Full Paper

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Tools developed to build land management capacity in the grazing sector with specific focus on gully erosion management in the Mary River Catchment

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Key Points

- Mary River catchment is a key contributor of sediment discharge to the southern Great Barrier Reef
- Controlling gully and stream bank erosion, which are the major sediment sources, aligns with landholder objectives
- User friendly extension tools have been developed to enable graziers to monitor land condition
- Monitoring gully projects is key to observe and quantify change over time

Abstract

The Mary River catchment is the southern-most of the Great Barrier Reef (GBR). The catchment is also recognized as a priority for sediment discharge into the southern GBR due to the efficient sediment delivery to the coast (Wilkinson et al. 2018). Grazing land constitutes approximately 70% of the land-use in the catchment. Consequently engaging with the grazing sector is extremely important to address downstream water quality improvements in the catchment. Since the inception of the initial Reef Plan in 2003 the Mary River Catchment Coordinating Committee (MRCCC) has been working in partnership with the grazing sector to address these concerns. At this time the MRCCC developed a working partnership with the local grazier group, the Gympie District Beef Liaison Group which prospers today. During this time extension tools were developed to enable graziers to benchmark property health from their grazing lands to riparian zones. Since 2015 the MRCCC has been specifically addressing gully erosion concerns with an Australian Government Reef Trust funded project. This project has predominantly targeted early intervention of gullies in known hot-spot catchments, working in partnership with technical advisors provided by Reef Trust. Using CSIRO Atlas of Australian Soils Landscape unit information from the 1960's priority landscape units are identified, providing direction for engagement activities. In these locations, on farm consultations determine preemptive low cost activities required to address drainage lines predicting to gully, or those showing early signs of gullying. Over the past 15 years, MRCCC has produced four key extension 'tools' used and customised for these projects to raise awareness and build on farm capacity to better manage grazing operations with the focus on reducing sediment loss to receiving water. They are user friendly tools providing landholders with succinct information to make informed decisions on management actions required to address grazing land condition, drainage line and gully condition and riparian zone condition. A monitoring program developed in partnership with Reef Trust has been established to objectively measure changes to the treatment gullies.

Keywords

Mary River, Great Barrier Reef, Mary River Catchment Coordinating Committee, streambank erosion, gully, monitoring, extension tools

Introduction

The Mary River catchment (MRC) is the southern-most of the Great Barrier Reef (GBR) catchments and is located in South-east Queensland, approximately 2 hours north of Brisbane. The Mary River is approximately 320km long, rising in the ranges west of Sunshine Coast flowing northward to Hervey Bay entering the Ramsar-listed Great Sandy Strait wetland, inside Fraser Island. It covers an area of 9466sq km.

The Mary River Catchment Coordinating Committee (MRCCC) was formed in 1993 as a community-driven Integrated Catchment Management (ICM) group in response to a series of devastating floods that occurred

throughout the entire catchment. The MRCCC is comprised of delegates from the primary industry sectors e.g. beef, dairy, sugarcane etc as well local government and community representatives that meet on a 6 weekly basis. Since 1995 the MRCCC has operated a riparian rehabilitation program. The value of this work was validated in 2002 when CSIRO undertook the initial application of the SedNet model which identified the primary source of erosion in the MRC was from streambank erosion (De Rose et al, 2002). Since its formative years the MRCCC has worked with thousands of landholders, mainly primary producers, to adopt best land management practices and restore riparian zones.

Engaging the grazing industry

The 9466sq km catchment contains a variety of vegetation communities ranging from ex-rainforest with improved pastures (up to 2000mm average annual rainfall) to open woodland with native pasture in the west (<700mm average annual rainfall). The larger commercial grazing enterprises are generally located in the western parts of the MRC. Grazing land constitutes approximately 70% of the land-use in the catchment. Within the catchment there are sodic soil 'hot-spots' where gullying can be extensive, primarily within the western sub-catchments. Within the GBR the MRC supplies a disproportional quantity of sediment, compared to its catchment size and discharge (DNRM, 2017), with streambank and gully erosion contributing approximately 80% of sediment load from the MRC (De Rose et al, 2002). The MRC delivers sediment efficiently into the southern GBR and is recognized as a priority catchment due to its high sediment discharge (Wilkinson et al. 2018).

Given the vast majority of the MRC is managed by the grazing industry, engaging with this sector was considered a high priority to proactively address downstream water quality improvements in the catchment.

Since the inception of the initial Reef Water Quality Protection Plan in 2003 the MRCCC has been working in partnership with the grazing sector to address downstream water quality entering the GBR. At this time the MRCCC developed a working partnership with the local grazing group, the Gympie District Beef Liaison Group (membership of 250 enterprises) with an informal joint agreement (a working partnership) between the Chairs of each organisation. A successful working partnership was also formed with the local DPI Grazing Extension Officer at this time. Combined the groups successfully applied for National Landcare Program (NLP) funding in 2005 to implement a suite of priority on-ground projects identified by participating graziers in the Western Mary Catchments based on the premise of improving water quality, in particular sediment loads, entering the GBR.

Between 2006 and 2009 approximately 300 graziers were engaged through a series of 18 jointly organized field-days and workshops to introduce the concept of improving downstream water quality for the GBR, promoting best grazing land management practices and 'showcasing' on-ground projects at participating properties. Showcasing properties with on-ground projects has had a profound long-term effect on the uptake of best land management practices and on-ground works. Many graziers today mention their adoption of best land management practices is a result of viewing a particular showcase property – sometimes this adoption may not be immediate but occurs sometime later (upwards of 4 years later) after their initial exposure (sometimes referred to as 'planting the seed'). The project team also found through graziers participating at these field-days, inspecting completed project works and undertaking field-based assessments e.g. pasture and riparian zone condition, they had a far richer understanding of the aims of the project to improve downstream water quality for the GBR; were more focused and engaged in the direction of the project when on-property 1-on-1 extension activities occurred on their property, compared to those that had expressed interest but had not attended any showcasing field days etc.

A strong focus in these formative years of reef-related on-ground projects (pre-2009) was to understand the water quality of grazed sub-catchments, in particular recruiting volunteer graziers to the MRCCC Waterwatch program. Between 2003 and 2009 Waterwatch networks were formed in the Western Mary Catchments where graziers that participated in on-ground projects also voluntarily collected monthly water quality data which is

then compiled into 3 yearly reports demonstrating water quality trends. Today three water quality report cards (based on an A,B,C,D system) have been produced between 2010 and 2017 for these sub-catchments using data collected by at least 25 graziers (Dean et al , 2018). After more than 10 years of data collection these graziers continue to collect data resulting in a far greater understanding of the water quality of their catchment and grazing properties.

Since 2010/11 there have been over 130 graziers access incentive funding for projects to improve downstream water quality. Changing land management has been documented by way of grazing land practice score cards. These are based on an easy-to-understand A,B,C,D scoring system. The assessments are conducted in the paddock with the help of extension project officers in the first instance with the view they could be completed independently by graziers for other sections of the property or, as a follow up assessment following treatments. For example, if a grazier had uncontrolled stock access to the riparian zone a score of "D" is given with documented recommended management actions to improve their practices. The follow up assessment after the grazier has adopted the improved practices may show an improvement from D to C or B. The grazier responds positively to this documented change thereby providing the grass roots for further positive change. In this manner, approximately 480 ha of riparian zone in the MRC on grazing properties have adopted improved management through Reef-related projects since 2010.

Strategic targeting of gully erosion projects and diversity of treatment options

Since 2015 the MRCCC has been working with the grazing sector in priority catchments of the MRC to address gully erosion concerns with an Australian Government Reef Trust Phase II funded project. This project has operated alongside the Reef Trust Phase III project which targets a different priority area. The Munna, Wide Bay & Widgee Creek sub-catchments (collectively known as the Western Mary catchment) contains the highest proportion of highly sodic sub-soils prone to gully erosion. Some gullies have a history of advancement of over 50 years, with many long-term graziers providing key anecdotal evidence and are able to describe in detail gully advancement stages e.g. key cyclones.

A technical advisor is provided by Reef Trust from a university or a research institution to provide professional technical oversight of and advice to the gully erosion project. These advisors visit project sites every 6-12 months, and provide a conduit from the local project implementers and Reef Trust in Canberra. The benefit of these technical advisors is immense and far-reaching for the organization. MRCCC was involved in a similar arrangement with the then Land & Water Australia in the late 1990's, with the MRCCC and catchment community acknowledging the benefit of the involvement in a nation-wide collaboration of riparian projects.

This gully erosion project has predominantly targeted early intervention of gullies in known hot-spot catchments, working in partnership with the technical advisors. Gully erosion hot-spots were identified across the catchment using CSIRO Atlas of Australian Soils Landscape unit information prepared in the 1960's. Specific landscape units are known to contain sodic subsoils which are more likely to gully. This approach of using old, but solid, information appears to be viewed as novel in an age of LiDAR analysis and remote sensing. However LiDAR information is scant in the catchments that gullies occur. Vegetation community information i.e. pre-clear vegetation mapping (Qld Regional Ecosystem mapping) is also used to identify hot-spots as specific regional ecosystems also contain indicator tree species that are found in fragile, gully prone landscapes, e.g. gum-topped box (*Eucalyptus molluccana*).

Within these priority landscape units pre-emptive actions on drainage lines predicted to gully, or showing early signs of gullying are targeted for low-cost activities such as fencing and alternative stock watering systems, revegetation or construction of timber porous check dams. Gully erosion is minimized and significant future sediment losses avoided at a far reduced cost through pre-emptive actions. Other effective and low-cost actions to rehabilitate gully erosion sites include adoption of wet season spelling of the gully and the surrounding paddocks. Stock are excluded from the gully during the growing season (a good rule of thumb is Christmas to Easter) when flood flows are likely to occur. Without grazing pressure gully erosion sites are able to recover by

allowing groundcover to stabilize bare ground, allowing pastures to set seed or shrubs to establish. By adopting this simple technique rate of recovery can be assessed and if recovery is not obvious or satisfactory further intervention can be investigated and plans for implementation developed, e.g. rock chutes or porous check dams. In many cases after a few years of wet season spelling stock can be re-introduced for short sharp (1 or 2 days), winter grazing.

In recent years MRCCC has focused on installing water points e.g. tanks and troughs, high in the landscape to create new cattle camps well away from gullies, drainage lines and riparian zones. This has a benefit to downstream water quality in that stock will water and subsequently camp as far as practical away from potential contamination entry points to streams. Graziers now have a far greater understanding of the benefits of this approach which includes more effective on-farm nutrient and sediment capture and have responded positively to this concept. Since the inception of the project in 2015 approximately 50% of the graziers involved are new to Reef-related activities.

Extension tools supporting landholder engagement in erosion control projects

Since 2006 the MRCCC has raised awareness of key Reef Plan concepts within the grazing community by developing of series of field-based extension tools. These capacity building tools have been continually developed in the field using feedback from the graziers. The tools are:

1. Pasture / land condition assessment
2. Riparian zone condition assessment
3. Drainage line condition assessment
4. Forage budget tool

These tools have now been used by hundreds of graziers at field-days and during 1-on-1 on-property consultations. The information recorded provides a valuable snapshot which can be used for benchmarking at a later date. They have been developed specifically to meet the needs of the grazing industry within the MRC where each landholder can take more control over their land management.

The ‘pasture condition assessment’ tool and the ‘riparian zone condition assessment’ tool have been used extensively over the last decade to address the need for customized information for improvements to pasture, groundcover and riparian zones. The pasture condition assessment tool assesses the proportion of desirable (3P – perennial, productive, palatable) grasses, their dry matter yield and pasture groundcover using an A,B,C,D scoring format for each item assessed. Individual pasture species are also identified and ranked according to the 3P, 2P, 1P system. 3P grasses provide better groundcover and are deep rooted and are vitally important for managing rates of runoff in paddocks. This system was customized for pastures in the MRC from the Qld DPI Stocktake pasture monitoring process (DERM, 2011).

The riparian zone condition assessment tool was developed out of a need for a quick, simple, grazier-friendly assessment system that captured the key elements landholders needed to be aware of in a riparian zone. The MRCCC had vast experience using complex riparian zone assessment systems such as Index of Stream Condition, which was generally beyond the scope of landholders’ ability and time. The tool assesses the structure of the vegetation in the riparian zone ie trees, shrubs, grasses, forbs; the shading and buffer width, extent of bank erosion and cattle pugging and extent of weed infestations. The riparian zone condition assessment uses the A,B,C,D scoring system and is included on the pasture condition assessment sheet so that the two assessments can be completed together in a paddock. These assessments may not be as scientifically valid as more complex systems eg. ISC; the key role these play is to inform and build awareness of the grazier on key aspects and how to improve the condition of the grazing land and collectively identify key management actions that can be implemented that will improve the score.

Recently a ‘drainage line condition assessment’ tool has also been developed focusing on gullies. The drainage line condition assessment provides a benchmark and is the first step towards documenting actions for remediation of current and future gullies. A suite of indicators related to drainage line condition are assessed

using an A,B,C,D scoring system. These indicators are used to determine if the drainage line is in relatively stable condition (A,B condition), heading towards the early stages of gully erosion (C condition) or may display characteristics of active gully erosion (D). A subsequent Gully Erosion severity assessment has been developed where obvious gully erosion is occurring but ranks the gully erosion according to its severity using key indicators. A suite of management actions is also recommended according to the severity of the erosion. By ranking the severity of the gully erosion the grazier is more aware of the scale of works and options required to remediate these erosion hot-spots.

A forage budgeting tool was developed in response to demand from graziers to ensure adequate groundcover is maintained during the dry season (winter to early Spring) in readiness for the break of season towards the end of the calendar year. Forage budget workshops have been held annually in May (at the end of the growing season) since 2012. Using feedback from the grazier client base they indicated a preference for paper-based calculations when forage budgeting rather than smart-phone based apps. Subsequently the MRCCC developed a simple, sequential step-by-step forage budget tool.

In development since early 2018 is an indicative stocking rate / carrying capacity calculator based on grazing land condition assessments conducted with the graziers during the paddock-based consultations and the indicative stocking rates for individual grazing land types sourced from the locally relevant grazing land type booklets. To determine the quantity and types of grazing land types on the property the Qld Government FORAGE website (www.longpaddock.qld.gov.au/forage) is used in conjunction with Qld Globe grazing land type mapping. This new tool prepared by MRCCC attempts to tie all the information available to the grazing industry into a framework for making decisions for on-property stocking rates (SR), i.e. current land condition, SR recommendations in land type booklets, FORAGE website options etc. The grazier is more aware how to bring all this information together into a useful format that will help with future on-property management decisions.

These user friendly tools provide landholders with succinct information to make informed decisions on management actions required to address or improve grazing land condition, streambank stability, gully and riparian zone condition. Favouring the structured, systematic and locally customised information graziers are keen to gain a deeper knowledge of all aspects relating to land condition which is ultimately resulting in an improvement of overall property condition and positive on-ground change. These four assessment tools go a long way towards providing a framework for holistic land management and are a key component of extension activities for the Gully Erosion Control Program project.

Monitoring program and evaluation of success

A gully erosion monitoring program, developed in partnership with Reef Trust and the technical advisor, has been established to objectively measure changes to the gully project sites. The gully erosion project sites are benchmarked for rate of gully head advancement, ground cover composition within and around the gully, before work commences. Measurements are taken post implementation to ascertain the rate of change. To date 25 sites have been monitored using this methodology. An outcome of this monitoring is determining the sediment saved by implementing the project. An important calculation is determining the historical growth rate of gullies by using historical aerial photography or speaking with long-term graziers to understand the annual rate of advancement of the gully. By monitoring a site before work has commenced, conducting key measurements for dimensions and installing photo monitoring points in the gully, post-implementation monitoring (6-12 months later) can determine if erosion has been reduced based on historical rates of advancement. A significant early finding of this monitoring has been the impressive vegetative / pasture growth response from one wet season spell of the fenced gully erosion sites. This action has resulted in sediment build-up on the gully floor and subsequent colonization of stoloniferous grasses. At some sites natural regeneration of shrub species e.g. she-oak has also occurred. In this scenario, the landholder would repeat the drainage line and pasture assessment using the tools listed above and note the positive change in the landscape thereby building confidence to extend the possibilities to other sensitive sites.

Conclusions

The MRCCC has worked with landholders to rehabilitate the catchment for over 20 years. Over the past decade the group has formed fruitful working partnerships with locally relevant primary industry groups, in particular the Gympie District Beef Liaison Group, to increase awareness of the Great Barrier Reef and the important role of the local grazing industry to improve downstream water quality. Enthusiastic support from these groups, the development and use of easily interpreted on-ground extension tools customized to the MRC and implementation of on-ground projects that directly impact on the southern Great Barrier Reef has been embraced. As each phase of the Reef Trust program emerges, landholders have the opportunity to gain a deeper understanding of the land they manage thereby providing the foundations for positive long-term change in land management practices which in turn delivers far reaching environmental outcomes.

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References

Dean JR, Smith T. and Wedlock B. 2018. Benefits of the Mary River catchment Waterwatch Program for integrated stream management and monitoring outcomes. In: Vietch G, Rutherfurd ID (Eds), Proceedings of the 9th Australian Stream Management Conference. Hobart, Tasmania

Dept of Environment & Resource Management. 2011. Managing grazing lands in Queensland, Qld Government.

Dept of Natural Resources & Mines 2017, unpublished. Chronosequence mapping of streambank erosion Mary River – Wide Bay Creek to Munna Creek, Qld Government

DeRose RC., Prosser IP, Wilkinson LJ, Hughes AO and Young WJ 2002. Regional Patterns of Erosion and Sediment and Nutrient Transport in the Mary River Catchment, Queensland, CSIRO

Wilkinson SN, Hairsine PB, Hawdon AA, Austin J. 2018. Addressing gully erosion in the Great Barrier Reef catchments: priorities and progress. In: Vietch G, Rutherfurd ID (Eds), Proceedings of the 9th Australian Stream Management Conference. Hobart, Tasmania.