

Managing stock in wetland grazing

GUIDELINES FOR GRAZING IN THE
GWYDIR WETLANDS AND MACQUARIE MARSHES

SECTION FOUR

Introduction

Grazing livestock in the Gwydir Wetlands and Macquarie Marshes can lead to both positive benefits and potentially significant negative outcomes. Positive benefits of good grazing practices include:

- sustainable plant growth;
- high plant species diversity;
- limited development of plant monocultures; and
- economic benefits.

Negative outcomes of poor grazing practices can include:

- increased populations of exotic plants;
- loss of desirable grazing species;
- reduction in plant species diversity;
- loss of bird breeding habitat;
- soil structural problems;
- increased water turbidity;
- removal of groundcover;
- damage to aquatic habitats; and
- damage to long-term economic outcomes.

Negative outcomes usually result from:

- Inappropriate stocking rates over time that lead to overgrazing. This depends on:
 - frequency and extent of wet or dry periods;
 - length and timing of grazed and un-grazed periods; and/or
 - season and climatic conditions.
- Stock trampling causing soil and plant disturbance through pugging and compaction of wet soils.
- Erosion of stream banks and sedimentation of wetland areas.

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Current grazing management

Historical management

Cattle and sheep were introduced to the Gwydir Wetlands and Macquarie Marshes during the 1830s alongside populations of native herbivores:

- Cattle generally grazed in the wetland areas.
- Sheep generally grazed on wetland edges and on floodplains.

Set stocking in response to feed availability was the main management practice:

- Stock numbers tended to fluctuate depending on conditions.
- A semi-permanent grazing regime developed in the period before flow regulation in the Gwydir and Macquarie river systems.



Grazing cattle (NSW DPI)

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Pasture trampling

Landholders can generally assume that 15–30% of available pasture will be lost because of stock trampling. Some grazing methods employ the '1/3 rule' – this is where stock consume a third of available pasture, trample one third and leave one third.

Sustainable grazing in wetlands

Understanding the difference between good, fair and poor pastures is important in all grazing systems (Jessop *et al.* 2008):

Good pastures are stable and close to maximum productive potential.

- Plant communities are diverse and include a mix of annual and perennial plant species.
- Ground cover protects the soil from wind and water erosion in all but exceptionally bad seasons and following fire.

Fair pastures are productive, but below maximum productive potential.

- Recognised by reduced vegetation cover and reduced regeneration of palatable perennial species.
- Some establishment of less preferred unpalatable plants.
- Productivity remains high in good seasons but is markedly reduced in dry seasons.
- Reduced ground cover increases the susceptibility to soil erosion in most seasons and there is evidence of moderate erosion on susceptible land types.

Poor pastures have severely reduced productivity.

- Most noticeable during drought periods.
- Require extended periods of spelling to improve condition.
- Identified as those dominated by annual, short-lived or unpalatable perennial species.
- Little or no regeneration of desirable perennial plants, productivity is impaired and the seasonal response is poor.
- Soils are unstable and susceptible to erosion in all seasons and past erosion leaves the site susceptible to further soil movement if grazed.
- Require intervention to re-establish plant species and prevent erosion.



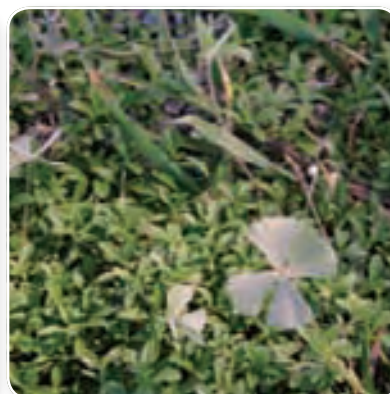
Cattle pad in wetland vegetation (NSW DPI)



Good pasture (NSW DPI)



Fair pasture (NSW DPI)



Poor pasture, Lippia with Nardoo (NSW DPI)

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Native herbivores

Native herbivore populations have been a feature of these wetland areas for thousands of years. These populations fluctuated according to feed and water availability.

The introduction of agriculture with domestic livestock and feral animals alongside native grazing populations has resulted in higher total grazing pressure. The use of these grazing systems with alternative watering points has increased the period over which vegetation has had to cope with grazing pressure. This affects plant recovery from grazing and, with limited management options for native animals, the impact of total grazing pressure needs to be factored into any grazing management regime.

Changing water regimes

It is well understood that flow regime is the major driver of vegetation change within wetlands. Graziers report that the previously unregulated flood patterns of these rivers provided good grazing reliability to the Gwydir Wetlands and Macquarie Marshes. However, the flow regimes have been significantly altered resulting in less flooding. Good grazing management is going to be an increasingly important aspect for the continued care of remaining wetland areas.

Total grazing pressure refers to the combined grazing pressure exerted by all grazing animals including domestic stock, feral animals and native herbivores on the vegetation resources of a landscape.

Graziers place great value on wetland areas. They indicate that the change in wetland area between pre-regulation (1960s) and the current extent of these areas has decreased from an average of:

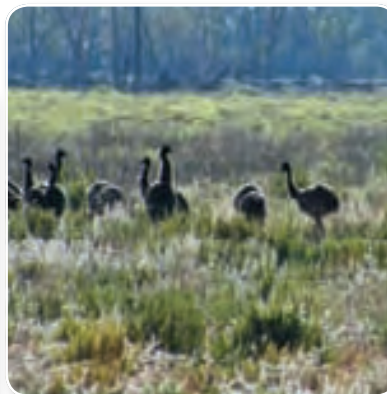
- 87% to less than 20% of property area in the Gwydir Wetlands; and
- 40% to less than 10% of property area in the Macquarie Marshes.

The reduced area of flooding has significantly reduced the growth of grazing species. The response of graziers to this reduction has varied:

- Some graziers in the Gwydir Wetlands and Macquarie Marshes are strongly focused on maintaining core breeding cattle herds because of their reported adaptation to grazing in wetlands. Some graziers report that cattle introduced into wetlands for the purpose of fattening perform poorly in semi-permanently flooded landscapes if they have not been raised around wetlands or are not with cattle that have spent time in wetlands.



Feral Pig ripping (NSW DPI)



Emus in the Macquarie Marshes (NSW DPI)



Pugging around wetland edge (NSW DPI)



Edge effect (NSW DPI)



Macquarie River (NSW DPI)

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- Other graziers believe that buying and selling trade cattle in response to fodder availability allows less pressure to be applied to wetland areas during dry times and more when conditions allow.

For more information on the change in areas of flooding see the:

- Gwydir Wetlands Adaptive Environmental Management Plan (DECC 2009a).
- Macquarie Marshes Adaptive Environmental Management Plan (DECC 2009b).

Importance of wetlands to graziers

In the Gwydir Wetlands many reported that their wetlands were critical for 'every day' grazing as well as drought refuge. In the Macquarie Marshes the wetlands are still highly valued for their productivity. While the area of wetlands on properties has been reduced and graziers state clearly that their wetlands are still crucial for their grazing enterprises, the effect of the loss of these wetland areas should not be underestimated. One respondent in the Macquarie Marshes stated that the lack of wetland in 2005 cost them over \$1M, with many other survey respondents reporting large declines in the carrying capacity of their properties. This reduces income and the ability to make desired management changes.

Stock movement

Most graziers report that they manage cattle feed requirements and move stock between paddocks in response to a number of triggers. These triggers are generally a combination of:

- pasture condition (based on groundcover, species and plant height); and/or
- time (usually measured in months).

Fodder management options adopted by graziers in response to triggers include:

- moving cattle to alternative wetland or floodplain paddocks;
- moving cattle to cropped or pasture improved paddocks;
- providing supplementary feed (e.g. hay or grain); and/or
- de-stocking.

The triggers for moving stock are not the same triggers that initiate supplementary feeding or de-stocking.

Constraints to grazing management

Current constraints that impact on grazing management decisions include:

- income;
- paddock size (generally between 400 and 1000 ha);
- vegetation management;
- water access; and
- time.



Shade in paddocks (NSW DPI)



Macquarie Marshes (NSW DPI)

Constraints are both real and perceived and often large paddocks have been fenced for specific reasons. Some graziers report that:

- wetland paddocks require some higher ground for livestock safety during flooding; and
- cattle shift to where shade and water are abundant without appearing to over-graze parts of large paddocks (>600 ha).

Other graziers report that in open wetland paddocks reducing paddock size and moving stock at intervals of weeks to months has increased production per hectare.

Paddock size

There is no 'magic bullet' when it comes to determining paddock size, and most graziers agree that it needs to be based on the type of pasture you have, cost and management requirements.

In the Gwydir wetlands, one grazer felt that the wetland paddocks could remain large (around 400 ha) because the feed quality remained for a long period. In the drier native grass paddocks, he liked smaller paddocks of approximately 280 ha, again because the feed usually kept for longer. However, in the introduced pastures, smaller paddocks (40–60 ha) were preferred as the feed went 'rank' much faster. Stock movements were triggered by vegetation condition only, and length of grazing interval was not considered to be a factor.

In the Macquarie Marshes paddock size varied hugely from 4,000 ha to 50 ha. The critical factor according to one grazer is the plant rest period. One respondent suggested:

- 300 days as an appropriate rest period for dry wetlands; and
- 200 days as more than sufficient for floodplain paddocks.

Most graziers in the Gwydir Wetlands and Macquarie Marshes agree that it is important to have high and low ground within the wetland paddocks, a mix of plant species and tree cover to offer stock refuge during inundation and during hot weather.

Current grazing

Graziers indicate that reduced wetland flooding has led to less plant growth and a reduced carrying capacity. Landholders have responded by reducing cattle numbers.

- Some graziers operate set stocking grazing regimes with stock moved after periods of more than 6 months. Movement is dictated by vegetation condition rather than time.
- Most graziers in the Gwydir Wetlands appear to have adopted rotational grazing based on pasture condition. In these systems, stock tend to be moved between paddocks when pasture condition drops beyond a trigger point. Trigger points are different for different paddocks.
- Most graziers in the Macquarie Marshes tend to use either:
 - strategic grazing systems based mainly on pasture condition; or
 - time based strategic grazing.
- A small number of graziers are actively changing their grazing systems and significantly reducing the size of paddocks to facilitate improved stock management.

Plant recovery

One grazer in the Macquarie Marshes suggested that a good sign that a plant has recovered from grazing is when some grass leaves start to oxidise (go grey-brown) while the majority of the plant is still green.

Paddock size helps to dictate the level of pasture utilisation that occurs. It is generally accepted that smaller paddocks grazed for shorter periods:

- allow greater pasture utilisation when compared to larger paddocks containing the same number of cattle;
- reduce selective grazing and overgrazing; and
- require more intensive management.

Graziers who have adopted this practice have:

- installed more fences;
- installed more watering points (trough and pipe); and
- increased time requirements for stock management.

Managing stock in wetland grazing

Some graziers from the Gwydir Wetlands and Macquarie Marshes suggested that grazing smaller paddocks for shorter periods has several benefits:

- increased production through better weight gains and higher stocking rates;
- increased ecological outcomes (e.g. grazing can be managed around bird breeding); and
- controlled management of seed set.

Adopting smaller paddocks requires careful consideration of production outcomes, costs and management loads. Grazing smaller paddocks for shorter periods (weeks) could be used to manage grazing across different types of vegetation.

Reduced flooding leads to reduced resilience and grazing management must adapt. Past grazing methods might have achieved the desired benefits to the environment and the business but changes to flooding events means the grazing methods need to be modified.

Grazing and stock water

Most graziers have indicated that when stock graze inundated wetlands, they most often drink the water in those wetlands. Stock watering in these areas has the potential to cause significant disturbance to the edges of, and further into wetlands that are flooded.

During wetland drying, livestock become increasingly reliant on channels, billabongs and alternate watering points such as dams and/or trough systems.

Using alternate watering points is a good way of encouraging grazing stock to move away from the saturated soils of wetlands when they want water. This can reduce the potential for soil compaction, pugging and vegetation trampling.

Graziers should establish alternate watering points and where possible install trough systems rather than ground tanks or dams. This is because troughed water:

- usually provides higher water quality;
- results in greater animal weight gain;
- reduces soil disturbance; and
- can be emptied when not in use helping to decrease grazing pressure.

Response of plants to grazing

Grazing influences plant communities

The impact of livestock on wetland plants is determined by the timing, frequency and duration of grazing. This is because:

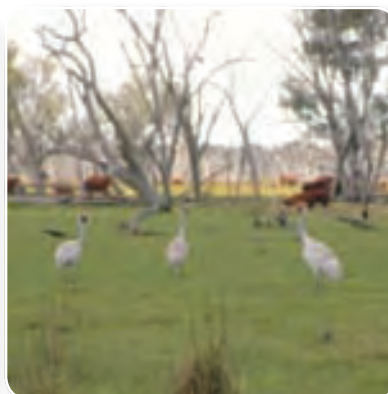
- grazing affects wetlands and wetland species differently when they are wet to when they are dry; and
- species digestibility and palatability changes according to plant life cycles (e.g. *Lignum* tends to be grazed more heavily during vigorous growth).

Wetland communities are often resilient and can overcome some disturbances (e.g. grazing). The ability of wetlands to overcome disturbances determines the sustainability of management practices. Wetland resilience is determined by the wetting regime and plant community, and can be characterised by:

- community diversity;
- prolific seeding;
- ability to grow from tubers; and
- perenniality.



Grazing in wetlands (NSW DPI)



Brolgas and cattle (Glenn Turner, DNR)

Managing stock in wetland grazing

Some grazing management practices cause fewer disturbances to wetlands than others, and careful grazing management will help ensure that the diverse plant communities of wetlands persist. Research by Wilson *et al.* (2008, 2009a) has shown that grazing can influence biodiversity. For example where tall herbaceous species dominate (e.g. Marsh Club-rush) grazing reduced the shading effect from this species and allowed other, lower growing, species to flourish. This resulted in a short-term increase in plant diversity.

However, wetlands that are overgrazed take longer to re-grow, and the diversity of species can be affected. Wetland plant communities subject to any major disturbance (e.g. extended drought, fire or continued overgrazing) will not necessarily re-develop with the same plant composition.

General responses of wetlands to grazing

Globally, studies conducted on a variety of grazing systems have been analysed to identify patterns in vegetation responses to grazing. These studies generally compare grazed sites with matching ungrazed sites:

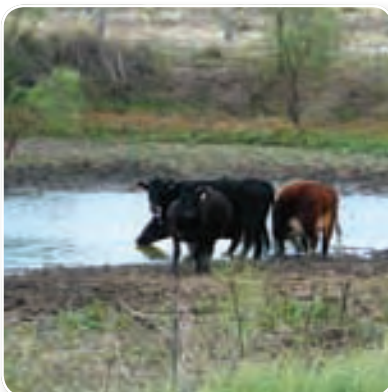
- Response of plant communities to the removal of grazing appears to be governed by wetland productivity. The response is reflected in the amount of biomass produced by vegetation. Vegetative productivity is largely controlled by soil nutrients and moisture (Milchunas *et al.* 1988, Olff & Ritchie 1998, Cingolani *et al.* 2005).
- If inundation rate, frequency and duration are not changed (Proulx & Mazumder 1998, Cingolani *et al.* 2005, Lunt *et al.* 2007):
 - Excluding grazing from productive sites (sites producing >2 t of biomass/ha/yr), leads to increased biomass of large grazing-sensitive, herbaceous species.
 - Tall leafy plants that are sensitive to grazing can shade out lower the growing species below, causing a reduction in small-scale plant diversity.
- Removal of grazing at low productivity sites (sites producing <2 t of biomass/ha/yr), may result in little change in biomass but produce a rise in small-scale plant diversity as low-biomass grazing sensitive species become more common.



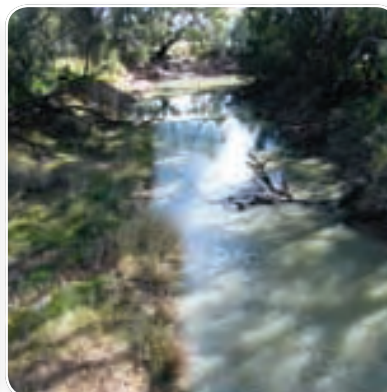
Pugging in wetlands (NSW DPI)



Marsh Club-rush (NSW DPI)



Cattle at a dam (NSW DPI)



Channel (NSW DPI)

Managing stock in wetland grazing

Response of specific plant communities to grazing

Grazing by herbivores has been a part of wetland ecology for thousands of years; wetlands rely on some level of grazing to encourage diversity. A small number of studies have looked at the impact of grazing on the composition of plant communities in the Gwydir Wetlands. The impact of grazing cattle on flooded wetland communities in the Macquarie Marshes has not been quantified, but the observations of graziers broadly support the findings of exclusion trials from the Gwydir Wetlands.

Unpublished Research trials in the Gwydir Wetlands (1994–2008) indicated that grazing can alter the composition of plant communities (Wilson *et al.* 2008, 2009a). The

presence of livestock in this wetland area is a disturbance to the wetland plant community because of:

- Grazing;
- Trampling; and
- Pugging.

A record of how specific wetland plant communities have changed following the exclusion of grazing by domestic livestock has been developed. It includes the following plant communities:

- Water Couch (receives regular annual flooding of 4–12 weeks);
- Water Couch meadows with significant Lippia (receives brief flooding once every 3–4 years and short inundation periods);
- Warrego Summer Grass floodplain grassland (receives flooding once every 5–10 years);
- Marsh Club-rush (receives regular annual flooding of 4–12 weeks).

The grazing of Water Couch beds is important for farm productivity. Inundation is important for these meadows and dry conditions have reduced the distribution of these areas. To maintain and encourage Water Couch growth, it is a good idea to:

- graze when wetlands are not inundated where this is possible;
- maintain at least 50% of bulk Water Couch growth; and
- allow seed set following flood-induced growth (takes approximately 2–3 months).

Reduced flooding across the Gwydir Wetlands and Macquarie Marshes means that reed beds (e.g. Marsh Club-rush and Common Reed) have declined. Reed beds should be given an opportunity to establish after flooding and before they are grazed. This means that:

- new growth should not be grazed early; and
- in some areas, plants should be given the opportunity to set seed.

As a rule of thumb, reeds should be taller than 1 m before grazing stock are introduced.

Grazing and the impact of Lippia

Graziers in the Gwydir Wetlands indicate that Dry Sheep Equivalent stocking rates, where Lippia occurs are up to half those reported for other semi-arid floodplains (Robertson 1998; Wilson *et al.* 2008).

Lippia successfully out-competes desirable native wetland species (e.g. Water Couch) that once dominated the shallow margins of wetland plant communities in both the Gwydir Wetlands and Macquarie Marshes. McCosker (1994) noted that:

- Successful Lippia establishment often occurred following prolonged or repeated intense disturbance.
- Long-term changes to the water regime of wetlands in combination with overgrazing favoured the establishment and growth of Lippia.
- Bare soil and reduced vigour of existing native species, due to water stress contributes to the rapid expansion of Lippia.



Lippia (NSW DPI)

Water Couch

Site characteristics:

- Inundated once every 1–2 years.
- Inundation duration of 4–12 weeks.
- Inundation depth of 10–20 cm.

Plant community characteristics:

- Seeds prolifically and re-develops from plant rhizomes.
- Grazing appears to help maintain the dominance of Water Couch through the removal of tall grazing-sensitive species.
- Removal of grazing results in the growth and dominance of taller herbaceous species such as:
 - Knotweed; and
 - Princes Plume.
- Other commonly occurring species in these grazing exclusion areas are:
 - Aster Daisy; and
 - Dock.
- Un-grazed plots contain larger populations of amphibious responder plants than grazed plots (e.g. Water Primrose).
- Depth and duration of flooding plays an important role in limiting the growth of Lippia present in this community.
- Graziers in the Macquarie Marshes indicate the same response of Water Couch meadows to grazing.



Water Couch un-grazed plot September 2007 (Peter Berney, UNE)



Water Couch grazed plot September 2007 (Peter Berney, UNE)



Water Couch un-grazed plot March 2008 (Peter Berney, UNE)



Water Couch grazed plot March 2008 (Peter Berney, UNE)

Managing stock in wetland grazing

Water Couch meadow containing Lippia

Site characteristics:

- Flooded once every 3–4 years.
- Flooded duration of 4–6 weeks.
- Flooded depth of 10–15 cm.

Plant community characteristics:

- Water regime has been altered and the frequency, depth and duration of flooding have been reduced by water regulation and reduced rainfall.
- Grazing did not appear to greatly affect species composition which was dominated by:
 - Water Couch;
 - Lippia; and
 - Lignum (less extensive growth outside of exclusions due to grazing).
- Grazed and un-grazed sites are currently dominated by Lippia.
- Summer rainfall results in the growth of tall herbaceous species that commonly occur in un-grazed sites (e.g. Sesbania Pea). In grazed sites the tall herbaceous species are consumed.
- Removal of flooding has reduced the extent of the soil seed bank and the plant community contains many short-lived annual species in both grazed and un-grazed sites:
 - Black Roly-poly; and
 - Blown Grass (present in early spring).
- Plant community appears to have crossed a transition and unless frequency and duration of flooding is increased, it is expected that wetland species will decline at sites like these.



Water Couch meadow containing Lippia un-grazed site September 2007 (Peter Berney, UNE)



Water Couch meadow containing Lippia grazed site September 2007 (Peter Berney, UNE)



Water Couch meadow containing Lippia un-grazed site March 2008 (Peter Berney, UNE)



Water Couch meadow containing Lippia grazed site March 2008 (Peter Berney, UNE)

Warrego Summer Grasslands

Site characteristics:

- Located on the floodplain these sites are currently flooded once every 5–10 years.
- Inundation duration of 1–2 weeks.
- Inundation depth of 5–10 cm.

Plant community characteristics:

- Removal of grazing at this site has resulted in an increased diversity of grass species. Species that are present inside enclosures but absent at grazed sites are:
 - Queensland Blue Grass;
 - Wheat Grass; and
 - Silky Brown Top.
- At grazed sites Burr Medic is common.
- Species of Roly-poly have become more common across all sites over time. Differences between grazed and un-grazed sites are most evident during dry periods.
- Summer rains result in vigorous plant growth at grazed and un-grazed sites. The key species are:
 - Curly Windmill Grass; and
 - Native Millet.



Warrego Summer Grass un-grazed site September 2007 (Peter Berney, UNE)



Warrego Summer Grass grazed site September 2007 (Peter Berney, UNE)



Warrego Summer Grass un-grazed site March 2008 (Peter Berney, UNE)



Warrego Summer Grass grazed site March 2008 (Peter Berney, UNE)

Managing stock in wetland grazing

Marsh Club-rush

Site characteristics:

- Inundated once every 1–2 years.
- Inundation duration of 4–12 weeks.
- Inundation depth of 10–15 cm.

Plant community characteristics:

- Tall highly competitive plants capable of producing a large amount of biomass in a single growing season (1.5 kg/m^2).
- Seeds prolifically in the right conditions following winter/spring flooding and re-develops from rhizomes.
- Shades competitors resulting in reduced species diversity at the site until the dense canopy is disturbed by:
 - grazing; or
 - fire.
- Canopy disturbance results in germination and growth of understorey competitors. Examples include:
 - Swamp Buttercup; and
 - Knotweed.
- Graziers in the Macquarie Marshes indicate that Common Reed and Cumbungi behave similarly.



Marsh Club-rush un-grazed site September 2007 (Peter Berney, UNE)



Marsh Club-rush grazed site September 2007 (Peter Berney, UNE)



Marsh Club-rush un-grazed site March 2008 (Peter Berney, UNE)



Marsh Club-rush grazed site March 2008 (Peter Berney, UNE)

Implications

Research comparing grazed and un-grazed sites in the Gwydir Wetlands shows that grazing influences the composition of wetland plant communities. This research concludes that:

- Grazing disturbances influence competition between plant species.
- Grazing exclusion leads to a steady transition to wetland communities dominated by tall herbaceous species. Examples of these types of species are:
 - Marsh Club-rush;
 - Cumbungi; and
 - Knotweeds.

The key implications of this research are that:

- some grazing helps to maintain diverse wetland plant communities; and
- overgrazing can result in wetland degradation that can not always be reversed.

Impact of wetting regime

Plant community composition is strongly influenced by moisture regime. There are three broad communities:

1. Heavily flooded areas support plants that tolerate extended or permanent wetting. Plants can:
 - rely on water to support leaves;
 - be poorly adapted to grazing; and
 - establish using seed or rhizomes.
- The cover provided by amphibious responder plants has been observed to be less at grazed sites compared with un-grazed sites (Wilson *et al.* 2008, 2009a).
- Soil pugging damages soil structure, seeds and rhizomes and these areas are highly susceptible to overgrazing, particularly when the frequency of flooding is low.
2. Plant communities that tolerate variable flooding depth are adapted to conditions that vary between complete inundation and conditions of limited inundation. Some plant species have seeds that have a significant potential for dormancy. Seed dormancy:
 - is vital because the frequency of flooding in the transition zone is less consistent than in permanent or semi-permanent wetland areas; and
 - gives these plant communities the ability to respond to flooding, drought or over-grazing events.

Nesting waterbirds

Lignum is used by birds (e.g. Straw-necked Ibis) as a nesting site and management of grazing intensity is important for the maintenance of this species in wetlands.

Some paddocks contain plant communities that are:

- permanently inundated;
- in the transition zone; and
- on the margins of wetlands.

This means that grazing pressure focuses on some areas more than on others. In this situation it is wise to consider if:

- selected grazing regimes are appropriate;
- stocking rates are appropriate; and/or
- paddocks can be divided permanently or semi-permanently according to plant communities.

Remember the size of wetlands is an important factor in deciding the grazing pressure applied to a paddock.

Seed dormancy refers to the ability of seeds to survive over time. This can allow plant species to regenerate following long periods of unfavourable climate conditions. It also provides a safeguard against whole generations perishing if favourable germination conditions end before seedlings reach the establishment stage.

Maintaining the seed bank and rhizomes is one of the most important management objectives for graziers. The seed bank and the rhizomes help to ensure the continued ecological function of wetlands. This means that if inundation frequency is low, then grazing should be kept at a level that allows high levels of flowering and seed set.

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3. Plant communities on wetland margins are infrequently flooded. If wetting occurs, it tends to occur for only short periods and these areas tend to be dominated by terrestrial plant species.

Water regimes are often unreliable and highly variable and plants depend on rainfall events and short periods of flooding.

Graziers need to consider:

- grazing disturbance; and
- interval required for recovery from grazing.

Grazing systems for wetlands

Grazing in the Gwydir Wetlands and Macquarie Marshes can be influenced through:

- farm business enterprise mix (e.g. fattening steers/heifers, breeding herds/flocks or opportunity grazing);
- stocking rates and response to flooding events;
- grazing timing (e.g. using seasonality or plant growth stages to determine grazing management); and
- grazing system.

Enterprise mix

A number of different agricultural enterprises are being managed as part of grazing businesses in the Gwydir Wetlands and Macquarie Marshes. On-farm enterprise mix is usually determined by property resources (e.g. wetland, pasture and water), infrastructure and individual grazer preferences. The main enterprise categories for graziers that own areas of wetland or former wetland are:

- self-sustaining beef cattle production;
- opportunistic purchasing and selling of beef cattle depending on markets and seasons (trade cattle);
- dryland cropping (e.g. Wheat, Chickpeas or Barley);
- irrigated cropping (e.g. Cotton or Wheat);
- wool production;
- fat lamb and meat sheep production; and
- meat and fibre goat production.

Sacrifice paddocks can be significantly overgrazed with long-term damage done. However, by limiting overgrazing to one paddock (away from sensitive areas), other grazing paddocks and wetlands are maintained and will respond more quickly to rainfall and inundation.

Climate variability and less frequent substantial flooding means that grazing farm businesses must be flexible in their stock management practices. This can mean:

- movement between enterprise mixes or de-stocking certain land or paddocks during dry or drought periods;
- that businesses have the capacity to change the way they manage different enterprises and move between alternate enterprises; and/or
- that stock can be:
 - opportunistically grazed or rotated between paddocks according to a defined or semi-defined grazing program;
 - supplementary fed on sacrifice paddocks outside of traditional wetland areas;
 - grazed under agistment;
 - grazed on appropriate road ways;
 - sold as a last resort, but before wetlands are degraded through overgrazing. Stock numbers are either reduced or stock are completely removed depending on the business' situation.

It is likely that some graziers lack flexibility in their stock management and are not cautious in their approach to grazing management. These landholders are more likely to graze heavily and for extended time periods with some short-term grazing benefits. However, grazing practice suggests that these benefits will be short-lived and long-term production will be severely compromised.



Cattle in the Gwydir Wetlands (NSW DPI)

Stocking rates

Appropriate stocking rates (grazing intensity) must be determined according to the vegetation present and the ability of plants to recover. Stocking rates depend on the:

- number of animals;
- grazing interval (time); and
- grazing regime.

Stocking rate:

- represents the area of land allocated to each grazing animal for a specific time period;
- can be expressed in terms of the number of Dry Sheep Equivalents (DSE);
- influences animal performance, pasture recovery, long-term pasture production and long-term pasture species composition;
- represents a balance between grazing pressure (pasture demand) and carrying capacity (pasture supply); and
- calculates the best animal to pasture production ratio over the long term.

Different grazing businesses are likely to manage different stocking rates. Rates will be determined by the:

- proportion of wetland;
- frequency of flooding;
- season and climate;
- types of plant species present; and
- grazing history.

There are no absolute standards which define clear stocking rates for all businesses across the Macquarie Marshes (and Gwydir Wetlands) (Cunningham 1996), due to differences in:

- past grazing pressures;
- total grazing pressure;
- seasonal conditions;
- wetland flooding;
- vegetation community differences; and
- soil differences.

Today these factors still apply today across both the Gwydir Wetlands and Macquarie Marshes.

Dry Sheep Equivalents: DSE is a standardised unit used to compare the feed requirement of different stock types in the assessment of carrying capacity for a property.

Cunningham (1996) reported that DSE's/ha on wetland Vertosols ranged from 0.7 to 12.4 DSE/ha with the majority of Macquarie Marshes landholders grazing at rates between 0.7 and 3.7 DSE/ha.

Currently the Macquarie Marshes are generally stocked at rates of 0.5–3.0 DSE/ha. Some properties vary stocking rates (e.g. between 1.7 and 5.7 DSE/ha, averaging 2.2 DSE/ha) in order to utilise available feed for trade cattle.

The Gwydir wetlands are generally stocked at rates of 1.2–3.2 DSE/ha. Some properties are stocked at rates of between 7.4 DSE/ha and 12.1 DSE/ha. These stocking rates are large enough that they cause concern for the long-term viability of these properties if flexible alternative management arrangements are not in place.

A general rule for wetlands is that conservative stocking rates should be managed through the choice of grazing regime, grazing interval and the use of alternative water sources. Conservative stocking rates:

- provide a margin of error for seasonal pasture availability;
- limit overgrazing when unexpected short periods of feed deficit occur; and
- need to incorporate the total grazing pressure into the calculation.

'A precautionary approach should be adopted when determining stocking rates in these wetlands. Stocking rates should be based on the response of the most sensitive parts of the ecosystem given that any visual impacts of stocking are patchy in these wetland systems. Rates of approximately 0.3–1.0 head of cattle per hectare are desirable for maintaining wetland values while providing sufficient disturbance to promote wetland plant diversity' (Wilson et al. 2008).

Managing stock in wetland grazing

Stocking rates should be determined each season, and needs to consider the total grazing pressure. Apart from domestic stock, the key species contributing to total grazing pressure are:

- Common Wallaroo (*Macropus robustus* spp. *erubescens* and spp. *robustus*);
- Eastern Grey Kangaroo (*Macropus giganteus*);
- Red Kangaroo (*Macropus rufus*);
- Western Grey Kangaroo (*Macropus fuliginosus*);
- Feral Pig (*Sus scrofa*); and to a lesser extent
- Emu (*Dromaius novaehollandiae*).

Most of these animals are protected native species and there are strict guidelines that concern their management. Management options for native animals include:

- buffer zones;
- fencing; and
- licensed damage mitigation and commercial harvesting.

Remember:

- Legislation protects Emus (*Dromaius novaehollandiae*) against any control or harvesting practices.

In the Gwydir Wetlands, kangaroos can be a problem for farmers and graziers, although one farmer has come up with a way to minimise damage to his crops. He has left, or allowed to regenerate, a series of native vegetation corridors in and around his cropping areas. By allowing the trees and native grasses to regenerate, the kangaroos congregate around these areas and rarely venture into the cropping lands. The farmer has noticed a substantial reduction in crop loss through trampling and consumption.

Stocking Density refers to numbers of stock per unit of area (often called stocking rate).

Stocking Rate refers to numbers of stock per unit area over time.

Carrying Capacity refers to the maximum stocking rate possible which is consistent with maintaining or improving vegetation or related resources. It may vary from year to year on the same area due to fluctuating forage production.

- Kangaroos are a protected species, but there is legislation that allows for the licensed shooting of different macropod species.

The NSW Commercial Kangaroo Harvest Management Plan allows the commercial harvest of only the following four macropod species within NSW:

- Red Kangaroo (*Macropus rufus*);
- Eastern Grey Kangaroo (*Macropus giganteus*);
- Western Grey Kangaroo (*Macropus fuliginosus*); and
- Common Wallaroo (*Macropus robustus* spp. *erubescens* and spp. *robustus*).

The kangaroo harvest is managed through strict legislative and policy provisions administered by the Department of Environment and Climate Change NSW. The program has been designed to allow for sustainable commercial use of these species. Population control is not an objective of the Commercial Kangaroo Harvest Management Plan.

Non-commercial licenses (occasionally referred to as damage mitigation licenses) can be applied for through your local Department of Environment and Climate Change NSW office. It is up to the discretion of the local authorised Department of Environment and Climate Change NSW officer to determine if a permit will be granted and the number of kangaroos that can be culled. The products from the kangaroos culled under a damage mitigation permit, are not to be used for any commercial purposes.

More information on the management of native herbivores can be obtained from your local Department of Environment and Climate Change NSW officer.

Management options for introduced pest animals include:

- fencing;
- shooting;
- baiting according to label directions with registered toxins; and
- trapping.

More information on introduced pest species can be obtained from the:

- Livestock Health and Pest Authority (formally known as the RLPB);
- NSW Department of Primary Industries;
- Department of Environment and Climate Change NSW; and
- Invasive Animal Cooperative Research Centre.

Managing stock in wetland grazing

Timing of grazing

The timing of grazing depends on the management system in place. Generally grazing should be avoided:

- at the onset of flooding (after a flood or heavy rainfall);
- after fire when vegetation is re-establishing;
- when native plants are flowering, seeding and establishing in degraded wetlands;
- during wetland drying where soils are still wet and prone to compaction and pugging; and
- early in plant growth cycles when new shoots are developing.

Grazing regime

Grazing strategies can result in positive biodiversity outcomes if they are properly managed. For example, in regions threatened by exotic species (e.g. Lippia) and that lack native grazing pressure, cattle can produce the type of disturbance required to help maintain diverse communities (Marty 2005).

Retaining and protecting existing wetland communities, as well as encouraging wetland connectivity, is expected to help improve environmental outcomes and economic benefits for graziers. This is because healthy wetland systems hold more water and produce more plant biomass resulting in more resilient wetlands with a range of habitats.

So it can be surmised from this that:

- It is often not necessary to permanently exclude livestock from in and around wetlands.
- It is important to control stock movement and to manage grazing pressure.
- Recovery periods for desired plant species should be considered.

Grazing pressure can be managed by varying the period of grazing in individual wetland areas according to the grazing regime in place. This requires planning.

Different grazing regimes include:

- continuous stocking;
- set stocking;
- tactical or strategic grazing;
- rotational grazing; and
- time controlled grazing.

Graziers are aware of the need to maintain nesting waterbird colonies when eggs or un-fledged young are present.

Some consideration should be given to land management across bird foraging areas to minimise the impact on food sources during these breeding events.

With each flooding event, different wetland paddocks or sections of wetland paddocks should be excluded from grazing to allow for unfettered seed set each year.

Many graziers in the Gwydir Wetlands and Macquarie Marshes use a combination of set stocking and semi-strategic grazing where stock are moved between paddocks either twice annually or each year in response to different triggers.

Set stocking in the wetlands:

'Grass butts are more important than cattle'

In the Gwydir Wetlands, one grazing couple are happy with how they have operated for the past 40 odd years. Using set stocking with a conservative stocking rate, they have managed to survive extended dry periods with around 500–600 breeders. They use a combination of experience and observation, to evaluate the pasture and wetland vegetation condition, and estimate the number of cattle that can be run for 12 months. This longer-term view has allowed them to be profitable and keep their wetland in good condition.

There is flexibility in their system, and when seasons turn bad they are prepared to reduce stock numbers. When seasons improve, they again take the longer term view and estimate the number of additional stock they can graze. One of their mottoes is that 'grass butts are more important than cattle' meaning you can always get more cattle, but once good plant species are gone, it's a lot harder to get them to re-establish.

Managing stock in wetland grazing

Five alternative grazing regimes

The key to choosing a grazing regime or combination of regimes is to have a very clear idea of your intentions. This includes knowledge of cost requirements, water and

fodder availability, time, and labour requirements. It is important to remember that any grazing strategy, that is not carefully implemented and managed, can result in long-term damage to pasture condition.

Positives	Negatives	General comments
Continuous Stocking Stocking rate remains the same for extended periods (more than 12 months).		
Very low management input.	Runs significant risks of: • patch overgrazing; and • selective overgrazing of palatable species. These risks can lead to long-term economic and environmental damage. Does not take advantage of good seasons and can do long-term damage in poor seasons.	Not recommended for wetland grazing. Negative impacts are usually the result of the stocking rate being too high for drier parts of each year.
Set Stocking Set stocking refers to a specific grazing period when stock are not moved (e.g. cows are set stocked during calving). The set stocking of pastures for shorter periods than 3 months may not necessarily be detrimental to pastures.		
Low management input. Can result in long-term economic and environmental positive, or at least benign, outcomes if carefully managed. Can be used to take advantage of good seasons and adjust management to poor seasons. Reduced fencing and watering cost as a result of using larger paddocks.	Set stocking can place significant pressure on palatable plant species and wetland ecosystems (depending on combination of stocking densities and time). Can under-utilise pastures resulting in reduced economic gain unless stocking rates are varied.	Has been shown to work in wetlands where low stocking densities are maintained and vegetation condition is used as a trigger for stock movement. Three set stocked periods could be used in a year with varying stocking rate and time periods to reflect the varying vegetation conditions. Rest periods can be included.



Feral pigs (NSW DPI)

Managing stock in wetland grazing

Positives	Negatives	General comments
Tactical Grazing Tactical grazing is completely flexible and is based on the goals (financial, animal, plant and soil) of the landholder. This can vary from paddock to paddock, season to season and flood period to flood period.		
Can adapt to changing seasons quickly, therefore improving long-term sustainability. Can reduce the chances of patch or species overgrazing. Examples of strategic grazing management actions are: • changing stock density to match seasonally changing paddock DSE's; • resting paddocks at critical times to encourage plant growth. • allowing pastures to seed and re-generate. • uniformly grazing paddocks for short periods.	Increased management load from set stocking as a tactical grazing regime will typically involve: • managing stock on a monthly or quarterly basis in semi-arid wetland systems; • setting a management objective for a paddock; • implementing a strategy; and • monitoring the results. May involve changes in paddock size and watering points depending on the results of monitoring.	Tactical grazing is recommended for use in the wetlands thanks to its flexibility and potential positive economic and environmental outcomes. In the Gwydir Wetlands and Macquarie Marshes tactical grazing can involve: • resting pastures in spring to allow germination of desirable species; • heavy grazing in summer to maintain the dominance of Water Couch in some areas while lightly grazing Marsh Club-rush in other areas to maintain its dominance; • resting to allow bird breeding; or • maintaining plants in the vegetative stage for maximum animal production. Short-term set stocking and rotational grazing are used to achieve the paddock objectives.
Rotational Grazing Rotational grazing describes the rotation of grazing stock based on short time periods (e.g. days or weeks). The length of a grazing period and of a recovery period is determined by: • pasture growth rates; • number of paddocks used in the rotation; and • number of DSE.		
Rotational grazing allows pasture to rest and recover from domestic grazing pressure, though some ongoing native animal grazing pressure should be expected. Involves gaining a detailed knowledge of pasture/feed species on your property. Can result in a higher stocking rate, and associated economic gain, if carefully managed. This increase results from utilising more of the vegetation.	Can mean an increase in paddock numbers and therefore associated costs of additional fencing and watering points. Increased management time and effort compared to set stocking. Has to be carefully managed in and around wetlands to reduce damage from pugging. Increased stocking rates may not be sustainable if not carefully managed, and may result in long-term damage to the vegetation.	Careful planning needs to be undertaken when introducing this regime into wetland dominated areas, for example when the wetlands are flooded, higher density stocking can result in significant damage due to pugging.

Managing stock in wetland grazing

Positives	Negatives	General comments
Time Controlled Grazing TCG grazing is flexible and is based on the goals (financial, animal, plant and soil) of the landholder. Time controlled grazing systems use higher stock density on paddocks for very short periods, the same as rotational grazing. The length of a grazing period and of a recovery period is determined by pasture growth rates and the number of paddocks used in the rotation. Time controlled grazing generally requires: • cells (group of paddocks on same or similar soil types); • use of grazing charts; • stocking rates to be matched to carrying capacities; and • planning, monitoring and managing.		
Can adapt to changing seasons quickly, and it reduces the chances of patch or species overgrazing. Examples of TCG grazing management actions are: • changing stocking rate to match seasonally changing paddock DSE's or carrying capacity. • giving adequate rest to desirable plant species. • uniformly grazing of paddocks because of high stock density of animals. • having animals on a higher plane of nutrition because of short graze periods. Potential to increase stocking rates sustainably. More production over the same area with less environmental damage.	Increased management when compared to all other grazing systems, and will typically involve: • managing stock and pastures on a daily or weekly basis in semi-arid wetland systems; • using grazing charts to plan and monitor; and • setting goals and objectives for people, property and animals. May involve changes in paddock size and watering points depending on goals and objectives. Has to be carefully managed in and around wetlands to reduce damage from pugging.	Careful planning needs to be undertaken when introducing this regime into wetland dominated areas.

Grazing and groundcover

Having indicators to decide when to graze and when not to graze is important. Groundcover assessment is one indicator.

Groundcover includes any material on or near the soil surface that protects the soil against the erosive action of raindrops, overland water flow and wind (Jessop *et al.* 2008). It includes all:

- vegetation;
- leaf litter; and
- plant debris.

Groundcover is not necessarily palatable pasture.

Benefits of groundcover

Groundcover protects the soil by (Jessop *et al.* 2008):

- enhancing pasture survival during dry periods;
- intercepting raindrops;
- slowing water flow;
- increasing water infiltration to soils;
- reducing evaporation from soil surfaces; and
- slowing wind speed and covering fine soil particles.

Removing groundcover

Soils without groundcover are susceptible to surface crusting, compaction, and erosion. Unprotected soil surfaces can lose up to 100 t/ha of topsoil through wind erosion in a year (Jessop *et al.* 2008). Groundcover slows down surface flow, allowing more infiltration and reducing the potential for erosion.

Groundcover requirements

Groundcover requirements are different across grazing businesses in the Gwydir Wetlands and Macquarie Marshes. It is suggested that in **most situations**:

- Reed beds and couch meadows are maintained at 100% groundcover 100% of the time in flooded (inundated) wetlands because of the large quantities of plant material.
- 70% groundcover is the minimum ground cover maintained in all other flooded (inundated) wetland communities.
- 70% groundcover is the minimum ground cover maintained in all dry wetland communities.

- 40% groundcover is the minimum required for non-wetland areas of farm businesses.

Remember:

- Groundcover provides a guide to what should be maintained.
- Groundcover is not the only indicator that should guide grazing management.
- It is best to maintain as much plant material as possible in all communities.
- Reducing trampling, minimising erosion, and maintaining groundcover will help wetland communities respond more rapidly to flooding.

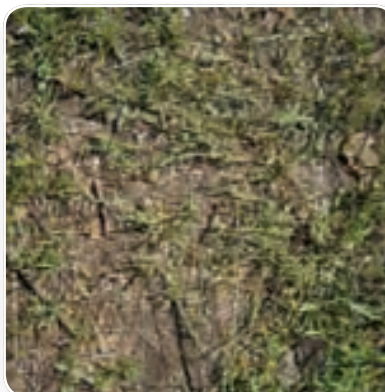
100% groundcover means bare soil cannot be seen.



90% groundcover (Robert Baun, CW CMA)



20% groundcover (Robert Baun, CW CMA)



40% groundcover (Robert Baun, CW CMA)



70% groundcover (Robert Baun, CW CMA)

Managing stock in wetland grazing

A single millimetre of soil cover per hectare weighs around 10 tonnes.

Ground cover measurement

Methods to estimate ground cover include (Jessop *et al.* 2008):

- visual assessment;
- step point method; and
- pointed stick technique.

More information on groundcover assessment is available from the Border Rivers-Gwydir Catchment Management Authority and the Central West Catchment Management Authority:

www.brg.cma.nsw.gov.au

www.cw.cma.nsw.gov.au

Black Roly-poly and other non-grazing plants are first stage succession plants. Such plants are not desirable for grazing systems, but:

- provide groundcover in areas that are no longer permanently or semi-permanently inundated;
- are better than bare soils; and
- provide the opportunity for other species to establish.

Stock behaviour

Stock grazing patterns

During the preparation of these guidelines, no scientific studies were available that describe stock grazing patterns in wetlands or the movement of stock between floodplains and/or different wetland areas.

The NSW Department of Primary Industries and the University of New England are currently seeking to capture some of this knowledge for semi-arid wetlands of NSW. A better understanding of stock grazing patterns will help graziers manage for economic and environmental outcomes. For example, the observations of graziers suggest that cattle prefer some species over others. Once determined, this sort of information can be used to more accurately predict appropriate stocking rates for long-term sustainability.

Stock performance

Very little scientific information is available that describes the performance of different stock or breeds in flooded wetlands.

Graziers report that livestock that are born in and around wetlands perform better than trade cattle in flooded areas. The reduced performance of cattle introduced to grazing in wet muddy landscapes has been reported previously by Petty and Poppi (2008) as:

- smaller live weight gains; and
- reductions in the number of cattle grazing at any point in time.

Wetting regime

During the preparation of these guidelines, no information was available that describes the impact of different wetting regimes on the behaviour of livestock.

Recommendations

The wetting regimes of the Gwydir Wetlands and Macquarie Marshes are variable. The wetlands can experience prolonged periods of extensive flooding and long periods of very limited flooding. Water regulation exaggerates dry periods where limited water is available for wetland flooding.

In these climatically variable wetland areas graziers should:

- have annual and seasonal flexibility in grazing management practices;
- respond to changes in pasture and flooding by moving stock between paddocks or removing stock completely from parts of properties;
- use conservative stocking rates;
- match animal requirements to seasonal pasture availability;
- identify pasture species and understand how they respond to grazing pressure;
- maintain appropriate levels of ground cover;
- manage for total grazing pressure exerted by livestock and native herbivores;
- consider using a sacrifice paddock to maintain essential stock;
- consider erecting one or two semi-permanent grazing exclusion plots (excluding stock and native herbivores). This will help graziers to compare the impacts of grazing with no-grazing;
- consider reducing the size of paddocks for more frequent resting of pastures following flooding. This will also help seed set; and
- consider introducing grazing systems that allow all sections of the floodplain the opportunity to replenish the seed bank on a cyclical basis.

Remember:

- Grazing management must be specific to wetland vegetation types, such as:
 - Reed beds; or
 - Water Couch meadows.
- Flooding, grazing pressure and grazing period influence wetland resilience.
- The reduced flood frequency and size leads to reduced resilience, and grazing management must adapt.

Managing stock in wetland grazing

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Disclaimer

The information contained in this publication is based on knowledge and understanding at the time of writing – May 2009. This information is not to be used in isolation from other information developed as part of the *Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes*.

Advances in knowledge since the publication of these *Guidelines*, means that users must ensure that information upon which they rely for management decisions 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 advisor.



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