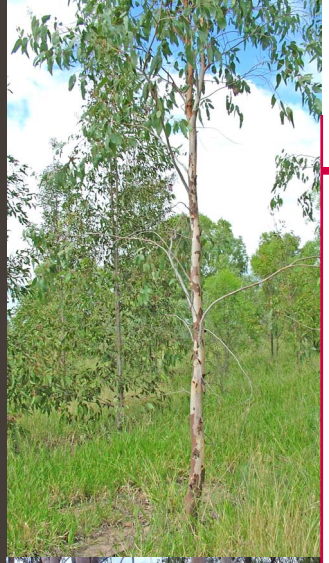
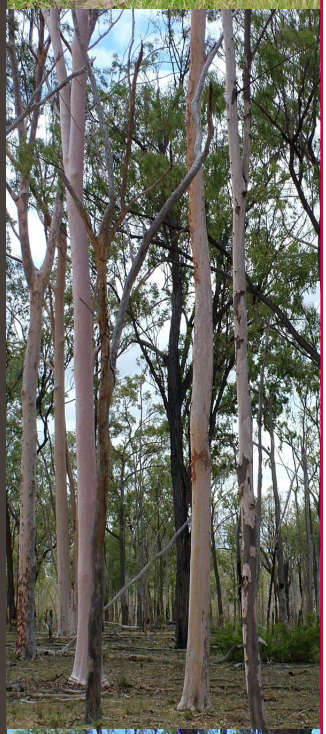
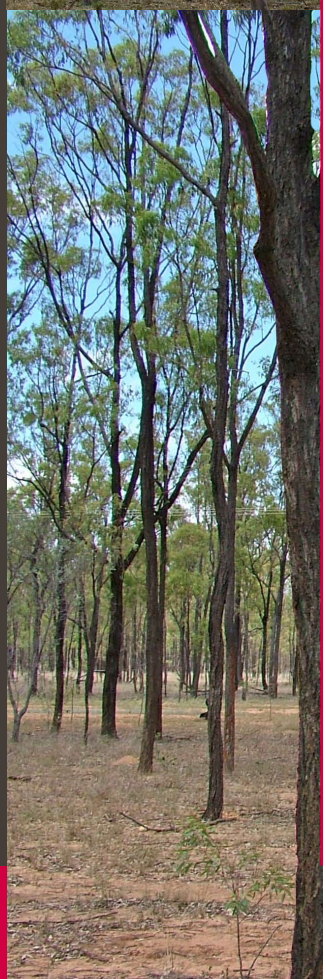






The role of trees in intensive agricultural systems

Trees and agroforestry type systems are typically adopted in central Queensland as a means to diversify a rural enterprises production portfolio such as fodder production or timber forestry. However, currently little thought is given to using these tree based systems for uses other than diversified income, such as spray, odour, noise and nutrient buffers.

A Buffer zone is an area of land with a primary function of minimising off site affects. Buffer zones are usually established adjacent to intensive agricultural activities, such as intensive livestock, high input broad acre crops and horticultural crops, where neighbouring land has potential to be adversely affected by the off site impacts caused by some elements of production.

Buffer zones are typically areas of natural vegetation or planted forests. Pastures or open ground can also be used as buffers, but are less effective means of intercepting nutrients, or controlling odours, as buffers with deep roots are required to intercept nutrients and tall buffers are needed to control odours.

Vegetative buffers (i.e. the natural vegetation and planted forests) provide excellent protection, while only utilising a small portion of land. For example, in Queensland, a vegetative spray buffer of 40 m is considered to do the same job as a non vegetated spray buffer (or open ground) of 300 m.

While buffer zones can achieve multiple outputs, they can be specifically designed for a task that is most pertinent to the proposed location. For example a buffer zone may be established purely to minimise chemical spray drift. This buffer zone may also function to help capture excess nutrient loads in the soil from moving off site.

The role of trees as buffer zones for capturing spray drift, odour, nutrients and protecting farm enterprises is further explained below.

Spray drift buffer zones

Vegetative spray drift buffer zones are established close to crops to capture chemical (pest, herb and fungicide) spray drift that even when applied with the greatest care can still drift off site.

Potential for use

These buffer zones are appropriate where horticultural and broad acre crops are managed using chemicals that are applied in a spray form, either from the air or ground. They are usually created around the edge of the crop in question, usually aligned across the prevailing wind path.

How it works

When chemicals are applied in spray form, some of the droplets can become caught in the wind/ breeze and become separated from the target area, these droplets then move off site, where they are unwanted and can cause sometimes adverse affects, depending on chemical, volume and area.

Spray drift buffers work by intercepting the spray droplets as they attempt to move off site. A vegetated buffer works by intercepting these droplets on the leaves and twigs of the trees and shrubs that the buffer is made from. The closer the buffer from the point of release, the more spray will be able to be captured.

Prepared by Ross Miller, 2007

FITZROY BASIN ASSOCIATION
Central Queensland FOREST ASSOCIATION
Australian Government Department of Agriculture, Fisheries and Forestry
Queensland Government Department of Primary Industries and Fisheries

Design

Spray drift buffers are best established adjacent to crops that receive the chemicals in spray form, considering prevailing winds and farming layout. A sample design is shown in Figure 1. They are best grown using trees and shrubs that will form a tall permeable layer. A narrow open belt of trees provides the greatest drift capture through horizontal filtering, as a dense buffer will deflect air over it and not capture the drift. The taller the buffer the greater its capacity to catch drift.

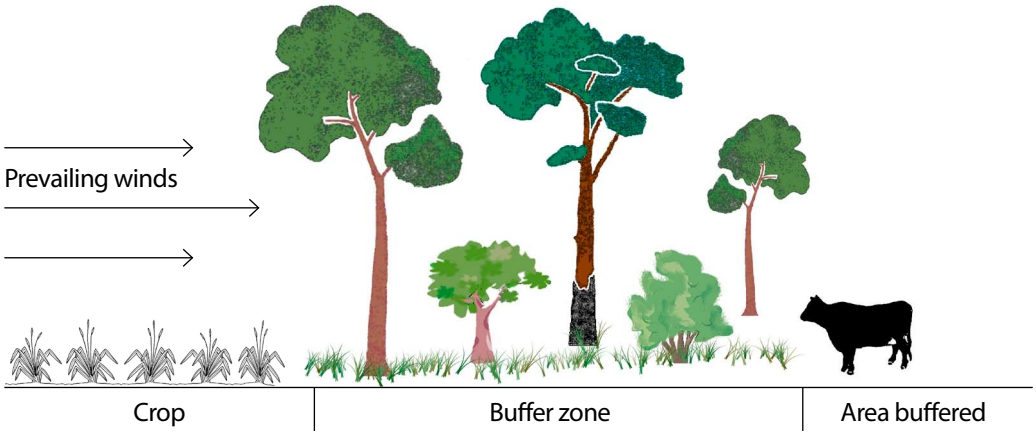
One important principle of spray drift buffers is the trees and shrubs that are suitable for this application. It is widely accepted that species with narrow leaves, like she oaks are the most effective in capturing spray drift. A spray drift buffer should be grown of a variety of trees that are suited to the site along with shrubs and grass layers, to effectively 'filter' the air as it passes through.

While Spray drift buffers can capture repeated doses of pesticide and fungicide in the medium to long term, they can be limited by the fact that trees are susceptible to damage from herbicide drift (such as 2,4-D or Gylphosate), particularly repeated applications over consecutive months.

Spray drift buffers alone will not prove to be 100% effective in reducing off site effects of chemical application, but will prove part of an effective barrier when combined with best practice farming techniques.

The suggested width for an effective spray buffer is 20-40 m. The buffer needs to be slightly longer than the edge of the spray target (crop) to allow for effective spray capture in various wind and climate conditions.

Figure 1. A suggested design of a vegetative spray drift buffer zones



Odour buffer zone

Vegetative buffer zones can help to control odour from point sources such as intensive animal facilities and effluent ponds. These can be established adjacent to these facilities to disperse odour, trap dust and improve visual amenities of these facilities.

Potential for use

Generally intensive animal facilities and associated effluent/manure storage in a rural setting is accepted by locals as part of the landscape along with the off site impacts such as odour and dust. However in peri-urban/semi rural and adjacent areas, these activities can become scrutinised for their off site impact such as odour and dust. Buffer zones can be a useful way of screening and minimising some off site impacts of these intensive activities.

In addition many of these activities are subject to development approval, through the Integrated Planning Act 1997.

How it works

Vegetative buffers reduce odours by physical interception of gases and dust, dilution and dispersion of odour concentrations, land deposition from reduced wind speed, biological sinks and aesthetics.

Odour sources from near the ground such as intensive animal facilities have a tendency to travel along the ground. Trees in a buffer zone disperse the odour and deflect it upwards leaving the down wind area less odorous. Buffer zones are known to trap dust and reduce noise, which can also be advantageous in these situations. The buffer zones trap the dust that settles on tree,

shrub and grass leaves, and slows wind speed which can lead to the deposition of larger dust particles.

It is thought that visual screening that is provided by vegetative buffer zones can play a role in suppressing off site effects of intensive animal facilities as the are 'out of site, out of mind'.

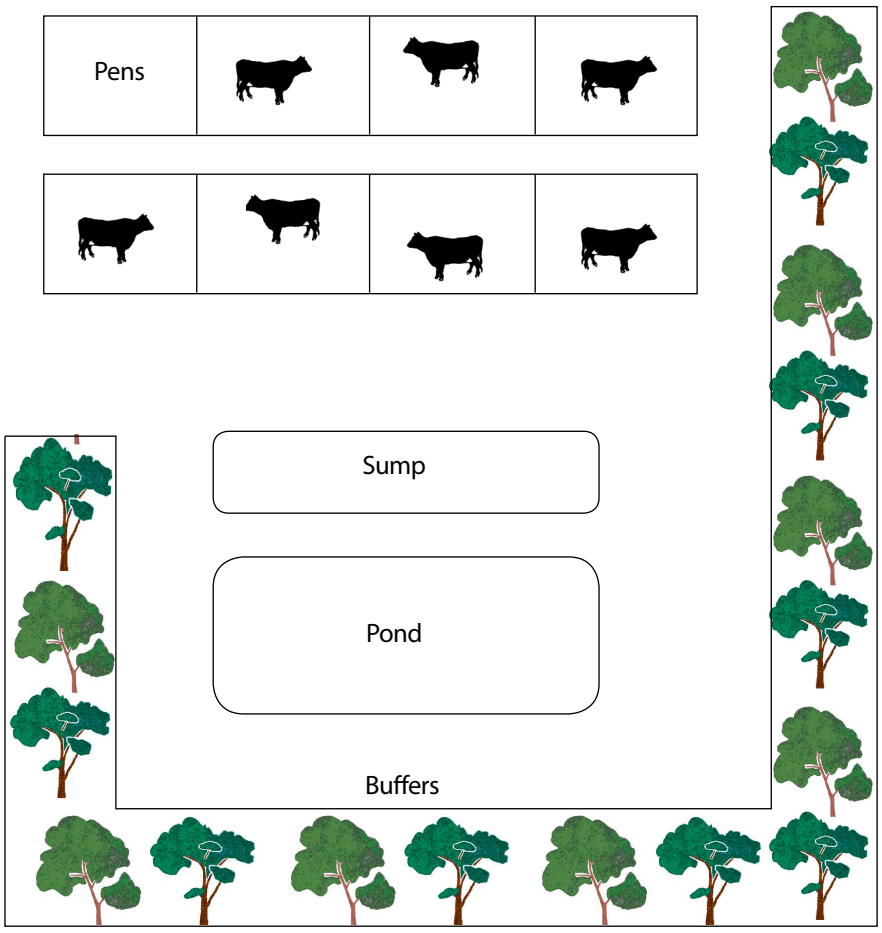
Design

Vegetative buffers should be established around the facility and loading ramps/yards feed mills etc to cater for wind from any direction. An odour buffer zone is shown in Figure 2. These trees need to be adjacent to the facilities, allowing for workability of the facility and future expansion plans for the facility, as the buffers will need at least 5 years of growth to become effective.

These buffers can be established from trees and shrubs that are suited to the site. Species suited to central Queensland can be found in Table 1.

Much of the research on the effectiveness off vegetative buffers to control odours is concerned with height not buffer width. However as leaves filter dust and other particles, a minimum of 20m in width should be considered. The length of the buffer needs to be long enough to ensure that most odours from the facility will come into contact with the buffer.

Figure 2. A vegetation buffer zone for odour control at an intensive animal facility



Nutrient buffer zone

Vegetative nutrient buffers are established to help with intercepting excess nutrients as they move with the ground water towards water courses. These are generally established close to possible sources of excess nutrients or on the lower slopes.

Potential for use

Some intensive animal facilities (e.g. feedlots, dairies or piggeries), farming activities, (with high levels of nutrient input) and horticultural activities can lead to excess nutrients loads present in the soil. These nutrients have the potential to cause off site impacts when leached into ground water and/or run off in storm events. As the nutrients leach into the ground water, they have the potential to reach a watercourse or aquifer causing contamination. By intercepting and utilising ground water and nutrients, these buffers can prove effective.

How it works

The basic requirements of tree growth are similar to agricultural crops and pastures including water and nutrients (such as N,P,K and traces) which can be applied as part of agricultural production. Even with best practice farming and fertiliser application, sometimes nutrients move off site in ground or surface water.

Some intensive animal facilities have systems or sites that have potential to release nutrients into shallow ground water. These nutrients have the potential to pollute ground and surface water.

Excess nutrients in aquatic environments can increase algae & water plant levels, choke waterways severely disrupting the natural ecosystem.

Vegetative buffers can be highly effective in trapping various nutrients such as Nitrogen and Phosphorous and other chemicals.

Strategically located vegetative buffers can utilise the excess water and nutrients as they move through the soil and help prevent any off site impacts. The more trees the greater the nutrients utilised. Maintaining a vigorous buffer zone here is important as rapidly growing trees will use more nutrients and water.

Design

Vegetative Nutrient buffers should be established from rapidly growing tree and shrub species that will tolerate the local soil and climate conditions. These buffers are best located 'low' in the landscape, so that potential 'nutrient laden' ground water will move toward the buffer, or in flat terrain adjacent to facilities that have the potential to be a source of excess nutrients. As with all buffers, the design and location of the nutrient buffer should allow for farming practices, farm layout and future development programs.

The minimum buffer width for a nutrient buffer is commonly 10-30 m, depending on the ability of the trees to capture the excess nutrients. The length should be long enough to capture likely movement of nutrients.

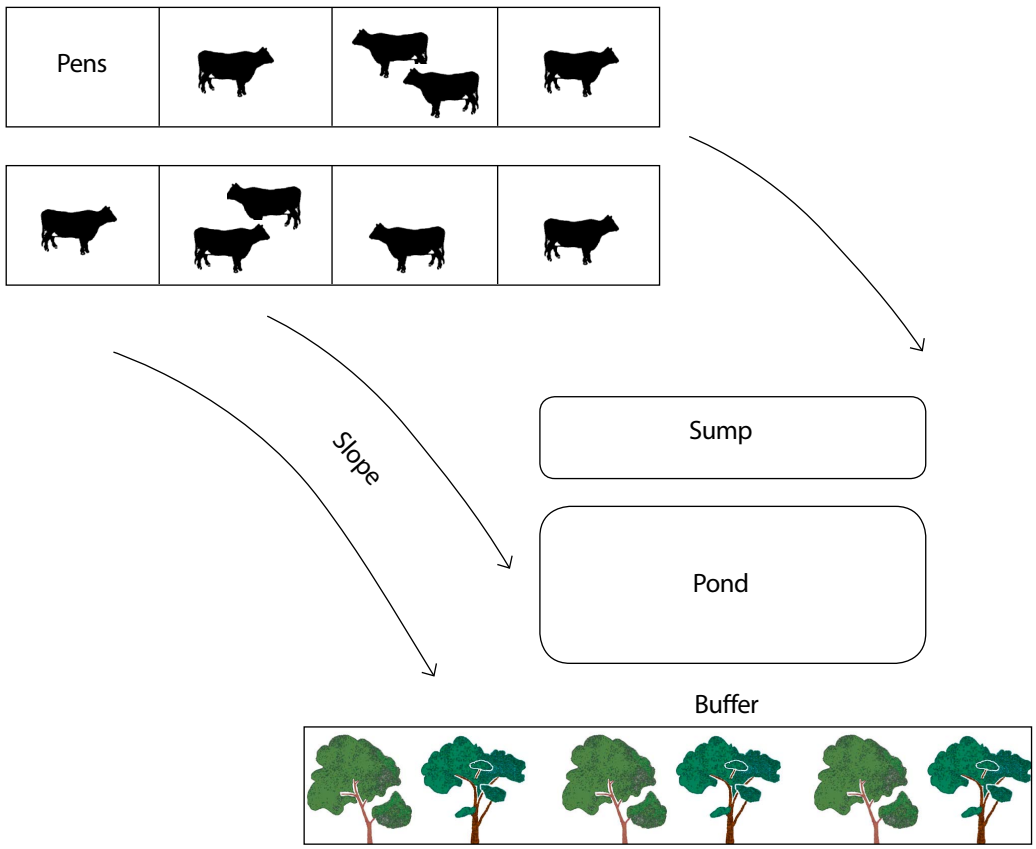


Figure 3. A vegetative buffer zone located to reduce nutrient movement off site

Farm enterprise buffer

Essentially a farm enterprise buffer is a buffer zone that is designed to separate farms with different management styles, usually organic and 'conventional' farms.

Potential for use

While the movement of 'organic' farming is expanding rapidly, it is by far still a minority style of farming. Certified organic producers are vulnerable to external 'contamination' with a substance that is not permitted by the organic standard. These producers must take steps to address these real risks, which a vegetative buffer zone can provide part of the solution.

How it works

A farm enterprise buffer works in a similar fashion to a spray drift buffer, except it is established around the organic enterprise, or in locations that may present inherently high risk, for example a directly neighbouring conventional horticultural enterprise, or a road side. These buffers can also trap pollen and wind borne seed from contaminating the site. The farm enterprise buffer works by minimising the likelihood of contamination for the enterprise by providing a barrier, such as a vegetative buffer, that is able to trap possible contaminants.

Design

These buffer zones should be established with rapidly growing trees and shrubs in strategic locations- i.e. where contaminants risks are the highest. They also need to be designed with the farm enterprises in mind to keep the farming efficient, and allow for future developments.

The suggested minimum width for an effective enterprise buffer is 40 m. The buffer needs to be put adjacent to any activities that pose a risk to production, and be long enough to effectively perform this task. An example vegetative farm enterprise buffer is shown in Figure 4.

Figure 4. An example of a vegetative farm enterprise buffer zone

Vegetative buffer zone establishment techniques

Effective vegetative buffer zones need to be at least three rows of trees, and shrubs to form a barrier which will become a successful buffer zone. When considering a buffer zone it is important to:

- Decide the primary reason for establishing the buffer zones, and choose appropriate buffer zone.
- Look at current and future enterprises and design a layout accordingly
- Choose suitable species for the sites taking into account soils, buffer type and growth.
- Consider establishment techniques to get an effective buffer zone rapidly.

Best tree establishment techniques

In order to have effective buffers, they must be healthy and tall, with excellent growth. A key to getting good healthy tree growth is in the preparation of the ground, selection of suitable species and early weed control.

Good ground preparation techniques include:

- Ripping
- Cultivation
- Weed control
- Moisture storage

Selection of suitable species is important to ensure that the buffers grow and remain viable throughout their life. Species selection techniques include:

- Talking with experienced locals
- Using recommended species
- Visiting local tree growing examples

Weed control is vital to tree establishment, so much so that to plant trees without adequate weed control is one way to guarantee failure. Good weed control needs to be done for the first two years until the trees become dominant. Weed control practices include:

- herbicide along rows
- mulch
- cultivation
- or a combination of the above

Detailed information on ground preparation, species selection, weed control and tree establishment can be found on fact the sheets: Steps to a successful plantation enterprise in central Queensland.

Suitable trees and shrubs

Growing trees for vegetative buffers needs careful consideration for the tree and shrub species that will grow and prosper in the given environment, taking into account the soils, available moisture, drainage and frost. Species with potential for use in vegetative buffer systems in central Queensland include those seen in Table 1.

Table 1. Tree and shrub species that may be suitable for vegetative buffers in central Queensland

Tree species	Common name
Acacia harpophylla	Brigalow
Acacia pendula	Myall
Acacia stenopylla	River Cooba
Acacia salicina	Sally wattle
Callistemon viminalis	Weeping bottlebrush
Allocasuarina cunninghamiana	River oak
Allocasuarina cristata	Belah
Eucalyptus camaldulensis	River gum
Eucalyptus argophloia	Western white gum
Eucalyptus microtheca	Coolibah
Eucalyptus coolabah	Coolabah
Eucalyptus moluccana	Gun topped box
Eucalyptus cambageana	Dawson river blackbutt
Eucalyptus thozeiana	Thozet's box
Eucalyptus ochrophloia	Yapunyah
Corymbia citriodora	Lemon scented spotted gum
Flindersia australis	Crows ash
Albizia lebbeck	Indian siris

To buffer or not to buffer

Vegetative buffer zones can be used in various capacities, as outlined above to minimise of site affects of some forms of agricultural production. In order to aide the decision making process, to determine if vegetative buffers can be successfully integrated to the enterprise, Table 2 identifies some possible advantages and disadvantages of using vegetative buffers.

Table 2. Possible advantage and disadvantage of establishing vegetative buffers to help manage off site impacts.

Advantages	Disadvantages
Greater control of off site impacts	Take at least 5 years to become effective
Can have multiple purposes	Can compete with adjacent crops/pastures
Can double as shade/wind break	Establishment cost
Increase farm appeal	If poorly designed can be in the way of operations
Controlling risks	Land is required that the business may not own
Can improve business image	

Further reading:

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