

NSW Wetland Recovery Program

FINAL REPORT

Macquarie Marshes and Gwydir Wetlands: *Best Management Practice for grazing in wetlands*



**Industry &
Investment**

Department of
Environment, Climate Change and Water NSW



Australian Government
Water for the Future

NSW Wetland Recovery Program

FINAL REPORT

Macquarie Marshes and Gwydir
Wetlands: *Best Management Practice for
grazing in wetlands*

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Holmes S, Speirs S, Berney P, Rose H (2009) *Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes*. NSW Department of Primary Industries.

Rose H and Speirs S (2009) *Glove box guide to plants of the Gwydir Wetlands and Macquarie Marshes*. NSW Department of Primary Industries.

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Executive Summary

The Gwydir Wetlands and Macquarie Marshes have faced extended periods of stress due to changed water regimes and ongoing dry conditions. Vegetation communities have changed as a result: wetland vegetation condition has declined, wetland plants have reduced in area and terrestrial plants have increased in area. In an attempt to stop, or limit, further reductions in the areas of viable wetland communities the Australian Government and the NSW State Government initiated the NSW Wetland Recovery Program for the Gwydir Wetlands and Macquarie Marshes.

The NSW Wetland Recovery Program funded Industry and Investment NSW (formerly NSW DPI) in a project to document Best Management Practices for grazing in wetlands. The project was overseen by a steering committee that consisted of representative grazing landholders, and by representatives from the Border Rivers-Gwydir and Central West Catchment Management Authorities, the Department of Environment, Climate Change and Water NSW and Industry and Investment NSW. This project developed:

- *Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes.*
- *Glove box guide to plants of the Gwydir Wetlands and Macquarie Marshes.*
- Benchmarks of the current situation among consulted landholders in the Gwydir Wetlands and Macquarie Marshes.

To develop these products, and to develop an understanding of the research and extension needs of grazing landholders, interested landholders and stakeholders were consulted.

The process of landholder consultation in this project gave landholders and other stakeholders a sense of ownership over the products produced. This sense of ownership will be significant in influencing the use of the resources by landholders and provides the strongest means of influencing future management practices and consultation.

This report details a significant number of recommendations. It is imperative that there are future initiatives that focus on these needs and these recommendations provide a significant opportunity to influence future grazing management in the Gwydir Wetlands and Macquarie Marshes.

1. Introduction and background

In 1996, landholders in the Macquarie Marshes commissioned a study into grazing practices that included best management practice recommendations (Cunningham 1996). Since then the Macquarie Marshes and the Gwydir Wetlands have faced significant drought. This has impacted on the extent and management of these areas and many landholders now consider 'good marsh' a distant memory. In 2006, the NSW Wetland Recovery Program was initiated to assist the recovery of the Gwydir Wetlands and Macquarie Marshes. One intent of the program was to develop and document land and water best management practices (BMP) to help reduce the decline of ecological quality and to assist landholders in the uptake of sustainable land-use practices. These actions would assist in the restoration and management of critical ecological functions and habitats. The BMP for grazing in wetlands was a project funded by the NSW Wetland Recovery Program. It was aimed at developing:

1. *Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes.*
2. Paddock Plants information sheets for key species.
3. An extension plan and associated delivery of specific activities.

These products were developed to foster sustainable grazing practices among landholders across these wetlands. Both areas are recognised as important sites for biodiversity and are subject to considerable degradation due to, amongst other things, altered flow regimes. In this degraded condition, landholders are restricted in their ability to influence ecological function and it is important to identify sustainable management practices where agriculture occurs in wetlands.

The implementation of management guidelines is the responsibility of individual landholders. The role of the products developed through this project is to provide graziers with resources that include new and current knowledge to assist individuals in tailoring their business decisions for current and future challenges.

2. Project specifications

The BMP for grazing in wetlands project had a series of broad objectives, and then further refined or second-level objectives. Key performance indicators, project outcomes and milestones were also clearly established.

2.1 Broad objectives

The broad objectives for the Best Management Practice for Grazing in Wetlands project were:

1. Benchmark current management practices and identify suitable environmentally and financially sustainable management changes.
2. Produce one management guidelines publication for grazing in both wetland areas.
3. Promote and coach landholders in adoption of sustainable management practices for wetland longevity.

2.2 Second-level objectives

The second-level project objectives were:

- Collate existing knowledge of wetland grazing management currently in the NSW NRM arena.
- Summarise landholder knowledge, from both wetland areas, to benchmark current management practices via the Wetlands Workbook being trialled as part of the 'Wetlands on Farms' project.
- Develop and prioritise grazer identified training needs and deliver targeted training activities.
- Prepare management guidelines for grazing in wetlands.
- Produce two fact sheets on sustainable wetland grazing practices (1 per CMA).
- Promote guidelines across various information media (e.g. hard copy, CDs, Internet) to facilitate dissemination across NSW and Australia.

2.3 Key performance indicators

The key performance indicators for the project were:

1. Paddock Plants knowledge for both wetlands collated and presented in draft format.
2. Landholder responses from both wetland areas collected and summarised to allow for the benchmarking of current management practices.
3. Production of management guidelines for grazing in wetlands.
4. Production of two fact sheets on sustainable grazing practices.

5. Delivery of a series of workshops across both wetlands that will address on-farm environmental issues relating to wetlands and farm production.

2.4 Project outcomes

The proposed project outcomes were:

- Provide a tested model and associated resources for delivery of wetland grazing knowledge to assist in the adoption of best practice.
- Encourage better management practices amongst landholders to achieve broader long term environmental outcomes for the Gwydir Wetlands and Macquarie Marshes.
- Provide a framework for the broader adoption of better grazing practices across the wetlands of inland NSW.

It was proposed that the achievement of these outcomes would assist in the development of Wetland Management Plans, Property Management Plans and/or an Environmental Management System approach by Industry and Investment NSW, Central West CMA and Border Rivers-Gwydir CMA where opportunities become evident as part of CMA Catchment Action Plan targets.

2.5 Project milestones

- | | |
|---------------|---|
| December 2007 | - Endorsement of project plan by NSW Wetland Recovery Program Project Control Group (PCG). |
| March 2008 | - Draft communication strategy developed.
- Paddock Plants for wetlands commenced.
- Protein analysis of available key seasonal grazing species for Paddock Plants commenced. |
| August 2008 | - Draft Paddock Plants completed.
- Consultation phase commenced. |
| March 2009 | - Detailed findings of the stakeholder consultation phase reported.
- Detailed benchmarks, drivers, opportunities and needs reported.
- Protein analysis of available key seasonal grazing species for Paddock Plants completed.
- Paddock Plants and Prograze™ completed. |
| June 2009 | - Stakeholder workshops completed.
- Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes completed.
- Information prepared for each of the two wetlands. |

2.6 Project operation

The BMP for grazing in wetlands project was conducted by Industry and Investment NSW. It brought together a team with skills in wetland management, botany, farming and grazing systems, soil science and communication. The project was managed within Industry and Investment NSW with significant consultation between the project manager, project staff and the project Steering Committee. The Steering Committee consisted of one member from each of the following stakeholder groups:

- Border Rivers-Gwydir Catchment Management Authority.
- Central West Catchment Management Authority.
- Department of Environment, Climate Change and Water NSW.
- Graziers, Gwydir Wetlands.
- Graziers, Macquarie Marshes.
- Industry and Investment NSW.

The project contracted the services of other organisations where appropriate. Two organisations that provided assistance to the development of the products produced through the project were:

- Sustainable Soils Management, Warren – Mapping and review of soils information.
- University of New England, Armidale – Specific knowledge of wetland plant communities and grazing in wetlands.

The project consulted widely to ensure that the technical content of the developed products represented the best available knowledge at the time of writing.

2.7 Delivered outputs

The products developed by the BMP for grazing in wetlands project were:

- Review of literature specific to grazing.
- Reported benchmarks, drivers, opportunities and needs of current management practices.
- *Glove box guide to plants of the Gwydir Wetlands and Macquarie Marshes* publication, which includes;
 - Crude protein and metabolisable energy.
 - Growth patterns.
 - Management considerations.
 - Plant mineral composition.
- *Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes* publication.
- Review of Prograze™.
- Established and prioritised training needs and delivery of specific training.

Individual factsheets were not prepared for the project because this information was included in the *Glove box guide* and the *Guidelines for grazing*.

The remainder of this document will report against each of the specific outputs.

2.8 Communication strategy

A communications strategy was developed at the beginning of the project to facilitate actions. The communication strategy is included at Appendix 1.

3. Steering committee project review

The project steering committee reviewed the process and direction of works. Strengths and weaknesses of the project, and future opportunities were documented.

3.1 *Project progression*

The project was delivered on time and on budget, apart from the launch of the Guidelines and the delivery of paddock plants days. The Guidelines were launched in the Gwydir Wetlands and Macquarie Marshes during August and September 2009.

Paddock Plants days have been planned with each CMA and landholders for spring 2009.

3.2 *Project resourcing*

The resources available for this project were adequate.

3.3 *Outcomes*

No unforeseen outcomes have been identified at this stage. The steering committee indicated that it was premature to gauge successful outcomes relating to this project. However, it is recognised that the Guidelines will provide a useful resource for persons visiting the Gwydir Wetlands and the Macquarie Marshes.

3.4 *Highlights and drawbacks*

There are three key highlights identified by the steering committee:

- The *Glove box guide to plants of the Gwydir Wetlands and Macquarie Marshes*.
- The *Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes*.
- Formal involvement of landholders as part of the steering committee and their involvement as a strong influence over the development of the project.

There were no identified drawbacks that related to this project.

3.5 *Further requirements*

The project steering committee has identified a number of recommendations. All recommendations identified through the project are detailed later in the report (Section 12). The steering committee endorses all project recommendations.

3.6 *Future opportunities*

The opportunity exists to conduct long-term grazing related research trials in the Gwydir Wetlands and Macquarie Marshes based on the recommendations of this project. The opportunity exists to use the Guidelines produced by this project in the education of other community groups and interested individuals.

3.7 Key lessons

The project identified four key lessons:

1. Engage landholders early during research and extension projects and provide participants with results relating to their contributions.
2. Formally engage landholders in project steering committees.
3. Provide greater recognition and/or remuneration for the considerable time provided by a small number of key landholders to research and extension projects.
4. Only a small number of landholders are willing to allow groups of people access to their properties.

4. Review of the literature

Guidelines for grazing in wetlands are important for maintaining ecosystems in the Gwydir Wetlands and Macquarie Marshes and for promoting sustainable grazing management. The development and implementation of these guidelines depends on a clear understanding of desirable management outcomes (Casanova 2007). Clear management outcomes are identified by using relevant literature and on-ground experiences to direct landholder and stakeholder consultation and further investigation.

Published literature indicates that the impacts of grazing on wetlands are largely density dependent, but there is insufficient reliable grazing information relevant to the Gwydir Wetlands and Macquarie Marshes. A significant reliance therefore is placed on research conducted in other wetland systems where differences in soils, wetting regime and other features can influence outcomes. The application of such research to the Gwydir Wetlands and Macquarie Marshes is further complicated by the complexity of these systems and by the often contradictory reports of different grazing trials.

The aim of the literature review was to determine where gaps exist in our knowledge of wetland grazing for the express purpose of developing grazing guidelines for the Gwydir Wetlands and Macquarie Marshes. The gap analysis used the NSW Wetland Recovery Program review *The effect of grazing of freshwater wetlands in Australia* (Casanova 2007) as the basis for this gap analysis.

4.1 Effect of grazing of freshwater wetlands in Australia

The Casanova (2007) review was commissioned by the NSW Wetland Recovery Program to identify existing information concerning the role of grazing in wetland ecosystems. This review placed particular reference on floodplain wetlands of the lower Gwydir and Macquarie rivers.

The Casanova (2007) review was broad in its approach and it did not provide an analysis of the various management options for grazing that are discussed elsewhere (e.g. Briggs 1988; Buxton 1991; Sheldon 2005) for wetland systems. The review included very little information on the response of individual species to grazing and limited guidance on how plant responses would affect grazing strategies. The references section of this report includes a number of relevant resources required for the development of guidelines for grazing in wetlands that had not been cited by Casanova (2007).

4.1.1 Limitations

The Casanova review (2007) does not cite a number of relevant Australian references, including some references that specifically focus on the impacts of grazing in the Macquarie Marshes (e.g. Mitchell 1848; Peacocke 1943; Brander 1987; Cunningham 1996; REU 2000; Barnes and Wise 2003; Shelley 2007). Furthermore, Casanova often refers to literature obtained from work conducted on wetlands under different environmental climates and landscapes to those of the Gwydir Wetlands or Macquarie Marshes (e.g. potholes and lakes with sharp boundaries between wet and dry vegetation).

Casanova (2007) placed a significant reliance on the results of work conducted outside Australia (particularly America, Europe and Africa). The wetlands it focuses on are likely to have developed in association with pressures from naturally hard-hoofed animals. The Casanova review does not differentiate between the impacts of native animals and livestock or clarify grazed species in studies. This complicates the applicability of grazing management studies to the Gwydir Wetlands and Macquarie Marshes. An additional constraint in the Review, noted by Casanova, was the reporting of simulated grazing (clipping) studies that do not effectively mimic livestock activity. For example, Crossle and Brock (2002) clipped plants at 1-2 cm above the soil level regardless of submersion depth. In some other cited publications, Casanova reports that there were no attempts to determine (or report) the stocking rates used. Instead, extremely broad generalisations were concluded. In one example, Casanova reports set stocking of grazing cattle as being successfully used to remove infestations of para grass, and at reducing the biomass of Phragmites. It is not mentioned that Williams *et al.* (2005) did not find any change in the cover of phragmites or in biodiversity in their study.

4.1.2 Cell grazing

Cell grazing is suggested as a useful tool for refining grazing management in wetlands (Casanova 2007), but this suggestion is not supported by the references cited. For example, Jackson (1999) suggested that the total exclusion of grazing was beneficial to native wetland species establishment, while Stromberg and Kephart (1996) did not refer to cell grazing, but to strategic grazing in late winter and early spring in an old agricultural paddock and not a natural wetland (Fitzpatrick 2004).

4.1.3 Introduction of exotic species

Casanova (2007) suggested that grazing is likely to increase the risk of introducing exotic species that would have severe effects on these wetlands. This is not supported by current evidence for the presented examples. water hyacinth, para grass and lippia, are all human and/or water transported species. Indeed, under small scale stock exclusions Casanova (2007) indicates that in the absence of grazing, sites may become dominated by perennial exotic pasture grasses such as *Paspalum paspalodes*. It should be noted however, that *Paspalum paspalodes* is the name formerly used to identify the native *Paspalum distichum* (water couch).

4.2 Guidelines for grazing

An objective of the *BMP for grazing in wetlands* project was to develop guidelines for grazing aimed at achieving healthy wetlands. The guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes are supported in NSW by *Wetland management – Recommendations for management of wetlands on farms in inland NSW* (McIntyre *et al.* 2009).

Other BMP resources have been developed for grazing in different Australian and International wetlands (e.g. Briggs 1998; Buxton 1991; Sheldon 2005, Butcher 2006, Wetland Care Australia 2008; Murrumbidgee CMA 2008). Guidelines have been developed for local burning and grazing since the 1940s and are a potential source of knowledge that could feed into best management practices for grazing in wetlands (e.g. Peacocke 1943). Components of these resources are applicable to grazing in the Gwydir Wetlands and Macquarie Marshes. This project was aimed at compiling a

document that contains information specifically related to plant communities and the impacts of grazing in these two important semi-arid wetlands.

4.3 Research needs

The gap analysis raised a number of knowledge gaps. Research needs identified through the gap analysis pertaining to grazing management in the Gwydir Wetlands and Macquarie Marshes are:

- Assessment of the impact of grazing water stressed areas. For example, Nicol *et al.* (2007) discovered that sheep grazing on dry wetlands had a negative impact on seed bank density and diversity.
- Assessment of the possible impacts of climate variation on grazing ecosystems.
- Determine seed bank viability and seed dormancy. This would provide information on the ability of annual and perennial species to respond during drought and flood periods. This knowledge will enable landholders to determine grazing strategies (e.g. exclusion) with greater understanding of wetland ecosystems.
- Establish methods of determining the length of time that rhizomes' require to develop energy reserves in grazed plant species. This will help graziers to determine minimum periods between grazing events for wetland areas.
- Local short and long term grazing trials are required to determine the costs and benefits of grazing to the environment and to landholders. Trials will assist the development of knowledge on stocking rates, comparisons between stock exclusion, current practice and best management practice. This research will produce affordable, flexible and acceptable grazing strategies for local landholders.
- Quantify the impact of grazing by native animals and determine clear grazing thresholds. This reflects the suggestion that the recovery of reserve areas of the Macquarie Marshes is being restricted by native fauna. A total grazing exclusion site comparison is shown in Figure 4.1.



Figure 4.1: Grasses are common where total grazing is excluded (left side of fence), but virtually absent where native fauna graze at this site (right side of fence), Macquarie Marshes (March 2008).

4.4 Conclusions

Wetlands are highly complex ecosystems and it is difficult to compare information from wetlands that have different wetting regimes, climates, plant communities and soils. Current knowledge provides a general understanding of the processes and impacts in wetlands. However, it is difficult to apply this information to the Gwydir Wetlands and Macquarie Marshes with a large degree of confidence.

It will take many years to develop a full ecological understanding of livestock management in the Macquarie Marshes and Gwydir Wetlands. Hence, an interim set of guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes should be based on best management practices derived from current data, published material, and local knowledge. The guidelines should be tested using local trials and involve long term monitoring. These two aspects are beyond the scope of the current project.

In future research, the impact of native fauna needs to be distinguished from that of livestock and the associated private and public cost/benefit must be quantified. Long term studies will be required to help build this knowledge. This will determine the true effect of livestock grazing in wetlands.

5. Stakeholder consultation

Grazing landholders and other stakeholders have significant knowledge of plant species and grazing practices in the Gwydir Wetlands and Macquarie Marshes. This includes knowledge of the impacts and values of grazing practices on different plant communities. Stakeholder consultation was conducted to assist with:

- Identification of key Paddock Plants.
- Benchmarking current management practices (Section 6).
- Identification of suitable environmentally and financially sustainable management changes (real and perceived costs of management changes and training needs) and the real economic cost of implementing change to improve practices that focus on the condition of wetlands, improved overall stock production and farm productivity.
- Developing usable publications.
- Identifying future research and extension initiatives.
- Determining landholder aspirations and visions for private land and for the larger system.
- On-going review of project materials.

The role of consultation in the development of Paddock Plants, the *Guidelines* and development of training activities will be discussed in the relevant sections of this report.

5.1 Stakeholder surveys

Knowledge, views and perceptions were gathered from graziers and other key stakeholders. The aims of the stakeholder surveys were to:

- Understand current grazing management in these wetlands.
- Understand reasons behind management decisions.
- Identify areas where management may be improved or changed through the experiences of others.
- Capture stakeholder research, training and extension needs.

To do this, surveys were prepared for landholders (Appendix 2) and other stakeholders (Appendix 3). At the beginning of the project it was proposed that the Wetlands–On–Farms Planning Workbook (Holmes 2008) would be used to gather information from participating landholders. At the time the surveys were conducted, the Workbook had not been finalised. To overcome this constraint, the project team used the Workbook as the basis for the development of the landholder survey. The landholder survey was then used as the basis for the stakeholder survey. Survey questions focused on:

- Current management practice, including stocking rates and type, grazing periods, fodder requirements, fencing, watering points, yards and wetland access.

- Determining landholder understanding of the value of their wetlands within the whole wetland system.
- Understanding landholder perception of the unique nature of these wetland resources.
- Identifying landholder knowledge base and educational requirements in terms of soil type and management, wetland plant identification and seasonal nutritional value of wetland dependent plant species.

5.2 Engagement

It was proposed that 20–30 landholders would be engaged in the survey and that 10 non-grazing stakeholders would be consulted. To seek participation in surveys, the project team:

- Prepared an information flyer outlining the intent of the project and seeking involvement. This was circulated throughout the Gwydir Wetlands and the Macquarie Marshes by post and was supplied to recognised agencies and organisations in each wetland.
- Prepared a media release that was published in the:
 - The Land;
 - Warren Advocate;
 - The Walgett Spectator;
 - Coonamble Times; and
 - Moree Champion.
- Contacted graziers and other stakeholders directly to gauge interest.
- Conducted a radio interview with ABC Local Radio for distribution across the Tamworth and Dubbo regions.

As a result, 23 surveys were conducted with different grazing landholders (11 surveys in the Gwydir Wetlands and 12 surveys in the Macquarie Marshes) and 10 surveys with other stakeholders. The other stakeholders consulted were those who responded to the media release and to approaches by the project team and included persons from:

- Catchment Management Authorities;
- Department of Environment, Climate Change and Water NSW;
- Traditional Owners;
- Industry groups; and
- University of New England.

Participants were contacted by telephone to discuss requirements, copies of the surveys were provided and face-to-face interviews were arranged. The project team conducted each survey by visiting relevant properties and, in the case of other stakeholders, offices.

The information provided through the surveys has been collated and the results are presented in the following sections of this report.

5.3 Findings of grazing landholder surveys

Graziers in the Gwydir Wetlands and Macquarie Marshes reported that:

- Landholders have strong social values that they associate with their wetlands.
- Grazing of cattle occurs in wetland areas, while sheep are grazed on flood plains.
- They have a solid understanding of how to manage these wetlands when they are inundated, but are finding it difficult to adjust to extended periods of limited inundation.
- Prior to river regulation, wetlands covered an average of 85% of each respondent's property in the Gwydir Wetlands and an average of 40% of each respondent's property in the Macquarie Marshes.
- Prior to river regulation, more than 90% of farm income was generated from grazing on wetlands.
- Wetlands currently represent less than 15% of the area of grazing properties, and graziers from both wetland areas indicate that farm income has reduced comparatively.
- The role of wetlands, while still important to many as drought refuges and breeding areas, has become less important as the size of these areas has decreased.
- Grazing wetland and floodplain areas across different properties accounts for an average of 65% of land-use, but provides only 30% of total farm income (includes income from off-farm employment).
- In the Gwydir Wetlands, 60% of surveyed landholders have accessed NRM funding or technical support. In comparison, 40% of surveyed landholders in the Macquarie Marshes have received technical support or funding for NRM management related activities (30% have never applied for NRM funding, 30% have applied unsuccessfully).
- Broadly the debt levels of different grazing businesses have risen. This has occurred for a number of reasons and includes the significantly reduced numbers of livestock.

5.4 Drivers of grazing decisions

Three key drivers of grazing decisions were identified through landholder surveys (Table 5.1).

Table 5.1 Drivers of grazing management according to respondents.

Driver	Explanation	Priority
Water	The participants continually highlighted reduced inundation extent and frequency across both wetlands. This is seen as the greatest limiting factor for grazing in both the Gwydir Wetlands and Macquarie Marshes by a large proportion of landholders.	<i>High</i>
Income	Income is generally low and many businesses in the Gwydir Wetlands and Macquarie Marshes have increasing levels of debt. Generally reduced farm income and increasing levels of debt are associated with reduced livestock numbers. Reduced livestock numbers are a reflection of limited fodder availability. <ul style="list-style-type: none"> - 30% of Gwydir landholders indicated that farm income was not sufficient to undertake desired grazing changes. - 85% of Macquarie landholders indicated that farm income was not sufficient to undertake desired grazing changes. 	<i>Medium</i>
Support	Most landholders suggest that they receive inadequate assistance from advisors. This occurs because landholders believe that there are a limited number of suitable advisors and that these advisors tend to have limited knowledge of wetland systems.	<i>Low</i>

5.5 *Grazing landholder needs*

During consultation, three key landholder needs were identified (Table 5.2). Information relating to research and extension needs was also obtained (Tables 5.3 and 5.4).

Table 5.2 Landholder needs as reported by respondents.

Need	Explanation	Priority
Water	This is the primary driver of wetland functionality and without inundation from river water, these wetland systems will continue to deteriorate with or without grazing.	<i>High</i>
Grazing knowledge	Significant research has been conducted in both the Gwydir Wetlands and Macquarie Marshes, but with some exceptions, there is a dearth of documented research knowledge that helps drive grazing management decisions.	<i>Medium</i>
Extension	Functional knowledge of wetlands and wetland grazing among advisory services tends to be low.	<i>Medium</i>

Table 5.3 Landholder identified research needs.

Research needs	Number of responses*	
	Gwydir Wetlands	Macquarie Marshes
Lippia Management	4	1
Weed management	1	-
Alternative grazing species	2	1
Native pasture establishment	1	1
Seasonal value of different pastures	-	3
Water use efficiency of wetland grazing	1	-
Mechanisms for water management	-	2
Independent assessment of the impact of water regulation	3	-
Irrigation efficiency and water transport	-	2
Grazing impacts on wetlands under climate change	3	1
Determination of the full cost of water distribution	-	1
Wetland viability	-	1
Assessment of the guidelines for grazing against environmental and economic outcomes	2	2
Impacts of different wetting regimes	-	1

* Landholders were permitted to identify multiple research needs.

Table 5.4 Landholder extension needs according to respondents.

Extension needs	Number of responses*	
	Gwydir Wetlands	Macquarie Marshes
Re-snagging lower Macquarie	-	1
Soils <i>General</i>	4	-
<i>Soil carbon</i>	1	-
<i>Soil Biology</i>	1	-
Supplementary feeding	-	1
Development of a literature and research library	-	1
Plant identification	2	3
Plant production	4	3
Grazing management	-	4
General weed and lippia management	5	3
Plant nutrition	2	2
Impacts of grazing on wetlands	2	-

* Landholders were permitted to identify multiple extension needs.

5.6 Results of non-grazing stakeholder surveys

The responses of non-grazing stakeholders were similar to those of consulted graziers irrespective of organisation or representative wetland (Gwydir Wetlands or Macquarie Marshes). Water was identified as the primary driver of wetland health in both areas and river regulation was recognised as having a major impact on the wetlands. The role of grazing management was viewed as important, but very much considered as a secondary influence on wetland health. There was acknowledgement of the economic importance of grazing.

It was recognised that poorly managed grazing could seriously impact on already stressed wetland systems.

Most non-grazing stakeholders generally:

- Rated the current health of the wetlands as poor, but some indicated that remaining core (semi-permanent) areas of the Gwydir Wetlands were in good condition.

- Thought that graziers should require a good understanding of the vegetation within wetlands and the impacts of grazing management on different plant communities to graze successfully.
- Suggested larger groundcover estimates for determining pasture condition than those indicated by landholders. Generally it was thought that landholders should aim to maintain 70–100% of groundcover most of the time.
- Indicated that the trigger point for livestock removal should be vegetation height rather than groundcover.
- Recognised that these wetlands are dynamic and that no single system of grazing management would provide a desirable solution in all circumstances. All management should be suited to the conditions and issues facing the individual properties.

Most non-grazing stakeholders generally thought that grazing was an appropriate land-use provided management accounted for wetland vegetation changes. Sound grazing management in wetlands was suggested to include:

- Plant community condition assessment prior to grazing and ongoing assessment until the removal of stock in response to a trigger point.
- Low stocking densities with rest periods.
- Removal of stock during flood events and during extended dry periods.
- Adaptive flexible management where stocking practices reflect vegetation condition and seasonal variations.
- Use of alternative watering points in areas that are not inundated.

5.7 Recognised opportunities identified through consultation

In this project, engaging landholders from the Gwydir Wetlands and Macquarie Marshes was difficult. The BMP for grazing in wetlands project, and current work by the Border Rivers-Gwydir CMA, the Central West CMA, DECCW and Industry and Investment NSW, appears to be driving a significant opportunity for future engagement with landholders across these important wetlands.

Landholders have shown particular interest in improving their identification and understanding of important wetland plants. The Paddock Plants component of this project, and the associated analysis of metabolisable energy, crude protein and plant nutrient composition, is likely to provide government with an opportunity to engage grazing landholders at a production level and thereby influence future management of these iconic areas. In so doing, a targeted approach to training is being developed between DECCW (RERP Sub-program IV), BRG CMA, CW CMA and Industry and Investment NSW to deliver:

1. Paddock Plants information days.
2. Soil information activities.

3. Tailored grazing management workshops.

It is imperative that interest in training activities is developed among landholders and that these landholders drive participation in activities. It is important that the State and Australian Governments provide appropriate support for future training activities.

6. Landholder benchmarks

The knowledge obtained through consultation with grazing landholders was used to identify benchmarks of management practices and grazing businesses in the Gwydir Wetlands and Macquarie Marshes. The results of these surveys are presented according to the number of survey responses for each of the two wetlands or as the average percentage indicated by respondents.

6.1 *Grazing and wetland area*

The average area of on-farm land used for grazing and the changes in estimated proportions of on-farm wetlands in the Gwydir Wetlands and Macquarie Marshes according to participants are shown in Table 6.1. The estimated proportions of wetland area, land-use and income are presented as average percentages for respondents from each wetland area.

Table 6.1 The proportionate use and area of wetlands according to respondents.

Land-use	Gwydir Wetlands	Macquarie Marshes
Grazing as a proportion of total land-use (%)	62%	91%
Grazing as a proportion of total income (%)	50%	97%
Estimated proportion of on-farm wetlands pre-1980 (%)	85%	40%
Estimated proportion of on-farm wetlands 2008 (%)	16%	13%

6.2 *Use of wetlands*

According to survey respondents, wetlands of the Gwydir Wetlands and the Macquarie Marshes were generally used for grazing (Table 6.2). The wetlands have historically provided the backbone of grazing enterprises and are particularly important during the dry/drought periods. Cropping (grain production) usually occurs on small areas of both wetlands (usually around the margins) and can be opportunistic.

Table 6.2 Different uses of wetlands according to respondents. Some landholders indicated multiple uses of wetlands.

Uses of wetlands by consulted landholders	Gwydir Wetlands	Macquarie Marshes
Water extraction	6%	8%
Grazing / dry feed	69%	92%
Cropping	25%	-

6.3 Grazing enterprises

The survey respondents generally graze cattle across non-cropping land in the Gwydir Wetlands and Macquarie Marshes (Table 6.3). Small numbers of sheep and goats were grazed in different parts of these wetlands. The survey results outline the primary grazing enterprises for participants from each wetland (includes wetland and floodplain grazing).

Table 6.3 Grazing livestock enterprises for survey respondents.

Wetland grazing enterprises	Number of respondents	
	Gwydir Wetlands n = 11	Macquarie Marshes n = 12
Cattle grazing	7	8
Cattle and sheep grazing	3	4
Cattle and goat grazing	1	-

6.4 Grazing management practices

Grazing management practices in the Gwydir Wetlands and Macquarie Marshes receive considerable scrutiny. Landholders that do not use set stocking for grazing livestock, use various systems for identifying when stock movement should occur. In the Gwydir Wetlands and Macquarie Marshes 64% and 20% (respectively) of participants use pasture condition, rather than groundcover percentages, to inform grazing management practices. Generally, this meant that pasture condition was visually assessed according to height and condition. No records were maintained to define pasture height or condition at the time of stock entry and removal from different paddocks.

In the Macquarie Marshes, groundcover percentage was used as a trigger for stock movement in some cases. However, regardless of the system used, most landholders prefer to use estimates of groundcover percentage as trigger points for stock entry and removal. The distribution of current management practices among landholders from each wetland (rotational grazing is not distinguished from strategic grazing) is given in Table 6.4.

Table 6.4 Utilisation of current grazing management practices for survey respondents.

Grazing management practices	Number of respondents	
	Gwydir wetlands n = 11	Macquarie Marshes n = 12
Set stocking	3	4
Rotational (time and condition)	8	6
Rotational (time)	-	1
Rotational (no strict regime)	-	1

Respondents were asked to suggest groundcover estimates for the entry and removal of grazing livestock from different areas of grazing properties (Table 6.5). Groundcover was selected as a means of pasture assessment to maintain the continuity of messages reaching landholders from State Government agencies.

Table 6.5 Suggested groundcover limits according to survey respondents.

Suggested groundcover limits		Gwydir wetlands	Macquarie Marshes
Wetlands	<i>Stock entry</i>	80–100%	70–100%
	<i>Stock removal</i>	30–40%	40–50%
Elevated floodplains	<i>Stock entry</i>	Not considered applicable	
	<i>Stock removal</i>	30–40%	20–40%

6.5 Profitability

Financial information was a highly sensitive issue for most landholders. This restricted the level of detail that could be obtained from consulted participants. Rather, an indication of profitability and debt levels was obtained (Table 6.6). This showed that not one of the consulted businesses was consistently profitable during the last five years.

In all cases, profitability and debt were determined for whole farm businesses and included grazing and cropping enterprises. Generally those businesses that included cropping were more profitable. In some cases profitability and debt levels have been influenced by landholder investment in infrastructure and machinery (e.g. pipe and trough systems or cropping). In the Gwydir Wetlands, some landholders had increased farm debt due to expansion and increased investment in cropping infrastructure. In these wetlands, the use of cropping was often seen as a means of

managing lippia. In comparison, some landholders in the Macquarie Marshes had made significant investment into pipe and trough water systems with the assistance of government incentives.

Table 6.6 Profitability as indicated by respondents.

Profitability	Number of responses	
	Gwydir wetlands	Macquarie Marshes
Profitable during 2003–2004	4	6
Profitable during 2004–2005	3	4
Profitable during 2005–2006	3	5
Profitable during 2006–2007	3	6
Profitable during 2007–2008	3	7
Rising levels of debt	7	6
Falling levels of debt	1	1
Stable debt levels	-	4
No debt	1	1

Respondents were also asked if they had developed a written property business plan, if income was sufficient to implement planned changes on farm, and if off farm income supported the business. Three respondents from the Gwydir Wetlands and four respondents from the Macquarie Marshes reported having a written business plan. This did not mean that the business plans were used. Five landholders from the Gwydir Wetlands and two from the Macquarie Marshes have sufficient farm income for implementing proposed changes. Three respondents from the Gwydir Wetlands and two from the Macquarie Marshes have businesses currently supported by off farm income.

6.6 Costs associated with management change

A significant issue for landholders, in the Gwydir Wetlands and Macquarie Marshes were the costs associated with implementing management change (Table 6.7). In the Gwydir Wetlands, management costs focus on fencing and weed management. In the Macquarie Marshes, reliable stock water, fencing, and supplementary feed, stock adjustment and selling stock were key management constraints.

The participants report considerable costs associated with not sustainably managing these wetland areas. They reported that not managing wetlands sustainably would mean loss of production values and loss of environmental, social and aesthetic values. Landholders across both areas felt that a loss of wetland plant diversity and

abundance through overgrazing, lack of water or weed invasion would impact on their ability to be profitable. The loss of wetland plants would also result in decreased biodiversity through loss of habitat.

Table 6.7 Participant-reported costs associated with changing management.

Costs associated with implementing on-farm change	Number of responses*	
	Gwydir Wetlands	Macquarie Marshes
Fencing	5	4
Weeds (lippia and water hyacinth)	5	-
No change needed	1	-
Vegetation management (black wattle and coolibah)	1	1
Equipment/infrastructure maintenance and purchase	1	-
Supply of water	-	4
Changed water regime	-	1
Mustering and labour	-	1
Management of feral pest animals and native herbivores	-	1
Supply of supplementary feed, livestock adjustment and selling of stock	-	5

* Landholders were permitted to identify multiple costs associated with on-farm change.

6.7 *Blockages to management changes*

Blockages to management change were identified by landholders during consultation (Table 6.8). Income and water (including river regulation) were viewed as the most significant factors blocking management change in both areas. Many of the consulted graziers thought that changes in wetland wetting regimes (i.e. water) were reasons that explained the need for management change, but Gwydir Wetland graziers did not consider changes in wetting regimes as an impediment to management change. Interestingly, graziers in both wetland areas considered time, labour and knowledge as less important blockages to management change in both wetlands. Some landholders thought that no real blockages existed that would influence the changing of management practices.

Table 6.8 Blockages to management change according to survey respondents.

Blockages to change	Number of responses*	
	Gwydir Wetlands	Macquarie Marshes
Income	5	6
Water and regulation	3	7
Lack of knowledge of grazing in semi-arid wetlands	-	1
Labour and time	1	2
None	2	1

* Participants were permitted to identify multiple blockages to management.

6.8 Key constraints to grazing

Water availability and regulation were the key issues for most consulted landholders in the Gwydir Wetlands and Macquarie Marshes (Table 6.9). Many graziers felt powerless in their ability to manage land given current water availability and regulation because these issues were viewed as being beyond landholder control.

Table 6.9 Key constraints to grazing in the Gwydir Wetlands and Macquarie Marshes according to survey respondents.

Key constraints	Number of responses*	
	Gwydir Wetlands	Macquarie Marshes
Water regulation	7	10
External intervention (e.g. Government)	4	4
Lippia (<i>Phyla canescens</i>)	6	1
Invasive Native Scrub	2	4
General weed control	2	3
Native herbivores (e.g. kangaroos)	-	2

* Participants were permitted to identify multiple constraints.

6.9 Exotic weeds

Consulted landholders from the Gwydir Wetlands and Macquarie Marshes gave an indication of important introduced weed species (Table 6.10). In both wetland areas, lippia was the most prominent weed problem and was viewed as the most difficult weed to manage. This weed was influencing land management practices, and in the

Gwydir Wetlands lippia was driving pasture improvement and cropping to ensure some profitability across areas infested with lippia.

Table 6.10 Important introduced weed species.

Weeds	Number of responses*	
	Gwydir Wetlands	Macquarie Marshes
Lippia (<i>Phyla canescens</i>)	10	10
Water hyacinth (<i>Eichhornia crassipes</i>)	4	-
Noogoora burr (<i>Xanthium occidentale</i>)	5	5
Bathurst burr (<i>Xanthium spinosum</i>)	5	5
Scotch thistle (<i>Onopordum acanthium</i>)	2	-
Mexican poppy (<i>Argemone mexicana</i>)	1	-
African boxthorn (<i>Lycium ferocissimum</i>)	2	2
Green cestrum (<i>Cestrum parqui</i>)	1	-
Tiger pear (<i>Opuntia aurantica</i>)	1	-
Wild turnip (<i>Brassica tournefortii</i>)	1	-

* Participants were permitted to identify multiple important weed species.

In addition to introduced weed species, landholders in the Macquarie Marshes strongly identified black roly-poly (*Sclerolaena muricata* ssp.) and bushy groundsel (*Senecio cunnunghamii*) as native plants that were established and dominating plant populations in formerly inundated wetland areas.

7. Paddock Plants

In the project communication strategy (Appendix 1), it was proposed that paddock plants information sheets would be prepared for up to 20 relevant wetland plant species. The Paddock Plants sheets are generally prepared as individual double-sided A4 documents that detail the appearance, habit, importance, management and other similar plants for each of the selected species. Relevant Paddock Plants sheets are used as extension material at field days to teach landholders and other participants the importance and attributes of different plants.

In consultation with graziers it was decided that Paddock Plants information sheets would be more useful if presented in a single publication, the *Glove box guide to plants of the Gwydir Wetlands and Macquarie Marshes*. In total 300 copies were printed for distribution at Paddock Plants days. Industry and Investment NSW will continue to use the information contained in the *Glove box guide* as part of Paddock Plants extension beyond the completion of this project.

The *Glove box guide to plants of the Gwydir Wetlands and Macquarie Marshes* includes new information on the:

- Crude protein and metabolisable energy of selected plants; and
- Plant nutrients of selected species.

7.1 Selected plants included

In consultation with 12 stakeholders (predominantly graziers), 41 grasses, herbs, shrubs, sedges, bulrushes and ferns were selected for inclusion in the *Glove box guide* (Table 7.1) This included wetland plants, floodplain plants, and key weed species.

Table 7.1 Selected plant species.

Grasses	Broadleaf Herbs
Brown beetle grass (<i>Leptochloa fusca</i>)	Bathurst burr (<i>Xanthium spinosum</i>)
Common reed (<i>Phragmites australis</i>)	Burr medic (<i>Medicago polymorpha</i>)
Cup grasses (<i>Eriochloa</i> species)	Common water-milfoil (<i>Myriophyllum papillosum</i>)
Curly Mitchell grass (<i>Astrebla lappacea</i>)	Lippia (<i>Phyla canescens</i>)
Curly windmill grass (<i>Enteropogon acicularis</i>)	Noogoora burr (<i>Xanthium occidentale</i>)
Fairy grass (<i>Sporobolus caroli</i>)	Poison pratia (<i>Pratia concolor</i>)
Marsh millet (<i>Echinochloa inundata</i>)	Princes feather (<i>Persicaria orientalis</i>)
Native millet (<i>Panicum decompositum</i>)	Slender knotweed (<i>Persicaria decipiens</i>)
Queensland blue grass (<i>Dichanthium sericeum</i>)	Spear thistle (<i>Cirsium vulgare</i>)
Umbrella canegrass (<i>Leptochloa digitata</i>)	Swamp buttercup (<i>Ranunculus undosus</i>)
Warrego summer grass (<i>Paspalidium jubiflorum</i>)	Swamp lily (<i>Ottelia ovalifolia</i>)
Water couch (<i>Paspalum distichum</i>)	Tiger pear (<i>Opuntia aurantiaca</i>)
Bulrushes	Water hyacinth (<i>Eichhornia crassipes</i>)
Cumbungi (<i>Typha</i> species)	Water primrose (<i>Ludwigia peploides</i>)
Ferns	Wavy marshwort (<i>Nymphoides crenata</i>)
Common nardoo (<i>Marsilea drummondii</i>)	Willow primrose (<i>Ludwigia octovalvis</i>)
Shrubs	Sedges
African boxthorn (<i>Lycium ferocissimum</i>)	Dirty dora (<i>Cyperus difformis</i>)
Budda pea (<i>Aeschynomene indica</i>)	Flat spike-sedge (<i>Eleocharis plana</i>)
Lignum (<i>Muehlenbeckia florulenta</i>)	Marsh club-rush (<i>Bolboschoenus fluviatilis</i>)
Mimosa bush (<i>Vachellia farnesiana</i>)	Tall sedge (<i>Carex appressa</i>)
Sesbania pea (<i>Sesbania cannabina</i>)	Tall spike-sedge (<i>Eleocharis sphacelata</i>)
Soft rolypoly (<i>Salsola kali</i>)	

7.2 Crude protein and metabolisable energy

During spring (Sp), summer (Su), autumn (A) and winter (W) available plant material was collected from important grazing species in the Gwydir Wetlands and Macquarie Marshes to determine metabolisable energy and crude protein (Table 7.2)

Table 7.2 Plant species sampled during at least one season for assessment of metabolisable energy and crude protein.

Grasses	Broadleaf Herbs
Brown beetle grass (<i>Leptochloa fusca</i>) ^{Sp, Su, A}	Burr medic (<i>Medicago polymorpha</i>) ^W
Common reed (<i>Phragmites australis</i>) ^{Sp, A, W}	Common water-milfoil (<i>Myriophyllum papillosum</i>) ^A
Cup grasses (<i>Eriochloa</i> species) ^{Sp, Su}	Lippia (<i>Phyla canescens</i>) ^{Sp, Su, A, W}
Curly Mitchell grass (<i>Astrebla lappacea</i>) ^{Su}	Noogoora burr (<i>Xanthium occidentale</i>) ^{Sp, Su, A, W}
Curly windmill grass (<i>Enteropogon acicularis</i>) ^{Sp}	Swamp buttercup (<i>Ranunculus undosus</i>) ^{Sp, Su, A, W}
Fairy grass (<i>Sporobolus caroli</i>) ^{Sp}	Water hyacinth (<i>Eichhornia crassipes</i>) ^A
Marsh millet (<i>Echinochloa inundata</i>) ^{Su, A}	Sedges
Native millet (<i>Panicum decompositum</i>) ^{Sp, Su, A, W}	Dirty dora (<i>Cyperus difformis</i>) ^{Su, A}
Queensland blue grass (<i>Dichanthium sericeum</i>) ^{Sp, Su}	Flat spike-sedge (<i>Eleocharis plana</i>) ^{Sp, Su, A, W}
Warrego summer grass (<i>Paspalidium jubiflorum</i>) ^{Sp, Su, A, W}	Marsh club-rush (<i>Bolboschoenus fluviatilis</i>) ^{Sp, Su, A, W}
Water couch (<i>Paspalum distichum</i>) ^{Sp, Su, A, W}	Tall sedge (<i>Carex appressa</i>) ^{Sp, Su, W}
Bulrushes	Tall spike-sedge (<i>Eleocharis sphacelata</i>) ^{Sp, Su, A}
Cumbungi (<i>Typha</i> species) ^{Sp, A, W}	Shrubs
Ferns	Budda pea (<i>Aeschynomene indica</i>) ^{Su, A, W}
Common nardoo (<i>Marsilea drummondii</i>) ^{Sp, Su, A, W}	Lignum (<i>Muehlenbeckia florulenta</i>) ^{Sp, A, W}
	Sesbania pea (<i>Sesbania cannabina</i>) ^{A, W}

7.3 Plant nutrients

During spring (Sp), summer (Su), autumn (A) and winter (W) available plant material was collected from important grazing species in the Gwydir Wetlands and Macquarie Marshes (Table 7.3). The nutrients measured were sodium, magnesium, calcium, cobalt, copper, iron, manganese, phosphorous, potassium, selenium, sulphur and zinc. These plant nutrients are not representative of the nutrient availability of fodder resources, but are of interest to graziers.

Table 7.3 Plant species sampled for assessment of nutrients.

<p>Grasses</p> <p>Brown beetle grass (<i>Leptochloa fusca</i>)^{Sp, Su}</p> <p>Common reed (<i>Phragmites australis</i>)^{Sp, A, W}</p> <p>Cup grasses (<i>Eriochloa</i> species)^{Sp, Su}</p> <p>Fairy grass (<i>Sporobolus caroli</i>)^{Sp}</p> <p>Marsh millet (<i>Echinochloa inundata</i>)^{Su, A}</p> <p>Native millet (<i>Panicum decompositum</i>)^{Sp, Su}</p> <p>Queensland blue grass (<i>Dichanthium sericeum</i>)^{Su}</p> <p>Warrego summer grass (<i>Paspalidium jubiflorum</i>)^{Su}</p> <p>Water couch (<i>Paspalum distichum</i>)^{Sp, Su, A, W}</p> <p>Shrubs</p> <p>Budda pea (<i>Aeschynomene indica</i>)^{Su, A}</p> <p>Lignum (<i>Muehlenbeckia florulenta</i>)^A</p> <p>Sesbania pea (<i>Sesbania cannabina</i>)^{A, W}</p>	<p>Broadleaf Herbs</p> <p>Lippia (<i>Phyla canescens</i>)^{Sp, Su}</p> <p>Noogoora burr (<i>Xanthium occidentale</i>)^{Su}</p> <p>Swamp buttercup (<i>Ranunculus undosus</i>)^{Su}</p> <p>Ferns</p> <p>Common nardoo (<i>Marsilea drummondii</i>)^{Sp}</p> <p>Bulrushes</p> <p>Cumbungi (<i>Typha</i> species)^{Sp}</p> <p>Sedges</p> <p>Dirty dora (<i>Cyperus difformis</i>)^{Su}</p> <p>Flat spike-sedge (<i>Eleocharis plana</i>)^{Sp, Su, A, W}</p> <p>Marsh club-rush (<i>Bolboschoenus fluviatilis</i>)^{Sp, Su, A, W}</p> <p>Tall sedge (<i>Carex appressa</i>)^{Su}</p> <p>Tall spike-sedge (<i>Eleocharis sphacelata</i>)^{Sp, Su, A, W}</p>
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8. Prograze™

8.1 Outlining Prograze™

The project reviewed the Industry and Investment NSW Prograze™ training package for delivery across different wetlands. Prograze™ is run in the field and has been developed to teach participants fundamental skills in grazing management. The aims of Prograze™ are to teach participants:

- To visually assess pasture quantity and quality.
- To understand how pasture quality and quantity impact on animal production.
- Assess livestock fat scores.
- To use pasture and livestock assessment as a basis for matching pastures to livestock requirements.
- Use grazing management to improve the productivity and sustainability of pastures.

The learning outcomes of Prograze™ are intended to give graziers methods to:

- Assess the pasture characteristics influencing pasture and animal production.
- Use pasture assessments to predict livestock production.
- Develop a pasture management plan.
- Develop a livestock management plan.
- Develop a grazing plan.

8.2 Prograze™ for wetland graziers

During the project, the BMP for grazing in wetlands team engaged Industry and Investment NSW staff involved in the development and delivery of Prograze™. Initially it was proposed that Prograze™ would be reviewed as part of the project to increase suitability for wetland grazing situations.

In the Prograze™ course, it is the role of the presenter, generally the local livestock officer and/or district agronomist to contextualise learning. In some cases, this is done through the use of supplementary material.

In consultation with Prograze™ staff, it was concluded that the finalised *Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes* would be used as a supplement to the Prograze™ materials in the delivery of grazing management training. This would assist staff in contextualising the course and provide valuable support information.

To assist the development of this material as a supplement, the Prograze™ team assisted with the development and review of the Guidelines.

9. Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes

9.1 Developing the Guidelines

The Guidelines were developed to assist landholders examine grazing management practices on their properties. The ideas presented were aimed at graziers in the Gwydir Wetlands and Macquarie Marshes.

The Guidelines were developed using relevant literature and the knowledge provided by consulted stakeholders (graziers and non-grazing stakeholders). Consultation was used, after circulation of draft editions, to refine the content of the Guidelines. They include information on planning for grazing (e.g. management objectives and risk planning), management options (e.g. grazing plan, buffers, weeds, access) and monitoring.

Initially it was proposed that the guidelines would provide information to assess wetland health and give tools to assist sustainable management of wetland environments. Wetland assessment is covered in the *Guidelines for management: wetlands on farms in inland NSW* (McIntyre et al. 2009).

The guidelines do not provide information on planning for alternatives to grazing in these wetland areas.

9.2 Consultation

The development of the Guidelines was associated with on-going input by graziers and other key stakeholders. The Guidelines utilise the significant information obtained through the consultation process and from key presentations:

1. Presenting the project goals to the Macquarie Marshes Environmental Landholders Association (MMELA), October 2008.
2. Presenting the findings of the landholder survey to MMELA, December 2008.
3. Presenting the findings of the landholder and stakeholder surveys to graziers in the Gwydir, February 2009.
4. Presenting the project to the Ramsar Managers Network, April 2009.
5. Presenting the project outputs to the PCG, May 2009.

The technical content of the Guidelines was reviewed during April 2009 by at least 16 individuals with different levels of technical expertise. This included members of the project steering committee, graziers and individuals from government and non-government organisations. Individuals were not discouraged from discussing the technical content of the Guidelines with colleagues where confidentiality was maintained and where discussion would provide positive influence to the development of these resources.

Subsequent drafts of the *Guidelines* have been provided to the project steering committee, selected individuals and to the PCG and the authors for comment.

9.3 Audience and intent

The intended audience for the Guidelines for grazing was grazing landholders in the Gwydir Wetlands and the Macquarie Marshes as well as government on-ground staff working with individual and/or groups of landholders. The principles presented in the Guidelines are applicable to grazing management in other wetlands, but the supporting information that has been included has generally been gathered from research and published information relating to these two important wetlands.

The intent of the Guidelines is to provide assistance to landholders and not to be prescriptive. Landholders have continually expressed a particular concern that the published guidelines may become a prescription for grazing in these wetland areas. The benefit of this concern to the project has been the strong interest of many landholders to:

- be continually involved;
- ensure consistency;
- ensure that it was clear that all wetlands within the Gwydir Wetlands and Macquarie Marshes could not be managed in the same way; and
- report exceptions to different practices.

9.4 Limitations

The development of the Guidelines for grazing has met with a number of important limitations in engagement, both for the project and for the recommendations, and in implementation that must be considered for future projects of this kind.

Project engagement – this project has been very successful at engaging the core participants needed to assist in the development of the Guidelines through constant contact, a number of presentations and opportunities for engagement. The project team was very clear about the purpose of the project; this being a focus on grazing rather than water. However, regardless of agricultural enterprise (e.g. grazing or cropping), farmers and graziers strongly believe that there is a large call on their time to assist in different surveys and projects. In some cases they generally believe that they are either not heard or that they do not receive the benefits of much of this work. Consequently, they see this as a cost in time and they have the view that this often leads to restrictions to the current and future operation of their businesses. This means that many farmers and graziers have limited inclination for involvement in projects and surveys.

The landholders in the Gwydir Wetlands and Macquarie Marshes are extremely vocal of this apparent problem, particularly in the face of drying wetlands and limitations to available water. This means that without some change to the approach of research and/or extension projects (e.g. intent of projects, engagement practice or agency collaboration), it may become increasingly difficult to engage the services of landholders.

Engagement in developing the guidelines – throughout the writing of the Guidelines there have been a small number of landholders constantly seeking

involvement. There was significant scepticism amongst landholders about the reasons for Government funding this project. Consequently, landholders were deeply concerned that information presented in the Guidelines may become legislation or drive policy directions for grazing in the future. The result has been that the *Guidelines* are presented as a series of 'ideas' for the consideration of graziers and the recommendations are such that graziers 'could' or 'should' respond depending on their situation. One of the criticisms of the Guidelines is no doubt likely to be the soft nature of the recommendations. This has been unavoidable if the intention of the project products is to have a positive influence on grazing sustainability in the Gwydir Wetlands and Macquarie Marshes.

Implementation – Undoubtedly, the largest limitation of the Guidelines will be their implementation on ground. Many landholders have actively implemented a number of the recommendations from these Guidelines prior to, and during, the project. Many others are unable to implement desirable actions because of other constraints that may be real or perceived. These include (but are not limited to) costs, time, landscape features, and the role of external factors that individual and/or groups of landholders cannot influence (e.g. management of bordering properties).

In so doing, it is important that, in some situations, landholder incentive funding is made available to assist with management changes such as the development of wetland management plans, participatory research, fencing, and pipe and trough systems.

9.5 Content

The Guidelines have been built as a series of seven individual components that are co-dependent. The intent of these components is to develop the reader's knowledge of wetland formation, wetland function and the ecosystems present in wetlands. The sections are:

Grazing in wetlands – describes the importance of the Guidelines, gives an explanation of the method of development, instructions for use, key recommendations and lists important resource material.

Understanding wetlands – defines wetlands, their formation and importance. It shows the distribution of wetlands across NSW and briefly identifies the importance of active wetland management.

The Gwydir Wetlands and Macquarie Marshes – provides detailed soil, climate, plant, animal and land-use information. This includes detailed information of different plant communities and of the impact of flooding and rainfall on plants.

Managing stock in wetlands – discusses current grazing management practices and the response of different plant communities to grazing. It describes the impact of wetting regime on plant communities and the role of grazing management where changes in grazing regime occur. The section presents information on alternative grazing systems that may be suitable for different wetland areas and presents groundcover as one measure of plant condition. The section provides some brief notes on the behaviour of livestock in wetlands. The section provides the key recommendations for grazing given in the Guidelines.

Managing stock water – provides information on the sources of water available to landholders, the importance of quality stock water and assessments that can be made. The section provides a series of recommendations.

Managing fire in wetland grazing – gives information on the role of burning in wetlands. It recommends that burning is not conducted, but recognises that burning is a required management tool in some situations and so, provides a number of recommendations.

Managing a drying climate – presents the current expected results of climate change in the Gwydir catchment and the Macquarie catchment and each wetland. It proposes a number of recommendations as part of business flexibility.

9.6 Grazing recommendations

The key recommendations that are provided in the Guidelines are aimed at a threefold endpoint:

1. Healthy wetlands with a patchwork of well functioning plant and animal communities, such as reed beds, grassy meadows and wooded areas;
2. profitable enterprises for graziers; and a
3. balanced lifestyle (combining work, family, social and community commitments).

Fundamental grazing management principles in wetlands that can help achieve these outcomes are:

- Adaptable grazing management that can respond rapidly to changing conditions and issues.
- Vegetation condition should be one of the main drivers of stocking decisions, regardless of the stocking strategy used.
- There needs to be a match between stocking rates (animal demand) to carrying capacity (pasture supply) to avoid overgrazing.

As a result, landholders should consider:

- total grazing pressure (i.e. combined impacts of livestock, feral animals and native herbivores) when planning the stocking rate to use;
- stocking rates based on the response of the most grazing sensitive parts of the ecosystem within a paddock;
- maximising groundcover of desirable species;
- the timing and location of stock to maximise establishment of native species, maintain or increase the wetland seed-bank and minimise soil pugging;
- paddocks that contain a mix of open and shady areas for stock shelter, and fence paddocks according to different vegetation communities when looking at alternative paddock designs;
- burning practices. Burning wetlands for grazing management is not recommended, but if burning is required in tall reed beds, then only cool winter burns when the soil is wet are recommended; and

- using stock water sources other than flooded wetland areas, billabongs or channels to help maximise pasture utilisation (e.g. pipe and trough systems).

10. Extension

The consultation process enabled the project team to identify four landholder training needs. It was clear from discussions with graziers that these training requirements need to occur through a staged approach. A staged process reflects the need for initial activities to assist in building interest in future activities. The delivery of workshops should occur in the order of:

1. Paddock Plants days.
2. Lippia management.
3. Soil health workshops.
4. Grazing management training.

The *Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes* have been presented to landholders and other stakeholders during launch events held in each of the two wetland areas during August 2009.

10.1 Paddock Plants

The project team will deliver training in wetland plants via Paddock Plants information days. These days will be delivered in each of the Gwydir Wetlands and the Macquarie Marshes during spring 2009. These activities are being run in collaboration with the Border Rivers-Gwydir CMA, the Central West CMA and the RERP (DECCW NSW).

The days will provide each participant with a copy of the *Glove box guide to plants of the Gwydir Wetlands and Macquarie Marshes* produced by this project. The days will include information on plant identification, production and nutrition. They will not include information on alternative pastures or plant establishment.

There are two reasons that Paddock Plants days were postponed (beyond June 2009):

1. The development of the Glove box guide and associated plant nutrition values exceeded the initial scope proposed at the beginning of the project. This meant that the finalised Glove box guide was available for use mid May 2009.
2. Key wetland plant species are dormant during winter months and fresh growth occurs in response to inundation during late winter and spring. This means that key wetland plant species are more likely to be present during the Paddock Plants days.

10.2 Lippia management

Lippia management activities were not proposed as part of the BMP for grazing in wetlands project. Sufficient interest exists among landholders for the delivery of Lippia extension activities that addresses the management of this important weed. These activities can be conducted immediately based on expertise developed through NSW Wetland Recovery Program projects and other sources.

10.3 Soil health and grazing management

Soil health workshops and grazing management training activities have not been conducted as part of the current project. It was recognised during the consultation period of the project that many landholders would not be responsive to some training needs unless the need for these activities could be demonstrated. Consequently, the delivery of these activities is proposed through collaboration between the Border Rivers-Gwydir CMA, the Central West CMA, Industry and Investment NSW and the Rivers Environmental Restoration Program (DECCW NSW). The Rivers Environmental Restoration Program is facilitating these activities in the Macquarie Marshes during 2009–2010.

10.4 Launching the Guidelines for grazing

The *Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes* were launched at workshops in each of these important wetland areas. These workshops involved collaboration between the Border Rivers-Gwydir CMA, the Central West CMA, Industry and Investment NSW and RERP (DECCW NSW).

The Gwydir Wetlands and Macquarie Marshes launch events were attended by 30 and 60 landholders and other interested stakeholders respectively.

11. Performance against targets

11.1 Objectives

The performance of the BMP for grazing in wetlands project against broad targets is summarised according to each of the initial objectives:

1. Current grazing management practices, and the broad financial position of grazing businesses, have been benchmarked and suitable environmental practices have been recommended. This project was not able to complete a full analysis of financially sustainable management changes because of limited access to landholder information.
2. One set of Guidelines for grazing have been produced for the Gwydir Wetlands and Macquarie Marshes and includes information that aims to positively influence environmentally sustainable grazing.
3. The products produced through the project have been widely promoted to landholders and other stakeholders and will be used by the Border Rivers-Gwydir CMA, the Central West CMA, Industry and Investment NSW, the RERP (DECCW NSW) and other stakeholders to coach graziers in sustainable management practices for wetland longevity.

11.2 Key performance indicators

The performance of the BMP for grazing in wetlands project against key performance indicators is summarised according to each of the initial key performance indicators:

1. Paddock Plants knowledge has been compiled and published as the *Glove box guide to grazing in the Gwydir Wetlands and Macquarie Marshes* and has been presented to the PCG.
2. Landholder responses from both wetland areas have been collated, summarised and used to benchmark current management practices.
3. Production of Guidelines for grazing management has been completed.
4. Two fact sheets on sustainable grazing practices were not produced as part of the project. Information that would have been included in fact sheets is published as part of the seven sections within the *Guidelines for grazing*.
5. A series of workshops have not been delivered across each wetland to date. Industry and Investment NSW is committed to delivering Paddock Plants days in each wetland area as part of this current project. The Border Rivers-Gwydir CMA, the Central West CMA, Industry and Investment NSW and the RERP (DECCW NSW) are collaborating in the development of extension programs for these iconic wetland areas.

12. Project recommendations

The project has identified a number of future recommendations. The recommendations are focused on the requirements of grazing landholders and each has been given an importance ranking and a priority rating.

12.1 Extension recommendations

The project has identified five training and extension needs for landholders in the Gwydir Wetlands and Macquarie Marshes (Table 12.1). These recommendations are ranked and given a priority of high, medium or low.

Table 12.1 Prioritised extension recommendations.

Rank	Training and extension needs	Priority
1	Wetland plants: 1. Plant production 2. Plant identification 3. Plant nutrition	<i>High</i>
2	Weed management (e.g. lippia)	<i>High</i>
3	Soils – understanding the influence of soils on plant growth and grazing, impact of grazing on soils and the role of soil carbon and biology on wetland ecosystems.	<i>Medium</i>
4	Grazing management – understanding grazing management and the impacts of different grazing practices on wetlands.	<i>Medium</i>
5	Ongoing evaluation – required to determine changes in practices that occur normally and those that occur as a result of the <i>BMP for grazing in wetlands</i> project.	<i>Medium</i>

12.2 Recommendations for incentives

The project team has identified three opportunities for landholder incentives in the Gwydir Wetlands and Macquarie Marshes (Table 12.2). These recommendations are ranked and given a priority of high, medium or low.

Table 12.2 Prioritised incentive recommendations.

Rank	Incentive program	Priority
1	<p>Wetland Management Plans – all wetland landholders that obtain incentive funding for infrastructure or training should be required to complete a Wetland Management Plan which must include recorded management plans for the entire property. Wetland Management Plans must:</p> <ul style="list-style-type: none"> - have at least partial incentive funding; and - be the basis for approval of future incentive investments. 	<i>Medium</i>
2	<p>Infrastructure (e.g. fencing and water troughs) – influencing management in the Gwydir Wetlands and Macquarie Marshes will depend on the ability of landholders to access funding for capping bores, piping water, water troughs and fencing. Continued delivery of incentive funds for these purposes is likely to be one of the more tangible factors influencing adoption of the Guidelines.</p>	<i>Medium</i>
3	<p>Education – to assist landholders in taking up education opportunities in the Gwydir Wetlands and Macquarie Marshes incentive funds for partial or complete packages are likely to be required. The Australian Government's Farm Ready program and the Catchment Management Authorities provide potential sources of these funds.</p>	<i>Low</i>

12.3 *Communication recommendations*

The project team has identified three communication recommendations (Table 12.3). These recommendations are ranked and given a priority of high, medium or low.

Table 12.3 Prioritised communication recommendations.

Rank	Communication needs	Priority
1	Coordination of landholder access – landholders are frustrated with the requirement of their time for contributions to projects and other off-farm commitments. The process of consulting and engaging landholders needs to be developed so that less competing pressure is placed on these stakeholders for their time.	<i>High</i>
2	Landholders driving communication – it is apparent that in cases where landholders play a strong role in communication, there is a greater level of interest among the community and increased uptake of information occurs. As a result, assisting landholders to drive communication will drive management adaptation in the Gwydir Wetlands and Macquarie Marshes.	<i>High</i>
3	Communication of results – there continues to be a view among landholders that there is a low level of communication of results between projects and collaborative landholders. Researchers must actively provide information or updates to landholders.	<i>High</i>

12.4 *Research recommendations*

A number of research needs for landholders in the Gwydir Wetlands and Macquarie Marshes have been identified (Table 12.4).

Table 12.4 Prioritised research recommendations.

Rank	Research issue	Priority
1	Long-term studies – many projects occur over durations of 1–3 years and there is significant concern that projects do not always build on other research to develop long-term outcomes that can direct grazing management.	<i>High</i>
2	Grazing in a variable climate: <ol style="list-style-type: none"> 1. Understanding management of livestock in wetlands subject to climate change predictions. 2. Comparing the impact of wetting regime and grazing pressure on the growth and longevity of different wetland plant species. 3. Timing of grazing and stocking rates. 	<i>High</i>
3	Roly-poly species: <ol style="list-style-type: none"> 1. Determining the influence of roly-poly species on ecosystems. 2. Understanding the establishment of native grasses and shrubs in lands dominated by roly-poly species. 	<i>High</i>
4	Water distribution – quantifying the impact of wetland vegetation volume and soil moisture status on wetland water distribution.	<i>High</i>
5	Grazing value for landholders – understanding the financial and ecological costs of changing grazing practices in the Gwydir Wetlands and Macquarie Marshes.	<i>Medium</i>
6	Burning reed beds – impact of burning and of burning frequency on the growth and longevity of different wetland plant species (e.g. <i>Bolboschoenus fluviatilis</i> and <i>Phragmites australis</i>).	<i>Medium</i>
7	Understanding the behaviour of livestock in wetlands: <ol style="list-style-type: none"> 1. Grazing patterns of livestock in wetlands. 2. Performance of livestock grazing along moisture gradients. 3. Influence of wetting regime on livestock behaviour. 	<i>Low</i>
8	Wetland plants for grazing – determining annual and seasonal differences in crude protein, metabolisable energy and minerals of different plant species over multiple sampling years.	<i>Low</i>
9	Wetlands and fish breeding – role of wetlands as fish habitat for breeding and the influence of reduced flood frequency on breeding activity and food availability.	<i>Low</i>

12.5 Specific recommendations of the project steering committee

There are three core recommendations of the project steering committee:

1. The *Guidelines for grazing in the Gwydir Wetlands and Macquarie Marshes* should be reviewed in 3 years (2012) depending on the availability of new knowledge for these areas. These resources should be developed in a digital format and must be available for general public use.
2. The *Glove box guide to plants of the Gwydir Wetlands and Macquarie Marshes* should be reviewed in 5 years (2014). Plant photos should be reviewed and updated and introduced weed species should be more clearly distinguished in the publication from other species. The review must consider the addition of other wetland plants, information on toxicity issues and more nutritional information obtained over a number of years.
3. Landholder input into research and extension projects in the Gwydir Wetlands and Macquarie Marshes is essential. However, landholders on the steering committee for the *BMP for grazing in wetlands* project indicated that they are currently dedicating at least 1 working day per week to project development, community works and training activities for numerous agencies and groups. As a result, projects that require considerable time from individual landholders should provide some form of financial compensation (e.g. sitting fees or attendance fees) or incentive payments to relevant participants.

There are four secondary recommendations of the project steering committee:

1. The involvement of the Industry and Investment NSW in these key wetland areas should be increased.
2. The water issue must be maintained as part of the public agenda. The major problem in these wetlands, as viewed by the project steering committee, continues to be limited flood water availability.
3. A detailed economic analysis of business performance is not required. Such a study would be difficult and is not viewed as important by the project steering committee.
4. The process of engaging landholders in these two important areas must be addressed. There is a significant level of disillusionment among grazing landholders in the Gwydir Wetlands and the Macquarie Marshes. This makes implementing research and/or extension programs difficult.
5. Surveys are a common feature of natural resource management works. Future survey activities should be developed in consultation with landholders and should be conducted face-to-face.

13. Conclusions

A number of specific conclusions have been made by those involved in the projects.

Key performance indicators – the key performance indicators outlined for this project have been completed. This is with the exception of delivering Paddock Plants information days in each wetland. These will be completed during spring 2009 in collaboration with the RERP (DECCW NSW), the Central West CMA and the Border Rivers-Gwydir CMA.

Project steering committee – the steering committee is satisfied with the products produced by the project and has made recommendations relating to the review of these documents.

Communication – the project has had a strong reliance on communication among the project steering committee, graziers and the members of the project team. This has given landholders and other stakeholders a sense of ownership over the products produced. This will influence the use of the resources by landholders and provide the strongest means of influencing future management practices and consultation.

Consultation – the project conducted 23 surveys with participating landholders. It was very important that these surveys were conducted face-to-face with participants.

Use of outcomes – the material developed through the project is available for future use in the Gwydir Wetlands and Macquarie Marshes. Copies of the *Glove box guide to plants of the Gwydir Wetlands and Macquarie Marshes* and the *Guidelines to grazing in the Wetlands and Macquarie Marshes* are each available for graziers from the Industry and Investment NSW regional office, Dubbo and the Industry and Investment NSW district office, Kempsey. Industry and Investment NSW intends to:

- Use the materials prepared for the Glove box guide in future Paddock Plants days in these wetlands and other wetland areas.
- Use the Guidelines as a supplement for the Prograze™ course.
- Utilise these resources in other wetland extension activities.

On-going evaluation – a priority for future wetland funding must be the development of resources that assist landholders to monitor changes in management practices.

Recommendations – a significant number of recommendations have been made by this project. It is imperative that there are future initiatives that focus on these needs. These recommendations provide an opportunity to influence future grazing management in the Gwydir Wetlands and Macquarie Marshes.

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