process is a property management plan that can be used to help in developing and managing your property sustainably and profitably.

A property management plan should consist of four main components dealing with:

- Natural resource management,
- Human resource management,
- Financial management,
- Production and marketing.

Before you start, it is useful to have a vision or an idea of what you would like your property to look like in the future and to have a clear idea of why you choose to live where you do. This will help you to develop your property plan and to guide your subsequent management actions. It is best to write this down in a few sentences.

Compiling relevant information about your property and its resources is an important step. Information that you could consider gathering includes:

- Land related data - land resource areas, land type, geology maps and soil summary sheets,
- Topographical maps,
- Vegetation maps and vegetation community descriptions,
- Aerial photographs or satellite images of your property,
- Enterprise information - for example if grazing livestock information on grazing management and pastures, etc

Preparing a map of your property can help to capture your vision for your property and the plans that you have for it. A property map/plan can also help to turn your plans and aspirations into reality.

Start off by preparing a plan of your property on paper or on your computer, drawing in all the various features - fence lines, gullies, buildings, tracks, areas of native vegetation, areas of cultivation, etc (you can make use of aerial photographs or satellite images to start from, but make sure that it is at a scale that will be useful for planning). This provides a starting point for building or developing a property plan. You may find it easier to use clear plastic overlays and to draw the various property features, such as land class, soil types, vegetation, waterways and property infrastructure on separate sheets. This will help prevent the one drawing becoming too cluttered with details.

It is also useful to take into consideration how your property fits into the landscape - for example, where are patches of native vegetation in the local area, do some of the features of my property link in with other parts of the landscape, is there erosion impacting on my property from next door? We need to be aware of external impacts on our property, just the same as realising that what we do on our property can impact on our neighbours either for better or worse.

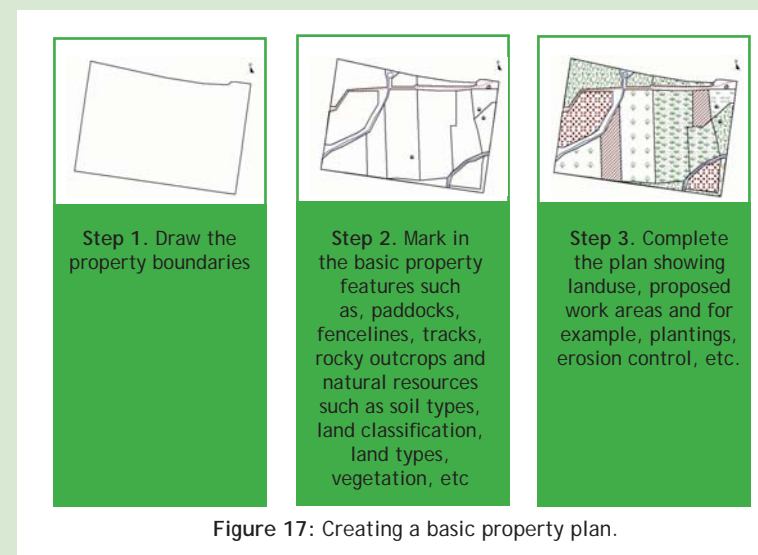


Figure 17: Creating a basic property plan.

### Taking stock of our resources

The next step is to undertake a stock-take of the natural resources, infrastructure and any development on your property. The main features that should be recorded are:

- Infrastructure,
- Land,
- Water, and
- Biodiversity (flora and fauna).



Adding these to your base map will make the management process easier. You can use a computer based mapping system (commonly termed Geographic Information System or GIS), transparent maps to overlay the base map or use separate maps to build up the picture. The following categories of property details may help you. The following dot points may help you to think about the sorts of features to record on your property map.

### 1. Infrastructure

- Dams, bores, windmills,
- Poly pipe,
- Troughs,
- Buildings, and
- Contour banks.

### 2. Land

- Land characteristics (property boundaries, slope, aspect, ridgelines, rocky outcrops etc),
- Soil types/characteristics,
- Land classifications and land types,
- Land use (tenure, pasture types and area, crop types and area, nature conservation areas, cultural heritage areas, forestry areas),
- Land condition (areas of current or potential degradation due to erosion, weed and pest animal invasion), and
- Cultural heritage sites.

### 3. Water

- Location of drainage lines or watercourses (including springs and wetlands if applicable), and
- Water supplies (sources, entitlements, volume, reliability and limitations),

### 4. Biodiversity (vegetation and fauna)

- Natural vegetation and biodiversity significance (areas of remnant vegetation, their conservation status and significance to biodiversity;
- Windbreaks and wildlife corridors; Habitat areas; areas of regrowth),
- Productive vegetation (areas of native and sown pastures; timber resources),
- Pest plants and animals (weed infestations; problem regrowth; land and water pest animals),
- Fauna (aquatic and terrestrial animals and their distribution).

### Action - the moment we've been waiting for

The planning is over for the time being and now it's time to put plans into action. It's easy to underestimate just how much time and effort is involved in carrying out and more importantly, maintaining the works. Be conservative in what you think that you can achieve (at least initially until you know what you are capable of), - there's no point in planting hundreds of trees and then discovering that you cannot maintain them through a drought, or controlling several hectares of woody weeds only to have them re-invade an area.

Here we need to outline objectives and set targets and actions to achieve those targets that address the issues raised from assessing your resources. For example, the objective may be to change to a minimum tillage system to reduce soil erosion in cultivation. The target may be increased stubble cover.

A point to remember is that targets should be able to be measured. This is especially important when considering monitoring activities. You can use the information in this booklet to assist you in determining how to best manage your property and to set your objectives and targets.

Aim to set targets that are SMART. That is they are:

**S Specific** - don't describe a vague idea of what needs to happen.

**M Measurable** - you will need to be able to measure/monitor progress.

**A Achievable** - don't set yourself an impossible task.

**R Relevant** - the target should be absolutely related to your objective, and the cause of the impact it is trying to address.

**T Time constrained** - set time frames for achievement.

After the work is done, be sure to celebrate your successes - you've earned the right to.







### Prioritising actions

When faced with the prospect of undertaking a number of projects, it can be difficult to decide which one to start on. A way to prioritise which action to undertake is to perform a risk assessment. This will determine the actual or potential severity of an impact if action is not taken. Using a Risk Assessment Matrix will identify the likelihood of an environmental impact occurring in conjunction with the consequence of the impact if it does occur. Based on the risk assessment you will be in a better position to prioritise issues and actions.

Table 4: Risk assessment matrix

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	H	H	E	E	E
Likely	M	H	H	E	E
Possible	L	M	H	E	E
Unlikely	L	L	M	H	E
Rare	L	L	M	H	H

E = extreme risk, H = high risk, M = moderate risk, L = low risk

**Important - Any real or potential impact that is illegal or could result in death or serious injury should always be rated with a likelihood of *almost certain*, and a consequence of catastrophic to give it a rating of E (*extreme*).**

#### Impact and influence

An alternative tool to use in determining actions is 'Impact and Influence'. The idea behind 'Impact and Influence' is that if the proposed action will have little or no impact, then it is probably not worth implementing it. Additionally, even if the proposed action is likely to have a significant impact, if you are limited in your ability to implement it, then it is unlikely that you will be able to fully realise the action. Aim to choose options that will have significant impact and which you can influence. Leave behind those lower impact options or those that you cannot influence.

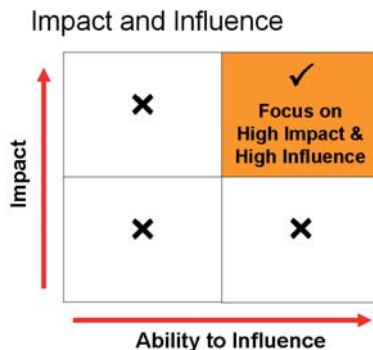


Figure 18: Impact and influence matrix

### Monitoring

Monitoring is used to make sure that our project is on target to achieve our goals and to record what is happening along the way. It's easy to get caught up in the activity of a project and overlook what is actually happening and to not keep track of our progress. We need to keep a record of our activities and make assessments on the impact that they are having. Our records can take two forms: records of activities (outputs, for example how many trees were planted) and measuring the results of these activities (outcomes, for example how many trees survived). More about monitoring later on.

### Reviewing - how did we go?

When we've completed a project, the tendency is to rush off into the next one without pausing to reflect on what we learnt. If the project was a disaster we may prefer to forget all about it, whilst if it went well, we may not think that there is any need to look closely as to why it succeeded. We can use the information that we have been gathering in the monitoring process to help us do this. Every project is a learning experience and by reflecting on and reviewing how our project or activity went, we can be in a better position for our next one.

So review - "how did we go?"

Then, "did we make a difference?"

Followed by, "let's celebrate!"

And finally, "where to from here?"

#### Where to go for assistance

- SEQ Catchments - Property planning
- Department of Environment and Resource Management - One Plan
- Lockyer Valley Regional Council - NRM Officer

#### Where to go for more information

- Understanding and Managing Soils in the Moreton Region - Available from NRW Ipswich
- Land Types of the Lockyer Valley - SEQ Catchments



## Land & soils

There is a strong relationship between the underlying geology of the Lockyer Valley and the soils present. The soils properties and characteristics determine to a large extent the use of the land. There is a diversity of soil types in the Lockyer Valley, ranging from highly fertile deep alluvial soils in the valleys to low fertility, shallow highly erodible soils in some upland areas. This means that an understanding of these characteristics and properties is required if the soil resource is to be managed sustainably.

The maintenance of the soil resource is a key requirement in a rural community, which depends on it for its livelihood. Soil naturally forms at a very slow rate, so any soil losses today will be a cost to the community for many generations to come.

Major erosion and sediment movement events are strongly episodic in the Lockyer Valley and result from intense heavy rains and associated flooding. The impacts of climate change are predicted to result in an increase of extreme of weather events such as droughts and floods.

### What I can do

There are a number of management actions that landholders can implement to minimise the loss of soil from their property and to improve soil health. These actions include:

- Determine if the soils on my property are prone to erosion,
- Keep the amount of bare ground to a minimum,
- Maintenance of good groundcover (greater than 70%),
- Minimising the amount of time soil is cultivated and maintaining groundcover (i.e. crop residue) where achievable, using minimum till and sod agriculture where possible,
- Ensuring that water is not unnaturally concentrated,
- Graze conservatively and only allow limited stock access to high-risk areas, and
- Seek advice and treat erosion areas sooner rather than later.

## Erosion Control

Soil erosion is a major concern in many rural areas as it can occur in a variety of landscapes. It has the potential to impact downstream on creeks, rivers, reservoirs, lakes, estuarine and marine environments. The costs of erosion are varied, the most obvious being repairs to fences, roads, driveways and contour banks, but there are also the less obvious costs in soil fertility loss, lower crop yields, reduced water quality and reduced land value.

Soil erosion caused by water is one of the most common and serious forms of land degradation in the Lockyer Valley, with the potential to occur on

most soils. The potential for erosion depends on vegetation cover present, soil type and the degree and length of slope. The longer and steeper the slope, the more potential there is for erosion to occur. This is especially the case in steep hilly areas, though overland flows on the alluvial plains can also be a significant problem. Although erosion is a natural phenomenon, rates of erosion currently occurring in the region are now much higher than in pre-European times. The majority of erosion is the result of human land management activities. Serious and widespread soil erosion by wind and water occurs when ground cover is lacking, particularly during the summer months when high intensity storms are more common.

Areas of active erosion within the Lockyer Valley are associated with new subdivisions and heavy grazing pressure on ridge areas and roads. The poor state of creek bank vegetation in some areas is also contributing to erosion. Although erosion is more likely to occur on cultivated lands, rill and gully erosion can also occur on grazing lands. Over-grazing and excessive burning of pasture in upland areas can all contribute to increased rates of erosion. Erosion may also occur where roads, tracks, watering points and fences have been inappropriately located, leading to the concentration and diversion of runoff water which in turn can contribute to severe erosion.

Erosion starts when land management practices cause increased and concentrated flows of surface run-off, or remove protective layers from the soil surface. Maintaining adequate and appropriate vegetation cover, especially dense ground cover, can significantly reduce the risk of erosion.

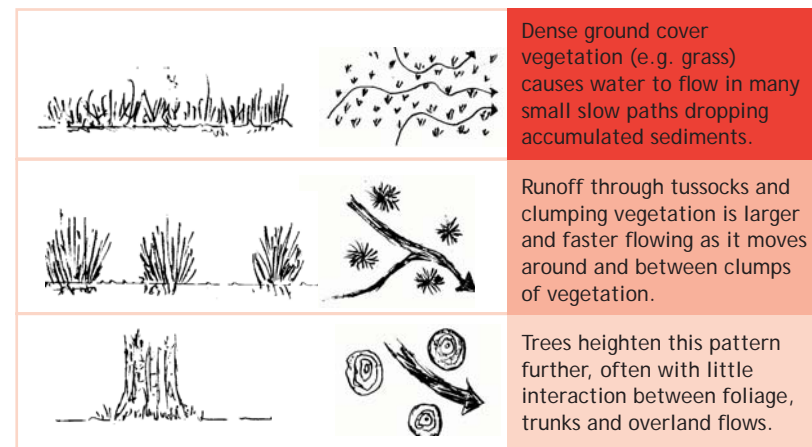


Figure 19: Flow paths of water through different types and density of vegetation. (Redrawn from Land and Water Australia 2001)



There are a number of different types of erosion including gully, sheet, rill and tunnel erosion.

**Sheet erosion** can be difficult to recognise but is responsible for extensive soil loss in both cultivated and non-cultivated environments. It is a potential hazard on all soils in the Lockyer Valley; however bare areas such as heavily grazed hillsides or cultivation are more susceptible. Continued sheet erosion of shallow topsoils can expose less stable, highly dispersive subsoils which are prone to more severe erosion. Sheet erosion occurs as a shallow 'sheet' of water flowing over the ground surface taking with it a layer of soil and also available nutrients and organic matter.

**Rill erosion** results from the concentration of surface water (sheet erosion) into deeper, faster-flowing channels. As the flow becomes deeper the velocity increases detaching soil particles and scouring channels up to 30cm deep. Rill erosion represents the intermediate process between sheet and gully erosion.

**Gully erosion** is an advanced stage of rill erosion where surface channels have eroded to the point where they can not be removed by tillage operations. Gully erosion is responsible for removing large amounts of soil, damaging farmland, roads and bridges and reducing water quality by increasing the sediment load in streams. Gully initiation is thought to be intensified by the removal of vegetation. The collapse and slumping of the sidewalls of the gully usually contributes the greatest proportion of soil loss.

**Tunnel erosion** is a subsurface form of erosion which occurs when water scours underground channels through highly erodible, dispersive subsoils while initially leaving the surface soil relatively intact. Water enters through areas which may have been weakened or disturbed by tree roots, fence post holes, animal burrows or land management practices. In time the surface can collapse causing gully erosion. Tunnel erosion can occur in areas where the subsoil rests on an impermeable soil layer and erodes more easily than the topsoil. Often the dispersed subsoil is deposited further downhill. These 'tunnels' then collapse and form open gullies.

#### Preventing and remediating erosion

Trees have a potential role to play in stabilising and rehabilitating eroded sites. However, trees are only part of a rehabilitation plan which should also include increasing groundcover with shrubs and grasses, managing animal access and, in some cases, remedial earthworks. Tree planting or regeneration should be one of the last steps used to effectively combat soil erosion. Activities such as fencing, diversion banks, shaping of the banks and grass cover establishment may be required prior to woody vegetation establishment. Advice should be sought from Department of Environment and Resource Management or suitably qualified officers before attempting to stabilise active gully, rill and tunnel erosion. Wherever possible, use local native plant species for rehabilitation works as they have the advantage of being adapted to local conditions.

Characteristics that can predispose soils to water erosion include:

- Little or no structure,
- High silt and fine sand content,
- Low levels of organic matter,
- Low infiltration of water due to crusting and hard setting soils (rainfall tends to flow over the surface rather than soak into the soil), and
- Highly dispersive soils that lack cohesion when exposed to water and rapidly collapse to slurry.

These features can all be natural characteristics of the soil, but soils can also become more prone to erosion through poor management. For example, overgrazing can reduce organic matter, permeability and soil structure.

Two key principles in managing problem soils to avoid erosion are:

1. **Maintain ground cover, and**
2. **Avoid disturbance.**

#### What I can do

- Determine if the soils on my property are prone to erosion,
- Keep the amount of bare ground to a minimum,
- Maintain good ground cover vegetation on my property,
- Graze conservatively and only allow limited stock access to high-risk areas, and
- Seek advice and treat erosion areas sooner rather than later.



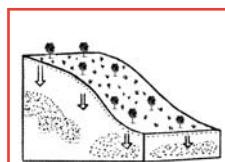




## Salinity

The expression of naturally occurring sub-surface salt levels in ground level soil or in waterways is known as salinity. When underlying rocks and soil become saturated, dissolved salts are transported to the surface, where the water evaporates, leaving behind the salts. Irrigating crops with salty irrigation water creates another form of salinity in the Lockyer Valley. This impacts both the immediate and long-term viability of production by depositing salts, resulting in crop mortality and degradation of soil structure.

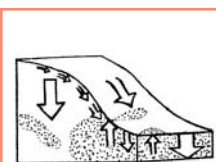
Salinity has been identified as an issue of concern and monitored in the Lockyer Valley since the 1940's. This natural process can be amplified by a combination of land use practices and climatic conditions. The past sixty years have seen various practices which have acted to amplify the natural process of salinity. Decreased native deep-rooted perennial vegetation cover such as trees results in unutilised rain in the landscape moving through the soil profile, gathering salts; increased irrigation acts to both saturate the water table and directly transport salty water to the surface; and increased urban and peri-urban development and associated infrastructure such as roads and dams retain and channel more water in the landscape. All of these actions contribute to the severity of the salinity problem in the Lockyer Valley. For more information contact the Lockyer Valley Regional Council or SEQ Catchments.



Landscape prior to European settlement - open woodland.



Landscape post European settlement - woodland thickening on upland areas.



Landscape post European settlement - total clearing of native woody vegetation.

Figure 20: Landscape model showing changes in vegetation cover and movement of water within the landscape prior to and post European settlement.

## How do I know if I've got a salinity outbreak?

There are many signs that can indicate a salinity problem. They may not immediately be obvious and can slowly manifest themselves over a period of time. The more noticeable signs can include:

- The ground surface is permanently or seasonally waterlogged,
- Areas of bare soil and in severe cases salt crystals are present,
- Deterioration in the quality of groundwater,
- Livestock refuse to drink water, and
- Increasing erosion.

There can also be changes in vegetation including:

- Changes in plant and pasture species composition with plants unable to endure saline conditions being replaced by salt tolerant species,
- Dieback of vegetation in low-lying areas, and
- Death of all vegetation in severe cases.

Landholders can reduce the potential for salinity outbreaks and protect the resources of soil and water by maintaining good ground cover. Living plants (grasses, shrubs and trees) together with ground litter play a key role in slowing and intercepting surface runoff associated with rainfall events. Figure 11 shown previously illustrates the positive benefits of maintaining high levels of groundcover and follow-on effects on soil and water quality contrasted with poor ground cover.

## What I can do

- Determine if I live in a salinity hazard area from mapping undertaken by the Environment and Resource Management,
- Maintain good vegetation cover on my property,
- Plant appropriate deep-rooted vegetation in recharge areas - native shrubs and trees in upland areas and permanent pasture or crops (for example lucerne) on plains country,
- Increase groundwater use in salt affected areas by establishing salt tolerant vegetation and excluding stock, and
- Work with my neighbours to address this problem at a larger-than-property scale.



## Pasture management

There are four main pasture management issues that need to be considered:

1. The purpose of growing the forage is to feed animals that will eventually produce income. Forage crops and pastures are not just for show, but must perform the task required.
2. The potential of the land, which will determine what can realistically be expected in terms of production. Soils with poor fertility are not capable of producing high quality feed.
3. Knowledge of pasture species suited to particular soil types and the types of animals you will be grazing needs to be known. To optimise production and keep pasture in good condition, management must aim at keeping desired pasture species, i.e., those that are **Productive, Perennial, Persistent and Palatable (the 4 P's)**.
4. Keeping individual plants in good health so that they retain sufficient structure above and below (roots) the ground to utilise the soils nutrient and water reserves when temperatures are suitable for growth.

Production will vary according to rainfall, temperature and soil fertility. Apart from burr medic, some other forbs (mostly introduced) and a few specialised grasses, the majority of pasture species are summer growing. It is important to manage summer growth so that there is a build up of forage for the dry, cool period when little growth occurs. Any winter growth of pasture even in a wet year is a bonus and should not be relied upon.

### Lockyer Valley soils and grass species

**Alluvial Soils** - originally lightly timbered with forest red gum and Moreton Bay ash. Common pasture species are Queensland blue grass, forest blue grass, and kangaroo grass. Naturalised grasses include Rhodes grass, green panic and paspalum.

**Scrub soils** - originally heavily timbered with softwood scrub species and often associated with brigalow. Because of the dense nature of the vegetation there is not a strong grass layer. Once cleared, the grass species composition on these soils is similar to that found on alluvial soils.

**Forest soils** - support predominantly spotted gum and ironbark communities. Native grasses are Black Spear Grass, Three-awned Spear Grass, Rats Tail Grass. Exotic grasses such as Red Natal Grass and African Lovegrass, are also common.

Legumes are also a valuable addition to pastures and are discussed in more detail on page 62.

A number of improved pasture species can be established in the Lockyer Valley. The following table lists a number of common useful pasture species that are readily available for planting. Care needs to be taken when selecting pasture species, as some have the potential to impact negatively on natural systems and nature conservation values. Additionally, some pasture species are suitable for cattle but can cause problems for horses such as kikuyu and setaria.

Table 5: Useful pasture species for cattle..

Variety	Preferred soil types	Comments
Creeping Bluegrass	Wide ranging, tolerates lower fertility	A hardy grass that will invade speargrass and establish on clays. Good for erosion control
Kikuyu	Red loams and basaltic soils	Has high fertility requirements and does best in moist and elevated, fertile basaltic tablelands
Premier Digitaria	Lighter soil types	Perennial tufted grass suited to acidic, sandy soils of low fertility
Paspalum	Fertile soil types	Palatable, tufted, grazing tolerant perennial grass best suited to higher fertility, high rainfall areas
Purple Pigeon Grass	Self mulching clays	Medium term perennial suited to self mulching clays
Rhodes Grass	A wider range of light to medium soil types	Productive, palatable, stoloniferous grass, suited for erosion control. Rhodes grass is quick to establish and has moderate salt tolerance
Setaria	Varying	Hardy and palatable grass well suited to sub-tropical regions

### Legumes

Where possible, legumes should be incorporated into pastures for a number of reasons. They have species of soil bacteria, called rhizobia, living symbiotically with them which fix nitrogen from the air. The nitrogen is for themselves (the rhizobia) and their legume hosts. They are particularly effective in low soil nitrogen situations. These bacteria do not interfere with the legume plant in any way except by beneficially providing them with nitrogen. Each species of legume has its own specific species of rhizobium. Legumes are particularly valuable in pastures as they are high in digestible protein and most are palatable.

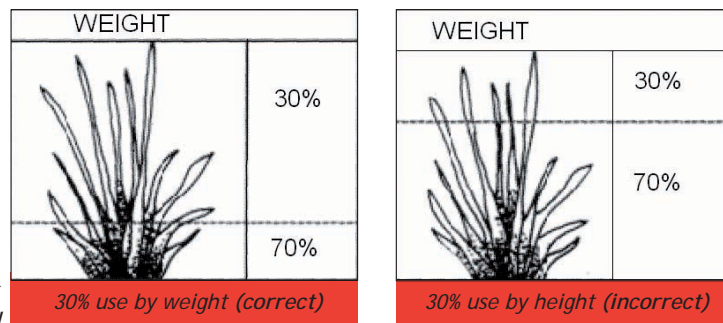
Legume	Preferred Soil Type
Stylo	Light
Wynn Cassia	Light-Medium
Siratro	Medium-Heavy
Medics - snail and barrel	Light-Medium
Lucerne	Light-Medium

Care needs to be exercised when selecting legume species for use in pastures as some can become environmental weeds, for example glycine.

### The "One Third" rule

The "One Third Rule" means that means in a well managed pasture, graziers allow

- the animals to eat 1/3 of the total dry matter of forage produced
- the plant to retain 1/3 of production to maintain its structure (major stems etc.)
- the remaining 1/3 for wastage - trampling, spoiling etc which remains on the paddock and provides ground cover.



Source GRASS CHECK Manual

Figure 21: The one third rule in grazing management

### Maintaining plant structure

The importance of maintaining plant structure cannot be over stated as it determines the growth rate of the species, the response to rain and the ground cover provided. It also provides a reserve of fodder in times of crisis, a seed reserve and prevents invasion of undesirable species. If a species normally grows to around 80 cm in height, using the 1/3 rule, it should be grazed down to about 20 cm (the big basal stems are heavier than the thinner top parts). If it is grazed harder than this, the plant will start to lose its root system. Energy is stored in the roots, and as a consequence of heavy grazing, this energy is used to promote growth and these roots will die off. New growth will have to come from the crown, where the growth rate is much slower than if it comes from the growing points up the stems.

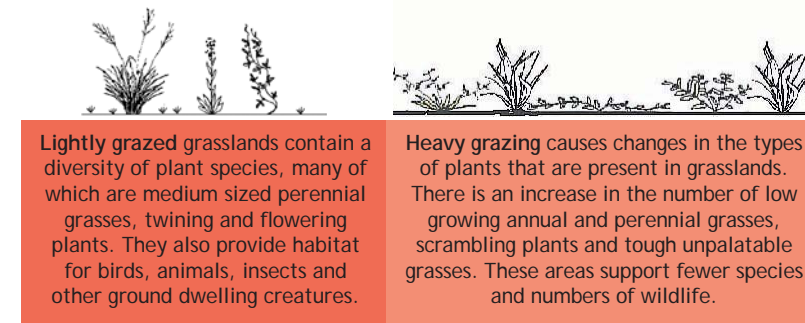
All in all, the plants will become smaller, provide slow regrowth and have a small root system that might not be able to utilise the soil nutrient and water reserves.

For example, if the soil is moist to 60 cm deep and the root system only reaches 10 cm, there is a serious wastage of the water resource and may even result in excessive deep drainage. Lateral root spread is also limited having serious implications when those plants have to hold the soil together in times of water runoff. They can become perched on mounds, termed plant pedestalling, which indicates soil erosions from around the roots of the plant.

(Source: Grazing Land Management - Producers Manual. Lambert & Pilcher 2008)

### Grazing management

Management of grazing has a great influence on pasture and its composition. Heavy grazing tends to select for shorter grasses and plants that are less palatable and have lower feed values. This is illustrated below. Prolonged heavy grazing of native pastures should be avoided where possible. Rotate stock on a regular basis to give pastures a chance to recover and to set seed.



Lightly grazed grasslands contain a diversity of plant species, many of which are medium sized perennial grasses, twining and flowering plants. They also provide habitat for birds, animals, insects and other ground dwelling creatures.

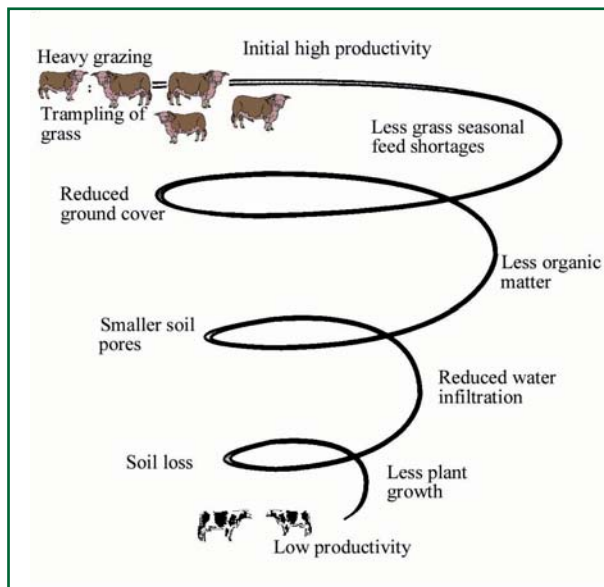
Heavy grazing causes changes in the types of plants that are present in grasslands. There is an increase in the number of low growing annual and perennial grasses, scrambling plants and tough unpalatable grasses. These areas support fewer species and numbers of wildlife.

Figure 22: Grassland plant structure resulting from light and heavy grazing pressure.





### The overgrazing spiral



Heavy grazing over an extended period of time can contribute to nutrient run down in the soil, changes in grassland species composition and soil compaction. This can result in reduced livestock production, less infiltration of rainfall, increased runoff and soil and nutrient loss.

Figure 23: The overgrazing spiral to lower production (Redrawn from Managing & conserving grassy woodlands CSIRO 2002).

### Horse Management

The subject of pasture and its management can be baffling to horse owners if they do not have a rural background. Horse paddocks are often regarded as somewhere for horses to exercise when in fact they should be regarded as a feed source.

Managing pastures properly has numerous benefits including:

- Pasture cushions and covers the soil. Without this cover, soil becomes bare and compacted. This leads to issues such as dust, mud, weeds and erosion,
- Pasture provides a cheap, nutritious and natural feed for your horses, and
- Pasture filters run off water reducing the amount of pollutants that enter the waterways.

Unlike cattle, horses have teeth in both the upper and lower jaw, which means they are able to graze pasture to much lower levels. As a result horses in the Lockyer Valley that are kept on small holdings are often fed with supplementary feed.

The area available for horse grazing in most situations is insufficient to provide enough pasture feed for the number of horses accommodated, even under what would otherwise be considered optimum management conditions.

This can result in either a greater reliance on purchased feed, and in some cases overfeeding, or excessive grazing pressures due to underfeeding. These circumstances can lead to an abundance of weeds, soil erosion, horse health problems and an undesirable environmental impact from dust, flies and weed transfer.

### Rotational Grazing Systems

A key to good grazing management for horses is to either rotate horses between several paddocks in order to maintain pasture cover and quality, or to confine the horses to an area where feed is supplied.

Pastures are far easier to manage if horses are rotated in groups around the various paddocks rather than if each horse has its own paddock. Pasture needs time to recover and time to set seed.

Some key points for rotational grazing are:

- Have several smaller paddocks rather than one large paddock in order to allow rotation which improves pasture growth and parasite control and reduces land degradation.
- Rotation allows grass species to recover from grazing pressure.
- Horses should be allowed to begin grazing a paddock when the pasture has reached an average height of approximately 15-20 cm and moved to another paddock when pasture is approximately 5-8 cm.
- As with cattle grazing, the objective is to maintain 70% groundcover, and a healthy presence of tussocks in the pasture at all times.
- Once animals are removed from a paddock, it should be harrowed, mowed or slashed evenly and then rested and allowed to re-grow.
- Any areas that have less than 70% ground cover or are bare should be temporarily fenced off with electric tape, mulched and scattered with seed to promote recovery.

### Yards

Feeding yards, either in association with stables or by themselves, are invaluable for small property management. They enable the exclusion of horses from the grazing area when there is not enough feed.

If yards are not available, a 'sacrifice' area can be created in the paddock using an electric tape fence, so that the horses can be confined to one part of the paddock while the remainder of the paddock is able to rest and recuperate. It is far better to confine your horses some of the time so that the time they do spend in the paddocks is 'quality time' (eating grass).

A yard should provide about 50 square metres per horse and have a well drained, non-erodible surface (e.g. fine rubble and sand).

### Manure Management

If manure removal is impractical or infrequent, spreading manure by harrowing should be practised in order to; distribute plant nutrients and organic matter, avoid clumpiness in pasture growth and prevent manure being washed into waterways. Rotational grazing greatly assists the application and effectiveness of this practice by resting areas for a period after harrowing. This allows pasture to freshen and assists in worm control. Harrowing can be undertaken with a piece of weldmesh or logs tied together, dragged by a vehicle or by hand.

### What I can do?

#### General grazing management

- Check pasture condition regularly for composition of species present,
- Maintain 70% coverage of desirable species,
- Maintain height of pasture above 8cm,
- Rest pastures by rotating stock through different paddocks to allow pastures to recover and reseed, and
- Determine your pasture supply and appropriate stocking rates

#### Horse management

- Improve the quality of the pasture,
- Rotate horses around paddocks so that pasture has time to recover,
- Harrow larger paddocks to spread manure and fertilise when necessary, and
- Manage water and waste appropriately.



Figure 24: Horse in overgrazed paddock

### Water supply & farm dams

Australia is famous for "droughts and flooding rain". Most people living in rural areas are dependent on rainfall for water supplies for domestic and agricultural activities. As such, it is important to understand the variability of rainfall in your area from year to year and to adapt your activities to these changes. Three major factors need to be considered:

1. Water availability,
2. Water quality, and
3. Offsite impacts (e.g. nutrient rich runoff, aquatic weeds, salinity or soil erosion).

A reliable water supply is an important consideration for a rural property and can have a significant impact on the way you use and enjoy your property. Farm dams are one of the most common ways of providing water for domestic, stock and irrigation purposes. Utilising farm dams and offstream watering points can help to preserve riparian and instream environments from the impact of domestic livestock.

A good farm dam is a valuable asset that will service your water requirements in most seasons with minimum maintenance costs. Proper planning will ensure that the construction and operation of the dam will be a success. The main consideration is to provide enough water for your farming operations at an economical cost.

Professional advice is recommended for all dam projects and is particularly critical for larger storages.

The basic steps in planning a farm dam are:

- Estimating water requirements,
- Selecting a dam site,
- Estimating the catchment yield,
- Checking the yield will meet water requirements,
- Investigate suitability of site, e.g. bywash, cutoff and construction materials, and
- checking for licensing and other regulatory requirements.

#### Water requirements - how much do I need?

Water requirements will vary according to location and the proposed use of the water. A rough estimate can be obtained using the following:

- Domestic: 220 litres/person/day
- Cattle: 55 litres/head/day
- Irrigation: 4,000,000 to 8,000,000 litres/ha/yr
- Allowance should also be made for evaporation and seepage losses. Seepage losses will vary for individual sites depending on geology and soil types whilst evaporation from a water surface can range from 1400 mm to 2900 mm annually depending on the location.



### Licences and permits

Landholders need to be aware that the State Government has placed restrictions on the construction of dams on properties in the Moreton Region which includes the Lockyer Valley. This means that if you are planning to construct a new dam that will take overland flow water; you will need to comply with a self-assessable code specified by the Department of Environment and Resource Management. A Water Licence and a Development Permit from the Department of Environment and Resource Management may be required for dams depending on their location and size. In addition, other permits may be required from the Lockyer Valley Regional Council and the Department of Employment, Economic Development and Innovation Queensland Primary Industries and Fisheries. Contact them to check if this is necessary.

### What I can do

- Work out the amount of water that is required for the different activities on my property,
- Adjust the number of livestock and level of horticultural and other activities to water availability,
- Determine if the land is suitable for constructing a dam and whether it will contribute to salinity outbreaks,
- Check whether a permit or licence is required to construct a dam,
- Measure water quality - to identify its suitability for livestock, gardens or agriculture,
- Fence off dams to exclude livestock, and
- Buffer dams and wetlands with native vegetation to slow water flows, intercepts nutrients, and prevent erosion.

### Additional information

Lockyer Valley Regional Council

Department of Environment and Resource Management

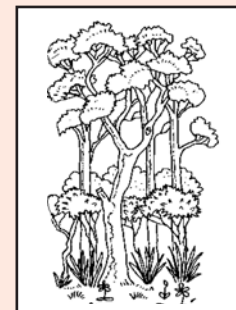
A number of fact sheets are available from the Department of Environment and Resource Management offices or website including:

- Planning your farm dam
- Water requirements - Stock and domestic purposes
- Water requirements for trees
- Limited capacity water storages

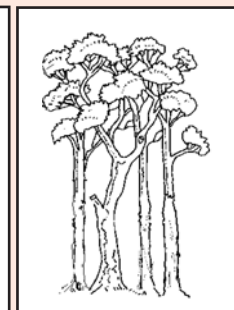
## Vegetation

### Vegetation layers and management

Different 'layers' in natural vegetation provide different areas and types for foraging, nesting locations and shelter for wildlife. Some wildlife species search for food in the ground layer, others in canopy foliage, or on branches and tree trunks, whilst others in shrubs and bushes. Property management (e.g. fire, grazing, natural regeneration, etc) can be adjusted to cater for the requirements of the various layers.



✓ Aim to retain or recreate natural layers in vegetation



✗ Change property management to avoid ending up like this

### Maintain a diversity of vegetation

Natural plant communities have a sense of randomness about them. Plants do not grow in straight, regularly spaced rows but occur in a 'patchy' manner that can comprise scattered thickets, sparsely covered areas interspersed with small clearings. A mixture of tree and shrub species of different ages and sizes enhances natural patchiness along with diversity of growth forms and bark textures. This patchiness of vegetation can provide native wildlife with a diversity of resources such as food, habitat and shelter.

### Promote patchiness of vegetation

When revegetating areas, patchiness can be developed by irregular spacing of trees and shrubs, planting in groups and clumps rather than straight rows, and by using plants with different growth forms and bark types (e.g. ironbark, gum, or box types). Patchiness can be created, enhanced and maintained by a range of management techniques including planting, use of fire and thinning of sapling forests. Consider adding logs and other large wood debris to provide additional habitat for wildlife.



### What I can do

- Identify vegetation communities on my property.
- Maintain or re-create layers in at least 30% of my bushland.
- Resist the urge to 'tidy up'.
- Retain large old trees - both living and dead. Forestry guidelines suggest a minimum of 2 habitat trees (large old trees containing hollows) per hectare.
- Fence off strategic clumps and allow regeneration to occur in planned areas.
- Control grazing in areas of remnant vegetation.
- Learn what animals live in and use the various layers.
- Retain leaf litter and fallen woody debris.
- Use fire with caution
- Manage weeds

### Additional Information

Land for Wildlife Technical notes

Department of Environment and Resource Management

Lockyer Valley Regional Council

## Riparian management

Unfortunately, riparian areas are often degraded due to vegetation clearing and weed invasion. The aim of any riparian rehabilitation program should be to produce a stable stream channel with well vegetated banks. Restoration of riparian vegetation needs careful planning and it is recommended that you obtain advice from suitably qualified people before undertaking any major restoration project. The following guidelines will provide a starting point.

There are a number of ways you can protect riparian lands and riparian vegetation, to benefit native wildlife and property productivity. They include:

- Revegetating banks and riparian areas, using a variety of native plant species (trees, shrubs, herbs and grasses)
- Fencing to restrict stock access to waterways and drainage lines. Stock watering can be provided through alternative off-stream watering points
- Controlling noxious and environmental weeds

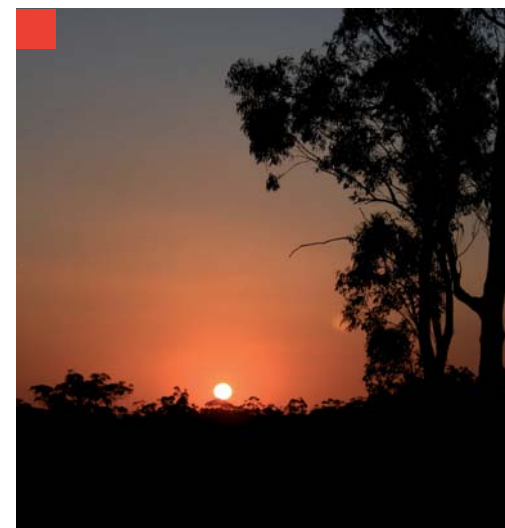
Before starting work, it is important to work out what needs to be done and how to do it. The following steps can help to increase our chances of success.

1. **Assess the condition of the stream** or waterway to identify problems and determine priorities for rehabilitation. This will involve documenting vegetation, stream bank condition and the impact of adjacent land uses. The highest priority for managing riparian vegetation should be to protect areas in good condition and, where degradation has occurred, seek to rehabilitate and restore those areas.

2. **Clearly identify extent of works required.** You will need to develop a clear idea of what you ultimately want to achieve; for example, restoring riparian vegetation to a natural state, managing stock access by fencing, erosion and weed control or installation of offstream watering facilities for livestock.
3. **Select appropriate strategies and techniques** to accomplish your desired outcome. This could be choosing between natural regeneration and planting, electric fencing or traditional cattle fences and the most effective methods of erosion control.
4. **Species selection.** When replanting, it is important to select locally indigenous species to maintain the genetic integrity and biodiversity of the rehabilitated area. Consideration will need to be given to frost tolerance and where different types of plants are situated in the stream profile (will they be exposed to regular or occasional flooding?) Some plants, like lomandras, have a strong, matted root system, and offer little resistance to flood waters so are ideal for lining the main channel. Larger, deep rooted trees are suitable for the upper banks where they will not unduly impede the flow but will help stabilise the banks. Trees growing in the main stream channel will create turbulence in floods resulting in undercutting of banks and erosion so avoid planting trees and shrubs here.

### What I can do

- Protect riparian areas in good condition.
- Rehabilitate / revegetate degraded areas.
- Minimise disturbance.
- Implement a weed control program.
- Control / manage stock access in riparian areas.
- Provide off-stream watering points for livestock.
- Undertake a regular monitoring program to identify any problems developing or becoming more serious.





## Nature conservation

### Creating Corridors for Wildlife Movement

In the one and a half centuries since Europeans settled the area, much of Lockyer Valley's native vegetation has been cleared for agriculture. What is left is a number of remnants of varying sizes and shapes that are in some cases connected by strips of vegetation. These connections are referred to as corridors or linkages in the landscape. They are extremely valuable for the maintenance of healthy viable populations of wildlife and assist in sustaining genetic variation.

Corridors and linkages of remnant vegetation permit wildlife to move in response to catastrophic events such as fire, flood and drought and to recolonise areas. They can improve the conservation value of an area of remnant vegetation by decreasing its isolation and assisting its colonisation by wildlife species. Several factors that are for the most part responsible for determining the number of species found in areas of native vegetation are:

- The distance from the remnant to the nearest large area of habitat,
- The quality of the intervening landscape,
- The size and shape of the remnant habitat, and
- The behavioural characteristics of particular wildlife.

Restoration of landscape linkages is important for the movement of wildlife through the Lockyer Valley and to ensure its long-term survival. The principles of the three R's should be used for conserving flora and fauna when reconnecting and reconstructing landscapes,. These are to *retain* the priority remnant vegetation that remains, *restore* the quality of degraded habitats and then *revegetate* cleared areas.

#### More than one or two rows

To be effective wildlife corridors that are planted to reconnect patches of remnant vegetation should be a minimum of 30 metres wide, comprise at least five rows of plants and consist of a mixture of both trees and shrubs. It is important that trees and shrubs are not planted into grassland areas that are naturally devoid of trees. Doing so can significantly degrade the conservation values of native grasslands. The following diagrams show various ways in which linkages can be re-established in the landscape.

At a property scale, there are three ways in which revegetation can be used for the benefit of wildlife (both plants and animals), by increasing the habitat area, by creating linkages between patches of vegetation and by improving the quality of existing habitat areas.

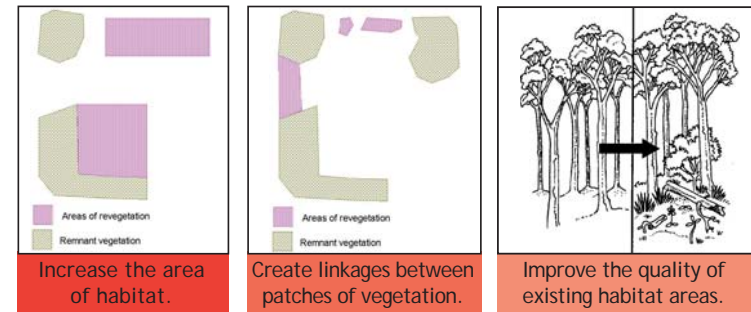


Figure 25: Three ways revegetation can increase habitat value of native vegetation at a property scale. (Redrawn from Bennett et al 2000)

### Options for revegetation

There are a number of options to consider when undertaking a revegetation program. These include:

Enlarging patches of remnant vegetation by regeneration or planting. Queensland studies have shown that patches of native vegetation of at least 5 to 10 hectares are required to support a range of wildlife species in the long term.

Expanding or widening narrow strips of vegetation such as along roadsides and streams. Fencing off areas and replanting or allowing natural regeneration to occur can help to achieve this. Strips need to be a minimum of 30 metres wide to be effective and preferably wider.

Creating new patches or islands of vegetation to permit wildlife movement through the landscape. Wildlife movements are greatly restricted once distance from areas of habitat increase beyond 1 km.

Creating linkages or corridors between patches of native vegetation should be undertaken using species local to the area. Wildlife species have different habitat requirements for moving through the landscape. Figure 26 indicates three different levels of connections between patches of vegetation in the landscape.

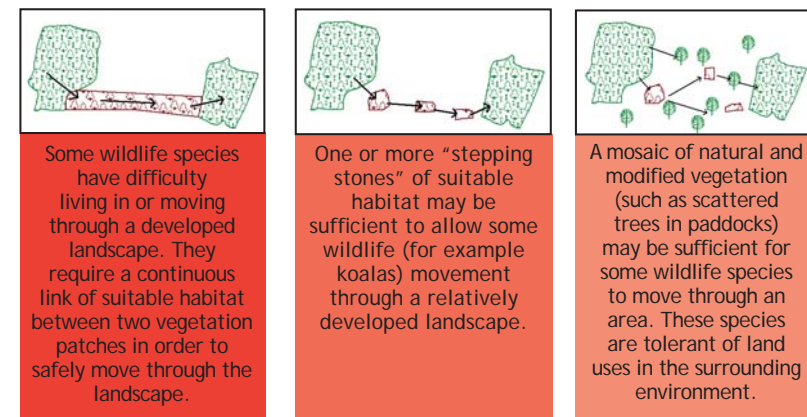


Figure 26: Achieving landscape connections with different habitat arrangements. (Redrawn from Bennett et al 2000)

## Natural Regeneration

The re-establishment of native vegetation by tree plantings has proven at times to be an arduous and expensive exercise. However if nature can do the work with only a little assistance from land managers, then there can be considerable potential for financial savings and benefits.

Allowing and encouraging natural regeneration is one of the most effective means of bringing back the bush. Natural regeneration refers to natural regrowth of native species from self-sown seeds and or vegetative sources in cleared or disturbed areas. Revegetation is the deliberate planting and re-introduction of vegetation. Natural regeneration is however only an option when there is a nearby seed source or the seed bank is still viable. In areas which have been cleared for long periods of time and where there is little surrounding bush, revegetation may be the only option.

Factors which can limit natural regeneration include; grazing and browsing, limited seed supply, soil condition (including compaction), competition from other exotic plants, fire; climatic influences (droughts and frosts), and catastrophic natural events (floods). The precise formula for promoting natural regeneration can be somewhat elusive, however following some basic principles can lead to a measure of success.

A very common problem affecting natural regeneration is the dominance of weed species that out-compete native species in disturbed environments. Weeds compete with native species by occupying space and using available nutrients and water. The control of weeds is one of the most important issues for successful natural regeneration.

In degraded sites where little or no topsoil remains, it is recommended that pioneer species such as acacias are encouraged. Over time these pioneers help to recondition the soil, allowing other plant species to grow. The reintroduction of a small amount of topsoil from nearby healthy ecosystems that are free of weeds will help to reintroduce beneficial soil microorganisms and fungi. Lightly mulching the degraded site can help to trap soil moisture, restart the soil formation processes and assist the emergence of pioneer plant species.

Fencing of regeneration sites may be required to prevent grazing and trampling by domestic livestock, native and feral animals. Make sure that the fencing style matches the animal you are aiming to exclude.



## Revegetation

### Site Selection

In selecting your site first consider the purpose of your planting (e.g. for shade, for wildlife habitat, for amenity). Revegetation will be most efficient and effective if you work outwards from your healthiest native vegetation remnant. Starting to plant in the middle of an open paddock is much more difficult. Planting can be used to best effect in situations such as:

- Expanding and buffering existing remnants.
- Improving connectivity of remnants (corridor planting).
- Restoration of riparian corridors.
- Restoration of areas cleared of environmental weeds.
- Preventing or mitigating soil erosion.

### Tree Planting and Selection

As with everything both on and off your property, it is important to give careful consideration to where and what you are going to do, before actually doing it. As planting can be expensive you want to get the greatest benefit for the investment of your time and money. Think strategically about what and where you will plant.

### Planning

The first task is to identify your purpose for planting trees. Reasons may include habitat for native animal species, shade-lines for cattle, wind-breaks or corridors linking existing remnant vegetation. This will help determine the design of your plantings with regard to location, shape, composition and size. Once you identify the purpose, you can then consider additional benefits from your planting, such as planting a mosaic of floral types such as native ground-cover, shrubs and trees. This will support a more varied array of native animals and establish a multi-dimensional ecosystem. The 'Three R's' should be used when revegetating an area:

1. Retain remaining priority vegetation including remnants and old trees with hollows providing important habitat for many bird and mammal species,
2. Restore the quality of degraded habitats, and
3. Revegetate cleared areas.

Consider carefully the location of plantings on your property with thought given to soil type, topography and access for ongoing maintenance such as weeding and watering. Following site selection, seasonal conditions need to be taken into account. Although planting is possible for much of the year, it should preferably be carried out after rain when the soil is moist and avoiding seasons where extremes of weather (either hot or cold) could be expected. Between February and April has been traditionally recognised as a good time to plant along with spring months once the risk of frosts has passed.





### Plant selection

Where possible, any seed or plant used in revegetation should be sourced locally, from plants growing in the region (i.e. be of local provenance) and from relevant Regional Ecosystems. Indigenous species have adapted to suit local conditions (soils, climate and topography), provide food and shelter for local wildlife and will not become environmental weeds. The Lockyer Valley Regional Council and SEQ Catchments have information sheets and plant lists available.

Helpful hint: Determine the regional ecosystem for your property. See page 38 for more details.

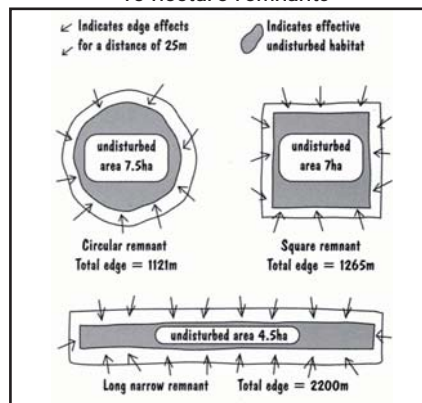
Wattles and other fast-growing, hardy pioneer species are strongly recommended for degraded and exposed sites. Pioneer species naturally create a micro-climate, improve soil health, retain soil moisture and provide shelter to encourage the growth of slower-growing, long-lived trees. Pioneer species scattered through revegetation areas will also help to shade out exotic grasses and other weeds.

Plants in tubes (tubestock) are preferred over more advanced plants and provide much better value for money. Tubestock cost less to purchase, plant and maintain, and have a lower risk of transplanting shock and a higher survival rate for less care (less application of water, fertiliser, mulch and herbicide) than more advanced plants.

### Size and shape

For any given area of vegetation, the shape with the smallest perimeter length relative to its area, is least affected by outside disturbances. The closer an area of bushland or revegetated area is to a square or circle; the better its chances are of long term survival. Long narrow areas are most susceptible to edge effects such as wind exposure, weed invasion, fire and other disturbances. Figure 27 below shows the impact of edge effects on different shaped patches of vegetation.

Size, shape and edge effects - 10 hectare remnants



The shape and size design of your plantings are important specific to your identified purpose. The plants which are most likely to succeed in your area with minimum maintenance are those which naturally occur there. For this reason, where possible plant either seeds or tubestock sourced from endemic or locally occurring species. Your local council or Landcare group will be able to advise you on where to source these from.

Figure 27: The influence of size, shape and edge effects on remnant vegetation patches.

### Plant spacing

Where possible, plant density should be slightly higher than the type of habitat that you are attempting to recreate or reinstate. Some practitioners advocate dense plantings to minimise weeds and establish a micro-climate even though they may require thinning as plants grow. Wider spacing may be closer to the ideal for full grown plants but may result in a slower start.

Table 6 below provides a rough guide to appropriate spacings of canopy species for different vegetation types.

Table 6: Suggested plant spacing's and densities for various vegetation communities.

Vegetation community	Distance between trees (m)	Plants/ha*
Rainforest (e.g. vine forest, vine thicket)	2	2500
Forest (e.g. wet sclerophyll, moist eucalypt forest)	3	1500
Open forest (e.g. dry sclerophyll, eucalypt forest and brigalow)	5	500-1000
Woodland	8-15	250-500
Open woodland	10-20	100-250

\* planting space for canopy species only.

### Site preparation and planting

Good preparation of a planting site is important for successful plant establishment. It can also make the job a lot easier and reduce the amount of maintenance needed after planting. Site preparation needs to be well planned and executed to achieve optimal plant growth. It can include activities such as:

- Cultivation - to break down physical barriers to root penetration, improve water infiltration and control weeds,
- Weed control - to remove competition to young plants,
- Soil improvement - may include adding organic matter or gypsum to improve the soil's physical or chemical condition, and
- Animal protection which may involve fencing out of stock or other animals to prevent damage to young seedlings after planting.

Holes for planting can be dug using a purpose built 'wombat digger' fitted to a bobcat or tractor mounted posthole digger, a conventional posthole digger or by hand. If using a conventional posthole digger, the sides of the hole need to be dug out with a crowbar to overcome potential 'glazing' of the sides of the hole which would otherwise prevent plant roots from growing normally out into the soil. Alternatively the area to be planted can be ripped or cultivated. Care needs to be taken that this is not done when soil conditions are too wet as you can cause additional problems of soil compaction and soil structure problems.

### Weed control

Young plants are susceptible to competition for moisture and nutrients from weeds, and in particular grasses. A weed free area should be created at the preparation phase prior to planting and maintained around each plant until the majority of trees are over 3 meters high. Ideally this weed free area should be at least 1 meter wide at planting and can be increased to 2-3 meters wide as the plant grows. Methods of weed control can include cultivation and herbicides. Two sorts of herbicides can be used - broad spectrum ones such as glyphosate (Roundup®) that control virtually all plants and residual herbicides such as Simazine® that are more selective and can prevent the establishment of certain types of plants such as grasses for a period of time. It is essential to read the label prior to applying any chemicals and to follow all safety and application instructions.

### Water and nutrients

Successful plant establishment is dependent upon adequate moisture levels and nutrients being present. If planting conditions are dry, watering prior to planting (up to a week beforehand) with at least 20 litres per hole will assist plants to get off to a good start. An additional watering of at least 4 litres per plant immediately after planting will help settle the soil around the plant and ensure good contact between plant roots and the soil. Additional watering may be necessary and will depend on seasonal conditions.

Early growth rates of native plants can be enhanced by the use of a suitable fertiliser. The type and quantity of fertiliser used depends on soil types and conditions present at the site and the species being planted. Fertilisers containing nitrogen (N) and phosphorus (P) such as DAP are suitable to use. Care needs to be taken when fertilizing as many native plants are adapted to growing in low fertility soils and may be harmed if over-fertilised.

### Mulching and guarding

Placing guards around young plants can help to reduce the effects of wind, frost and drought and protect them from hares and wallabies. Commonly, plastic tubes, fertiliser bags and milk cartons are used. These can be removed once the plants are established and growing well.



Mulching (e.g. wood chip or forest mulch) helps to protect the soil surface, conserve soil moisture, lower soil surface temperature and reduce weed competition. A range of materials can be used such as wood chip, hay or straw or purpose manufactured weed mats. Mulching should preferably be at least 10 cm deep.

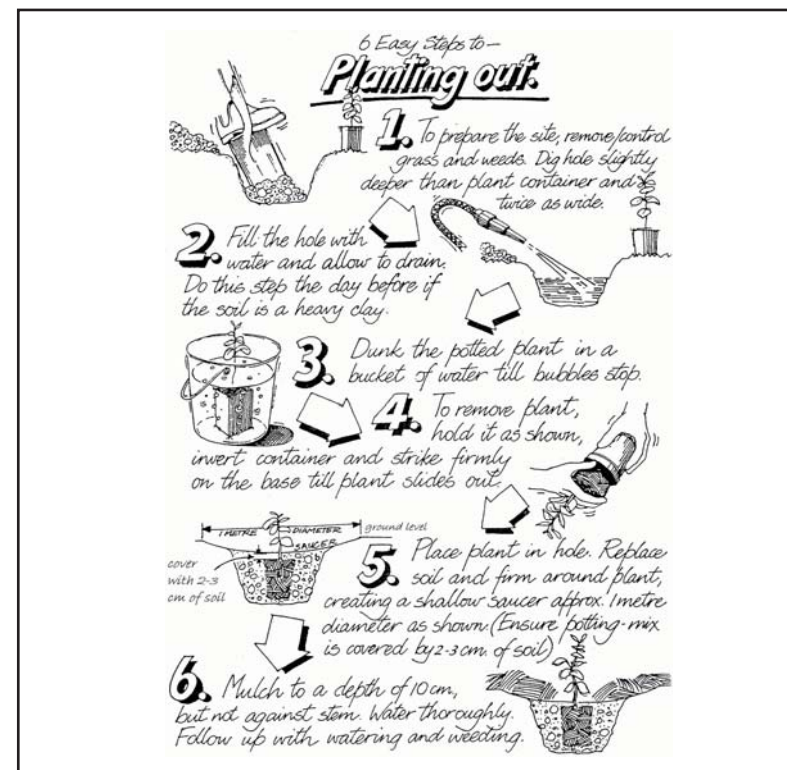


Figure 28: Six easy steps to planting out (reproduced with permission from Greening Australia)

### On-going Maintenance & Evaluation

It is important to regularly check on the progress of your trees and to maintain a routine of watering, fertilising, mulching and weed removal. You may also have to replace tree guards and maintain fencing to ensure trees are adequately protected. It is likely that not all of your trees will survive and will need to be replaced. Record the mortality and success of your trees for consideration in future tree planting activities.

#### What I can do

- Fence to manage livestock grazing,
- Control weeds and feral animals,
- Implement an appropriate fire regime,
- Identify plant species suitable to my area, and
- Re-establish native trees, shrubs, grasses and herbs by either natural regeneration or planting.

#### Additional Information

- Lockyer Valley Regional Council Officer
- Land for Wildlife
- Society for Growing Australian Plants
- SEQ Catchments



Table 7. Native plants to encourage wildlife

Plant species	Scientific name	Max height	Poorly drained	Well drained	Clay	Sandstone	Alkaline	Wildlife attracted
Swamp mahogany Queensland blue gum Brush box	Eucalyptus robusta Eucalyptus tereticornis Lophostemon confertus	25m 30m+ 30m+	✓ ✓ ✓	✓	✓ ✓ ✓	✓ ✓ ✓	✓	lorikeets, flying fox, gliders, koala, ringtail possum, red-tailed black-cockatoo
Plunkett mallee	Eucalyptus curtisii	8m		✓		✓		as above except koala
Broad-leaf tea tree Prickly-leaved paper bark Swamp tea tree	Melaleuca quinquenervia M. nodosa M. irbyana	20m 3m 5m	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	sugar glider, lorikeets, friarbird, Queensland blossom bat, thornbill, white-throated honeyeater
Dwarf weeping bottlebrush Wallum bottlebrush	Melaleuca viminalis (dwarf) Melaleuca pachyphyllus	2m 1.5m	✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓	lorikeets, honeyeaters
Narrow-leaf acacia Black wattle Brown salwood	Acacia longissima Acacia leiocalyx Acacia aulacocarpa	5m 6m 15m		✓		✓ ✓ ✓		sugar glider, thornbill, bronze-wing pigeon, red-tailed and yellow-tailed black cockatoo
Banks' grevillea Silky oak	Grevillea banksii Grevillea robusta	2.5m 30m	✓		✓ ✓	✓ ✓		lorikeets, honeyeaters
White cedar	Melia azedarach	30m	✓		✓	✓	✓	brushtail possum, wompoo pigeon, red-tailed black-cockatoo
Swamp banksia Coast banksia Hairpin banksia	Banksia robur Banksia integrifolia Banksia spinulosa var. collina	2m 15m 2.5m	✓ ✓	✓ ✓		✓ ✓	✓ ✓	feather-tail glider, lorikeets, Queensland blossom bat, white-throated honeyeater
Black she-oak River she-oak	Allocasuarina littoralis Casuarina cunninghamiana	8m 30m	✓ ✓	✓	✓	✓		glossy black cockatoo, thornbill
Moreton Bay fig Small-leafed	Ficus macrophylla Ficus rubiginosa	30m+ 20m	✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓	wompoo fruit-dove, fig bird, barred cuckoo-shrike, rose-crowned fruit dove

## Fire

Fire has an important and positive role to play in maintaining the diversity of native plants and animals in our landscape. For many of our native plants however, being adapted to fire does not mean that they will flourish under any burning regime. Whilst plants and animals have a variety of mechanisms to enable them to maintain their presence in the face of fire, there are limits. Either too frequent or too infrequent fires can lead to species decline and even their eventual local extinction.

Positive effects of fire include; opening up the foliage canopy, allowing sunlight to reach the ground, creating an ash bed that is rich in nutrients for germinating seedlings and potentially eliminating weeds, insects and fungal diseases. Many plants are stimulated to flower after a fire such as Grasstrees (*Xanthorrhoea spp.*) whilst others such as Banksias and Hakeas release their seeds from woody cases. Heat and smoke from fires are important in stimulating seed germination of many plant species, for example Hoveas.

Fire-adapted plants respond to fire in two ways.

1. Despite being burnt and appearing dead, plants are able to send out new shoots from stems and lignotubers. These plants are called 'resprouters'. Eucalypts are a common example of resprouters.
2. Plants that are killed by fire and rely on regeneration from seed, which is often produced in large quantities. These plants are called 'obligate seeders' and have no choice but to grow from seed.

### What about the animals?

Animals have a variety of ways to cope with fire. Some are 'avoiders' (for example wallabies and bandicoots), and manage to stay alive by either moving outside the burning area or by taking refuge underground or in hollow logs. Other species lose substantial numbers of individuals in a fire and rely on re-colonisation by populations from outside the burnt areas.

Many animal species in fire-adapted systems show a preference for a particular stage of post-fire regeneration, depending on their feeding and breeding needs. For example the Eastern Chestnut Mouse likes open forests and heathlands in the early and middle stages of post-fire regeneration. It begins to recolonise burnt areas about one and a half years after a fire and decreases when litter and understorey vegetation builds up. Antechinus prefer sites with thick undergrowth that develops some years after a fire. Birds also show similar patterns of preference for post-fire habitats.

Animal habitat requirements and life cycles need to be considered when planning a fire regime so as to minimise harmful impacts.





### Implications for using fire as a management tool

Four factors need to be considered when implementing a fire regime:

1. Fire frequency - how often fire occurs.
2. Fire extent - the area covered by the fire.
3. Fire intensity - how hot the fire is.
4. Fire season - what time of the year the fire occurs.

**Fire frequency** - Frequent fire tends to reduce shrub cover and encourage fire tolerant grass species such as blady grass. It can also cause '*obligate seeder*' plants to disappear from the landscape if there is insufficient time for them to grow to maturity and produce seeds. Long-term fire exclusion will disadvantage some species and they too may in turn disappear from the landscape as they grow old and die.

**Fire extent** - A patch burning or mosaic pattern is recommended. Mosaics occur naturally, even in uncontrolled wildfires. Unburnt areas provide:

- Places for animals to seek refuge in a fire,
- A source of food in the months after a fire,
- A seed source for plant regeneration, and
- A base from which animal species can recolonise the burnt area when it becomes suitable.

It is recommended that adjoining patches be burnt at intervals of not less than two years.

**Fire intensity** - is how hot the fire is, normally described as flame height and is influenced by the prevailing weather conditions, available fuel loads and season. There is no best answer as to the most appropriate fire intensity. Ecologically, variability in intensity is desirable and often occurs by default. Hotter fires are generally more destructive and will kill more animals and plants, whilst cooler fires are generally more patchy and remove less of the litter layer. Plants vary in their response to fire intensity with some requiring a hot fire to regenerate whilst others need a cool fire or smoke to stimulate germination.

**Fire season** - There is no one best time for burning, in fact research tends to suggest that a variation in season of burning is desirable. A mix of late summer, autumn and winter burning together could provide variability at the landscape level. In general, spring fires can have a detrimental effect on native fauna, as this is when birds are nesting and mammals are rearing their young. A spring fire can also remove summer food resources for these species. Fires in late autumn may have the least detrimental effect on native fauna, since as a general rule the life cycle of invertebrates (such as insects and spiders) has been completed, and birds and mammals have reared their young. Where possible avoid fire in dry times or drought.

Factors to consider when burning include:

- Breeding seasons of animals and birds. Where possible, wait until wildlife have completed their breeding cycle and are better able to cope with disturbances such as fire.
- Insect dormancy. Many invertebrates are dormant during winter and may be especially vulnerable to the effects of fire.
- Availability of seed. A late winter/early spring burn will prevent a year's flowering and seeding for many shrub species. Providing enough time has elapsed since any previous fires to allow a sufficient seed store to have built up, this may not be a problem.

Different vegetation communities and regional ecosystems have different requirements in regard to fire. Figure 29 identifies suggested fire regimes for the various vegetation communities of the Lockyer Valley.

It is important that expert advice is sought before undertaking a burn. This will help ensure that the ecological requirements of flora and fauna are met. It will also make sure that conditions are suitable, measures are in place such as firebreaks to prevent the escape of fire, and that adequate resources of people and equipment are on hand. Good preparation before undertaking a control burn will contribute to the likelihood of a successful outcome to the activity. A fire permit from your local fire warden is also required.

Creekside and gully vegetation - in general, don't burn			Tall forest - intervals between fires should exceed 20 years
Grassy Woodland - vary intervals between 3 and 6 years			Shrubby woodlands and mixed open forest - vary intervals between 7 and 25 years
Semi Evergreen Vine Thicket and Rainforest - exclude fire			Brigalow & brigalow associated communities - exclude fire

Figure 29: Suggested fire interval for different vegetation communities.



### A few guidelines

Fire should only be used in remnant vegetation for two reasons:

1. As a means to reduce a fire hazard, and
2. As an ecological management tool.

If possible, never burn the whole of a remnant at any one time. Unburnt areas provide potential refuges for wildlife.

### What I can do

- Develop a property management plan that includes fire,
- Burn in a mosaic pattern rather than burning an entire patch of vegetation at one time,
- Monitor the effects of fire on plants and animals,
- Wait until wildlife have completed their breeding cycle before burning an area,
- Vary the season and interval of burning,
- Work in with neighbours,
- Rake / remove fuel from around habitat trees and logs before burning,
- Keep records - photographs and notes, and
- Always ensure safety of life and property.

### Additional Information

- South East Queensland Fire and Biodiversity Consortium.
- Department of Environmental and Resource Management provide fire guidelines for some Regional Ecosystems on their website [http://www.epa.qld.gov.au/nature\\_conservation/biodiversity/regional\\_ecosystems/](http://www.epa.qld.gov.au/nature_conservation/biodiversity/regional_ecosystems/)
- Lockyer Valley Regional Council Land for Wildlife Officer
- SEQ Catchments
- Queensland Fire and Rescue Service - Rural Fires

## Pest management

Planning is essential for effective pest management, as it ensures resources are used in the most productive and efficient manner.

Pest management planning occurs at all levels - national, state, regional, local and property.

In many instances pests can impact on a variety of natural resources such as water, vegetation, land and cultural heritage. Planning for pest management, therefore, must be considered in association with other natural resource management issues.

### Pests - Weeds & Animals

The *Land Protection (Pest and Stock Route Management) Act 2002* (Qld) in conjunction with the *Land Protection (Pest and Stock Route Management)*

*Regulation 2003* provides the legislative basis for the management of pest plants and animals throughout Queensland. Pest management is considered to be an integral part of sustainable management of the natural resources of the Lockyer Valley, and as such, all landholders have clearly defined responsibilities for managing identified pests.

### Classes of pests

Pest plants and animals are divided into three classes:

**Class 1** pests are not commonly present in Queensland and their introduction would cause a serious economic, environmental or social impact. Class 1 pests established in Queensland are subject to eradication from the State. Landowners must take reasonable steps to keep land free of Class 1 pests.

**Class 2** pests are established in Queensland and have, or could have, a substantial economic, environmental or social impact. The management of these pests requires coordination and they are subject to local government, community or landowner led programs. Landowners must take reasonable steps to keep land free of Class 2 pests.

**Class 3** pests are established in Queensland and have, or could have, a serious economic, environmental or social impact. A pest control notice can only be issued for land that is, or is adjacent to, an environmentally significant area. The impact of a species in this Class is primarily environmental. It is illegal to sell a declared plant or its seed anywhere in Queensland without permission from Biosecurity Queensland.

Species not declared under the *Land Protection (Pests and Stock Route Management) Act 2002* may still be declared at a local government level under local laws. Species declared as Class 3 may be subject to local law control outside of environmentally significant areas.

### Landholder Obligations

Under the *Land Protection Act*, landowners - (not managers or occupiers) - are obliged to take reasonable steps to keep their land free from Class 1 and Class 2 pests. Generally, the following rules apply to all declared pests in all parts of the state:

- A declared pest cannot be offered for sale, traded or given away without a permit.
- People must take reasonable steps to ensure that their activities do not spread the pest.
- Landowners and managers are obliged to take reasonable steps to keep their land free of Class 1 and Class 2 pests.
- If a Class 3 pest on private land threatens an environmentally significant area, the owner of the private land may be required to take steps to control that pest.

### Biological calendars

Understanding the biology of a pest is an important step in devising a management plan to control them. Mapping out the key periods of activity, whether it be germination, flowering or seeding of a plant or breeding for an animal enables control methods to be better targeted. For example, research shows that good lantana control can be achieved when the plant is in full flower. Table 8 provides a biology calendar for Giant Rats Tail Grass, foxes and wild dogs as examples. The keeping of good records is also useful for the ongoing development of biological calendars.

Table 8: Example of biological calendars for pest plants and animals.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Lantana</b>												
Flowering	Yellow	Yellow	Yellow	Yellow						Yellow	Yellow	Yellow
Seed formation & drop	Red	Red	Red	Red	Red	Red					Red	Red
Germination	Green	Green	Green	Green							Green	Green
<b>Giant Rats Tail Grass</b>												
Germination									Green	Green	Green	Green
Flowering	Yellow	Yellow	Yellow							Yellow	Yellow	Yellow
Seed set & drop	Red	Red	Red	Red							Red	Red
<b>Pest animal</b>												
<b>Wild dogs</b>												
Mating					Purple	Purple					Purple	Purple
Juvenile Pup Activity		Purple	Purple					Purple	Purple			

### Weeds

Maintaining the healthy, natural functioning of ecosystems depends on preventing the degradation of natural resources. Weeds have the potential to significantly affect natural systems with resulting harmful impacts on the area's biodiversity.

A weed is simply a plant out of place. They can be exotic or native plants that have spread beyond their natural range. Weeds are characterised by their ability to spread rapidly and produce unwanted economic, environmental or social impacts.

Environmental weeds are those plants that are not native to the local area and can invade and displace native vegetation. All landholders have a responsibility to control weeds on their property. Weeds may or may not be Regional Council or State Government declared pest plants and can include:

- Plants forming dense thickets such as lantana that invade bushland areas, choking out native plants,
- Succulents like mother of millions that can establish virtually anywhere in the Lockyer Valley and form dense infestations, preventing native plants from re-establishing,
- Grasses such as Coolatai grass that can invade native grassy areas, especially along roadsides,
- Shrubs and trees such as celtis and broad leaf privet that can establish in riparian areas along streams and rivers. Duranta and boxthorn that can invade many of the open bushland areas, and
- Vines and creepers such as Cats Claw creeper and Maida vine that cover trees and eventually choke them out.

**Did you know** that invasion by alien species is the second greatest threat to biological diversity after loss and degradation of habitat and may pose a greater threat than salinity?

#### What causes weeds to invade?

Weeds usually need an event to trigger their invasion, as they don't automatically invade an area of native vegetation just because a seed source is available. One of the most important events that enable weeds to become established is disturbance of soil and native plant communities. This can often be seen in the growth of weeds along the edges of roads and tracks. Other factors include fire, increased nutrient levels, changes in drainage patterns, grazing and climatic events. The effects of these events are not limited to exotic weed species, as some native plants also require a level of disturbance in order to regenerate.





### What harm do environmental weeds do?

Environmental weeds are very effective at reproducing, dispersing and colonising new areas. Many can withstand harsh or difficult growing conditions. These characteristics combine to make them highly invasive. Environmental weeds can smother native vegetation, prevent seedling establishment of native species and contribute to changed fire regimes. This process can take many years and ultimately result in the loss of native vegetation communities. Associated with this process is a loss of habitat for native plants and animals and the potential local extinction of these species.

Table 9: Weed Species of the Lockyer Valley and methods of control

Weed status 1 Must be eradicated 2 Control required 3 Environmental pest E Local environmental weed	Growth habit C Creeper G Grass H Herbaceous plant RA Robust annual	S Shrub Su Succulent T Tree W Water Weed	Common Name	Scientific Name	Weed Status	Growth habit	Spot Spray	Physical removal	Cut stump	Basal bark	Stem injection	Foliar Spray	Biological control
			Water hyacinth	<i>Eichhornia crassipes</i>	2	W	X	X				X	X
			Salvinia	<i>Salvinia molesta</i>	2	W	X	X				X	X
			Annual Ragweed	<i>Ambrosia artemisiifolia</i>	2	H	X	X				X	X
			Giant Rat's Tail Grass	<i>Sporobolus pyramidalis &amp; S. natalensis</i>	2	G	X	X				X	
			Groundsel Bush	<i>Baccharis halimifolia</i>	2	S	X	X	X	X		X	X
			Mother-of-millions	<i>Bryophyllum delagoense</i>	2	Su	X					X	
			Parthenium	<i>Parthenium hysterophorus</i>	2	H	X	X				X	X
			Prickly Pear	<i>Opuntia spp.</i>	2	Su	X			X	X	X	X
			Harrisia cactus	<i>Harrisia spp.</i>			X					X	X
			Lantana	<i>Lantana camara</i>	3	S	X	X	X	X		X	X
			Madeira Vine	<i>Anredera cordifolia</i>	3	C	X	X				X	X
			Privet	<i>Ligustrum lucidum &amp; L. sinense</i>	3	T	X	X	X	X	X	X	
			Camphor laurel	<i>Cinnamomum camphora</i>	3	T	X	X	X	X	X		
			Celtis	<i>Celtis sinensis</i>	3	T	X	X	X	X	X		
			Cat's claw creeper	<i>Macfadyena unguis-cati</i>	3	C			X	X			X
			African Lovegrass	<i>Eragrostis curvula</i>	E	G	X	X				X	X
			Castor Oil Plant	<i>Ricinus communis</i>	E	S	X	X	X	X			
			Wild Tobacco Bush	<i>Solanum auriculatum</i>	E	S	X	X	X	X			
			Sisal Hemp	<i>Agave sisalana</i>	E	Su	X						
			White Moth Plant	<i>Araujia hortorum</i>	E	C	X	X			X	X	
			Lippia	<i>Phylla nodiflora</i>	E	H							
			Coolatai Grass	<i>Hyparrhenia hirta</i>	E	G	X	X				X	

### 5 principles to better weed management

Effective weed management requires a planned approach so that the problem can be addressed in a strategic and coordinated manner.

1. Prevention is the best form of weed control.
2. Avoid disturbance or creating an environment in which weeds will flourish.
3. Always treat weed infestations when small; do not allow weeds to establish.
4. Weed control is not cheap, but it is cheaper now than next year, or the year after.
5. Rehabilitate treated areas with native locally occurring plant species to prevent re-infestation.

### Some control methods

**Cut stump** can be used for controlling a wide range of woody weeds. Cut each stem off as close as possible to the ground and **immediately** (within 15 seconds) apply a suitable herbicide (e.g. glyphosate) mixture liberally to the cut surface paying particular attention to getting good coverage around the outer edge or cambium layer.

**Basal bark** is a useful method to use for controlling woody weeds with a trunk up to 10 centimetres in diameter. A suitable chemical (e.g. Access® mixed with diesel) is carefully applied in a 30 to 40 centimetre band around the base of each stem making sure that complete coverage is achieved.

**Stem injection** is the method whereby herbicide is injected directly into the stem of the plant. Cuts are made around the stem or trunk with an axe at regular intervals leaving a gap of 2 to 5 centimetres between each cut. Care should be taken that the axe leaves a 'pocket' into which the herbicide is immediately injected. A number of chemicals are available for stem injection treatment of weeds. Check with your local farm supplies agent, agronomist or extension officer as to the most appropriate chemical to use for your needs.

**Scrape and paint** is a useful technique to use on vines and scrambling plants with a woody stem. Starting at the base, scrape 2 to 100 centimetres of one side of the stem to expose the sap layer and apply a suitable herbicide to the scraped area within 10 seconds. Take care not to ringbark the stem. Stems greater than 1 centimetre can be scraped on 2 sides.

**Hand pulling** is suitable for small infestations or where there is an abundant source of labour. It is a useful technique for seedlings or other small weeds. Asparagus fern can be controlled by cutting the crown of the plant out with a sharp implement.

**Foliar spray** is a method that can be used to control large areas of weed infestations. Good coverage of the weed with chemical is required for optimal control.

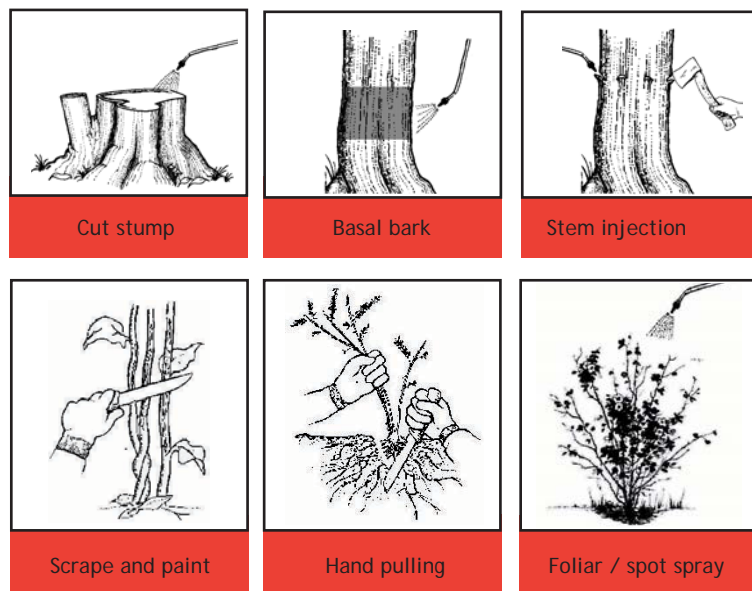


Figure 30: Six methods of treating woody weeds and vines.

#### Nine point check before undertaking chemical control

1. Identify the target weed.
2. Is treatment time right for growth stage of plant or season?
3. Are you using the correct rate?
4. Is a wetting agent required?
5. Are weather conditions suitable - is it windy or rain imminent?
6. Do you have suitable personal protective equipment and clothing for the chemicals being used?
7. Have storage and container disposal been considered?
8. Cleaning of equipment on completion of the task.
9. What is your post treatment management?

#### What I can do

- Identify weeds or plants on my property with weedy potential,
- Find out what the weed's life cycle or biology is,
- Establish the extent of the problem - is it minor or major? (Can I realistically eradicate it?)
- Identify the most appropriate method/s of control,

- Plan the control program - proper planning ensures value for each dollar spent,
- Follow up to prevent re-establishment,
- Use local native plants for landscaping and farm plantings, and
- Limit activities likely to contribute to weed establishment (e.g. minimise areas of disturbance).

#### Additional information

- Queensland Primary Industries and Fisheries -Queensland Biosecurity
- Lockyer Valley Regional Council Officer
- Land for Wildlife Fact Sheets
- SEQ Catchments

#### Ferals taking over

A feral animal is a non-native animal that has escaped or been released into the wild and successfully established itself there. In Australia, feral animals typically have few natural predators or fatal diseases and some have high reproductive rates. As a result, their populations are not naturally kept in check and they can multiply rapidly especially when conditions are favourable. Feral animals can impact on native species by predation, competing for food and shelter, destroying habitat, poisoning native wildlife and by spreading diseases.

It is difficult to totally eradicate feral animals, however in most cases they can be successfully managed to keep their populations below levels where they cause extensive environmental harm. The best place to start eradication is in your own backyard.

Some pest animals impact on specific habitats or species; others are more general and affect many species, ecosystems and ecological and physical processes. These impacts can lead to reduced populations of native species, a decline in the quality and quantity of their habitats, and ultimately the extinction of some native species.

Class 2 pest animals include:

- cat, other than a domestic cat (*Felis catus*),
- dingo (*Canis familiaris dingo*),
- dog, other than a domestic dog (*Canis familiaris*),
- European fox (*Vulpes vulpes*),
- European rabbit (domestic and wild breeds) (*Oryctolagus cuniculus*),
- feral pig (*Sus scrofa*), and
- goat, other than a domestic goat (*Capra hircus*).



### Managing your unwanted visitors

The key objective for the effective management of established feral animals is to reduce the damage they cause to an acceptable level in the most cost-effective and humane manner. A number of control methods are available for feral animals, consisting of conventional and biological control techniques. Guidelines for the humane treatment and removal of feral animals should be followed when undertaking control programs. Landholders have a responsibility to adhere to State Government animal welfare requirements.

#### Conventional control

Conventional methods of control include fencing, trapping, baiting and shooting. Fencing to exclude feral animals is only a viable option where the area to be enclosed is relatively small. It is impractical and nearly impossible to exclude feral animals from large tracts of land as fences designed to exclude feral animals are much more costly than conventional stock fences. These fences also need continuous inspection and maintenance, which is expensive.

#### Biological control

Biological control is the management of pests through the use of natural predators, parasites, and disease-carrying bacteria or viruses. Two noted success stories have been the effectiveness of the release of Myxomatosis in 1950 and Rabbit Calicivirus Disease in 1996. Best results are achieved by integrating biological control with conventional control techniques to effectively manage feral animal populations.

#### Pests - Ants

Ants are among the worst invasive species in the world - and the worst invasive ants are tramp ants. So called because of their association with people, tramp ants can arrive in Queensland by a number of means.

Tramp ants have the potential to impact on our outdoor lifestyle, unique environment and profitable agriculture. One tramp ant identified in south east Queensland is the Fire Ant which is subject to an ongoing eradication program. Fire ants are a social and health menace because of their painful sting. They swarm onto the body, and tend to all sting at once. They are a serious insect pest that has the potential to impact in a major way on our outdoor lifestyle, environment and agricultural production.

### Fish - the good, the bad and the ugly

Goldfish and other exotic fish can seem harmless in our aquariums and ponds but are unwelcome pests in Queensland waters. Carp and tilapia pose a major threat to our native fish and freshwater habitats and are illegal whether they are kept in a tank, pond, dam or bait bucket.

#### Native fish for mosquito control

Care needs to be taken when stocking a farm dam or pond with native fish for mosquito control purposes. This is because in periods of high rainfall and flooding, fish in many farm dams and ponds can easily escape and find their way into local creeks and river systems.

A permit is not required to stock fish in artificially created waters on private land (e.g. farm dam, ornamental pond) if the water is stocked with local fish which occur naturally in the area. From an ecological risk point of view, the escape of inappropriate native fish species stocked in farm dams can have just as severe impacts on natural systems as stocking fish directly into these systems. Some native alternatives for mosquito control are:

Aggassiz's perchlet (Olive perchlet) (*Ambassi agassizi*)

Duboulay's rainbow fish (*Melanotaenia duboulayi*)

Empire gudgeon (*Hypseleotris compressa*)

Firetail gudgeon (*Hypseleotris galii*)

Fly-specked hardyhead (*Craterocephalus stercusmuscarum fulvus*)

Pacific blue-eye (*Pseudomugil signifer*)

Australian smelt (*Retropinna semoni*)

Marjorie's hardyhead (*Craterocephalus marjoriae*)

#### Additional information

- Department of Employment, Economic Development and Innovation  
Queensland Primary Industries and Fisheries - Biosecurity.
- Lockyer Valley Regional Council Officer.



## Escaping Garden Plants and Native Alternatives

Some plant species that are commonly used in gardens and public landscaping have the potential to escape and become serious environmental weeds. Approximately 65% of our most serious environmental weeds are plants that escaped from gardens. Many species planted in gardens have become *naturalised* - that is, they are able to survive and reproduce outside of the garden environment. Some of these species have also become *invasive* - spreading rapidly through native vegetation, out-competing native plants, degrading wildlife habitat, contributing to poor landscape health and lost production.

There are currently over 1,000 different weed species in South East Queensland, and it is estimated that about 30 new plant species that have the potential to become environmental weeds are introduced into Queensland each year, many of them as saleable nursery stock.

Most people are aware of some plants that have escaped gardens to become major environmental weeds such as lantana, privet, camphor laurel and lippia (otherwise known as Condamine couch or no-mow grass).

However, it is not often realised that many of our current favourites are also starting to cause concern. These include *Murraya* (Mock Orange), *Duranta* (Sky flower), *Koelreuteria* (Golden rain tree), *Jacaranda* (Jacaranda), *Celtis* (Chinese elm), *Olea europaea* (European olive) and even the north Queensland *Corymbia torelliana* (Cadaghi). The environmental weed problem will only get worse, and the costs involved - financial, social and environmental - will continue to increase, unless there is a reduction in the weed pressure on our natural environments.

### What I can do

As responsible landholders, both urban and rural, there's plenty we can do.

- 1. Know the plants on your property:** If there are plants in your garden or on your property which you think may be weeds or have weed potential, have them identified by your local council weeds officer, local landcare coordinator or even the Queensland Herbarium.
- 2. Keep on top of property maintenance:** Regularly check your garden or property for plants which appear to be spreading, and ensure that measures are quickly taken to address any actual or potential weed problem - there is plenty of information and advice available from the Department of Environment and Resource Management Pest Fact Sheets, internet sources and local weeds officers.
- 3. Plant only non-invasive species:** Avoid planting species which are known to be invasive. Bear in mind that local native plants offer a safe alternative - they are adapted to the local conditions, provide suitable habitat and food for local birds and animals, and will not become weeds. Some commonly grown garden plants that have weed potential are listed and suitable alternative native species suggested.



Growth form	Plants to avoid	Alternative	Characteristics
Trees	European olive <i>Olea europaea</i>	Native Olive <i>Olea paniculata</i>	Small (12m) weeping tree with a dense rounded crown; small cream flowers
	Cadaghi <i>Corymbia torelliana</i>	Moreton Bay ash <i>Corymbia tessellaris</i>	Attractive hardy tree (to 30m) with stocking of tessellated bark and smooth white trunk and branches
	Camphor laurel <i>Cinnamomum camphora</i>	Crows Ash <i>Flindersia australis</i>	An attractive shade tree (to 20m); clusters of small white fragrant flowers and unusual woody fruits
	Chinese celtis <i>Celtis sinensis</i>	Deep yellow wood <i>Rhodospaera rhodanthema</i>	Large spreading deciduous tree to 20m (frost-tender when young); coppery new foliage
	Golden rain tree <i>Koelreuteria paniculata</i>	Native frangipani <i>Hymenosporum flavum</i>	Small tree (10m) with dark green leaves and highly perfumed creamy-yellow flowers
	Jacaranda <i>Jacaranda mimosifolia</i>	White cedar <i>Melia azedarach</i>	Attractive deciduous tree (10m) with lilac flowers and yellow berries
	Pepperina <i>Schinus terebinthifolius</i>	Green wattle <i>Acacia irrorata</i>	A medium-sized shade tree to 15m with dark green feathery leaves and golden flowers
Shrubs	Duranta <i>Duranta erecta</i>	Meemeei / Cattle bush <i>Pittosporum angustifolium</i>	A small, graceful tree with a rounded, weeping crown; creamy-yellow flowers, followed by orange capsules which split to reveal sticky, red seeds
	Lantana <i>Lantana camara</i>	Boobialla <i>Myoporum montanum</i>	Medium size rounded shrub. Fragrant white flowers with purple spots occur from winter to summer followed by purple fruit
	Orange Jessamine <i>Murraya paniculata</i>	Pavetta, butterfly bush <i>Pavetta australiensis</i>	Large shrub. Large heads of white, fragrant borne October-November followed by globular black berries
	Plumbago <i>Plumbago auriculata</i>	Native Plumbago <i>Plumbago zeylanica</i>	Straggling small shrub with olive-green foliage and white or pale blue flowers
	Privet <i>Ligustrum sinense / lucidum</i>	Diamond-leaf <i>Pittosporum Auranticarpa rhombifolia</i>	Small tree (to 10m) with a layered, spreading canopy; leaves distinctively white on the underside; clusters of fragrant cream flowers in Autumn.

Growth form	Plants to avoid	Alternative	Characteristics
Vines	Cat's claw creeper <i>Macfadyena unguis-cati</i>	Wonga vine <i>Pandorea pandorana</i>	Fast-growing climber with shiny green foliage and creamy-white flowers often with reddish throats
	Dutchman's pipe <i>Aristolochia littoralis</i>	<i>Pararistolochia praevenosa</i>	Large woody climber with a dense covering of brown hairs; flowers about 20 mm long, purplish.
	Madeira vine <i>Anredera cordifolia</i>	Jasmine-leaved wonga vine <i>Pandorea jasminoides</i>	An attractive climber suitable for pergolas; deep green leaves and red-throated pink trumpet flowers
	Morning glory <i>Ipomea indica</i>	Native sarsaparilla <i>Hardenbergia violacea</i>	Hardy twining plants, useful as a ground-cover; clusters of purple pea flowers.
	Moth vine <i>Araujia sericifera</i>	Gargaloo <i>Parsonsia eucalyptophylla</i>	An attractive climber with dense heads of creamy yellow flowers and long slender seedpods.
	Asparagus <i>Asparagus spp.</i>	Wombat berry <i>Eustrephus latifolius</i>	A reasonably vigorous twining plant or scrambling ground cover; white or pale pink flowers with hairy petals; orange berries held on plant for many months.
Ground cover	Creeping lantana <i>Lantana montevidensis</i>	Creeping boobialla <i>Eremophila debilis</i>	An attractive groundcover with pinkish berries; suited to rockeries and raised edges.
	Lippia <i>Phylla canescens</i>	Native pennyroyal <i>Mentha diemenica</i>	Low-growing herb, lovely to walk on as crushed leaves smell fresh and minty

#### Additional information

- Lockyer Valley Regional Council Officer
- Land for Wildlife Fact Sheets
- Society for Growing Australian Plants
- Species lists for Regional Ecosystems jointly produced by Lockyer Valley Regional Council and SEQ Catchments





## Domestic Animals - Pets

Domestic animals play a significant part in the lives of many people. However, if not contained and managed correctly, domestic pets and animals can have a negative impact on the environment in different ways.

Many native animals are unable to defend themselves against the predatory instincts of dogs and cats. Many small to medium sized mammals including feather gliders, bandicoots, birds and reptiles are often killed by domestic animals due to their lack of effective means of defence. Nocturnal native animals, or those active at night time are particularly vulnerable to stalking cats and dogs, as are arboreal species, or those spending most of their lives in trees, such as koalas. When on the ground, these animals tend to move slowly and therefore have little chance of escaping an attacking dog or cat. You may think your pet isn't aggressive, but even good-natured pets can be unpredictable around native animals. The health and wellbeing of native animals can be affected even by the barking of a dog. This causes the animal to stress which may result in increased susceptibility to fatal diseases and infections.

In addition to the impact on biodiversity, pets may have a significant impact on water quality as faecal material could contaminate waterways through runoff, decreasing the quality.

### What I can do

Consider your pets health:

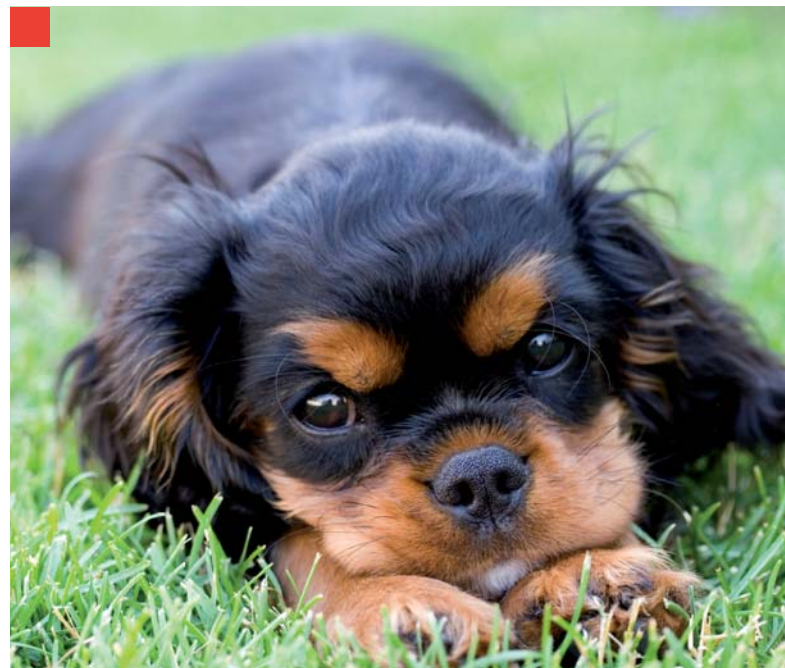
- Provide your pets with adequate food, water and care requirements including sufficient space on your property,
- Seek veterinarian advice if you have concerns about the health of your domestic animals,
- Consider wildlife,
- Register cats and dogs, and
- Keep cats indoors or in an enclosure at night,

Control dogs during the day:

- Keep your dog on its lead and use council-designated areas to exercise your dog off-lead,
- Provide animal 'runs' within your backyard, so that native animals can be safe in other parts of your yard,
- If you don't have a fence, restrain your dogs close to the house,
- Put bells on your dogs collar,
- Discipline your dog, and
- De-sex your dog.

- Control cats during the day:
  - Keep your cat indoors or confined all the time,
  - Put at least 2 bells and a small mirror on your cats collar,
  - Discipline your cat,
  - De-sex your cat,
  - Provide a good habitat for native animals, but ensure they are safe from your pets, and
  - Report any injured native animals to local wildlife carers or veterinarians. Take care if approaching any injured animals as they can be unpredictable and see you as a threat, rather than a friend.

The Lockyer Valley Regional Council has local restrictions on the keeping of domestic animals including the numbers that can be kept per house-hold as well as registration requirements. Contact Council to ensure that you are complying with these.







## Monitoring - Measuring success

Measuring our success (commonly termed monitoring) is important for two main reasons:

1. It is a valuable tool for improving management practices, and
2. It allows us to know whether natural resource condition is stable, improving or declining.

Monitoring requires that consistent records are taken and maintained so that comparisons can be made over time. We think that we can notice changes over time, however the human memory is not as accurate as we would like to think! Monitoring can help us to:

- Record changes over time,
- Document the effect of management actions,
- Document the extent and severity of (and then recovery after) extreme events e.g. flood, fire, storm, frost or hailstorm,
- Develop a benchmark against which future performance can be measured,
- Use the information gained to determine management actions, and
- Identify problems early.

A simple and very practical method for monitoring vegetation and management actions is to take a series of photographs, termed 'photo-point monitoring'.

### What is photo-point monitoring?

A photograph is a record of a particular site at a particular time. Any picture tells a story, but to take a good and useful monitoring photograph requires some thought. Using photographs takes the guesswork out of trying to recall how the property or vegetation used to look.

Photographs are best used for monitoring relatively slow changes to vegetation. They will build up into a valuable record that can be passed on to the next generation of the family or to new owners. Evidence of good management may also be useful when dealing with financial institutions! What photographs do not do is give exact details of species and sites, so each photo needs a precise set of notes to go with it.

### Some pointers

Use two star pickets at least fifteen to twenty metres apart to mark the position of the camera and direction of the photograph. This will help you to always come back to the same point each time. If possible, take photographs from an elevated position such as from the back of a ute. Identify the site in each photograph by using a small notice board (A4 size or bigger).

Think about what you are trying to find out and adapt your monitoring program accordingly.

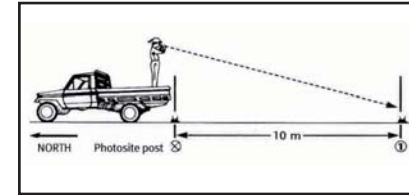


Figure 31: Photo point monitoring from the back of a vehicle

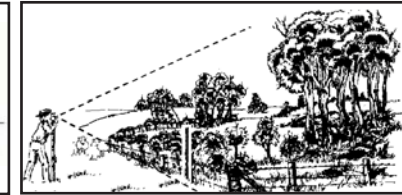


Figure 32: Photo-point monitoring. Have fixed and clearly identified reference points for taking your photos from on a regular basis. (Redrawn from WWF 2000)

### Golden rules for monitoring vegetation

1. Monitoring should be carried out at regular intervals (e.g. once or twice a year), at the same time each year, but be flexible to include major events such as heavy rainfall or bushfires,
2. Record your observations in a consistent manner that allows for easy comparison with previous results,
3. Observations and measurements must be written down, dated and stored together safely for future reference,
4. Compare the information recorded on several previous occasions to detect changes or reconsider management decisions and future actions, and
5. Monitor features that relate to your goals, i.e. issues you are concerned with, such as native tree or shrub regeneration, spread of weeds, changes in the soil or the presence of certain plants or animals.

### What I can do

- Establish a photo-point monitoring program to track the changes that occur on my property.
- Learn to identify the plants and animals that occur on my property and record their presence.
- Record the project activities that I undertake on my property to measure their success, for example number of trees planted and number surviving after 6, 12 and 24 months.
- Start a Nature Watch diary recording natural events of interest, weather details, wildlife observed, flowering of plants, etc.



### Indigenous cultural heritage

The traditional owners of the Lockyer Valley have bequeathed a treasure trove to all Australians - the sacred sites and tools they left behind are unique to the area and can never be replaced. Landholders have a duty of care to ensure that cultural heritage items and values on their properties are preserved.

There are a number of heritage management practices that can be put into place to conserve and preserve Aboriginal Sites of Significance. However, the best way to manage these sites is to consult the Traditional Owners of the area, to ascertain their requirements to preserve specific sites. There are a number of principles that can be followed that will reduce the risk of damaging a site:

- Minimise surface disturbance to a site,
- Reduce stock access to a site,
- Control feral animals,
- Erect fencing to keep out domestic and feral animals,
- Reduce weeds, pests and introduced plants around a site,
- Reduce the risk of fire near a site,
- Sandbagging if a site is threatened by water erosion,
- Get expert advice if a site, such as an art site, is degrading due to insect infestations,
- Erect temporary structures to prevent further environmental degradation of a site,
- Do not drive over a site, if a path is used regularly which has the potential to damage a site, block off the path and provide an alternative route away from the site,
- Regularly inspect the conditions, monitor the conditions and report to appropriate authorities if a site is further degrading,
- Restrict access of people to sites,
- Possibly allow indigenous people access to the site so that they may employ their own management practices,
- Keep natural environmental conditions similar, for example water flow through a fish trap, so that the integral part of the significance of a place is retained,
- Remove rubbish from the surrounding area,
- Repatriate cultural artefacts to the place where they were found, and

- Consult with traditional owners on the storage of artefacts if they need to be removed from an area.

Features likely to have Cultural Heritage Significance		
Ceremonial places Scarred or carved trees Burials Rock art Fish traps & weirs Wells	Quarries & artefact scatters Grinding grooves Contact sites Occupation sites (eg. stone tools, shell middens & scatters, gunyahs)	Landscape Features:- such as rock outcrops, caves, wetlands, springs, some hill and mound formations

If you find a site of significance do not remove items of cultural heritage for any reason without consulting traditional owners first.

(Source: Leslie C. and McFadden L. 2006. Cultural Awareness Manual for Pastoralists and Farmers of the Condamine Catchment)

#### Additional information

South East Queensland Traditional Owners Alliance  
 PO Box 796,  
 Ashgrove Qld 4060  
 Phone: (07) 3366 1116 Fax: (07) 3366 1115  
 Email: info@seqtoa.com.au





## Local, State & Commonwealth Government Laws and Legislation

### Lockyer Valley Regional Council local and planning laws

The Lockyer Valley Regional Council has in place planning and local laws which may govern activities that you would like to do on your property. Some of these local laws may be in addition to State and Commonwealth legislation. Penalties may apply if you do not have the required permits or permission prior to undertaking certain works or activities. If you have any doubt about what can do on your block you should contact the Lockyer Valley Regional Council for further information. Even if the activity does not require any local permits, you still need to comply with your 'Duty of Care' (see below for details). Some of the activities that may be restricted by the Lockyer Valley Regional Council are:

- Lighting fires on your property,
- Intensive farming,
- Clearing vegetation,
- Activities that produce excessive noise, dust or odour,
- Keeping of animals,
- Construction of buildings, sheds and other structures,
- Earthworks,
- Discharge of sediment,
- Storage of flammable and combustible liquids above minor amounts, and
- The sale, production or manufacture of food.

The Lockyer Valley Regional Council also has planning requirements for the removal of vegetation in areas mapped as 'Biodiversity', or of 'Ecological Significance' within its Planning Scheme. In these areas you must obtain permission from Council to remove vegetation, even if you already have permission from a State Government agency.

More details and information is available from the Lockyer Valley Regional Council which has offices in Gatton and Laidley or via their website [www.lvrc.qld.gov.au](http://www.lvrc.qld.gov.au)

### State Law

The Queensland environmental legal system consists of several laws which are relevant to the natural resource manager. These include:

- *Environment Protection Act 1994*
- *Nature Conservation Act 1992*
- *Vegetation Management Act 1999*
- *Integrated Planning Act 1997*
- *Water Act 2000*

- *Land Protection (Pest and Stock Route Management) Act 2002*
- *Land Act 1994*

### *The Environment Protection Act 1994*

The object of the *Environment Protection Act 1994* (EP Act) is to protect Queensland's environment. The EP Act places a general environmental duty on all persons to protect Queensland's environment while allowing for ecologically sustainable development. It also requires monitoring of the Environmentally Relevant Activities. An Environmentally Relevant Activity (ERA) is an activity that is required to be approved by either Council or State Government due to its potential to damage or pollute the environment (air, land, water and noise). The State Government, including the Department of Environment and Resource Management and other State Government agencies regulate higher risk activities while local councils regulate activities with only localised pollution potential.

### Duty of Care

A clear understanding of what '*duty of care*' entails and a commitment to practise is required to ensure good natural resource management. The concept of sustainability has as a basic premise that we have a 'duty of care' to maintain the environment for future generations to enjoy.

Throughout the Lockyer Valley there are many examples of where a 'duty of care' has not been met resulting in sediment being delivered to waterways, over use of forests and degradation of upland areas due to soil erosion.

The Queensland Environment Protection Act 1994 section 319(1) sets out the general 'duty of care', stating that: "a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise that harm".

### Nature Conservation Act 1992

The *Nature Conservation Act 1992* is based on principles to conserve biological diversity, ecologically sustainable use of wildlife, ecologically sustainable development and for establishing and managing protected areas. The Act's object is the conservation of nature. This is to be achieved by an integrated and comprehensive conservation strategy for the whole of Queensland involving matters including:

- Gathering, researching and disseminating information on nature, identifying critical habitats and areas of major interest, and encouraging the conservation of nature by education and co-operative involvement of the community;



- Dedication and declaration of areas representative of the biological diversity, natural features and wilderness of Queensland as protected areas;
- Managing protected areas;
- Protecting native wildlife and its habitat;
- Ecologically sustainable use of protected wildlife and areas;
- Recognition of the interest in nature of Aborigines and Torres Strait Islanders and their co-operative involvement in nature conservation; and
- Co-operative involvement of landholders.

The terms 'nature', 'conservation', 'biological diversity', 'ecologically sustainable use', 'threatening process' and 'critical habitat' are among many defined. In this context 'animal' means any member of the animal kingdom, and 'plant' means any member of the plant or fungus kingdom. Both terms include the whole or any part of the animal or plant as well as the genetic or reproductive material. 'Wildlife' means any taxon or species of an animal, plant, single cell organism, bacteria or virus.

#### Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006 - 2016

The *Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016* (the Koala Plan) outlines a statutory and policy framework for the purpose of conserving koalas in Queensland. Issues addressed in the Koala Plan include: habitat protection, vegetation clearing and development. Within the Lockyer Valley, there are requirements under the *Nature Conservation Act 1992* that in the event of the removal of koala habitat trees, clearing is undertaken in a sequential manner and that koala spotters are utilised.

#### Vegetation Management

Several items of legislation have been enacted in Queensland to manage vegetation. These are the *Land Act 1994* that deals with management of leasehold and state lands, the *Vegetation Management Act 1999* that regulates tree clearing on freehold land and the *Integrated Planning Act 1997* that identifies when permits are required to clear native vegetation.

#### Vegetation Management Act 1999

The *Vegetation Management Act 1999* was introduced to regulate tree clearing on freehold land. This legislation is a major component of Queensland's vegetation management framework that regulates the clearing of native vegetation. It protects the state's biodiversity and by conserving native vegetation, addresses land degradation problems such as salinity, soil degradation, erosion and declining water quality. Under the framework, the Queensland Government phased out broadscale clearing of remnant vegetation in December 2006. However, vegetation clearing is still allowed for certain purposes.

A landholder can apply to clear native vegetation for a relevant purpose under the framework. The types of activities where clearing may be permitted in the Lockyer Valley include:

- Encroachment management,
- Ensuring public safety,
- Building a fence, firebreak, road or other built infrastructure, where no suitable alternative site exists,
- Managing regrowth on leasehold land,
- Constructing a state-significant project,
- Thinning vegetation,
- Managing pests or weeds where necessary, or
- Conducting an extractive industry.

Before accepting an application, the Department of Environment and Resource Management must be satisfied that the clearing is for one of the relevant purposes provided for in the *Vegetation Management Act 1999*. It is recommended that any proposed clearing activities be discussed with a vegetation management officer before preparing an application.

**Exemptions.** Some types of vegetation clearing qualify for an exemption and can be carried out without approval under the framework. Exemptions depend on the tenure of the land, purpose of the clearing, status of the vegetation to be cleared, and extent of the proposed clearing. In some cases, who is proposing to clear, or the designation of the land in the local government planning scheme, will also determine if the clearing will be exempt.

While the framework might allow a landholder to clear under an exemption, there still may be other state, local or Commonwealth laws that one needs to comply with.

#### Property Maps of Assessable Vegetation (PMAV)

PMAV's are property-scale maps that show the location, boundary and status of vegetation. They are certified by the Department of Environment and Resource Management and replace regional ecosystem maps for determining the location of vegetation assessable under the *Vegetation Management Act*.

Some of the activities that may require licences or permits are:

- The installation of water pumps within a watercourse, lake or spring,
- The destruction of vegetation within a watercourse, lake or spring,
- Excavation within a watercourse, lake or spring, and
- The placement of fill within a watercourse, lake or spring (including the construction of a dam).

It is important that landholders contact the Department of Environment and Resource Management and your local council before undertaking any vegetation treatment or clearing and before conducting or installing any works within a watercourse. Failure to do so could lead to the imposition of significant penalties.



A landholder can apply for a detailed PMAV which outlines vegetation boundaries at a scale of up to 1:15 000. When applying for a detailed PMAV, a landholder can provide specific information about the location, structure and range of species which will be assessed by the Department of Environment and Resource Management. To apply for a detailed PMAV a landholder must submit:

- An application form,
- Specific information about the location, structure and range of species of vegetation on your property, and
- Spatially defined and accurate boundaries for the proposed vegetation categories (i.e. an accurate map).

The majority of landholders seeking a detailed PMAV will require the assistance of a consultant or suitably qualified person.

Changes continue to be made to Queensland's Vegetation Management Framework and it is important that landholders contact the Department of Environment and Resource Management and Regional Council before undertaking any vegetation treatment, management or clearing. Failure to do so could lead to the imposition of significant penalties.

#### Regional Vegetation Management Plans (RVMP's)

The focus of Regional Vegetation Management Plans is strategic vegetation management on a bioregional scale. These Plans provide guidance to landholders, local and State government agencies and others involved in vegetation management activities within a region. The Plans establish specific strategies for each region based on State objectives. They contain statutory codes for assessing applications to clear vegetation on freehold and leasehold land.

#### Land Act 1994

The *Land Act 1994* is the principal legislation that provides for the management of non-freehold land in Queensland and includes sections that deal with vegetation management. Elements of the Act that relate to the management of trees on non-freehold land are:

- Maintaining productivity and allowing for development of the land,
- Preventing land degradation and maintaining biodiversity,
- Maintaining environmental and amenity values of the landscape, and
- Maintaining scientific, recreational and tourism values of the land.

#### Integrated Planning Act 1997

The Integrated Planning Act 1997 identifies what vegetation management works can be carried out, the exemptions that may apply and permit

requirements. The purpose of the Act is achieved mainly by providing:

- Codes for the Planning Act relating to the clearing of vegetation,
- Enforcement of vegetation clearing provisions,
- A framework for decision making, and
- A range of exemptions where clearing for certain activities, including clearing for routine and essential management, can be carried out without a development permit.

#### Stream Management and Water Use

##### *The Water Act 2000*

The focus of the *Water Act 2000* (the Water Act) is to provide for

- The rights to water,
- The measurement and management of water,
- The construction, control and management of works with respect to water conservation and protection,
- The irrigation and water supply, drainage, flood control and prevention, improvement of the flow in or changes to the courses of watercourses, lakes and springs, and
- The protection and improvement of the physical integrity of watercourses, lakes and springs.

The Water Act gives landholders the opportunity to apply for a license to take water from a groundwater source or from a surface water stream that crosses or forms the boundary of their land.

Some of the activities that may require licences or permits are:

- The installation of water pumps within a watercourse, lake or spring,
- The destruction of vegetation within a watercourse, lake or spring,
- Excavation within a watercourse, lake or spring, and
- The placement of fill within a watercourse, lake or spring (including the construction of a dam).

It is important that landholders contact the Department of Environment and Resource Management and your Regional Council before undertaking any vegetation treatment or clearing and before conducting or installing any works within a watercourse. Failure to do so could lead to the imposition of significant penalties.

## Commonwealth Law

Commonwealth law is the legislation made by the Australian Government. The centrepiece of Commonwealth environmental legislation affecting natural resource managers is the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

### *Environment Protection and Biodiversity Conservation Act 1999*

The Australian EPBC Act protects the environment, particularly matters of national environmental significance. The EPBC Act promotes the conservation of biodiversity by providing strong protection for threatened species and ecological communities, migratory, marine and other protected species.

An action will require approval under the EPBC Act if the action has, will have, or is likely to have, a significant impact on one of the following matters of national environmental significance:

- World Heritage properties,
- National Heritage properties,
- Ramsar Wetlands of international importance,
- Threatened species and ecological communities,
- Migratory species protected under international agreements,
- The Commonwealth marine environment.

If the proposed activity is likely to have a significant impact, then a referral must be made to the Department of the Environment, Water, Heritage and the Arts for a decision on whether assessment and approval is required under the EPBC Act. Substantial penalties can apply for taking such an action without approval.

#### Additional information:

##### Local Government

Lockyer Valley Regional Council

##### State Government

Department of Environment and Resource Management

Department of Infrastructure and Planning - Local Government

##### Commonwealth Government

Department of the Environment, Water, Heritage and the Arts







## Endangered, Vulnerable and Rare native species of the Lockyer Valley Region

A number of native species - both flora and fauna - occurring in the Lockyer Valley are classified as endangered, vulnerable or rare under the *Queensland Nature Conservation Action Act 1992* and the *Environment Protection Biodiversity Conservation Act 1999*

Species	Scientific Name	Common Name	NCA	EPBC
Amphibians	<i>Litoria pearsoniana</i>	cascade treefrog	V	
	<i>Kyarranus kundagungan</i>	red-and-yellow mountainfrog	R	
	<i>Lechriodus fletcheri</i>	black soled frog	R	
Birds	<i>Mixophyes fleayi</i>	Fleay's barred frog	E	E
	<i>Erythrotriorchis radiatus</i>	red goshawk	E	V
	<i>Accipiter novaehollandiae</i>	grey goshawk	R	
	<i>Lophoictinia isura</i>	square-tailed kite	R	
	<i>Nettapus coromandelianus</i>	cotton pygmy-goose	R	
	<i>Stictonetta naevosa</i>	freckled duck	R	
	<i>Aerodramus terraereginae</i>	Australian swiftlet	R	
	<i>Calyptorhynchus lathami</i>	glossy black-cockatoo	V	
	<i>Ephippiorhynchus asiaticus</i>	black-necked stork	R	
	<i>Climacteris erythroptus</i>	red-browed treecreeper	R	
	<i>Geophaps scripta scripta</i>	squatter pigeon	V	V
	<i>Falco hypoleucos</i>	grey falcon	R	
	<i>Anthochaera phrygia</i>	regent honeyeater	E	E
	<i>Melithreptus gularis</i>	black-chinned honeyeater	R	
	<i>Menura alberti</i>	Albert's lyrebird	R	
	<i>Lewinia pectoralis</i>	Lewin's rail	R	
	<i>Rostratula australis</i>	Australian painted snipe	V	V
	<i>Ninox strenua</i>	powerful owl	V	
	<i>Turnix melanogaster</i>	black-breasted button-quail	V	V
		<i>Tyto tenebricosa tenebricosa</i>	sooty owl	R
Mammals	<i>Petrogale penicillata</i>	brush-tailed rock-wallaby	V	V
	<i>Phascolarctos cinereus</i>	koala	V	

Species	Scientific Name	Common Name	NCA	EPBC
Reptiles	<i>Hemiaspis damelii</i>	grey snake	E	
	<i>Hoplocephalus stephensii</i>	Stephens' banded snake	R	
	<i>Delma torquata</i>	collared delma	V	V
	<i>Harrisoniascincus zia</i>	a skink	R	
	<i>Coeranoscincus reticulatus</i>	three-toed snake-tooth skink	R	V
Plants	<i>Bothriochloa bunyensis</i>	Bunya Mountains bluegrass	V	V
	<i>Brasenia schreberi</i>		R	
	<i>Callitris baileyi</i>	Bailey's cypress	R	
	<i>Caustis blakei</i> subsp. <i>macrantha</i>		V	
	<i>Clematis fawcettii</i>		V	V
	<i>Dendrobium schneiderae</i> var. <i>schneiderae</i>		R	
	<i>Dichanthium setosum</i>		R	V
	<i>Eucalyptus taurina</i>	Helidon ironbark	V	
	<i>Grevillea quadricauda</i>		V	V
	<i>Grevillea singuliflora</i>		R	
	<i>Hibbertia monticola</i>	mountain guinea flower	R	
	<i>Indigofera baileyi</i>		R	
	<i>Leonema obtusifolium</i>		V	V
	<i>Melaleuca formosa</i>		R	
	<i>Melaleuca groveana</i>		R	
	<i>Melaleuca irbyana</i>		R	
<i>Notelaea lloydii</i>	Lloyd's native olive	V	V	
<i>Paspalidium grandispiculatum</i>				
<i>Picris evae</i>		V	V	
<i>Rhaponticum australe</i>		V	V	
<i>Sophora fraseri</i>	brush sophora	V	V	
<i>Thesium australe</i>	Austral toadflax	V	V	

E - Endangered

V - Vulnerable

R - Rare

Species extracted from the Department of Environment and Resource Management Wildlife online facility on 28 February 2009



## Sources of additional information

### Local Government

Lockyer Valley Regional Council  
Offices are located at:

**Head Office: Gatton**  
26 Railway St  
Gatton, Qld 4343

**Branch Office: Laidley**  
9 Spicer Street  
Laidley, QLD 4341  
[www.lvrc.qld.gov.au](http://www.lvrc.qld.gov.au)

Natural Resource Management Officer - Phone 1300 005872  
Conservation Officer - Phone 1300 005872  
Land for Wildlife - contact Council's Conservation Officer

### State Government

Department of Environment and Resource Management - Ipswich  
Phone: (07) 3884 5300  
[www.derm.qld.gov.au](http://www.derm.qld.gov.au)

Department of Infrastructure and Planning - Local Government  
[www.localgovernment.qld.gov.au](http://www.localgovernment.qld.gov.au)

Department of Employment, Economic Development and Innovation Queensland  
Primary Industries and Fisheries  
[www.dpi.qld.gov.au](http://www.dpi.qld.gov.au)

### Commonwealth Government

Department of the Environment, Water, Heritage and the Arts  
General information on the Environment Protection Biodiversity Conservation Act - [www.environment.gov.au/epbc](http://www.environment.gov.au/epbc)  
Area search for EPBC matters [www.environment.gov.au/erin/ert/epbc/](http://www.environment.gov.au/erin/ert/epbc/)

### Other organisations

SEQ Catchments  
Community Partnerships Manager - Lockyer  
[www.seqcatchments.com.au](http://www.seqcatchments.com.au)  
Landcare Queensland [www.landcare.org.au](http://www.landcare.org.au) 07 3211 4413  
South East Queensland Fire and Biodiversity Consortium [www.fireandbiodiversity.org.au](http://www.fireandbiodiversity.org.au)  
Society for Growing Australian Plants [www.sgapqld.org.au](http://www.sgapqld.org.au)

### Further reading

**Understanding and Managing Soils in the Moreton Region** - 1996 Queensland Department of Primary Industries  
**Managing and Conserving Grassy Woodlands** McIntyre, McIvor and Heard 2002 CSIRO Publishing Collingwood  
**Managing horses on small properties** Jane Myers 2005 Landlinks Press

### Wildlife

**Wildlife of Greater Brisbane.** Ryan M. (ed) 1995 Queensland Museum, Brisbane.  
**Wildlife on Farms: how to conserve native animals** Lindenmayer and Claridge et al 2003 CSIRO Publishing Collingwood  
**Nestboxes for wildlife: a practical guide** Franks 2003 Bloomings Books Melbourne  
**Field guide to freshwater fishes of Australia** G Allen, S Midgley, M Allen 2002 CSIRO  
**A field guide to the frogs of Australia** M Robinson 2002 New Holland  
**A field guide to the reptiles of Queensland** S Wilson 2005 Reed New Holland  
**Field guides for Australian Birds** - several available

### Plants

**Bush Regeneration - Recovering Australian Landscapes.** Buchanan R. 1989 TAFE, NSW.  
**Rainforest trees and shrubs: a field guide to their identification** G Harden, B McDonald, J Williams 2008 Gwen harden Publishing  
**Field Guide to Eucalypts Volume 3 Northern Australia** M Brooker, D Kleinig 2004 Bloomings Books  
**Flora of South Eastern Queensland.** Volumes 1, 2, 3. T Stanley, E Ross 1983 Queensland Department of Primary Industries  
Species lists for Regional Ecosystems jointly produced by Lockyer Valley Regional Council and SEQ Catchments

### Useful websites

Wildlife online - [www.epa.qld.gov.au/nature\\_conservation/wildlife/wildlife\\_online/](http://www.epa.qld.gov.au/nature_conservation/wildlife/wildlife_online/)  
Regional ecosystem maps - Regional ecosystem maps - [www.epa.qld.gov.au/REMAPS/](http://www.epa.qld.gov.au/REMAPS/)