



# Best Management Practices for retained areas in forestry plantations

**Title: Best Management Practices for retained areas in forestry plantations**

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### **Disclaimer**

The information contained in this publication is based on knowledge and understanding at the time of writing (May 2009). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up-to-date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

# Best Management Practices for retained areas in forestry plantations



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## Abbreviations

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NRCMA	Northern Rivers Catchment Management Authority
DECC	New South Wales Department of Environment and Climate Change
NSW DPI	New South Wales Department of Primary Industries

**Note: A glossary of key terms and other abbreviations is provided in the Appendices.**

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# Section 1 Introduction

This guideline has been designed to assist plantation managers and operators to:

- identify the risks (or threats) to the conservation of biodiversity in retained areas within authorised plantations
- establish baseline information to assess existing biodiversity and to monitor change over time
- manage potential impacts associated with routine plantation management activities
- plan on-ground works.

The conservation of biodiversity and ecological integrity within retained areas in plantations is required under the *Plantations and Reafforestation Act 1999*. This guideline is designed to guide planning and operations in ways that minimise impacts, manage risks and conserve biodiversity in these areas. Specific activities will need to be tailored to each site.

Retained areas are specified in the *Plantations and Reafforestation Regulation (Code) 2001* (Clause 22) and include each of the following:

- any area of native vegetation required to be retained by the complying development standards in Division 3 of Part 4 of the Code
- any buffer zone of a drainage feature
- any buffer zone of a place, object or item of cultural heritage.

In addition, Clause 23 requires the retention of specified numbers of habitat trees. These should also be monitored and managed to conserve their biodiversity values.

This guideline is designed for the plantation forestry industry in the Northern Rivers catchment management area of New South Wales (Figure 1). Plantation forestry has been expanding rapidly in this area over the last decade and now occupies an approximate area of 145,000 hectares.

Funding for the development of this manual was provided by the Northern Rivers Catchment Management Authority (NRCMA), with the objective to provide the plantation industry with 'best practice' guidelines for conserving the biodiversity and ecological values of retained native vegetation areas.

Further background information can be found in **Appendix 2** Overview of northern rivers catchment, plantation forestry and biodiversity; and **Appendix 3** Legislation applicable to plantation forestry.



Remember:

That this document applies to authorised plantation areas and for works in other areas, permits may be required.



Figure 1 Map of the Northern Rivers Catchment Management Authority area

## The importance of retained areas of native vegetation

Scientific research shows that remnant native vegetation patches, riparian vegetated strips and paddock trees (particularly older trees with hollows) within an agricultural landscape contribute to biodiversity at both the local and regional scale. The significance of the contribution depends on the:

- vegetation condition and structural components
- landscape context of the remnants (how well they are linked with other habitat areas)
- conservation significance of the vegetation type at the site (rarity and conservation status).

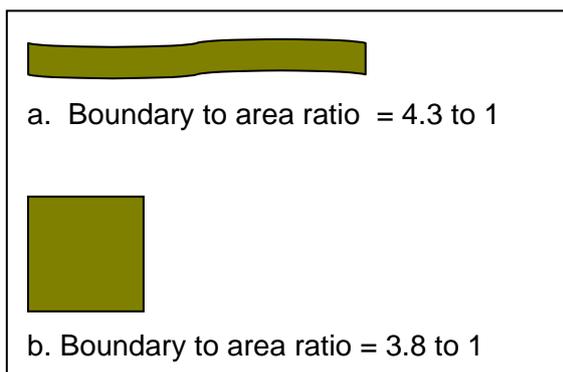
The key factors that influence the biodiversity value of remnants include:

- Size

Even small remnants (0.5 – 3ha) support higher overall species diversity than adjoining agricultural lands. Remnants greater than 3ha are considerably more species diverse.

- Shape

While strips such as riparian vegetation are important, there is an issue of the 'edge effect' that comes with having a high ratio of boundary compared to overall area. Patches with a smaller boundary to area ratio generally have less disturbance (edge effects) and better ecological integrity.



**Figure 2 Two shapes illustrating how shape affects the boundary to edge ratio. Each of these shapes has the same area, however the higher the ratio, the greater the 'edge effect'. A lower ratio is preferred for biodiversity outcomes. In other words a long thin strip has more issues in terms of protecting biodiversity values than a square/round shape.**

- Connectivity

Patches linked across the landscape, via riparian vegetation or other remnants (generally with gaps less than 500m), provide both habitat and make it possible for species to move in response to changes in conditions, seasons and adverse events (eg fire).

- Structural complexity

Patches with leaf litter, logs or rocks on the ground, and a diversity of grasses and herbs, understorey plants, mid-storey species and canopy species (including trees with hollows) are said to have 'structural complexity'. More structurally complex areas of vegetation, with various layers and age classes, usually have higher biodiversity.

- Isolated paddock trees

Larger, old paddock trees situated within the landscape, but within 500m or so of other vegetation, have significant habitat value for wildlife such as microbats and hollow nesting birds.

## Provisions for native vegetation in establishing plantations

The Code allows the clearing of certain native vegetation within essentially cleared agricultural landscapes (refer to Division 3, Clauses 22 and 23), including:

- regrowth vegetation less than 10 years old<sup>1</sup>
- projections from patches of retained native vegetation (if less than 10% of patch area and the clearing is necessary for functional design of the plantation)
- patches of native vegetation less than 1 ha
- isolated paddock trees(**only** if habitat tree requirements are met).

The native vegetation clearing provisions of the Code are offset by a requirement to retain certain types and areas of native vegetation. Clause 22(1) in Division 3 requires the retention of the following native vegetation within the authorised plantation area (i.e. if surrounded by plantation):

- any area of rainforest or wetland
- any area of native vegetation on rocky outcrops
- any native vegetation of a type listed in the regional vegetation schedule
- any native grassland of high conservation value
- any individual patch of woody native vegetation (other than that referred to in the first 3 dot points above) of more than 1 hectare.

Officers from DPI's Plantation Assessment Unit should be consulted in regard to the regional vegetation schedule and high conservation grassland. Clause 23 of the Code specifies the habitat tree retention requirements: specifically a minimum of 30 habitat trees per 30 hectares of plantation or all habitat trees if less than 30 trees on any given 30 hectares.

Areas of retained vegetation must be managed to conserve their biodiversity and ecological integrity, in accordance with Clause 56 of the Code.

## How to use this document

This document can help you through the process of managing the risks to and impacts on the biodiversity and ecological integrity of the retained native vegetation within your plantation area. Section 2 *Getting Started* takes you through how to:

- establish a baseline understanding of the biodiversity values associated with the retained native vegetation
- identify which activities might need to be managed
- identify the level of risk associated with things that impact the retained native vegetation.

It also points you to the Best Management Practice guidelines in Section 3 that can guide you in your management operations.

Alternatively, if you have already identified an activity that you think could be a problem, go directly to Section 3 where there are individual Best Management Practice recommendations for specific activities.

More information and resource materials, including templates and a glossary, are provided in the Appendices.

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<sup>1</sup> The policy was amended to allow clearing of regrowth since 1st January 1990 for consistency with the *Native Vegetation Act, 2003*

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# Section 2 Getting started

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To be able to conserve biodiversity and the ecological integrity of retained native vegetation and manage the impacts associated with routine plantation management activities you need to understand:

- what the current biodiversity assets are
- what risks are threatening, or could threaten, biodiversity or ecological integrity, including:
  - naturally occurring, for example where land is subject to landslip or catastrophic events such as floods or bushfire
  - created, for example as a result of plantation management operations
- what the actual or potential impacts of plantations operations could be.

Understanding these factors will enable you to adopt appropriate best management practices that are targeted to your situation and issues.

## Step 1

### Step 1 Establish your baseline: assess biodiversity assets

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It is important to establish the condition of the retained native vegetation – your biodiversity assets – at a given point in time (that is, a ‘baseline’).<sup>2</sup> The following approaches will also help you get an understanding of the baseline biodiversity associated with the retained native vegetation:

- **Use on-line mapping tools** to identify the likely/actual presence of threatened species of plants and animals. DPI plantation officers also access this information to use in the assessment of plantation applications and may be able to provide this information to you (see Resources in **Appendix 4 Monitoring**).
- **Use on-line databases** to identify any items of cultural heritage that need to be taken into consideration (see below). DPI plantation officers also access this information to use in the assessment of plantation applications and inspect the site for presence of items. They may be able to provide this information to you.
- **Identify key habitat resources** within retained areas such as diversity of vegetation types, structure of forests, whether older trees with hollows are present and /or other features such as logs on the ground, rocky outcrops, flowering and/or nectar producing plants, streams etc.
- **Identify where natural revegetation is occurring.** Look for seedlings and young saplings that correspond to the different types of vegetation found in the retained area. For example, wetland grasses in swampy areas, dry woodland trees on rocky areas, and so on.

A template to assist with the establishment of baseline information is provided in **Appendix 4 Monitoring**. This can then be used to track any changes.

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<sup>2</sup> A full and accurate understanding of these assets is a lengthy and specialist job, often requiring the assistance of people with expertise in specific fields. It is recognised that this is might not be feasible for most land managers and a number of tools can be used to provide an indication of the assets present at the site.

Establishing a baseline is very important for monitoring purposes. Changes can be slow so regular (for example, annual) monitoring against the documented baseline can be the only way to demonstrate change or lack of change (see: Set up photo-points and Observation Assessment in **Appendix 4 Monitoring**).

### Cultural heritage values

Cultural values are not only limited to physical artefacts but may also include places of social and or spiritual importance, and may be linked to the ecological values of the area too. Land managers that have culturally significant places are encouraged to manage these areas in a way which ensures that the cultural values are not compromised.

Cultural sites, like our landscape can be very fragile and damage to the integrity of an area can easily occur if appropriate management practices are not implemented. For further information, contact DECC.

# Step 2

## Step 2 Determine what could be impacting on biodiversity assets

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Start at Question 1 and depending on your answer you will be directed to another question or to a BMP. However, you should also complete Step 4 before going to the BMPs.

**Question 1.** Do livestock (cattle, sheep, deer) graze in areas of retained native vegetation?

**No** – Go to Question 4

**Yes** – Go to Question 2

**Question 2.** Do the livestock use a creek or wetland for watering or for access to another paddock / grazing area?

**No** – Go to Question 4

**Yes** – Go to Question 3

**Question 3.** Is there evidence of *any* of the following in the areas where livestock graze or camp?

pugging

erosion

weeds

pollution from manure (for example, you see algal growth in the water)

damage to retained native vegetation (eg trampling, rubbing or browsing of shrubs/young trees)

overgrazing (for example, can you see lots of bare soil (less than 70% groundcover) or is the grass or other groundcover less than 5 cm high)

**No** – Go to Question 4

**Yes** – see BMP 1 *Managing the impact of stock* AND continue to Question 4

**Question 4.** Are there weeds present in retained native vegetation?

**No** – Go to Question 6

**Yes** – Go to Question 5

**Question 5.** Are any of these weeds

noxious? (eg Groundsel Bush)

dominant or becoming dominant? (eg Lantana)

spreading rapidly and/or overgrowing the native vegetation? (e.g. Cats claw)

plantation wildlings?

**No** – Go to Question 6

**Yes** – see BMP 4 *Managing the impact of weeds* AND continue to Question 6

**Question 6.** Is there a build up of flammable material in the retained native vegetation?

**No.** – Go to Question 7

**Yes** – see BMP 2 *Managing fire* AND continue to Question 7

**Question 7.** Is there evidence that feral pests are present or otherwise causing damage to any native plants animals or their potential habitat?

**No** – Go to Question 8

**Yes** – see BMP 5 *Managing feral pests* AND continue to Question 8

**Question 8.** Are chemicals being sprayed in plantation area to manage weeds or insect pests?

**No** – Go to Question 10

**Yes** – Go to Question 9

**Question 9.** Is the chemical usage causing damage (vegetation dying, or foliage showing signs of chemical 'burning') or likely to cause damage to retained native vegetation?

**No** – Go to Question 10

**Yes** – see BMP 3 *Managing spray drift* AND continue to Question 10

**Question 10.** Is there evidence of erosion, bare ground or mud slides in retained areas?

**No** – Go to Step 3

**Yes** – Go to Question 11

**Question 11.** Is this causing damage, or likely to cause damage to waterways and/or to the retained native vegetation or threaten the retained area's ecological integrity?

**No** – Go to Step 3

**Yes** – see BMP 6 *Managing erosion*. Go to Step 3.

# Step 3

## Step 3 Assess the level of risk

Once threats have been identified it is important to assess the level of a risk they are to the conservation of biodiversity in the retained area. The level of risk can be assessed using a matrix that matches the likelihood of the threat with the consequences of it occurring. Something that is highly likely and has moderate or severe consequences requires higher priority management.

Figure 3 provides an example of a risk analysis. The higher priority risks – those that need to be managed - are those in orange and red.

Likelihood	Consequences			
	Major	Serious	Minor	Insignificant
Very likely	extreme	high	high	medium
Likely	high	high	medium	medium
Unlikely	high	medium	medium	low
Very unlikely	medium	medium	low	low

Figure 3: An example of a risk analysis. Adapted from Australian Standard No 4360.

The classification of the risk will also depend on the timeframe. For example, over a 20 year planning framework there is a high likelihood of severe drought, and given the severity of prolonged droughts in the 1990s and early 2000s, the consequences of another severe drought are likely to be serious.

It is also important to look at the resources needed to address a risk when prioritising them. Your high probability risks may not be the most urgent ones that need to be managed if their impact is low. A helpful way of deciding how to respond to a particular level of risk is shown in Figure 4.

Level of risk	Type of strategy
Extreme	Immediate action required
High	Action plan required
Medium	Specific monitoring or procedures required
Low	Manage through routine procedures

Figure 4: An example of how to match level of risk to type of response.

There are also 'known/unknown' risks. In other words, we know there will be risks associated with increased climate variability, but what those risks are, particularly at a regional or local level, is not yet clear. We also know risks can change in line with the community's ideas about what is valuable. For these reasons, this process of monitoring the condition of retained areas, observing what is occurring, identifying threats and assessing the risks they pose, is a continuous one.

### What to do

For each activity that you identified in Step 2 as being relevant to your plantation you need to:

- Write down the threats to biodiversity values associated with that activity. The questions in Step 2 provide some of these and the tables in **Appendix 5** can also help.
- For each threat, write down how likely it is and what the consequences are if it occurs. Use your answers to identify the level of risk using Figure 4.
- For threats that are a medium to extreme risk, go to the relevant BMP for guidance on management options. You might seek expert advice for any that are rated 'extreme'.

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# Section 3 Best practice options

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The following section contains best management practice guidelines for:

1. Managing the impact of stock
2. Managing fire
3. Managing chemical application
4. Managing weeds
5. Managing feral animals
6. Managing erosion

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# BMP 1 Managing the impact of stock

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*The quickest and easiest way to protect biodiversity?*

Exclude or actively manage stock access strategically in retained areas.



The Code requires the exclusion of stock from retained native vegetation areas for a period of *12 continuous months* from the date that all plantation establishment is complete

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## Manage grazing

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When livestock are introduced to the plantation, it is not always practical or feasible for stock to be completely restricted from retained areas. Under some circumstances managed grazing can be beneficial for very short periods of time (crash grazing), for example to reduce fire hazard or control weeds. Using a small mob over a longer period may not achieve the desired results.

It is vital to monitor grazed areas for signs of damage. This way grazing patterns (intensity and duration) may be modified to avoid damage.

The use of temporary fencing (e.g. electric fencing) and off-stream water points may be able to be negotiated with stock agistees to allow effective grazing management.

### Recommended management options

- Time grazing in retained areas to:
  - minimise stock access when ground is saturated
  - minimise stock access during extended dry periods and droughts
  - prevent negative impacts on native fauna in wetlands and streams
  - restrict stock access when native ground cover and grass species are flowering/seeding. For example, Kangaroo Grass (*Themeda australis*) and Queensland Bluegrass (*Dicanthium sericeum*) are two valuable species that should have grazing restricted during late summer to allow seeding to occur.
- Exclude grazing completely from highly eroded areas (including stream banks) or overgrazed sites and where waterways may be polluted.
- Restrict stock from areas that are being revegetated for up to 6 months or until vegetation is mature enough to withstand grazing pressure. For example, tree saplings need to be at least 2m high.
- Put a large mob of stock in for a short period.
- Remove stock when grazing pressure reduces pasture coverage and/or pasture height to a level where risk of soil erosion and weed invasion is increased (< 70% groundcover, or minimum pasture length of 5 cm). This is particularly important in drainage feature buffers.
- Where plantations are owned/managed in close proximity, a rotational grazing system could be beneficial.

## Use fencing

Fencing is a useful tool to better manage stock access and therefore grazing pressure.

It is essential that in the initial stages of developing a plantation establishment plan, existing fencing be assessed to determine which fences should be retained due to their strategic location for grazing and stock management (based on their condition and location). For example, fencing that limits stock access to drainage features should be retained where practical.

### Recommended management options

- Use a fence type appropriate to site, stock and landscape features.
- Consider using electric fencing for temporary stock exclusion.

**Image 1 Well placed and sized access gates are essential if the fencing is going to work for both grazing and plantation**



### Recommendations for fences associated with drainage features

- Fence off drainage features wherever practicable, particularly where:
  - off-stream water is available or can be provided
  - the retained area contains relics, cultural heritage, threatened species and/or rare vegetation types such as rainforest that would be damaged by stock access or grazing activities
  - there is an increased risk of causing or exacerbating land degradation (for example, where there are highly erodible soils, on steep slopes)
  - damage to stream banks, native vegetation or water pollution caused by grazing stock cannot be adequately managed using the recommendations given above.
- Fence parallel to water flow in drainage feature or waterway.
- Fence outside the flood zone where possible.
- Install an access gate - a width of at least 4m is recommended to allow vehicle access.
- Ensure a minimum distance of 10 metres from the top of the banks of small creeks and at least 30 metres from the banks of major rivers, and creeks in areas prone to erosion. For improved environment outcomes, a minimum width of 30 metres is recommended. The further away the fence is placed from the waterway the straighter it can be, resulting in less material being required and less time to erect and maintain. This reduces the capital cost of the fence and increases environmental benefits.

### Recommendations for fences not associated with drainage features

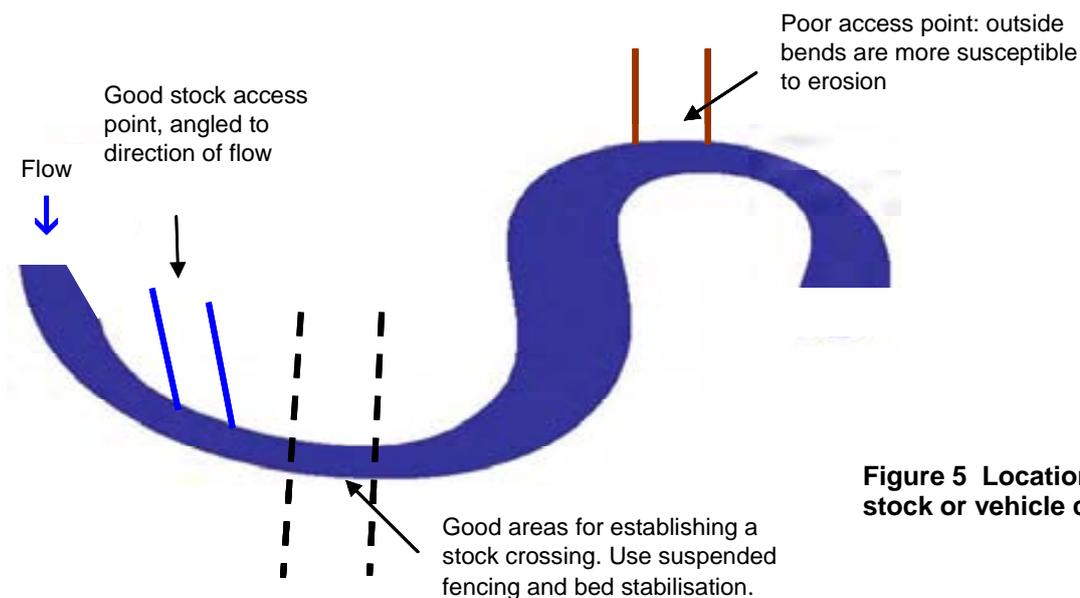
- Fencing of retained native vegetation patches is recommended where:
  - the retained area contains relics, cultural heritage threatened species and/or rare vegetation types such as rainforest that would be damaged by stock access or grazing activities
  - there is a increased risk of causing/exacerbating land degradation for example steep slope, highly erodible soils.

## Stock watering points

- Allow stock to drink from streams only at properly constructed and controlled access points. Locating watering points on inside bends and angled away from the direction of the flow reduces the risk of erosion.
- Provide an adequate number of stable, restricted watering points off-stream such as troughs or dams, where practicable. Locate water points in each paddock and in large areas, more than one may be necessary. Providing off-stream water points will reduce stock impacts on water quality, stream bank stability and erosion.
- Off-stream infrastructure present prior to plantation development should be retained or modified to the plantation layout where practical.

## Waterway crossings

- Construct designated stock (and vehicle) crossings. Locate creek crossings in stable areas. If stock must be moved across watercourses, use points that are less prone to damage or erosion, e.g. along a straight section of a waterway or on the inside of a bend where water flow is slower and banks less prone to erosion.
- Ensure crossings do not impact negatively on water flow and the movement of fish.



**Figure 5** Locations for stock or vehicle crossings.



**Image 2** This crossing has been stabilised with rocks and gravel to minimise damage and erosion. Stock are prevented from entering the riparian area either side of the crossing by suspended fences.

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## BMP 2 Managing fire

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A bush fire hazard reduction certificate must be obtained from the NSW Rural Fire Service prior to any hazard reduction burning

The relationship of fire and different vegetation types and wildlife habitats is complex. A range of fire regimes, including both fire intensity and frequency of burning, is required for different vegetation types, and is dependent on landscape characteristics such as slope and aspect.

The most effective way to protect biodiversity is to be prepared for the potential impact of bush and grass fires. Plan and implement fire mitigation strategies that integrate biodiversity management with the protection of other farm assets and work closely with the Rural Fire Service (RFS).

Managing fuel levels in accordance with acceptable levels for each vegetation type and location within the landscape may help limit the size and intensity of a fire.

'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' is listed as a **Key Threatened Process** under the *Threatened Species Conservation Act 1995* (see useful resources - Fire).

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### Assess and Monitor Fire Risk

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The level of fire risk will vary with each vegetation type and likely native species present. Land slope and aspect, as well as past and present weather and rainfall should also be taken into account. Your monitoring and planning needs to be appropriate given the level of risk for your area.

#### Recommended management options

- Monitor fuel loads and determine the level at which management action is needed. This will depend on vegetation type, topography and site conditions.
- Contact the RFS for assistance regarding management options.

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### Work with neighbours and local authorities

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- Negotiate with neighbours and implement a joint fire mitigation strategy.
- Work together when planning action plans for prevention.
- Get advice from your local Rural Fire Service.

## Reduce fire hazards

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### Recommended management options

#### Manage fuel loads

##### *Crash grazing*

- In an area considered of high fire risk, allow cattle to graze intensively for short periods of time but infrequently.

##### *Hazard reduction burning*

- This option requires a Bush Fire Hazard Reduction Certificate (HRC) issued by RFS. In issuing a HRC the RFS considers matters including vegetation type and its susceptibility to fire.
- Intervals between burns will vary depending on the type of vegetation.
- Burns should be undertaken in a mosaic pattern over different time periods to allow refuge areas of unburnt habitat.



Remember:

A bush fire hazard reduction certificate must be obtained from the NSW Rural Fire Service prior to any hazard reduction burning.

##### *Clearing*

*No clearing of native vegetation for fire breaks is allowed within retained areas.*

- Fire breaks will assist in managing unplanned burning by creating an asset protection zone between the plantation and retained area.
- Slashing (or other method) should be used to ensure fuel materials decompose before summer.
- In areas where there is pasture, aim to create a strip that is clean, short and growing (that is, green).

#### Maintain asset protection zones

- Provide clear areas around significant habitats, such as wetlands, rainforest and areas dominated by rainforest plants, and around cultural heritage sites.

## Prevent fires from starting

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### Recommended management options

- Avoid activities which may ignite a fire during periods of high fire danger. For example, a slasher striking a rock can cause a spark.

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# BMP 3 Managing chemical application

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*The quickest and easiest way to protect biodiversity?*

Only spray when conditions are favourable



Apply chemicals in accordance with the instructions on the label (as required under *Pesticides Act 1999* regulations).

Spraying for insect and weed control may be necessary within an authorisation plantation area. Aerial or ground spraying might be used.

It is important to consider the potential harm to non-target species and areas including isolated habitat trees.

All chemicals are to be used in accordance with their label as required under the *Pesticides Act 1999* regulations.

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## Communicate and record

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### Recommended management options

- Notify your neighbours prior to spraying.
- Use a spray diary to record any chemical spraying including date, location, type of product used and the prevailing weather conditions at the time of spraying. The diary can be used as evidence should spraying activities become contentious.

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## Use integrated pest management principles

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### Recommended management options

- Use integrated pest management practices as much as possible, including strategic grazing, slashing, manual removal, biological control and chemical application.
- Manage retained areas to provide habitat for natural predators of pest insect species.
- Only use chemicals when pest species or weeds reach levels of infestation that will cause irrevocable damage.

## Avoid non-target species or areas

### Recommended management options

- Choose the most appropriate chemicals and application methods for the targeted species (weeds and insects), and to minimise damage to non-target species.
- Establish a chemical free buffer zone between sprayed areas and:
  - sensitive areas such as native vegetation, wetlands and streams, including those on neighbouring properties
  - retained habitat trees.
- Aerial spraying is only suitable when there is low wind, and the direction will not direct spray drift towards any native vegetation and neighbouring properties. Spray drift needs to be avoided.



**Image 3** Ground-based spraying can be necessary during plantation establishment and for ongoing weed control. Care needs to be taken to avoid damage to habitat trees and edges of retained areas.

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# BMP 4 Managing weeds

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*The quickest and easiest way to protect biodiversity?*

Prevent weeds becoming established



Noxious weeds need to be controlled in accordance with the *Noxious Weeds Act*

The spread of weeds identified as new or emerging species, eg Coolatai grass, should be prevented. It can be possible to eradicate new or emerging weeds before they become widespread or established. Utilise an impact management approach where established and/or widespread species, such as lantana, affect sites and surrounding area/s of 'Endangered Ecological Communities' or are recognised as a 'Threatening Process'.

## Assess weed presence

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- Identify weeds present. Determine whether they are new to the area or are established and/or widespread (see the Northern Rivers Invasive Plants Action Strategy for up-to-date lists).
- Determine risk to retained vegetation associated with the species present. For example, the species might be known for smothering vegetation and is therefore a high risk.

## Prevention

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### Recommended management options

#### Monitor

- Monitor regularly for weeds, particularly new & emerging species (and priority weed species as per Northern Rivers Invasive Plants Action Strategy). A visual assessment can be all that's needed.
- Make a record of what you see.
- Establish follow-up treatment based on monitoring results.

#### Maintain weed-unfriendly conditions

- Shade and competition will prevent weed invasion.
- Bare and/or disturbed ground and open, sunny areas are prime sites for weeds to establish. Ensure a mix of native plant types are present including ground cover, understorey and overstorey trees. Overstorey trees are important for providing canopy cover and shade.

## Minimise spread and infestation of priority weeds

- Wash down vehicles or other machinery that have been in weed infested areas before they are moved into clean areas.
- Minimise stock movements through infested areas to clean areas and through areas where weeds are present and fruiting (for example, burs, spear or sticky grass seeds).
- Strategically manage weeds along access tracks, including stock access tracks.

## Control

Control of noxious and environmental weeds is important before any other rehabilitation work, such as fencing or revegetation, is completed.

### Recommended management options

Select the most appropriate weed control method.

- Control method used will depend on:
  - weed species present – determine new/emerging or widespread species
  - access to the infested site/s.
- Control options include: (see *Useful Resources – weeds* for guidance)
  - manual removal, including painting cut stems with herbicide
  - spraying with herbicides (ground or aerial)
  - mechanical methods, such as slashing
  - mulching and smothering
  - competition from native plants
  - fire
  - grazing
  - biological controls (limited options available).



Remember:

Noxious weeds need to be controlled in accordance with the *Noxious Weeds Act* and the weed category control requirements.

### Minimise the risks associated with control

- Some weeds can act as a habitat and a corridor for wildlife therefore removal may need to be gradual. Begin removal from the least infested areas and work towards the denser areas.
- Soil stabilisation controls (e.g. temporary cover crop) may be needed in the interim between weed removal and regeneration of native vegetation.
- Avoid herbicide and /or mechanical methods in or adjacent to waterways and wetlands
- Use precaution during treatments to minimise impacts on non-target species and sensitive species such as amphibians.

## Follow-up treatment

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### Recommended management options

- Weeds regenerate very quickly therefore follow-up treatments are crucial.
- Weeds will regenerate more quickly in areas:
  - where ground cover is less than 70%
  - that are close to wetlands, creeks and or drainage lines
  - where control actions may have left seeds or roots in place. Both allow for fast regeneration.

## Communicate with your neighbours

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Weeds are not usually an isolated problem nor will managing them on one site necessarily be enough to contain the problem. Control and maintenance at a sub-catchment scale is advised.

### Recommended management options

- Working with your neighbours will assist in reducing the spread of weeds and reduce costs.
- Take a collaborative approach when working in areas close to boundary fences.
- Participate in local community groups' weed control activities.



**Image 4 Cat's claw creeper is an increasing problem in riparian areas in the northern rivers region. It grows quickly and smothers native vegetation. Photo: NSW DPI**

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# BMP 5 Managing feral animals

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*The quickest and easiest way to protect biodiversity?*

Prevent feral animals becoming established



The impacts of several feral animals are listed as *Key Threatening Processes* under either State or Commonwealth legislation, or both.

The most common feral animals include wild dogs, foxes, wild pigs, deer, feral cats, rabbits, cane toads and Indian miner birds. This list is not exhaustive and other animals, including insect species, may be found. The *Northern Rivers Catchment Pest Animal Management Strategy* (see Useful Resources – Feral animals for link) provides information about the specific animals likely to be of concern in the region.

## Prevention

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### Recommended management options

#### Monitor

- Monitor regularly for feral animals – look for tracks, scats, paw prints, partial carcasses and damage associated with particular animals, especially new & emerging species and priority widespread species, as per the *Northern Rivers Catchment Pest Animal Management Strategy*.
- Make a record of what you see.
- Talk with neighbouring landholders. Determine if the animals are moving around or becoming established within a specific area.

## Control

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Control of feral animals needs to be considered when numbers are likely to pose a risk to the identified biodiversity assets.

### Recommended management options

- Consult with the relevant Livestock Health and Pest Authority and with neighbours.
- Use methods appropriate for the targeted pest species e.g. trapping, baiting or shooting. A talk with recreational shooting clubs may be appropriate.
- If using poison baits it is essential that risks to non-target species are minimised (see *Useful Resources – feral animals*)

- Utilise containment/eradication methods for identified new/emerging species;
- Identify widespread pest animal species and manage particularly for their impacts to populations or potential habitat of 'Threatened Species'; or for their recognised 'Threatening Process'.
- Minimise cruelty. Consult with RSPCA for guidance.

## **Communicate with your neighbours**

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Feral animals are not usually an isolated problem nor will managing them on one site necessarily be enough to contain the problem. Control and maintenance at a sub-catchment scale is advised.

### **Recommended management options**

- Working with your neighbours will assist in reducing the spread of feral animals and reduce costs.
- Take a collaborative approach when working in areas close to boundary fences.
- Participate in local community groups' feral animal control activities.

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# BMP 6 Managing erosion

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*The quickest and easiest way to protect biodiversity?*

Prevent erosion



Part 4 of the Code details provisions for plantation establishment to prevent erosion

Part 5 of the Code details provisions for roads to prevent erosion

The cost of remediation of soil erosion can be extreme, so all plantation operations should be undertaken to prevent erosion occurring in retained areas.

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## Assess the erosion and the risk it poses

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### Recommended management options

#### Identify the type of erosion that exists

Refer to Table 1 (page 23).

#### Existing soil erosion

Where erosion already exists in authorised plantation areas, it is recommended that an assessment of the erosion be undertaken to determine the risk it poses to biodiversity values in retained areas, including any aquatic habitat they may contain. The results of this assessment will determine what's needed and the priority of any remediation activities.

- Develop an action plan based on the:
  - type of erosion present
  - the risk posed by the erosion (see Step 3 in Section 2)
  - the location of the erosion
  - damage caused or likely to be caused to the biodiversity assets in retained areas if no control measures are implemented.



Remember:

It is often much cheaper and easier to fix erosion problems when they are small

**Table 1. Types of erosion**

Sheet		Slippage or mass movement	
Gully		Tunnel	
Rill			

## Control and prevention

### Recommended management options

#### Manage groundcover in retained areas

- Maintain a minimum of 70% groundcover. To protect the surface from rain drop impact and from water running over the surface, the groundcover would ideally include materials that protect the soil surface both:
  - within 5cm of the surface (grass, leaf litter, mulch, etc)
  - above 5 cm from the surface (ferns, shrubs and trees).
- Manage grazing, or other vegetation management activities to maintain good ground cover (see BMP *Managing the impact of stock*).

#### Manage water flow

- Overland flows and sheet erosion can be reduced by increasing the soil's capacity to absorb water and by slowing water flows. The most effective ways to increase water absorption into soils (in both plantation and retained areas) are to:
  - improve groundcover: vegetation intercepts and slows water so that it has more time to soak in
  - design plantation layout to ensure ripping / mounding, or other water interception works such as roads, direct run-off water to stable drainage depressions or features.

## Remediation

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### Recommended management options

- GET HELP. Erosion control and rehabilitation is a complex issue, and erosion control structures often require engineering design. In moderate and extreme cases it is recommended that expert help be sought to ensure proposed works will be effective and designed and constructed accordingly.
- Restore groundcover on bare areas which may be subject to sheet erosion. Revegetation of both groundcover (pasture) and canopy species may be necessary if natural regeneration does not occur.
- Divert run-off water from erosion areas, such as active gullies, mass movement areas or bare soils. This can be achieved through designing plantation layout to ensure ripping / mounding directs surface water to stable drainage features or through the construction of other diversion works, e.g. graded banks.
- Install appropriate water storage structures where necessary to divert water around active gully heads and restrict the volume of water entering eroded gullies. These can also serve to provide stock watering points and water for fire fighting purposes and can be designed to provide flood detention functions.
- Treat gullies with active bank erosion by reshaping sides to establish a stable grade that can be quickly revegetated and, where necessary, installing grade stabilisation structures in the bed to catch sediment and prevent further bed lowering.
- Restrict stock access completely from areas where remediation works have been undertaken until groundcover has been restored.

## Monitor

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### Recommended management options

- Monitor actual and potential erosion sites regularly. Using photos or diagrams is recommended, particularly following storm events.
- Where erosion has developed as a result of storm events, it should be remediated immediately if assessed as a high risk of becoming worse or degrading biodiversity values.

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# Section 4 Supporting material

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# Appendix 1 Glossary

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<b>A</b>	Acid sulfate soils	A mix of low-lying coastal clays and sands that contain sulfur-bearing compounds at concentrations above 0.05% in clays and 0.01% in sands. These soils become acidified if exposed to air.
	Aerobic	Living or active only in the presence of oxygen.
	Algal bloom	The rapid growth increase of algae in an aquatic ecosystem.
	Alternative watering point	Troughs, tanks or dams providing drinking water for livestock away from creeks or rivers and their associated riparian areas.
	Anaerobic	Not requiring or using free oxygen. Anaerobic organisms usually make use of compounds containing oxygen atoms (i.e. Carbohydrates, nitrates or sulphates) for their metabolism.
	Anoxic	Without oxygen.
<b>B</b>	Best Management Practice (BMP)	An economically viable management practice that has been determined to be the most effective and practical means of preventing or reducing environmental harm.
	Biodiversity	The variety of life forms, the different plants, animals, micro-organisms and the ecosystems they form.
	Biomass	The mass of living organisms, and dead matter such as wood, leaves, and other organic matter.
	Bog	A wet area overlying peat or other soft matter. Bogs often form through the degeneration of lakes or streams.
	Brackish water	A mixture of freshwater and seawater.
	Buffer zone	A strip of vegetated land that is reserved between a potential source of pollution and an area that must be protected from the pollution.
<b>C</b>	Catchment	The area of land that collects rain that then flows into a waterway.
	Clay pan	A compacted layer in the subsoil that is considerably more clayey than the soil above. The clay reduces the vertical water movement through the subsoil and restricts the growth of roots downwards.
	Corridor	A strip of land that is reserved from harvesting to allow wildlife to move through. This prevents population from becoming separated and maintains the genetic pool in the population.
	Crop rotation	The growing of different crops and pastures on the same paddock in annual succession.
	Cultural heritage (Places, objects or items)	Means a relic (as defined in the <i>Heritage Act 1977</i> and in the <i>National Parks and Wildlife Act 1974</i> ) or an Aboriginal place (as defined in the latter Act).

<b>D</b>	Deciduous plants	Dropping all their leaves during autumn, including petals and bark.
	Dissolved oxygen (DO)	Water in a healthy stream has oxygen dissolved in it. Low levels of DO indicate a problem, and may kill fish and other instream micro-organisms, plants and animals.
<b>E</b>	Ecosystem	A community of organisms and the physical environment with which they interact.
	Ecosystem services	The benefits people obtain from natural assets, such as soil, plants, animals, air and water that include provision of clean water, maintenance of biodiversity, liveable climates, pollination, people's cultural, spiritual, intellectual needs and provision of options for future generations.
	Endemic	Regularly or only found in a particular region.
	Environmental Management System (EMS)	A system that is used to manage environmental impacts on a methodical and continuous basis.
	Electrical conductivity	Electrical conductivity unit commonly used to indicate the salinity of water (1 EC = 1 microsiemen per centimetre, measured at 25°C).
	Effluent	Any waste products (whether treated or untreated) that are discharged into the environment.
	Ephemeral	Lasting only a day or a very short time; short-lived; transitory.
	Erosion	The wearing away of the land by running water, rainfall, wind or other geological agents.
	Estuary	The part of a river in which water levels are affected by sea tides, and where fresh water and salt water mix.
	Evapotranspiration	The movement of water from plants to the atmosphere.
<b>F</b>	Fauna	A general term used for animals
	Flora	The general term used for plants.
	Fuel loads	The potential fire risk dependent on native and pest species diversity, and their relationship with slope, climate and weather.
<b>G</b>	Groundcover	A vegetative layer of grasses and or other low lying plants or plant residues providing nutrient filter and protection against erosion.
	Gully erosion	Processes where the removal of soil is characterised by large incised channels in the landscape. The channels are generally more than 30cm in length.
<b>H</b>	Habitat trees	Mature, large trees, with a diameter at breast height (as defined in clause 24 of the code) of more than 40 centimetres that provide a habitat for tree-dwelling fauna.

	Hydrocarbons	Organic molecules containing hydrogen and carbon.
	Hydrosol	Soils that are covered by water either permanently or intermittently.
<b>I</b>	Introduced fish	Fish that are not native and are brought into the country or into a water system that they would not naturally occur within
	Invertebrates	An animal lacking a backbone or spine (i.e. insects, jellyfish, worms, molluscs)
<b>L</b>	Large woody debris	See 'snags'
<b>M</b>	Macro-invertebrates	An invertebrate animal (animal without a backbone) large enough to be seen without magnification.
	Macrophyte	A plant that grows within the stream; may be fully or partly submerged e.g. ribbon weed or reeds.
	Marshes	An area of damp, boggy land, either regularly or permanently under water. Marshes are usually found on flat, poorly drained sites with clayey soils or on gently sloping coasts.
	Mitigate	To lessen the severity of an event i.e. flooding.
	Monosulphuric black ooze (MBO)	Goosey black sediments formed in low oxygen environments. They form on the bottom of drains or where land has been covered with water for long periods of time.
<b>N</b>	Native fish	Fish native to the waters in which they are found
	Native grassland of high conservation value	<p>(a) that has been extensively cleared from the region, is inadequately conserved within it, or is at its geographical limit, and</p> <p>(b) that exhibits one or more of the following features:</p> <p>(i) it is relatively large in area, or is an area that connects two other large areas of native vegetation,</p> <p>(ii) it is in unusually healthy condition (that is, it is in much the same condition, and has much the same species composition and community structure, as may have existed a hundred or more years ago),</p> <p>(iii) it includes a diversity of native species (that is, not just grass species, but a diversity of forbs that grow between the grass tussocks, such as native legumes, orchids, daisies and lilies),</p> <p>(iv) it is a habitat for rare and threatened species of native plants and animals,</p> <p>(v) it has very few weeds and has had only minimal past disturbance from ploughing, spraying or fertilising, and</p> <p>(c) that is determined by the Department (based on the preceding factors and associated surveys) to be native grassland of high conservation value</p>

<b>O</b>	Oxidation	Combination with oxygen, especially of ferrous iron to produce ferric iron (rust). Acid water leached from oxidising acid sulfate soils can cause rust coloured stains and slimes.
<b>P</b>	Parts per million (ppm)	Method of describing small concentrations and means exactly what the term says. Mg per kg is also ppm.
	Patch of woody native vegetation greater than 1 hectare (> 1ha)	An area of woody native vegetation, the existence and boundaries of which are determined in accordance with Schedule 1 of the <i>Plantations and Reafforestation (Code) Regulation 2001</i> .
	Pathogens	A disease-producing fungus, bacterium or other living organism, especially one that is a parasite.
	Perennial plants	A plant that survives for three or more growing seasons, especially flowering plants that produce flowers every year.
	pH	Relative acidity or alkalinity of a liquid or solid and is expressed on a log scale of 0 - 6 (acid) to 8 -14 (alkaline), with 7 being neutral.
	Photo points	A method of monitoring where a photo is taken of the same place intermittently over a period of time to show positive or negative impacts.
	Potential ASS	Acid sulphate soils that have not been exposed to oxygen.
	Property Vegetation Plan (PVP)	A voluntary but legally binding agreement between a landholder and the local Catchment Management Authority (CMA).
	Pugging	Soil damage (compaction) caused by grazing animals when their weight cannot be supported by the soil surface, such as deep footprints of cattle in muddy areas.
<b>R</b>	Rainforest	A closed community dominated by trees which form a two or more layered dense canopy in which lianes and epiphytes are usually conspicuous, and a lower sparse assemblage of smaller trees, shrubs, herbs including ferns.
	Riparian	Of, inhabiting, or situated on, the bank and floodplain of a river, creek or wetland.
	Road	A way that is constructed primarily for vehicles by means of earthworks involving the cut or fill (or both) of the natural surface on the way. A road may include a fire trail if it is so constructed. 'Track' means a way primarily for vehicles that is not constructed.
	Rocky outcrop	Any area of at least 0.2 ha, 70% of the surface of which is comprised of exposed boulders of more than 0.6 of a metre in diameter.
	Routine Agricultural Management Activity	Farming, safety and other activities where clearing of native vegetation does not require approval.

<b>S</b>	Salinity	The amount of mineral salt dissolved in water or existing in solid form. The groundwater table rises due to changes in land use in areas where most rain falls, the salts rise with the water and make the soil saline and unproductive.
	Sheet erosion	The removal of a fairly uniform layer of soil from the land surface by rain
	Snags	Trees and old logs that fall into the water and provide suitable habitat and protection for both big and small native fish. Also known as 'large woody debris'.
<b>T</b>	Terrestrial	A common term used for land based objects or activities.
	Turbidity	The relative clarity of water, which may be affected by material in suspension in the water.
<b>W</b>	Water quality	The chemical, physical and biological condition of water.
	Weed	Any plant growing where it is not native or is unwanted
	Wetland	(a) covered by a shallow body of water (being a body of water that is not the result of unusual flooding, high rainfall, temporary water diversion, or a marked permeability break in the soil profile leading to the development of a perched water table), and (b) inundated cyclically, intermittently or permanently with water, and (c) under normal circumstances, predominantly vegetated with plant communities adapted for life in saturated soil conditions, and (d) characterised by soils that exhibit reducing conditions. Wetlands generally include marshes, billabongs, swamps and sedge lands.
	Wildling	A plantation species growing outside the plantation area

# Appendix 2

## Overview of northern rivers catchment plantation forestry and biodiversity

### The Northern Rivers Catchment

#### Landscape setting

The Northern Rivers region under the auspices of the Northern Rivers Catchment Management Authority (see Figure 6) covers five million hectares, about three million of which still contains native vegetation<sup>1</sup>. The region extends from the northern NSW coast to the escarpment of the Northern Tablelands, and from the Queensland/NSW border southwards to south of Port Macquarie. Freehold land comprises some 60% of the region, with 5% Crown Land, 22% National Park and 12% State Forest<sup>2</sup>.

There are nine major river catchments in the northern rivers region, namely: the Tweed, Brunswick, Richmond, Clarence, Coffs Harbour Waterways, Bellinger, Nambucca, Macleay and Hastings catchments. All nine major catchments have numerous sub-catchments. The major land uses include grazing, cropping, forestry, dairy, horticulture and urban development.

#### Bioregions

The Northern Rivers region is made up of six Bioregions, namely: Murwillumbah, Richmond-Tweed, Woodenbong, Clarence Basin, Nymboida, Manning-Macleay, Southern Coastal Lowlands.

Bioregions are land areas defined by geographical and ecological features and environmental processes<sup>3</sup>. Bioregional information improves our understanding of landscape processes within the catchment by linking information on vegetation hydrology and/or geomorphology and is becoming a standard tool in biodiversity assessment and planning.

A full consideration of bioregional information is beyond the scope of this document, we encourage the reader to access information on the six bioregions from - *The Bioregions of New South Wales: their biodiversity, conservation and history* (see **References**).



Figure 6: Northern Rivers region as defined by the Northern Rivers Catchment Management Authority area.

## Plantation forestry in context

Plantation forests represent less than one per cent of Australia's forests, yet they supply over half of the wood used by domestic wood producers. Although most of these plantations are established on broad acre lots, there has been growing interest in integrating plantations with existing land uses through the establishment of small woodlots, shelter belts and alley belts. This interest is largely driven by the fact that plantations can be established to provide a wide range of values and uses other than wood.

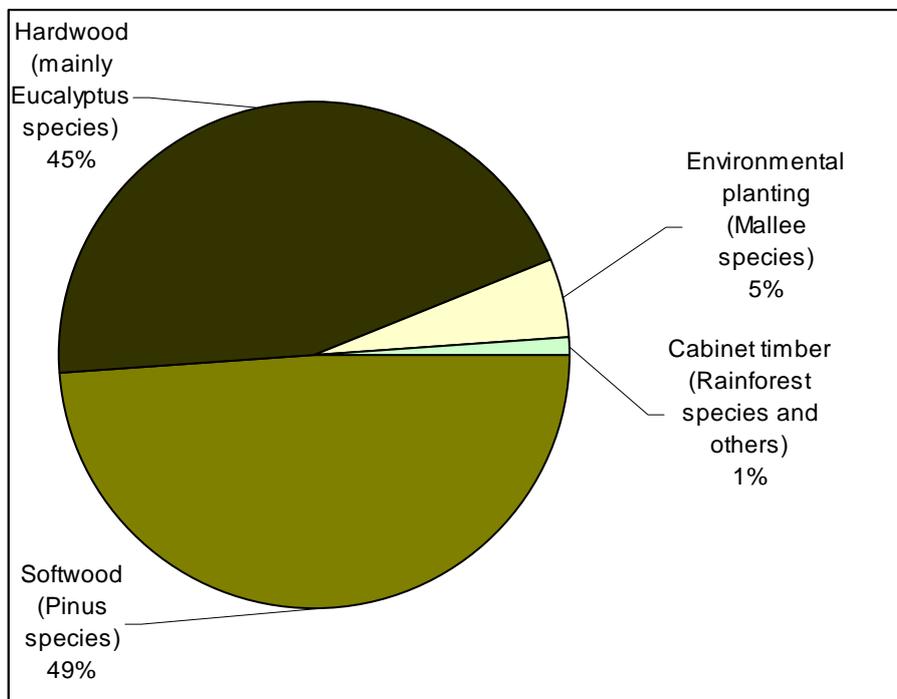


Figure 7. Plantation type in NSW (NSW DPI, 2008)

## Plantations in northern NSW

Plantation resources have rapidly expanded in the North Coast region since 2000. Over 62% of the current plantation resource was planted over the last decade and a large proportion of this was new plantings, rather than replanting. The majority of these new plantings have been hardwood plantations. Hardwoods now comprise 76% of the total plantation area and softwoods 23%, and the remaining 1% mixed species, mostly cabinet timbers<sup>4</sup>.

During the period from December 2001 to 31 March 2009, 352 plantations were authorised, comprising an area of 81,663 ha. The authorised plantation area is comprised of 70,827 ha of plantable area and 10,826 ha of native vegetation to be retained and managed in accordance with the Code. The majority of this area has been established to hardwood (Eucalypt spp). A further significant area was accredited under the *Timber Plantation Harvest Guarantee Act 1994*, however the available data does not provide an accurate figure for this area. Some existing plantations established prior to 1994 have not been registered at this time – they will need to be authorised when proceeding into the next rotation.

### Softwood

Softwood plantations are concentrated in larger blocks, north of Grafton and around Walcha. Plantation area authorised for softwoods since 2001 is 3,632 ha, whilst the area accredited to Forests NSW under TPHG is 40,491 ha. Approximately 48% of the softwood resource comprises southern pine hybrids. Although not planted in the north coast region since 1994, Slash pine (*Pinus elliottii*) represents 17% and loblolly pine (*P.taeda*) 19% of the softwood area. About 10% is radiata pine (all planted since 1995), and another 6% is hoop pine.

## Hardwood

Hardwood plantations are dispersed from the northern NSW coast to the escarpment of the Northern Tablelands, and from the QLD/NSW border southwards. The region has approximately 11,000ha of eucalypts 25 to 40 years old.

Hardwood plantings authorised since 2001 has totalled 62,588 ha, and the area accredited to Forests NSW under TPHG is 23,943 ha. Eucalypt plantings by Forests NSW are comprised mainly of flooded gum (*E. grandis*), blackbutt (*E. pilularis*), blue-leaved stringybark (*E. agglomerata*) and silvertop stringybark (*E. laevopinea*). Eucalypts planted in the last decade include Dunn's white gum (*E. dunnii*- 24%), blackbutt (24%), spotted gums (*Corymbia maculata* and *C. variegata* - 18%), flooded gum (*E. grandis* - 16%), Gympie messmate (*E. cloeziana* - 3%) and shining gum (*E. nitens*- 1%)<sup>Error! Bookmark not defined.</sup>



## Biodiversity

Since European settlement in north-east NSW the biodiversity of the region has been in decline<sup>5</sup>. Conserving the rich biodiversity of the region requires the coordinated involvement of agencies, organisations and individual land owners through implementation of best management practices that will prevent further losses and improve environmental conditions. Good management will increase the capacity for ecosystems and species to survive<sup>Error! Bookmark not defined.</sup>

## Facts about biodiversity in the Northern Rivers

North-east NSW is very diverse and rich in biodiversity. While the region represents only some 7% of the state, it provides habitat for over 40% of NSW's threatened species, including many vegetation types listed as Endangered Ecological Communities. The region also contains a large number of endemic species (species only found in this region). The Border Ranges region of New South Wales and south-eastern Queensland is a biodiversity 'hotspot'. Its richly diverse landscapes and abundant animal and plant species are recognised and valued, and this is reflected in both the levels of protection through legislation and community expectations about good land management practice.

### Plants

Two hundred and two plant species found in the North Coast Bioregion are listed in the schedules of the TSC Act. Of these, 108 are endangered, 89 are vulnerable and 5 are considered extinct in the bioregion<sup>6</sup>. Several of these species are endemic, found no where else except within small areas in this bioregion.

### Animals

One hundred and fifty-seven fauna species recorded in the North Coast Bioregion are listed in the schedules of the TSC Act. Of these, 36 are listed as endangered and 121 are listed as vulnerable.

The subtropical habitats of the North Coast Bioregion are rich in bird diversity, with many endemic species and species with restricted distributions, especially in rainforest habitats where there are also several threatened species. Numbers of grassland species and ground-feeding insectivorous birds, as well as temperate woodland and forest birds, appear to have declined in the bioregion. This decline in forest birds is against the national trend<sup>7</sup>. While rainforest species remain stable, the loss of woodland birds, particularly those sensitive to fragmentation, is likely to continue.

## Wetlands

Eight significant wetlands have been identified in the North Coast Bioregion:<sup>8</sup> Cudgen Lake, the Brunswick River Floodplain, Cumbebin Swamp, Cokora Lagoon, Blue Lake (within Yuraygir National Park), Lake Innes and Grahamstown Lake. An unnamed swamp next to Kalang River in the Nambucca catchment has also been identified as one of the most significant wetlands in the bioregion.

Threats to the wetlands in this bioregion are numerous and include changed drainage patterns from construction of roads, drains and channels, particularly in expanding urban areas. Cudgen Lake in particular is affected by increased flooding because the lake's entrance is permanently open.

# Appendix 3 Relevant legislation

**Disclaimer: The information provided below does not constitute legal advice. It is provided as a general overview only. Legal advice should be sought before any actions are taken that might affect water, soil, air, plants, animals or heritage.**

Plantation forestry operates within a framework of a number of commonwealth, state and local authorities legislative requirements with the primary legislation being the *Plantations and Reforestation Act 1999* (P&R Act) and the *Plantation and Reafforestation (Code) Regulation 2001* (P&R Code). These define what constitutes a plantation, and what management outcomes are required of plantation managers.

It is essential that you contact your local council, NRCMA and relevant state agency (NSW DPI, DECC, etc) before engaging in any activities that may impact upon the retained areas within your plantation. The primary Acts and their associated regulations that apply to plantation forestry management are detailed here.

Clause 56 of the P & R Code underpins this BMP manual. Clause 56(2) states: 'Any retained area must be managed so as to conserve its biodiversity and ecological integrity'. To 'conserve' in this context means to protect and maintain.

Table 2 describes legislation that may be relevant to plantations. This listing is not meant to be inclusive of all potentially relevant legislation. Unless otherwise noted, these are enacted under NSW law. Legislation can be accessed at

- [www.legislation.nsw.gov.au/maintop/scanact/inforce/NONE/0](http://www.legislation.nsw.gov.au/maintop/scanact/inforce/NONE/0) (NSW)
- [www.comlaw.gov.au/](http://www.comlaw.gov.au/) (Commonwealth)

Table 2: **Legislation applicable to plantation forestry in NSW.**<sup>3</sup>

Legislation	Comment
<i>Aboriginal Land Rights Act 1983*</i>	Makes recognition of Aboriginal people's traditional and cultural rights to the land and provides for the vesting of claimable Crown lands in the NSW Aboriginal Land Council or Local Aboriginal Land Councils on the Aboriginal owner's behalf.
<i>Environmental Planning and Assessment Act 1979</i>	Requires assessment of the environmental (and other) effects of activities which are not conducted under an integrated forestry operations approval issued under the <i>Forestry and National Parks Estate Act 1998</i> . This act does not apply to plantations authorised under the <i>Plantations and Reafforestation Act 1999</i> .
<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) is the over arching commonwealth legislation for the protection of biodiversity at species, communities and population levels. It is applicable to all properties within Australia and over-rides State legislation.
<i>Fisheries Management Act 1994*</i>	Provides for the protection of fish habitat, threatened fish species and the maintenance of fish passage through the application of a Fisheries Licence. This Act does not apply to plantations authorised under the <i>Plantations and Reafforestation Act 1999</i> .
<i>Forestry Act 1916</i>	Sets out long-term objectives of conservation and utilisation of timber from government owned plantations. It provides for an adequate supply of timber and protection of environmental values.
<i>Forestry and National Park Estate Act, 1998</i>	Provides for NSW Forest Agreements together with Integrated Forestry Operations Approvals, which integrate the licensing of State Forest forestry operations for a 20-year period.

<sup>3</sup> Modified from *Plantations for Australia: The 2020 Vision*.

Legislation	Comment
<i>Heritage Act 1977*</i>	Provides for the identification and conservation of environmental heritage.
<i>National Parks and Wildlife Act 1974*</i> <i>Threatened Species Conservation Act 1995*</i>	Provides for protection of native species and habitat, especially threatened species, through the application of agreed Conservation Protocols or Codes of Practice and is applicable to all properties within NSW. Provides for the registration and protection of Aboriginal heritage sites. Note that the TSC Act is over-ridden by the Commonwealth EPBC Act.
<i>Native Title Act 1993 (Commonwealth)</i>	Acknowledges native title and provides mechanisms to protect native title interests.
<i>Native Title Act 1994*</i>	Confirms certain rights and ensures NSW law is consistent with actions in the <i>Native Title Act 1993 (Commonwealth)</i> concerning future acts that affect native title.
<i>Native Vegetation Act 2003*</i>	Regulates the clearing of native vegetation (including trees) on private and some Crown lands, by requiring consent or approval as part of a Property Vegetation Plan. This Act is over-ridden by <i>Plantations and Reafforestation Act 1999</i> .
<i>Noxious Weeds Act 1993</i>	Provides for categorisation of noxious weeds and specifies the extent of control required for each category by private and public landholders.
<i>Occupational Health and Safety Act 1983</i>	Legislates for the occurrence of a safe work environment, use of safe equipment and adherence to safe working practices.
<i>Plantations and Reafforestation Act 1999</i>	Provides for the integrated approval and regulation of plantation operations on authorised plantations. Grants right to harvest for authorised plantations. The Act applies to timber and non-timber plantations on State land and private land.
<i>Plantations and Reafforestation (Code) Regulation 2001</i>	Operational guidelines for implementing the intent of the <i>Plantations and Reafforestation Act 1999</i> . All plantations are subject to the Plantations and Reafforestation Code. The owner of a plantation must ensure that their operations are carried out in accordance with this code. The Code provides standards for the protection of biodiversity, water and heritage during the establishment, management and harvesting of plantations <sup>9</sup> .
<i>Protection of the Environment Operations Act 1997.</i>	Provides for the protection of water quality from harvesting through the application of an Environmental Protection Licence and reporting of contaminated sites.
<i>Pesticides Act, 1999</i>	Provides for the use of pesticides (including herbicides) to ensure compliance with label conditions.
<i>Rural Fires Act 1997</i>	Provides for the co-ordinated prevention and suppression of bush fires.
<i>Soil Conservation Act 1938*</i>	Promotes the Department to oversee protection of the State's soil when affected by other agencies, including SFNSW.
<i>Timber Marketing Act 1977</i>	Enacts procedures to ensure appropriate quality in the grading and sale of timber.
<i>Wilderness Act 1987</i>	Provides for the identification, protection and use of wilderness.

\* Indicates the process is integrated into the *Plantations and Reafforestation Act 1999*

## Plans and policies

### State Environmental Planning Policies (SEPPs)

SEPPs are developed under the *Environmental Planning and Assessment Act 1979*. SEPPs likely to be relevant to retained areas within plantation forests include:

- SEPP 14 – Coastal Wetlands
- SEPP 26 – Littoral Rainforests
- SEPP 44 – Koala Habitat Protection

## Local Environment Plans (LEPs) and Development Control Plans (DCPs)

At the local level, on farm development is managed by the Local Council through the application of LEPs and DCPs. Both plans rank lower than SEPPs and REPs. They are however, more specific in terms of spatial controls and the definition of activities that may be permitted without consent, not permitted without consent or not permitted at all. LEPs and DCPs are developed and administered by your local council.

## Regional Environmental Plan (REPs)

REPs address specific issues within a defined region. Generally they are over-ridden by SEPPs. The only REP relevant to plantations within the northern rivers catchment management areas are the North Coast REP.

## Key Threatening Processes and Threat Abatement Plans

Threat Abatement Plans are legislated under either Commonwealth or State legislation. A Threat Abatement Plan is derived from the identification of a Key Threatening Process (KTP) which threatens the survival of native species and / or ecological communities. The Plans provide a framework for landholders to follow to address the impacts of a key threatening processes.

Threat abatement plans will be registered under the EPBC Act (Commonwealth), the Threatened Species Act (NSW) or the Fisheries Management Act (NSW). It is a requirement under these Acts that the relevant Minister review these threat abatement plans every five years<sup>10</sup>.

Relevant Key Threatening Processes include:

- Clearing of native vegetation
- Loss of hollow-bearing trees
- Degradation of native riparian vegetation along New South Wales water courses
- Removal of dead wood and dead trees
- Infection of native plants by *Phytophthora cinnamomi*
- Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams
- Invasion and establishment of exotic vines and scramblers
- Invasion of native plant communities by bitou bush & boneseed
- Invasion of native plant communities by exotic perennial grasses
- Invasion, establishment and spread of *Lantana camara*
- Competition and grazing by the feral European rabbit
- Competition and habitat degradation by feral goats
- Loss and/or degradation of sites used for hill-topping by butterflies

Relevant Threat Abatement Plans include:

- Removal of large woody debris from NSW rivers and streams
- Competition and land degradation by unmanaged goats
- Competition and land degradation by rabbits
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)

# Appendix 4 Monitoring

## Photo-points

Photopoint monitoring is a technique used to record change in an area or thing, usually by taking photographs of it over time.

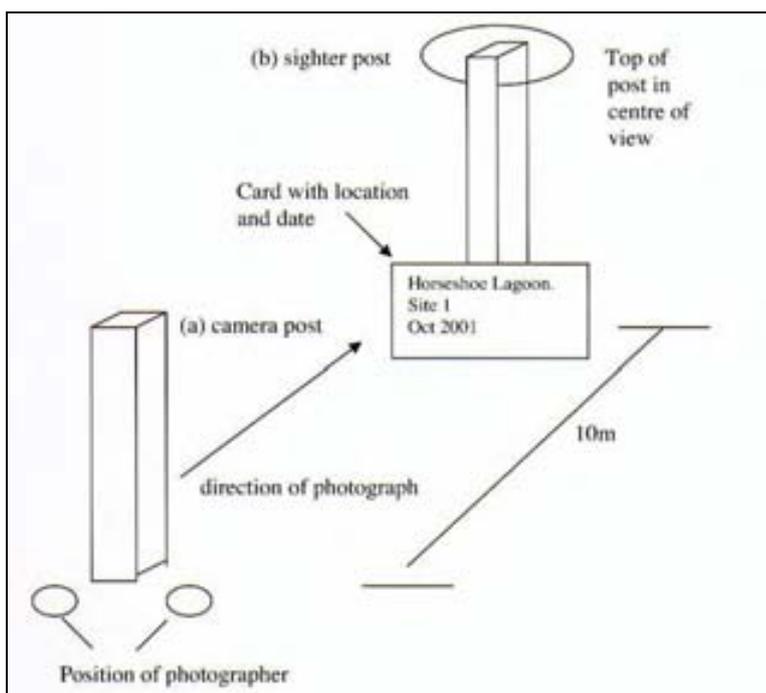
The benefits of using photopoints include:

- more accurate and longer lasting record of visible detail
- simple, quick, portable and inexpensive
- little technical skill needed
- low impact
- low measurement error and variation
- potential to store electronically and link to site records
- may provide information about change in indicator in response to management change (e.g. fencing) or major events (e.g. fire)

There are disadvantages, however. These include:

- may only detect changes large enough to see by eye from the camera position
- can measure apparent change in the number and size of something, but is limited in terms of providing actual numbers
- may not provide any evidence of cause of change in the site or thing of interest
- interpretation requires other data to also be collected, such as the date and time of photograph.

If the use of photopoints is suitable for what you want to measure, then it is a very useful monitoring technique. How to set up a photopoint is illustrated below.



**Figure 8** Setting up photo points can be as simple as putting two posts in the ground. Source: Murray Wetlands Working Group (2003).

# SAMPLE RETAINED AREAS ASSESSMENT FORM

Date:.....

Property Address:

Lot/ DP:

Site description:

(where the assessment is taking place)

Photopoint  Yes  No

Assessment method  Visual

Walk through Direction ..... Distance .....

## ASSESSMENT OF WHAT IS PRESENT

### Native Vegetation

Canopy layer	Growth Form	Main species present and density (Dominant (D), Scattered (S), Isolated plant (I))
Upper Canopy	Tree <input type="checkbox"/> Vine <input type="checkbox"/>	
Understory	Tree <input type="checkbox"/> Shrub <input type="checkbox"/>	
Groundcover	Grass <input type="checkbox"/> Sedge/Rush <input type="checkbox"/> Fern <input type="checkbox"/>	
<b>Threatened Species</b> Present <input type="checkbox"/> <b>Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Unknown</b> <input type="checkbox"/>		
Species and distribution (dense / scattered / isolated plant)		

## Non-Native Vegetation

<b>Species</b> <b>Weed Status</b> Noxious (N)    Environmental (E)    Not a weed (X) <b>Density</b> (Dominant (D)    Scattered (S)    Isolated plant (I)	
Trees	
Shrubs	
Grasses	

## Habitat Features

<input type="checkbox"/> Standing dead trees <input type="checkbox"/> Fallen hollow logs (hollows > 5cm diameter)	<input type="checkbox"/> Trees with hollows Small hollows < 15cm <input type="checkbox"/> Large hollows	<input type="checkbox"/> Flowering trees/shrubs eg Banksias - loose rock and rocky outcrops Loose barked trees <input type="checkbox"/> Mistletoe <input type="checkbox"/> Caves/Rocks	<b>Streams</b> <b>Wetlands / bogs</b> <input type="checkbox"/> Permanent water <input type="checkbox"/> Temporary water
---	---	--	--

## Evidence of disturbance

Grazing	Weeds	Feral animals	Logging
<input type="checkbox"/> None apparent <input type="checkbox"/> Moderate <input type="checkbox"/> Heavy	<input type="checkbox"/> None/few visible <input type="checkbox"/> Locally common <input type="checkbox"/> Abundant	<input type="checkbox"/> None visible/few signs <input type="checkbox"/> Locally common <input type="checkbox"/> Abundant	<input type="checkbox"/> None visible/few stumps <input type="checkbox"/> Conspicuous <input type="checkbox"/> Extensive

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**Fire**

- |                                 |                          |                       |
|---------------------------------|--------------------------|-----------------------|
| No evidence of recent fire      | <input type="checkbox"/> |                       |
| Evidence of recent light fire   | <input type="checkbox"/> |                       |
| Evidence of recent intense fire | <input type="checkbox"/> | Description of damage |

**Soil Erosion**

- |                                |                          |   |
|--------------------------------|--------------------------|---|
| No evidence of soil erosion    | <input type="checkbox"/> | Types of erosion observed:                      |
| Evidence of minor soil erosion | <input type="checkbox"/> | Sheet <input type="checkbox"/>                  |
| Evidence of major soil erosion | <input type="checkbox"/> | Rill <input type="checkbox"/>                   |
|                                |                          | Gully <input type="checkbox"/>                  |
|                                |                          | Mass movement/landslip <input type="checkbox"/> |
|                                |                          | Tunnel <input type="checkbox"/>                 |

**Cultural heritage**

- |                                 |
|---------------------------------|
| Evidence of Aboriginal heritage |
| Description                     |
| <br>                            |
| Evidence of European heritage   |
| Description                     |

**Other distinguishing features or issues**

# Appendix 5 Issues for retained areas

Sometimes the first indication that there may be an issue that needs attention is when you observe something occurring within the retained native vegetation area. What might not be clear is what's causing it. Table A1 offers some assistance to link what's observed to possible causes and to the appropriate BMP if needed.

Table A2 provides a link between an activity, such as grazing or harvesting, and the issues that might arise for retained areas.

**Table A3 Links between what's observed, possible causes and potential action**

Observed	Possible cause	Severity	Action
Algal bloom	<ul style="list-style-type: none"> <li>excess nutrient entering the waterway</li> <li>altered water regime</li> </ul>	<input type="checkbox"/> Minor	Monitor for change
		<input type="checkbox"/> Moderate	BMP Managing the impacts of stock
		<input type="checkbox"/> Severe	
Contamination	<ul style="list-style-type: none"> <li>chemical contamination</li> <li>stock effluent associated with stock use of the wetland for grazing and/or water</li> </ul>	<input type="checkbox"/> Minor	Identify source Monitor for change
		<input type="checkbox"/> Moderate	BMP Managing spray drift
		<input type="checkbox"/> Severe	BMP Managing the impacts of stock
Decline in birds and other wildlife	<ul style="list-style-type: none"> <li>loss of suitable habitat (shelter, food and water) due to vegetation damage caused by stock or feral animals</li> <li>increase in contaminants, either sediment or pollutants (including excess nutrients),</li> <li>loss of vegetation due to weed infestation</li> <li>inappropriate fire regime</li> <li>introduction of pathogens or disease through site machinery or equipment</li> </ul>	<input type="checkbox"/> Minor	Monitor for change
		<input type="checkbox"/> Moderate	BMP Managing the impacts of stock
		<input type="checkbox"/> Severe	BMP Managing feral animals BMP Managing weeds BMP Managing fire
Decline in soil structure	<ul style="list-style-type: none"> <li>inappropriate harvesting</li> <li>inappropriate stock access</li> <li>vehicle movement</li> </ul>	<input type="checkbox"/> Minor	Monitor for change Ensure stock and vehicles kept out of wet areas, especially after flooding
		<input type="checkbox"/> Moderate	BMP Managing the impacts of stock
		<input type="checkbox"/> Severe	BMP Managing erosion
Erosion	<ul style="list-style-type: none"> <li>over grazing</li> <li>drought</li> <li>insufficient ground cover</li> <li>catastrophic damage (eg storm, flooding)</li> </ul>	<input type="checkbox"/> Minor	Monitor for change
		<input type="checkbox"/> Moderate	BMP Managing the impacts of stock
		<input type="checkbox"/> Severe	BMP Managing erosion Seek expert advice

Observed	Possible cause	Severity	Action
Acid sulfate soils and / or Monosulfidic black ooze	<ul style="list-style-type: none"> <li>exposure of acid sulfate soils</li> <li>altered water regime</li> </ul>	<input type="checkbox"/> Minor	Monitor for change Adopt managed floodplain drainage practices
		<input type="checkbox"/> Moderate <input type="checkbox"/> Severe	Seek expert advice
Pugging	<ul style="list-style-type: none"> <li>grazing when wet</li> <li>grazing / stock camps too close to waterways or wetlands</li> <li>presence of feral pigs</li> </ul>	<input type="checkbox"/> Minor	Monitor for change
		<input type="checkbox"/> Moderate <input type="checkbox"/> Severe	BMP Managing the impacts of stock BMP Managing feral animals
Vegetation decline or degradation	<ul style="list-style-type: none"> <li>over- or inappropriate grazing by stock or feral animals</li> <li>inappropriate use of spraying</li> <li>weed infestation (including invasion of plantation seedlings ('wildlings'))</li> <li>inappropriate or catastrophic fire</li> </ul>	<input type="checkbox"/> Minor	Monitor for change
		<input type="checkbox"/> Moderate <input type="checkbox"/> Severe	BMP Managing the impacts of stock BMP Managing feral animals BMP Managing spray drift BMP Managing weeds BMP Managing fire
Weed infestation	<ul style="list-style-type: none"> <li>loss of native vegetation or groundcover</li> <li>inappropriate grazing</li> <li>vehicle movement</li> </ul>	<input type="checkbox"/> Minor	Monitor for change Work with neighbours for coordinated control and prevention
		<input type="checkbox"/> Moderate <input type="checkbox"/> Severe	BMP Managing the impacts of stock BMP Managing weeds BMP Managing fire

**Table 4 Links between uses, possible impacts and threats to biodiversity**

Use	Possible negative impacts	Possible threat to biodiversity
Grazing	<p>On-site:</p> <ul style="list-style-type: none"> <li>• pugging of soil (cattle disturb soil much more than sheep)</li> <li>• soil compaction and erosion, especially associated with camp areas and watering points</li> <li>• defecation in and around the water leading to excess nutrients</li> <li>• damage to vegetation, especially in and around drainage features and wetlands</li> <li>• weed incursion</li> <li>• reduced water quality and stock health issues from drinking poor quality water</li> <li>• loss of vegetation cover</li> </ul> <p>Off-site:</p> <ul style="list-style-type: none"> <li>• poor water quality (increased turbidity, nutrients and salinity)</li> <li>• loss of in-stream habitat</li> <li>• changes to river channel shape and silting of rivers and creeks</li> </ul>	<p>Erosion</p> <p>Decline in soil structure</p> <p>Contamination</p> <p>Algal bloom</p> <p>Vegetation damage</p> <p>Weed infestation</p> <p>Loss of species (plant or animal)</p>
Timber harvesting (Not permitted in retained areas)	<ul style="list-style-type: none"> <li>• loss of animal habitat</li> <li>• damage to habitat trees</li> <li>• erosion through loss of groundcover and soil disturbance</li> <li>• sedimentation of drainage features and waterways</li> </ul>	<p>Loss of species (plant or animal)</p> <p>Vegetation damage</p> <p>Erosion</p> <p>Acid sulfate soil exposure</p>
Tracks and access ways	<ul style="list-style-type: none"> <li>• erosion and sedimentation</li> <li>• spread of weeds</li> <li>• stock access leading to nutrients, pugging, erosion</li> <li>• access for feral animals</li> <li>• degradation of fish habitat through inappropriate waterway crossings, erosion and sedimentation occurring upstream of the retained area</li> </ul>	<p>Erosion</p> <p>Weed infestation</p> <p>Vegetation damage</p> <p>Pest species invasion</p> <p>Loss of fish passage and habitat</p>

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# Appendix 6 Useful Resources

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See also the resources sections for each of the BMP topics which follow

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## General

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### Organisations

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Northern Rivers Plantation Forestry	6672 2770	<a href="http://www.privateforestry.org.au/">www.privateforestry.org.au/</a>
NSW State Forests	6640 1600	<a href="http://www.dpi.nsw.gov.au/forests">www.dpi.nsw.gov.au/forests</a>
NSW Department of Primary Industries (Plantations)	6626 1200	<a href="http://www.dpi.nsw.gov.au">www.dpi.nsw.gov.au</a>
Department of Environment and Climate Change		<a href="http://www.environment.nsw.gov.au">www.environment.nsw.gov.au</a>
Department of Planning – Heritage Branch		<a href="http://www.heritage.nsw.gov.au">www.heritage.nsw.gov.au</a>
Northern Rivers Catchment Management Authority	6642 0622	<a href="http://www.northern.cma.nsw.gov.au/">www.northern.cma.nsw.gov.au/</a>

### Websites

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#### Threatened species

For a full list of the threatened species, endangered populations and endangered ecological communities listed under the NSW *Threatened Species Conservation (TSC) Act 1995*, along with detailed information about them, the threats to their survival and suggested management actions to help protect them, go to: [www.threatenedspecies.environment.nsw.gov.au/tsprofile/](http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/)

To view a list of Key Threatening Processes listed under the TSC Act, along with a detailed description, go to:

[www.threatenedspecies.environment.nsw.gov.au/tsprofile/home\\_threats.aspx](http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/home_threats.aspx)

[www.threatenedspecies.environment.nsw.gov.au/tsprofile/pas\\_ktp.aspx](http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/pas_ktp.aspx)

In NSW, threatened aquatic species and ecological communities are listed under the Fisheries Management (FM) Act 1994. To view a full list and detailed descriptions go to:

[www.fisheries.nsw.gov.au/threatened\\_species/general/what\\_is\\_currently\\_listed](http://www.fisheries.nsw.gov.au/threatened_species/general/what_is_currently_listed)

[www.dpi.nsw.gov.au/fisheries/species-protection/species-conservation/what-current#Key-threatening-processes](http://www.dpi.nsw.gov.au/fisheries/species-protection/species-conservation/what-current#Key-threatening-processes)

Nationally threatened species and ecological communities are listed under the Federal Environment Protection and Biodiversity Conservation (EPBC) Act 1999. To view a full list and further information go to:

[www.deh.gov.au/cgi-bin/sprat/public/sprat.pl](http://www.deh.gov.au/cgi-bin/sprat/public/sprat.pl)

To view a list of Key Threatening Processes listed under the EPBC Act, along with a detailed description, go to:

[www.environment.gov.au/cgi-bin/sprat/public/publicgetkeythreats.pl](http://www.environment.gov.au/cgi-bin/sprat/public/publicgetkeythreats.pl)

<http://www.environment.nsw.gov.au/biodiversity/nrrbiomanagemntplan.htm>

[www.environment.gov.au/biodiversity/threatened/tap-approved.html](http://www.environment.gov.au/biodiversity/threatened/tap-approved.html)

For information specific to northern rivers:

[www.northern.cma.nsw.gov.au/programmes\\_biodiversity.php](http://www.northern.cma.nsw.gov.au/programmes_biodiversity.php)

### **Natural resources**

Natural Resources Management Advisory Notes for Landholders

[www.environment.nsw.gov.au/cpp/LandholderNotes.htm](http://www.environment.nsw.gov.au/cpp/LandholderNotes.htm)

Planning for Biodiversity Management – a kit for landholders

[www.environment.nsw.gov.au/cpp/PlanningBiodiversityManagement.htm](http://www.environment.nsw.gov.au/cpp/PlanningBiodiversityManagement.htm)

### **Cultural heritage**

Australian heritage database [www.environment.gov.au/heritage/places/nsw/index.html](http://www.environment.gov.au/heritage/places/nsw/index.html)

### **Legislation**

Environmental Defenders Office (NSW) [www.edo.org.au](http://www.edo.org.au)

Legislation applying to NSW can be found at [www.legislation.nsw.gov.au/](http://www.legislation.nsw.gov.au/)

Legislation applying to all states can be found at [www.austlii.edu.au](http://www.austlii.edu.au)

## **Publications**

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*Grasses of the North Coast of NSW*. By Rose, H., Rose, C., and Campbell, T. (2006) Department of Primary Industries, Sydney.

*Policy and guidelines for aquatic habitat management and fish conservation* NSW DPI, available at: [www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-and-manuals](http://www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-and-manuals)

*Policy and guidelines: fish-friendly waterway crossings* NSW DPI, available at: [www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-and-manuals](http://www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-and-manuals)

*Climate Change in Australia: technical report 2007*. This report provides the currently most up to date assessment of Australia's changing climate. Available: [www.climatechangeinaustralia.gov.au/](http://www.climatechangeinaustralia.gov.au/)

*Indigenous heritage: frequently asked questions*, Department of the Environment and Water Resources, Factsheet 2007, available at [www.environment.gov.au/heritage/publications/about/pubs/indigenous-faq.pdf](http://www.environment.gov.au/heritage/publications/about/pubs/indigenous-faq.pdf)

*Natural heritage: frequently asked questions*, Department of the Environment and Water Resources, Factsheet 2007, available at [www.environment.gov.au/heritage/publications/about/pubs/natural-faq.pdf](http://www.environment.gov.au/heritage/publications/about/pubs/natural-faq.pdf)

*Managing Wetlands in Your Property – Inland NSW: Guidelines* by McKeon, J., Richardson, K. and Dunn, I. (eds) (2002) Prepared for the NSW State Wetland Advisory Committee, Department of Land and Water Conservation.

Northern Rivers Catchment Action Plan (NRCMA), available at [www.nrcma.nsw.gov.au](http://www.nrcma.nsw.gov.au)

Draft Northern Rivers Regional Biodiversity Management Plan (DECC in prep.)

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# Useful Resources – stock

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## Organisations

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NSW Department of Primary Industries	6626 1200	<a href="http://www.dpi.nsw.gov.au">www.dpi.nsw.gov.au</a>
Meat and Livestock Australia:	9463 9333	<a href="http://www.mla.com.au/default.htm">www.mla.com.au/default.htm</a>
NSW Farmers	8251 1700	<a href="http://www.nswfarmers.org.au">www.nswfarmers.org.au</a>
Livestock Health and Pest Authority		<a href="http://www.lhpa.org.au">www.lhpa.org.au</a>
North Coast	6621 2317	
Mid Coast	6562 7822	

## Websites

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## Publications

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Grasses of the North Coast of NSW (2006). Rose, H, Rose, C, and Campbell, T. NSW Department of Primary Industries and Northern Rivers Catchment Management Authority.

*How do water regime and grazing alter the reproductive capacity of aquatic plants?* Brock, M. A. (2000). LWRRDC, University of New England, DLWC & EA.

*Livestock Grazing in Wetlands. Implications for Management.* Department of Conservation and Natural Resources (1993). Draft Technical Paper. Melbourne.

*Stock and Waterways : a Manager's Guide.* Land and Water Australia 2006  
<http://products.lwa.gov.au/products/PR061132>

*Nutrients in rural waterways.* Department of Environment and Climate Change.  
<https://www.dec.nsw.gov.au/envirom/nutrient.htm>

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# Useful Resources – fire

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## Organisations

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NSW Rural Fire Service                      66432532                      [www.rfs.nsw.gov.au](http://www.rfs.nsw.gov.au)

## Websites

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Understanding fires:

[www.environment.nsw.gov.au/fire/howafirebehaves.htm](http://www.environment.nsw.gov.au/fire/howafirebehaves.htm)

[www.environment.nsw.gov.au/fire/fireandthenswbush.htm](http://www.environment.nsw.gov.au/fire/fireandthenswbush.htm)

<http://www.environment.nsw.gov.au/threatenedspecies/EcologicalConsequencesFiresKTPListing.htm>

[http://www.environment.nsw.gov.au/soe/soe2006/chapter6/chp\\_6.5.htm#c19.94](http://www.environment.nsw.gov.au/soe/soe2006/chapter6/chp_6.5.htm#c19.94) (for fire frequencies for different vegetation types to protect biodiversity)

For a range of information and guidelines about fires and fire fighting, see [www.dpi.nsw.gov.au/agriculture/emergency/bushfire](http://www.dpi.nsw.gov.au/agriculture/emergency/bushfire)

## Publications

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*Hotspots Fire Project, Fire and Grazing in the Northern Rivers Region*, Watson, P (2006), Nature Conservation Council of NSW. Available from:

[http://nccnsw.org.au/index.php?option=com\\_content&task=view&id=1459&Itemid=714](http://nccnsw.org.au/index.php?option=com_content&task=view&id=1459&Itemid=714)

*Bush Firewise – trees and fire resistance regeneration and care of fire-damaged trees*, NSW Rural Fire Service.

*Bushfire preparedness*, NSW DPI Primefact 403 (2006) Available at:

[www.dpi.nsw.gov.au/agriculture/emergency/bushfire/preparedness/bushfire-preparedness](http://www.dpi.nsw.gov.au/agriculture/emergency/bushfire/preparedness/bushfire-preparedness)

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# Useful Resources – chemical use

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## Organisations

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NSW Department of Primary Industries

6626 1200

[www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au)

NSW Department of Environment and climate  
Change

[www.environment.nsw.gov.au/home.htm](http://www.environment.nsw.gov.au/home.htm)

## Websites

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*Pest Genie* is a database specialising in plant protection and animal health products:

[www.pestgenie.com.au/](http://www.pestgenie.com.au/)

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is an Australian government authority responsible for the assessment and registration of pesticides and veterinary medicines and their regulation up to and including the point of retail sale: [www.apvma.gov.au/](http://www.apvma.gov.au/)

## Publications

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*Spray Sense No 16 – What pesticides can I use?* NSW Department of Primary Industries, Orange.

*Water Notes: Herbicide Use in Wetlands* by Taman, L (2001) *WN22 April 2001*. Water and Rivers Commission, W.A. Sourced 20/08/07 from

<http://www.amlnrm.sa.gov.au/LinkClick.aspx?fileticket=GWUWvYj1hS4%3D&tabid=548>

*Guidelines for Safe and Effective Herbicide Use Near Water* by Noble, M. (2002) Tasmanian Department of Primary Industries, Water and Environment Publication. Sourced 20/08/07 from

<http://www.environment.tas.gov.au/downloads/HerbicideGuidelines.pdf>

*Herbicides: guidelines for use in and around water* Cooperative Research Centre for Australian Weed Management. Sourced, 21/08/07 from

[http://www.weeds.crc.org.au/documents/gl01\\_herbicides\\_water.pdf](http://www.weeds.crc.org.au/documents/gl01_herbicides_water.pdf)

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# Useful Resources – weeds

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## Organisations

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Northern Rivers Catchment Management Authority	66420622	<a href="http://www.nrcma.nsw.gov.au">www.nrcma.nsw.gov.au</a>
NSW Livestock Health and Pest Authority		<a href="http://www.lhpa.org.au/">www.lhpa.org.au/</a>
North Coast	66212317	
Mid Coast	6562 7822	
NSW Department of Primary Industries	6626 1200	<a href="http://www.dpi.nsw.gov.au">www.dpi.nsw.gov.au</a>
Far North Coast Weeds County Council	6623 3833	<a href="http://www.fncw.nsw.gov.au">www.fncw.nsw.gov.au</a>
North Coast Weeds Advisory Committee		<a href="http://www.northcoastweeds.org.au">www.northcoastweeds.org.au</a>

## Websites

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Noxious Weeds Database: <http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed>

NSW Department of Primary Industries  
[www.dpi.nsw.gov.au/agriculture/farm/pest-weeds-management/weeds](http://www.dpi.nsw.gov.au/agriculture/farm/pest-weeds-management/weeds)

NSW Livestock Health and Pest Authority [www.lhpa.org.au/](http://www.lhpa.org.au/)

Weeds in Australia (Commonwealth Government sites)  
[www.weeds.gov.au/](http://www.weeds.gov.au/) and [www.weeds.org.au/](http://www.weeds.org.au/)

Noxious weed declarations in NSW [www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed](http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed)

## Publications

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Northern Rivers Invasive Plants Action Strategy (2008). Dr Meri Oakwood for NRCMA. Available from [http://www.nrcma.nsw.gov.au/programmes\\_biodiversity.php](http://www.nrcma.nsw.gov.au/programmes_biodiversity.php)

*Riparian Land Management Technical Guidelines*, Volume 2, Land and Water Australia, Canberra.

For a range of weed related publications, see [www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/publications](http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/publications)

*Weed strategies following drought, fire and flood*, NSW DPI Primefact 372 (2007) Available at: [www.dpi.nsw.gov.au/agriculture/emergency/bushfire/pasture-weeds/weed-strategies](http://www.dpi.nsw.gov.au/agriculture/emergency/bushfire/pasture-weeds/weed-strategies)

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# Useful Resources – feral animals

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## Organisations

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Northern Rivers Catchment Management Authority	66420622	<a href="http://www.nrcma.nsw.gov.au">www.nrcma.nsw.gov.au</a>
NSW Livestock Health and Pest Authority		<a href="http://www.lhpa.org.au/">www.lhpa.org.au/</a>
North Coast	6621 2317	
Mid Coast	6562 7822	
NSW Department of Primary Industries	6626 1200	<a href="http://www.dpi.nsw.gov.au">www.dpi.nsw.gov.au</a>

## Websites

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Codes of Practice and Standard Operating Procedures for the humane capture, handling and destruction of terrestrial pest animals:

- [www.environment.gov.au/biodiversity/invasive/publications/humane-control/](http://www.environment.gov.au/biodiversity/invasive/publications/humane-control/)
- [www.dpi.nsw.gov.au/aboutus/resources/majorpubs/guides/humane-pest-animal-control](http://www.dpi.nsw.gov.au/aboutus/resources/majorpubs/guides/humane-pest-animal-control)

NSW DPI

- [www.dpi.nsw.gov.au/agriculture/pests-weeds/vertebrate-pests](http://www.dpi.nsw.gov.au/agriculture/pests-weeds/vertebrate-pests)
- [www.dpi.nsw.gov.au/fisheries/pests-diseases](http://www.dpi.nsw.gov.au/fisheries/pests-diseases)

Invasive Animals Cooperative Research Centres: [www.invasiveanimals.com/](http://www.invasiveanimals.com/)

Feral animal management in Australia:

- [www.feral.org.au/](http://www.feral.org.au/)
- [www.daff.gov.au/brs/land/feral-animals/management](http://www.daff.gov.au/brs/land/feral-animals/management)

## Publications

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*Northern Rivers Pest Animal Management Strategy 2008-2013 for terrestrial, freshwater and estuarine ecosystems* (2008) Northern Rivers Catchment Management Authority. Available at [http://northern.cma.nsw.gov.au/publications\\_project\\_report\\_library.php](http://northern.cma.nsw.gov.au/publications_project_report_library.php).

NSW DPI (2008) *NSW Invasive Species Plan 2008-2015*, available [www.dpi.nsw.gov.au/agriculture/pests-weeds/nsw-invasive-species-plan](http://www.dpi.nsw.gov.au/agriculture/pests-weeds/nsw-invasive-species-plan).

NSW DPI *Monitoring techniques for vertebrate pests*, available: [www.dpi.nsw.gov.au/agriculture/pests-weeds/vertebrate-pests/general/monitoring-techniques](http://www.dpi.nsw.gov.au/agriculture/pests-weeds/vertebrate-pests/general/monitoring-techniques)

*Primefact 502 – Best practice pest animal management* by Braysher, M. and Saunders, G. (2007). NSW Department of Primary Industries. Orange.

*Mosquitoes and mosquito-borne disease in south eastern Australia* by Russell R.C. (1993) Department of Medicine, University of Sydney.

*Development of a model code of practice and standard operating procedures for the humane capture, handling or destruction of feral animals in Australia* by Sharp, T. and Saunders, G. (2004), Final report for the Australian Government Department of the Environment and Heritage.

*Vertebrate Pest Control Manual 2008*. NSW DPI. Available from the DPI Bookshop (cost \$35.00).

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# Useful Resources – soil conservation

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## Organisations

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Northern Rivers Catchment Management Authority	66420662	<a href="http://www.nrcma.nsw.gov.au">www.nrcma.nsw.gov.au</a>
NSW Department of Primary Industries	6626 1200	<a href="http://www.dpi.nsw.gov.au">www.dpi.nsw.gov.au</a>

## Websites

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NSW DPI soil health [www.dpi.nsw.gov.au/agriculture/resources/soils](http://www.dpi.nsw.gov.au/agriculture/resources/soils)

## Publications

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*Saving Soil – A Landholders Guide to Preventing and Repairing Soil Erosion* (2009). NSW Department of Primary Industries & Northern Rivers Catchment Management Authority. Can be downloaded from <http://www.dpi.nsw.gov.au/agriculture/resources/soils/erosion/saving-soil>

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- <sup>2</sup> Northern Rivers Catchment Management Authority 2008, 'The Northern Rivers Region', [http://northern.cma.nsw.gov.au/region\\_your\\_region.php](http://northern.cma.nsw.gov.au/region_your_region.php) [Accessed 04/12/2008]
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- <sup>6</sup> <http://www.environment.nsw.gov.au/bioregions/NorthCoast-Biodiversity.htm> accessed 6 April 2009
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- <sup>8</sup> Australian Terrestrial Biodiversity Assessment 2002 in <http://www.environment.nsw.gov.au/bioregions/NorthCoast-Biodiversity.htm> accessed 6 April 2009
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- <sup>20</sup> Rose, H., Rose, C., and Campbell, T. (2006) *Grasses of the North Coast of NSW*. Department of Primary Industries, Sydney.

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# Best Management Practices for retained areas in forestry plantations

