Australian Government
Cotton Research and Development Corporation

FINAL REPORT 2017

Choose an item.

Part 1 - Summary Details

Please use your TAB key to complete Parts 1 & 2.

CRDC Project Number: **CRDC1501**

Project Title: National NRM Technical Specialist

Project Commencement Date: **1/07/2014** **Project Completion Date:** **30/06/2017**

CRDC Research Program: Industry

Part 2 – Contact Details

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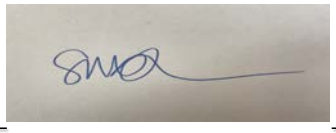
Signature of Research Provider Representative: 

Date Submitted: _____

Part 3 – Final Report

(The points below are to be used as a guideline when completing your final report.)

Background

1. Outline the background to the project.

CRDC 2013-2018 Strategic R&D Plan under its Responsible Landscape Management theme, outlines the industries desire to lead in managing natural resources and be recognized for its leadership in environmental performance. This project built on the past decade of investment in NRM research by providing a National NRM technical specialist who helped the industry meet this strategic goal through:

- developing and implementing annual national NRM campaigns,
- continuously improving the industries best practice recommendations for NRM, and
- facilitating the capture of past and current NRM research into project activities, outputs and outcomes.

A key measure of success under this goal as outlined within the Strategic plan is 1000km of riparian land and one million hectares of floodplain vegetation managed under best practice.

This project contributed to meeting this measure of success through:

- Collaboration with CottonInfo's REO's, regional NRM bodies and industry groups (eg WINCOTT) to implement a innovative initiative which used social networks, especially women, as a method for improving growers engagement in NRM capacity building activities.
- Development of new tools and resources that engaged growers in NRM awareness, monitoring and best management practice, and
- Capturing current practice's and condition information for biodiversity and riparian areas within the cotton industry.

The projects progress over the past 3 years has been reported in the bi-annual progress reports. This final report outlines how the project has met the strategic goals mentioned above as well as highlights some of the key outputs & outcomes of the project. This final report also summarises project activities for the last reporting period.

Objectives

2. List the project objectives and the extent to which these have been achieved, with reference to the Milestones and Performance indicators.

Lead the continuous improvement of the industry's best practice recommendations for NRM

1.1 Participate and assist the exchange of research results/activities amongst researchers and advisors working within NRM

Over the three years of the project I worked with CRDC researchers funded under the Responsible landscape program to assist them develop and implement their research activities and extend their research outcomes to the cotton industry, other relevant CRDC researchers and NRM advisors.

In addition I have worked with the CRDC Responsible Landscapes Program leader and the CottonInfo manager, to review the progress of individual research projects, identify R&D gaps and opportunities and identify adoption pathways for the outcomes of their research.

A highlight from the past 3 years was the Responsible landscape Management Forum held in Brisbane in May 2016. This forum organised by Jane Trindall (CRDC), Nicola Cottee (CA) and myself, saw thirty three researchers, growers and cotton industry stakeholders attended the 2 day forum to discuss the industries R&D needs and future challenges under the responsible landscape theme. A Sustainability Panel session held during the forum brought together cotton growers, leading cotton community leaders and other industry stakeholders to discuss what sustainability meant to their business and how to create sustainability value in a cotton business. The outcomes from the forum where used to advise the Grower panel strategy meeting and the sustainability stakeholder forum held later that year.

Other achievements, which saw the exchange of R&D among researchers and NRM advisors as a result of this project, include:

- Participation by relevant researchers and myself (including presentations) in the 2014 & 2016 Australian Cotton Conference and the 2015 Australia Cotton Science Conference
- Presentation and participation at the 2015 International River Symposium in Brisbane

- 2015 Mini Riparian researcher Forum- Moree in March- 5 industry Researchers undertook a tour of local cotton farms near Moree and met to discuss riparian R&D and monitoring and the implementation of project activities under the 25th Landcare Anniversary grant.
- 2015 Pathways to NRM collaboration – Twenty-five advisors participated in myBMP workshops extending the standards and resources within the Natural assets module as well as hearing presentations from CRDC researchers whose work underpins some of those BMP's.
- 2015 Advisor Spray Drift and Buffer Zone management workshop, Narrabri 28th & 29th April
- 2017 "Cottoning onto the Murrumbidgee field days" – collaboration between CottonInfo and the Southern NSW Landcare Irrigation Collective to extend cotton riparian R&D down south. The collective, which CottonInfo is a member since 2016, is made up of NRM NGO's, industry groups and local councils.
- GRDC & CSIRO Linkage project NRM tools for engagement- collaborated with CSIRO researchers Cate Paull and Nancy Schellhorn to establish linkages to cotton industry regional staff and develop a native vegetation planting guide for southern QLD.
- As a result of attending the NRM Regions workshop in Canberra in June 2017, I am involved in collaborative discussions between Cotton Australia, CottonInfo team manager and southern REO, Riverine LLS & the Murray LLS, on spray drift management RD&E.

In addition within this reporting period I have worked with CRDC funded researchers to assist them implement and extend their research, such as:

- Dr Kath Korbel (Macquarie University) – Co-ordinated Namoi groundwater health tool trial with growers.
- Dr Erin Peterson (University Queensland Technology) – Co-ordinated grower/site selection in Namoi for Honors project- Namoi microbat survey using acoustic monitoring
- Participation with other CRDC NRM researchers at the 2017 Restore, Regenerate & Revegetate Conference at UNE

1.2 Undertake annual review of practices in myBMP natural assets module and the water modules NRM components (e.g. groundwater management)

Annual reviews of the practices and supporting resources within the Sustainable Landscapes (natural assets) module have been undertaken and provided to Cotton Australia's myBMP team. In addition I worked closely with consultant Rachel Holloway to align the natural assets module with other modules whose practices overlapped (e.g water & pesticides) with those within the natural assets module. The natural assets module was used as a test case/benchmark to align other modules. The Natural assets module was also align with the structural changes made to the myBMP program as part of Rachel Holloways project. Key structural changes made to the module include, reduction of the number of standards, implementation of common language across all modules and the use of a standardised format for supporting resource sheets, based on the format previously developed for the natural assets. A document summarising the latest standards as of June 2017, for the myBMP program, including the natural assets module is outlined in Appendix 1.

1.3 Develop tools and resources (from research) for cotton growers and consultants that assist their adoption of NRM best practice.

The past 3 years has seen a large growth in NRM specific resources for growers and consultants. The development of a CottonInfo webpage by the CRDC/CottonInfo Communications Manager, has provided a platform on which many different types of NRM extension materials can be developed and extended to the industry. These include NRM research summary sheets, case studies, factsheets as well as links to YouTube videos, Smart phone App and social media sites. For a comprehensive list of material developed over the past 3 years for the CottonInfo NRM webpage refer to Appendix 2.

A highlight of the project was the development of the "Birds on Cotton Farm App" for smartphones released in early 2016 (further details in 4.3).

Another highlight of the project was the launch in 2016 of the National Cotton RiverCare Champion project. In late 2015 Mark Palfreyman, cotton farmer and zoologist, was appointed by CRDC to the role of Nation Cotton RiverCare Champion. In this 2 year role Mark is working with CottonInfo to demonstrate to cotton growers and the general public how best management practice maintains and or improves the good condition of riparian areas. The project is being developed and managed by myself. The aim of the project is to:

- Increase the industries awareness of the value of riparian land and engage them in the concept of Rivercare ie good riparian stewardship.
- Demonstrate to the cotton industry and the general public an example of a cotton growers "good stewardship" of riparian land, and
- Establish a long term riparian monitoring site looking at the impact of land management practice on riparian condition

Achievements to date under the project include:

- Establishment of 2 long term vegetation condition monitoring sites (one looking at impact of land practice change to non-grazing)
- Contracted professional ecologist, Phil Spark (North West Ecological) in October 2016 to undertake a four day fauna survey of "Taraba", results outlined in 5.1.
- Participation of Mark Palfreyman in his role as the National Cotton RiverCare Champion in the 2016 Australian Cotton Conference and the 2017 Restore, Regenerate and Revegetate Conference at UNE.
- Establishment of 2 "Cotton RiverCare" social media sites, one on facebook and twitter.
- We post to these sites twice a week using a combination of photos, info-graphics and videos. Our facebook site has almost 1100 followers and twitter has around 70. Facebook being a much more community and social interface receives a lot more comments and questions about the content compared to our twitter site. According to facebook analytics our followers are from across Australia, regional and metropolitan areas, with a few from overseas.

They are mainly women, 67% and almost 50% of total followers are over 55.

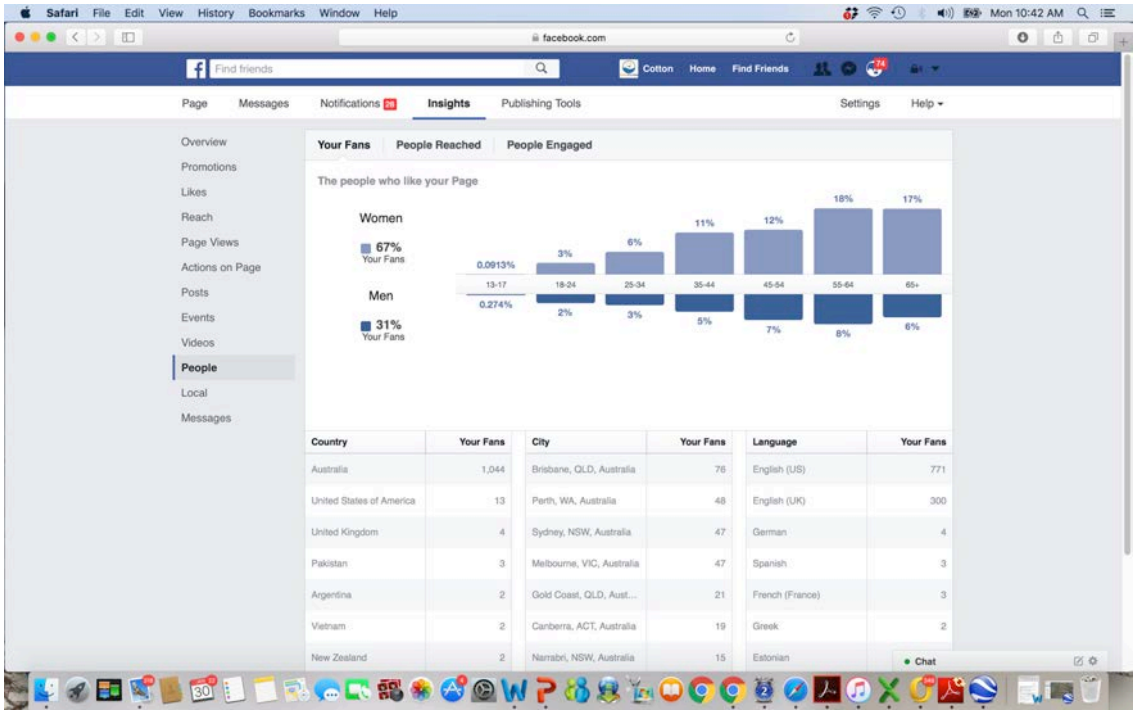


Figure 1: Facebook analytics for the Australian Cotton RiverCare page

- Our twitter site has around 70 followers and is a much more professional network with most followers being a combination of cotton growers, national and international cotton industry groups as well as, NGO's and NRM organizations and advisors. The content is re-tweeted often, particularly by other cotton industry groups providing a much greater reach then the 70 registered followers which can be seen in figure 2 in the top right hand corner which recorded 1700 impressions or views of the 2 tweets for that week. Good outcome for NRM extension.

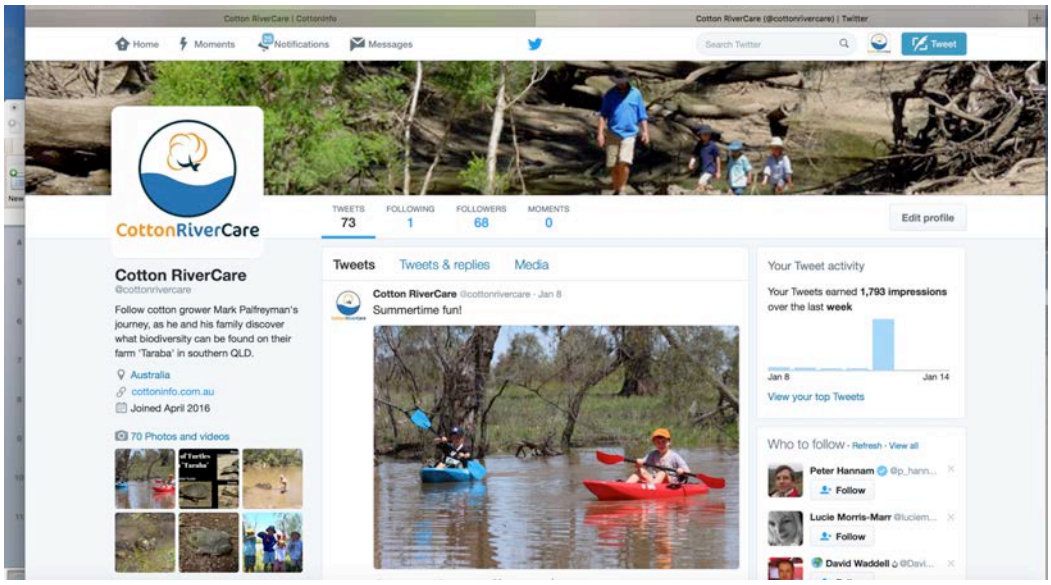


Figure 2: Australian Cotton RiverCare Twitter site

- In addition to the social media sites we also have a page on our CottonInfo website where we have a regular blog which enables us to go into more detail about the content in particular our best management practices. We have produced a number of YouTube videos about the project including Instructional videos such as how to establish permanent photo points for native vegetation monitoring. We also link these sites through to the cotton industries best management practice program, myBMP, providing cotton grower followers with more detailed information and resources for riparian and biodiversity management on farm.

Unfortunately a civil case being brought against Mr Palfreyman by his neighbour is threatening the continuation of this project. The details of this have been reported to CRDC program leader and a decision was recently made to cease all communication from the project until the matter is resolved.

In the last reporting period I co-ordinated the development of a project application under the Australian Governments "New and improved control technologies and tools for established weeds and pests" program. The application was successful. The 2 year project, starting in July 2017, seeks to develop a bio-herbicide for species and/or hybrids within the noogoora burr species complex from an existing, naturally occurring fungal pathogen agent (*Alternaria zinniae*). Sampling and testing will also determine if all Noogoora burr complexes are hosts of *Verticillium dahlia* – currently a pathogen of great concern to the cotton industry. Bio-herbicide development is currently constrained by taxonomic confusion within the complex. DNA sequencing will help clarify the current recognised distinctions between the complex and hybrids found in the field to ensure the efficacy of the agent against the species. The 2 year project led by NSW DPI is supported by CRDC, University of Queensland and Murrumbidgee Irrigation Association. The project has received $559,784 in funding from the Federal Government.

1.4 Participate in industry monitoring and benchmarking and survey metrics in understanding current NRM practice

Collaborated with industry riparian researchers and survey consultants to develop riparian practice questions for the 2014 & 2017 Cotton grower practices survey. Information collated from the 2014 survey was used in developing the annual CottonInfo NRM campaign and was extended to industry and the general public via

industry publications and conferences such as the International River Symposium. Information collected from the 2017 survey will be used as part of CRDC funded grower practice and attitudes research currently being undertaken by Dr Sam Capon from the University of Griffith.

Project activities and outputs have been reported in the CottonInfo YourDATA evaluation program. Information collated here was used by the CottonInfo JVC to assess progress against CottonInfo's Anuual Operating Plan (AOP) as well as development of new AOP's.

A comprehensive evaluation has been conducted of attendees of the "Cottoning onto the great outdoors" field days series (2015-2017) to provide evidence of changes in KASA (Knowledge, aspirations, skills and attitudes) as a result of attending the field days. All of the two hundred and eighty eight participants who attended theses field days recorded an improvement in their knowledge and capacity to implement riparian BMP as a result of their attendance. More information can be found in the following reports

- *Cottoning onto the Great Outdoors – river and riparian field days, 13-15 November 2015* (May 2016 progress report)
- *Cottoning onto the Great Outdoors – Emerald, November 2015* (May 2016 progress report)
- *Cotton RiverCare Champion Field day (wildlife spotlighting evening), October 2016* (November 2016 progress report)
- *Cottoning onto the Murrumbidgee River – river and riparian field days, 18-19 February 2017* Appendix 3
- *Cottoning onto the Macquarie River – river and riparian field days, 4 March 2017* Appendix 4

Develop the issue messaging for the delivery of NRM best practice through the CottonInfo" in it together" campaign

2.1 Demonstrate link between issue messaging and research outputs.

NRM Research outputs, both CRDC and other, were captured in the annual CottonInfo NRM "In it together" Campaigns, see Appendix 5, 6 & 7. These campaigns were developed in collaboration with researchers and the CottonInfo team members.

The implementation of the annual campaigns was successful with researchers and other NRM organisations working along side the CottonInfo team to extend and implement the campaign messages and activities.

NRM research outputs are also reflected in the annual review of the industries key guidebooks the Cotton Pest Management Guide and Cotton Production Manual.

2.2 Demonstrate link between issue messaging and grower/consultant information needs

Over the past 3 years a number of activities, reported in the bi-annual progress reports, where undertaken as a result of grower/consultant needs. Below are examples of some of these.

As a result of a 2016 grower panel request for more on-ground action in NRM I co-ordinated the development of a collaborative research project between CRDC, NSW DPI, University of Queensland and Murrumbidgee Irrigation to develop a bioherbicide for the Noogoora Bur complex. Noogoora Bur is a significant environmental weed in riparian and wetland environments across Australia. It also poses a threat to the cotton industry, as it is a known host of Verticillium Wilt. The 2 year project commencing in July 2017 is funded through the Australian Governments' Department of Agriculture and Water Resources grant program "New and improved control technologies for established pests and weeds".

Smith R, Capon S, Trindall J & Vogel S (2014) Internal discussion paper on causes of Gwydir valley tree dieback for the Gwydir Valley Irrigators Association Board member.

Provided the Crop Consultants Australia network & REO's with information about the NSW Native vegetation legislation as a result of a request from consultants for more information about the changes in NSW Native vegetation legislation.

Collaborated with Cotton Australia to review and provide policy officers with industry feedback on the:

- Draft 2015 QLD & NSW Pest and weed strategy
- NSW Biodiversity conservation reforms
- APVMA guidelines for buffer zones – native vegetation.

Worked with Bill Gordon to update and improve consistency of messages in our industry guidelines as well as review consistency of product label guidelines with industry guidelines for minimising spray drift impacts on native vegetation. Developed supporting resources in collaboration with Bill Gordon including delivering a Spray Drift Management workshop in 2015.

Recently I worked with CottonInfo team members and entomologists to collate R&D outputs on management of natural pests and their habitats for IPM as a result of

consultants request to Cottoninfo team for improved understanding of non-chemical practices in IPM.

2.3 Demonstrate the linkage between issue messaging for NRM best practice and CRDC measure of success "1000km of riparian land managed under best practice & 1 million hectares of floodplain vegetation managed under best practice"

It is difficult to make direct linkages between "issue messaging" and implementation of BMP of ground. In 2014 we developed a series of riparian land practices questions for the 2014 Cotton grower Survey to help provide the industry with information on the number of kilometres currently under best practice. According to the survey 91% of the 116 respondents who said they had a riparian area on their farm, averaging 8km in length, implemented at least one of the listed best management practices for riparian lands. This suggests that in 2014 957km of riparian land was managed under a BMP.

Since 2014 as outlined in this report there has been many different activities that have been undertaken as part of this project to extend BMP R&D for riparian lands. One of these activities was the delivery of a series of riparian BMP awareness field days across NSW & QLD targeting social networks of women in cotton. Evaluations undertaken at the field days showed that participants who were not already doing so were more likely to implement BMP as a result of attending the field days and had gained a greater level of confidence to implement what they had learned as a result of attending the field days.

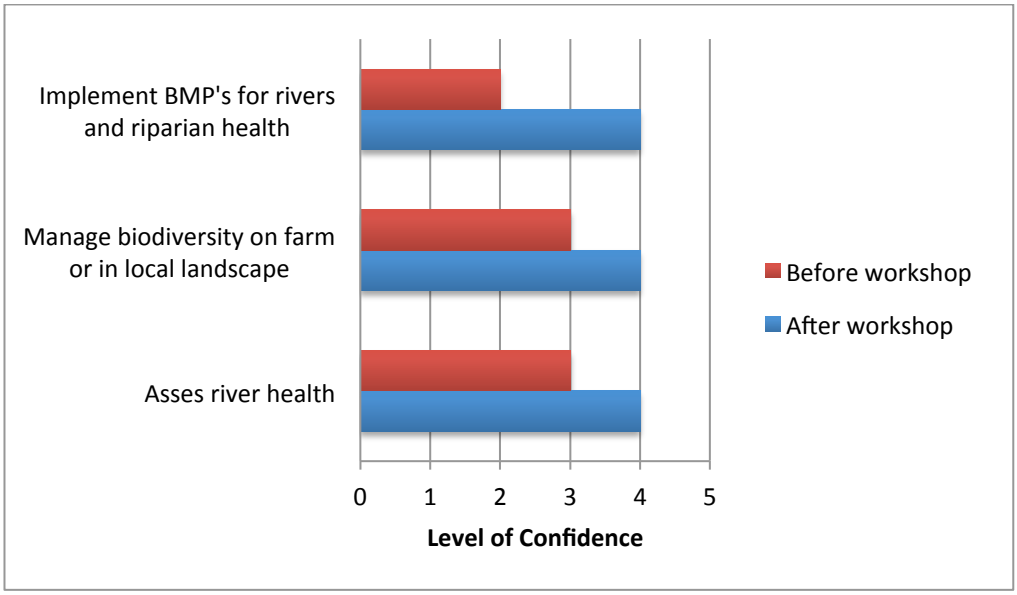


Figure 3 Summary from the 25th Anniversary grant landcare grant field day series (Moree, Boggabilla & Mungindi) of average level of confidence to implement practices in the 3 key areas before and after the field days, total of 4 field days, where 1 is very basic and 5 is very good.

In collaboration with CRDC researcher Dr Sam Capon from the University of Griffith, a series of questions that look at riparian values and best management practice have been submitted in the 2017 grower practice survey due for release in late June 2017. The results from this survey will help increase our knowledge of how much riparian areas is under BMP and what type of BMP's they are implementing in these areas.

Demonstrate awareness, understanding and utilisation of past and current NRM research findings in project activities

3.1 Relevant research findings (past and recent) are incorporated into communication product development

Incorporation of Dr Smith UNE riparian vegetation carbon storage and sequestration research outputs into

- 2014 Carbon neutral cotton farms paper and cotton conference presentation
- 2015 International River Symposium presentation
- 2015 Cotton Grower Production Manual
- Anthony Barlows Sustainability Case study – 25th Landcare Anniversary Grant
- Level 3 standard within the Sustainable Landscapes (natural assets) module of myBMP
- Biodiversity booklet- natures workforce
- 2015-2017 Cottoning onto the great outdoors series of field days (Emerald, Border Rivers Gwydir, Murrumbidgee & Macquarie Rivers)

Development of a Birds on Cotton farm App which captured Dr Adam Smith's & Rhiannon Smiths bird research data to update species list and habitat management principles within the App. Also collaborated with BirdLife Australia to update the checklist of birds found in cotton landscapes.

In collaboration with Bill Gordon updated spray drift management BMP recommendations for native vegetation through:

- Development of a factsheet on permanent vegetation barriers for spray drift management
- Updated spray drift management section in the 2015 Cotton Production Manual
- 2015 Spray Drift Management workshop Narrabri
- Updated spray drift standard and resources within the Sustainable Landscapes (Natural Assets) module of myBMP

Synthesis of R&D on dieback in the Gwydir valley into a paper by Dr R Smith UNE for GVIA board members

Dr Sam Capon and Dr Harry Balcombe's (GU) research findings on the role litter plays in reducing weed recruitment in riparian environments incorporated into

- "Auscott Midkin – "valuing riparian assets" case study 25th Landcare Anniversary Grant
- Managing riparian areas YouTube video.
- 2017 Cotton RiverCare Grazing management CottonInfo newsletter (DRAFT) see Appendix 8
- Biodiversity booklet- natures workforce
- Updates to the 2016 Cotton Grower production Manual
- 2015-2017 Cottoning onto the great outdoors series of field days (Emerald, Border Rivers Gwydir, Murrumbidgee & Macquarie Rivers)

Cotton RiverCare programs techniques for monitoring native vegetation condition incorporated into the instructional YouTube video - Monitoring vegetation changes over time (permanent photo points)

Dr Vesna Gagic's (CSIRO) initial research findings on pollinators contributing to the reduction of yield losses at high pressure for some insects incorporated into

- 2017 Cotton Pest Management Guide
- Currently being drafted into a Spotlight article, CottonInfo newsletter and NRM Research summary

In addition a summary of all CRDC NRM research projects goals and outputs are available on the Cottoninfo websites NRM page, see Appendix 2.

3.2 Attend/participate in at least one NRM conference each year

2014

- 2014 CSIRO & OECD international workshop on "Strategies to support both biodiversity and production in agricultural landscapes"

2015

- 2015 International River Symposium in Brisbane, 21– 23 September 2015. Presented "Carbon neutral cotton farms: valuing riparian vegetation"

2016

- 2016 CRDC R&D Review: Responsible Landscape Management 5-6th May Brisbane. Organising committee.

2017

- 2017 "Restore, Regenerate & Revegetate Conference UNE 5th-9th Feb 2017 – Presented – "Cotton RiverCare Champion project"

3.3 Provide technical NRM training opportunities to the CottonInfo team

- 2015 Pathways to NRM collaboration – myBMP workshops

- 2015 Spray drift management workshops
- 2015 Gwydir/Border Rivers Riparian Management Field days
- 2015 Emerald water quality monitoring and riparian management field day
- 2016 CRDC R&D Review: Responsible Landscape Management Forum
- 2017 Murrumbidgee River Riparian Management Field day
- 2017 Macquarie River Riparian management Field day

In addition to above workshops attended bi-annual National CottonInfo workshops where the annual NRM campaign messages where extended.

Increase grower capacity using 'social networks 'to engage in riparian and floodplain vegetation management

4.1 Support REO's in the development of regional riparian workshops in 7 cotton growing valleys

Gwydir (Alice Devlin)

November 2015, Cottoning onto the Great outdoors field day series – CottonInfo, North West Local Land Services and the Gwydir Valley Irrigators Association in partnership with the National Landcare program ran a series of riparian management field days at Boggabilla, Mungindi and Moree in the Gwydir valley. The aim of the field days was to extend the latest cotton industry riparian vegetation research outcomes as well as increase participant's awareness of the value of riparian vegetation on farms and educate them on the latest best management practices for riparian areas on cotton farms. 108 people participated in the field days with approximately 1500 cotton industry stakeholders across NSW and QLD being exposed to extension material directly related to the project. As part of the development and delivery of the field days 3 extension products were also developed, 2 case studies and 1 biodiversity booklet showcasing local River Red Gum Communities. The case studies currently provide supporting resource material for the Sustainable Cotton Landscapes (natural assets) module of the cotton industries myBMP program.

Emerald (Ngaire Roughly/Sharna Holm)

- ***October 2015 community Water quality monitoring***. Co-ordinated the Central Highlands Cotton Growers and Irrigators Association (CHCG&IA) successful application for the "Care for Creek" bursary through the Fitzroy Partnership for River Health (FPRH) to undertake water quality monitoring of the Nogoa river at Emerald. The data collected, using the bursary water monitoring kit, contributes to the Fitzroy Basin Reef Plan Report Cards, which underpin the

Reef Water Quality Protection Plan. The first data collection undertaken on the Nogoa River in October 2015 as part of CottonInfo field day "Family fun on the Nogoa River". The monitoring kit is shared with the Central Highlands Science Centre (CHSC).

- ***October 2015 Family fun on the Nogoa River field day.*** Development of a NRM "social networks" engagement activity to monitor water quality within the Nogoa River at Emerald on the 24th October 2015 in collaboration with CHRRUP, CHCGI, CA & FBA and the Fitzroy Partnership for River Health. 35 people attended and learnt about riverine health and management and contributed water quality data towards the Fitzroy Basin reef plan report card.

Namoi (Geoff Hunter)

- ***2015 Narrabri & Burren Junction Carp Muster.*** CottonInfo partnered with Namoi Water, NWLLS & Narrabri Fishing Club through sponsorship of the event, which saw over 500 people register across the weekend removing a significant amount of carp from the Namoi river.
- ***2015 Wee Waa recycled art metal sculpture workshop.*** CottonInfo partnered with Wincott, NWLLS, North West Landcare Chairs Network & Wee Waa Agricultural show society to hold a weekend workshop highlighting the importance of recycling. The workshop targeted local cotton women and their families.

Darling Downs (Jon Smith/Annabel twine)

- ***2015 Focus on Feathers -*** While this event did not progress due to low numbers the pre-event media including a launch in Millmerran of the event by the Mayor and a ABC radio interview helped advertise the recent release of the Birds On Cotton farm App for smart phones.

Border Rivers (Sally Dickinson)

- ***February 2016 "Farming with Birds, Bats and Beneficials" workshop and "Birds on Cotton Farm App' launch.*** The App was launched by local Cotton grower Association president and Nuffield scholar Nigel Corish.10 people attended.
- ***October 2017 Cotton RiverCare Champion wildlife spotlight evening.*** CottonInfo in partnership with the QMDC to run a field day to increase the

local communities awareness of eth Cotton riverCare Champion project and extend the findings of the Fauna Survey undertaken by Northwest ecological on "taraba". 29 people attended the field day with all participants recording an improved knowledge of the program and biodiversity in their local landscape as a result of attending the field day,

- ***March 2017 Science update – Lower Balonne Floodplain (fish, waterholes and trees)*** CottonInfo partnered with MDBA, University of Queensland, QMDC, Griffith University, DNRM & DSITI to hold a science update for growers in the Dirranbandi areas. Approximately 10 people attended.

Murrumbidgee (Kieran Okeaff)

- ***February 2017, Cottoning onto the Murrumbidgee River field days.*** CottonInfo, partnered with Murrumbidgee Landcare Incorporated (MLI), Murrumbidgee Irrigation (MI), Riverina Local Land Services (RLLS) and the Australia Government ran two field days in the Murrumbidgee valley. The aim of the field days was to extend the latest cotton industry riparian vegetation research outcomes, increase participants awareness of the value of riparian vegetation on farms and educate them on the latest best management practices for riparian areas on cotton farms. 71 people participated in the field days.

  As part of the development and delivery of the field days a biodiversity booklet showcasing local River Red Gum Communities was produced and distributed to participants. A key outcome for the field day was the collaboration between CottonInfo, MLI, MI and RLLS, as part of the newly formed Landcare Irrigation Area Collective (LIAC), to deliver the field day. This collaboration established new local networks between cotton growers and local natural resource management advisors.

Macquarie (Amanda Thomas)

- ***March 2017, Cottoning onto the Macquarie River field day.*** CottonInfo and Central West Local Land Services (CWLLS) in partnership with the Australian Government ran a riparian management field day at Warren in the Macquarie valley. The aim of the field day was to; extend the latest cotton industry riparian vegetation research outcomes, increase participants awareness of the value of riparian vegetation on farms and educate them on the latest best management practices for riparian areas on cotton farms. 45

people representing 10 cotton farms and 2 cotton industry service organisations participated in the field day.

As part of the development and delivery of the field day a biodiversity booklet showcasing local River Red Gum Communities was developed. A key outcome for the field day was the collaboration between CottonInfo and the Central West Local Land Service to deliver the field day. This collaboration established new local networks between cotton growers/advisors and the local natural resource advisor for the CWLLS.

4.2 Co-ordinate the development of a NRM ID guide for growers

Cottoning onto the great outdoors – biodiversity booklet

An A5 size booklet was produced which provided descriptions of some of the native plants and animals found within riparian areas in cotton landscapes, in particular those found within River Red gum woodlands. The booklet also provides BMP guidelines for riparian areas on cotton farms. The "Murrumbidgee" and generic biodiversity booklets also have a strong focus on ecosystem services provided by individual plants and animals and what the latest CRDC funded research is telling us regarding these services and BMP's.

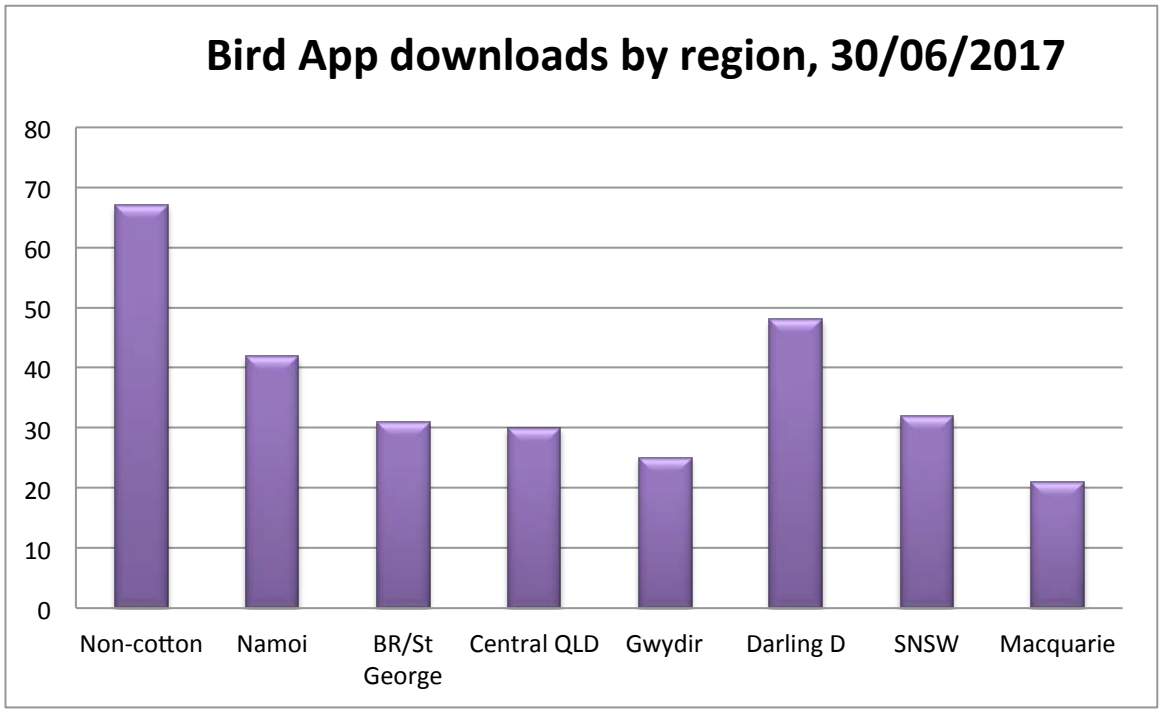
- Gwydir/Border Rivers – *distributed to 360 landholders within 100km of Moree and attendees of the 2015 "Gwydir Cottoning onto the great Outdoors" field day series and the 2016 Cotton RiverCare Champion project wildlife spotlight evening*
- Murrumbidgee – distributed to 71 attendees of field days as well as an extra 100 copies left in Murrumbidgee Landcare office in Griffith for use in upcoming field days.
- Generic industry- distributed to attendees of "Cottoning onto the Macquarie River" field day. Booklet also available for download from the CottonInfo websites's NRM page.

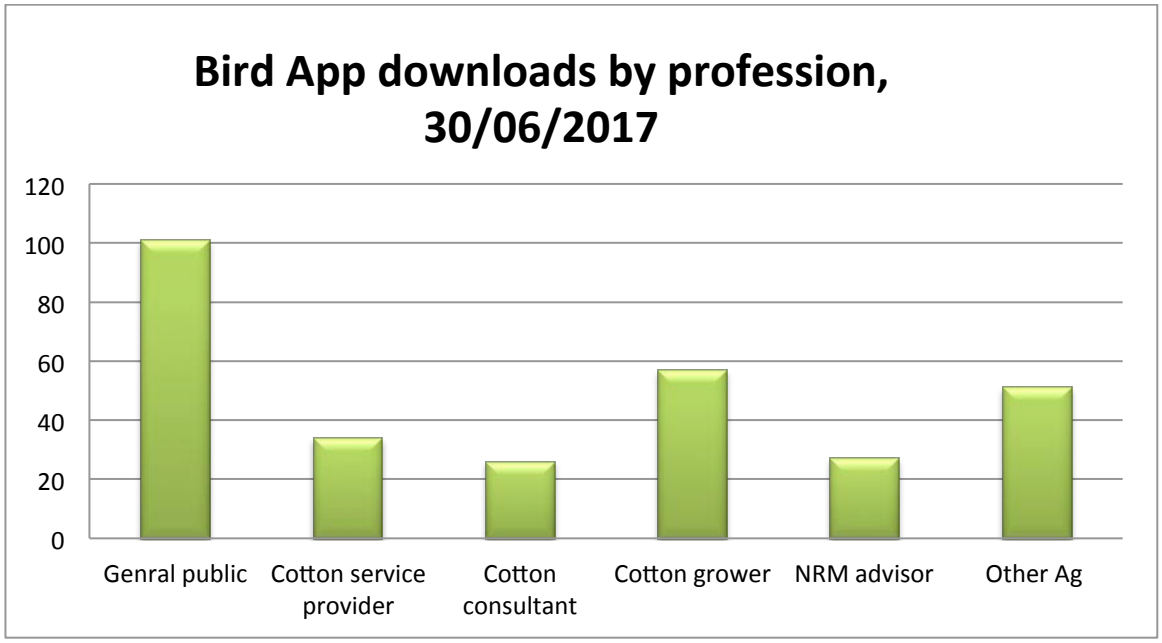
In the original contract twenty thousand dollars was allocated to the development of an NRM ID guide. Due to collaborative dollars and in-kind from organisations partnering in the delivery of the "Cottoning onto the….." series only minimal dollars where required to produce the biodiversity booklet. Therefore this twenty thousand dollars remains unspent.

4.3 Co-ordinate the development of a Birds on Cotton Farm App for smart phones.

The birds on Cotton farm App was launched on the 17th January 2016. The App provides another platform for growers to access information on bird identification and habitat management as well as allowing users to monitor and collate bird richness and abundance information on their farms. The region covered by the original book (southern QLD & northern NSW) has been expanded in the App to include southern NSW and central QLD cotton growing regions. Eleven new species of birds have been added to the App based on Dr Rhiannon Smiths CRDC funded bird survey and technical advice from CRDC funded bird researcher Adam Smith. The Checklist of birds found on cotton farms has also been updated by BirdLife Australia based on the Australian Bird Atlas data.

The App released in early 2016 incorporated the latest relevant research and a bird-monitoring tool. The App is a collaboration with many of the industries Cotton Grower Associations, Ginning companies as well as local natural resource organisations. The 2016 & 2017 CottonInfo NRM campaigns had a combined target of 200 unique users downloads of the Bird App and 40 unique users monitoring birds in cotton landscapes by June 2017, appendix 2. To date the App has had 296 downloads of which over 200 were in cotton growing regions. There has been 193 individual bird sighting recorded using the App's monitoring tool by 60 unique users. These results exceed the NRM CottonInfo NRM campaign targets. Below are two graphs showing some demographic data on who is downloading the App and where.


Bird App downloads by region, 30/06/2017
80
70
60
50
40
30
20
10
0
Non-cotton
Namoi
BR/St George
Central QLD
Gwydir
Darling D
SNSW
Macquarie


Bird App downloads by profession, 30/06/2017
120
100
80
60
40
20
0
Genral public
Cotton service provider
Cotton consultant
Cotton grower
NRM advisor
Other Ag

Benchmark and monitor riparian land condition and practice within the cotton industry

5.1 Establish a long term monitoring framework for riparian land condition with riparian researchers and establish monitoring sites

Two long-term vegetation condition monitoring sites have been established within riparian areas on the cotton farm "Taraba" near Toobeah in southern Queensland. These sites have been established as part of the Cotton RiverCare Champion project. The sites were established in April 2016 with benchmarking undertaken by myself, UNE researcher Dr Rhiannon Smith and Cotton RiverCare Champion, Mark Palfreyman. The sites were selected based on their different history of landuse and the owner's intention to change management practice from grazing to non-grazing on one of the sites. The original intension was to work with CRDC funded researcher Dr Sam Capon's team from the University of Griffith during 2017-2018 to develop a case study looking at grazing intervention on weed establishment at the sites. Unfortunately due to unforseen circumstances, previously discussed, we may not have access to these sites in the future and are therefore considering the use of a different site to undertake the land practice intervention case studies.

Site 1 is on the junction of Coomonga Creek and the McIntyre River. The site has had very little grazing. Even though it was extremely dry at the time of the vegetation survey, rainfalls had been well below average, the site had a very good cover of litter and diversity of groundcover species. Overall the site was in a very good condition with no dieback present at the site and regeneration of all age structures present. 3 canopy, 8 mid-low storey and 27 groundcover species where recorded at the site.

Site 04/02/2016 Site 2: 1: 05/03/2017

Site 2 is a north/south transect out from the ephemeral creek, Coomonga creek. This site has been opportunistically grazed since the 60's. It has a large infestation of Lippia along the banks, which is not evident in site 1. On average 40% of the site was covered in lippia with the % of lippia cover decreasing as you moved away from the riverbank. Again considering the dry conditions and the level of lippia infestation present, the site was in a good condition

with a slightly lower diversity of species present at site 2 compared to site 1. No dieback was present at the site and regeneration of all age classes was recorded at site 2. 3 canopy, 4 mid-low storey and 21 groundcover species where present at site 2.

Site 2: 04/02/2016

Site 2: 05/03/2017

In addition, a fauna survey was undertaken on the farm by a professional ecologist, Phil Spark (North West ecological) in October 2016. The survey was undertaken over four days and endeavoured to get a snap shot of species diversity across the farm. The survey was not repeated overtime and across different seasons therefore it is not a true representation of the full diversity of species that exist on "Taraba". The survey found a good diversity of native reptiles (23), birds (75), amphibians (28) and mammal (11) species however abundance for some of the species, such as microbats, was low which is a trend being observed across Australia. While the survey found a good diversity of species the expected trend, due to continued fragmentation of habitat in the local landscape, is for species diversity to decline over the coming decades. In the final report the ecologist identified riparian weeds as one of the biggest threats to biodiversity on the farm. "Weeds displace native plants and seriously modify the habitat for native fauna by removing important sources of seeds, fruits, and nesting materials, increase shading and ground cover that affects reptiles, and reducing litter foraging area for birds and reptiles". Appendix 9 contains the results from the vegetation, fauna and water quality monitoring.

5.1.1 Indicators of riparian health identified

CRDC research undertaken over the past 3 years by Dr Sam Capon (GU) and Dr Rhiannon Smith (UNE) identified 3 key indicators of riparian health; litter cover, canopy cover and presence of a shrub layer. A cotton industry resilience project by Bel Tempo NRM, also funded by CRDC, identified a number of key parameters for native vegetation condition for the cotton industry - 'proximity to habitat', 'patch size', 'connectivity' and 'vegetation cover'. Theses results have been incorporated

into communication tools and products developed for CottonInfo as well as used to develop the framework for Dr Sam Capon's intervention case studies.

The results from this research is also currently being collated by Erin Peterson from QUT who is looking at all these indicators, including non-cotton specific indicators identified by other research, to determine if an achievable, measurable and meaningful biodiversity sustainability target can be identified for the cotton industry.

5.2 Co-ordinate the update of industry guidelines for the best practice management of riparian lands within the Australian cotton industry

In collaboration with industry and non-industry riparian researchers and NRM advisors the guidelines for Best management practice of riparian lands within the Australian Cotton Industry have been updated and collated in key industry publications such as:

- 2017 Australian Cotton production Manual & the 2017 Australian Cotton Pest Management Guide.
- Sustainable Landscapes Module (Natural Assets) myBMP standards and supporting resource sheets
- CottonInfo website resource sheets, case studies and YouTube videos.
- Birds on Cotton Farms App for Smart phones, and
- Cottoning onto natures workforce biodiversity booklet

Currently working with Dr Sam Capon's team from the University of Griffith to develop 2 detailed case studies around riparian land practice interventions (vegetation planting/regeneration & grazing/weed management) as part of a new CRDC funded project.

Benchmark the current condition and land management practices of riparian land in cotton growing areas

The aim of this milestone was to provide the industry with improved knowledge regarding riparian condition and practice at a farm and landscape scale. The initial

intension was to collate and present the research outputs from Dr Rhiannon Smith's vegetation condition and grower practice data and Dr Sam Capons CRDC vegetation condition data in a joint riparian land practice research paper. However due to ill health, changes to research project deliverables ie no link to land practice data, and late delivery of condition data, the paper was not completed.

This project then investigated the feasibility of undertaking a more detailed grower practice and attitudinal survey of the cotton industry using a qualified social researcher, and linking this survey to the vegetation condition data collated by Dr Rhiannon Smith.

As reported in the November 2016 progress report, the outcomes of this investigation are summarised below.

- Dr Rhiannon Smith's vegetation condition dataset has over 200 sites across NSW & QLD and is variable enough that a range of vegetation conditions is present therefore potentially providing useful information in-terms of linking condition to practice and attitudes. *The dataset wasn't supplied to this project until early 2016.*
- The dataset would require additional work to stratify it eg NSW verse QLD, growing regions and enterprises (ie grazing or not) etc. Reference sites for condition based on NSW biometrics and QLD biodiversity condition would need to be determined.
- Collaboration with a social researcher to develop and implement the survey would be essential to the success of the project. The cotton industry would benefit from the development 2 separate surveys.
    - Industry Grower practice survey - series of land practice and attitude questions developed by social researchers which could be repeated in the grower practice surveys overtime to benchmark and evaluate changes in NRM practices and attitudes.
    - Vegetation condition and practice survey – linking vegetation condition data to practice and attitudes
- The time and cost associated with developing and implementing these surveys and stratifying/extrapolating Dr Rhiannon's dataset for use in the survey would cost well beyond the current budget of $20,000.

It was therefore determined that an industry grower practice survey linked to condition could not be achieved within this, the NRM Technical Specialist project. This was identified in the May & November 2016 progress report as a

research gap with discussions between myself and CRDC Program Leader Jane Trindall identifying two future research opportunities:

- Tender to an external group with GIS capabilities and an ecological background to capture vegetation condition data for the cotton industry at a landscape and farm scale using Dr Smiths data as well as other available datasets
- Tender to an external social researcher to undertake a detailed survey of growers current riparian land management practices and their values and attitudes which underpin their long term commitment to management practices.

In the 2017 CRDC FRP round EcoLogical were contracted by CRDC, as part of a larger Rural Research and Development for Profit Natural Capital accounting project, to provide a comprehensive database that documents the extent and condition of natural assets that the cotton industry utilises, and sets a foundation from which industry can develop and report against ecological sustainability targets under *Theme 2.2 Responsible Landscape Management*. The project will greatly assist in the definition of values and drivers relating to management of natural landscapes in cotton growing regions.

In Collaboration with Dr Sam Capon, a series of questions that look at grower riparian values and land practices were developed for inclusion in the 2017 Cotton Grower Survey. Dr Sam Capon as part of her current CRDC project will evaluate the results of this survey. However their are limitations in-terms of numbers of questions and format of this specific survey which may impact on how meaningful these results will be for the industry.

Methods

3. Detail the methodology and justify the methodology used. Include any discoveries in methods that may benefit other related research.

This project provided the cotton industry with a National NRM technical specialist 3 days a week who provided an important role within the cotton industries National extension team, CottonInfo. In this role the NRM Technical specialist over the past three years lead the continuous improvement of the best practice recommendations for NRM by:

- Being the technical lead for NRM and working with relevant NRM researchers & advisors (CRDC funded and others) to identify NRM R&D

opportunities and gaps, capturing key research messages and identifying and raising awareness of emerging issues

- In consultation with CottonInfo's Communication Manager and Team leader leading the capture and extension campaigns for NRM BMP, and
- In consultation with the myBMP team leading the continuous improvement of the BMP's recommendations and supporting resources within the Sustainable Landscapes Module (natural assets) of myBMP.

The challenge of increasing grower's capacity to engage in natural resource management was successfully addressed through this project by using an innovative methodology that targeted social networks of women, in particular families. With over 300 people attending field days on 'riparian management' across six valleys it is clear that attaining high level of attendance at non-production focused event is achievable if the right framework to engage them is used. The field day evaluations clearly show that the fact that these were family based events is the reason we had such high attendance. However the success we achieved in engaging families in each valley was dependent on how effective we were in engaging social networks of families. In reflection this often came down to having the right contact person (social connected) in a region when first planning and developing the field day. To provide a comparison, the field day held at Hay was organised via a committee based in Griffith with limited local contact had around 25 people attend. The field day held at Warren where a local contact with strong social networks was used had 45 people attend. Finally it is in my opinion based on my observations of these events that field days, which are tactile and require physical movement, are more engaging for families, generating more discussion and participant involvement.

In consultation with riparian researchers the Namoi Regional Vegetation (RVC) condition assessment methodology and condition benchmarks were used as the monitoring framework for the establishment of the two long-term monitoring sites. This framework is based on the Namoi riverine condition framework developed by Ecological for the Cotton CRC and Namoi CMA in 2009.

This framework was chosen as it captured condition indicators identified by CRDC researchers, could be undertaken by non-researchers (Cotton RiverCare Champion) and provided bio-condition benchmarks for the 2 vegetation communities identified at the site.

Note one site (Coomonga creek/land practice intervention) has been assessed using the QLD bio-assessment methodology, however neither of the monitoring sites under this methodology has a reference condition site under the QLD regional ecosystems framework. According to a report undertaken by EcoLogical for the MDBA & SRA (Sustainable Rivers Audit) in May 2010 "Preparation of a reference condition dataset" assigned RVC equivalents for QLD regional ecosystems where no benchmark data existed. (Site 1- 11.3.15:RVC 78) & (Site 2 - 13.3.5:RVC 73).

Results

4. Detail and discuss the results for each objective including the statistical analysis of results.

The results of the project are explained in detail in section 1.

Outcomes

5. Describe how the project's outputs will contribute to the planned outcomes identified in the project application. Describe the planned outcomes achieved to date.

Workshops/activities that target "social networks" of growers and their families delivered across 7 valleys - *Increased numbers of growers participating in NRM activities with improved knowledge of best practice for riparian management*

- As described in the methodology using 'social networks" clearly increased grower participation in NRM activities with 288 people attending the events. Evaluations undertaken after the events showed that respondents felt that they had improved knowledge and confidence to implement BMP as a result of attending the events.

Industry relevant indicators of riparian health in cotton growing areas identified - *Industry has gained knowledge on BMP that it can be undertaken to maintain or improve riparian condition*

- Key industry indicators of riparian health identified through R&D over the past 3 years were linked to known land practices that impact on these indicators and 'packaged' into CottonInfo extension messages, tools and products, including extension at the above mention field days.

A methodology for capturing riparian health in cotton growing areas developed and implemented - *Improved understanding of industries impact on riparian health and its ability to implement BMP to improve maintain riparian health in cotton landscapes*

- A YouTube video on using permanent photo monitoring points as a simple grower friendly method for assessing vegetation change overtime was developed using the National Cotton RiverCare Champion and resides on the CottonInfo website.
- In consultation with riparian researchers the Namoi Regional Vegetation (RVC) condition assessment methodology and condition benchmarks were used as the monitoring framework for the establishment of the two long-term vegetation condition monitoring sites.

Reports and recommendations made to CRDC from attendance at NRM research forums, meetings and conferences - *Industry able to identify gaps in knowledge as well as opportunities for future NRM research*

- NRM R&D gaps and opportunities were identified through developing and running forums such as the 2015 Mini Riparian researcher forum in Moree and the 2016 Responsible Landscape Management forum in Brisbane
- Attendance and participation at NRM and industry conference such as the Australian Cotton Conferences, International River Symposium, CSIRO & OECD international workshop, UNE Restore, Regenerate & Revegetate Conference
- Keeping abreast of grower and consultant issues through attendance and participation at CottonInfo bi-annual meetings and fortnightly teleconferences
- Participation in the 2017 NRM regions committee meeting in Canberra and the identification and initial discussions of a potential collaboration on spray drift management with Riverina LLS and Murray LLS.

Provide an Industry NRM lead for NRM best practice - *The CottonInfo Team has technical NRM support*

- For the past 3 years CottonInfo has had a NRM Technical Specialist 3 days a week that has lead the continuous improvement of NRM BMP recommendations and lead the NRM extension program for CottonInfo.

Annually recommendations for the improvement of the natural assets module made to Cotton Australia - *Growers and industry members using the latest NRM best practice knowledge to manage natural assets on farm*

- Sustainable Landscape Module (natural assets) annually reviewed and updated and inline with other modules with myBMP. Links provided from CottonInfo NRM webpage to myBMP.

Development of the 2 NRM knowledge products with CottonInfo Team management and relevant NRM researchers- *Growers and industry gain knowledge and tools for managing natural assets on farm*

- Birds on Cotton Farm identification and monitoring App developed and released. 296 downloads and 129 unique monitoring entries
- Cottoning onto biodiversity booklet series (3 editions)
- Using vegetative barriers to minimise spray drift on cotton farms factsheet
- Case studies: Demonstrating whole farm sustainability – Anthony Barlow
- Case studies: Valuing our riparian assets – Auscott's Midkin
- YouTube video – permanent photo pints

NRM campaign "in it together" messages, activities, and targets developed and described to CottonInfo Team- *Increased NRM knowledge of REO's and growers better supported on NRM issues*

- Development of 3 annual NRM Campaigns in collaboration with CottonInfo team member and assistance of team members in implementing and meeting campaign targets. All campaign targets met with assistance of team members.
- Seven NRM knowledge improvement and training opportunities provided to REO's
- NRM research updates given to CottonInfo team members at bi-annual national team meetings and fortnightly teleconferences.

Assist REO's develop and deliver NRM activities on regional issues as identified by REO's or research - *RDO's and growers gain knowledge on local NRM issues*

- 9 extension activities held across 7 valleys with around 320 people attending
- Regional issues covered include, water quality monitoring, riparian BMP, biodiversity BMP, Managing beneficials and floodplain management.
- Groundwater health tool trials undertaken in Namoi valley with 5 growers and REO.
- Microbat habitat requirements research undertaken with 5 growers in Namoi catchment.

Development of NRM communication products, articles etc. - *Growers and industry gain knowledge on current and regional NRM issues*

- Industry grower and consultant surveys are showing an increasing impact by CottonInfo on their awareness and knowledge, this includes NRM based products, publications, websites etc around issues such as, spray drift management, bird identification, management and monitoring and riparian management and monitoring.
- "KASA" Evaluations from 'social network' field days reported an increased in both awareness and confidence of participants to implement riparian BMP.

CRDC research program reflects regional NRM issues and NRM knowledge gaps - *Growers and industry have upto date NRM best practice information*

Research opportunities and gaps identified through this project currently being addressed through CRDC funded projects include:

- Through forums (Riparian research mini forum, NRM Responsible Landscape Management Forum) and internal and external discussions a knowledge gap was identified around the industry wide understanding of native vegetation condition and extent and what/where areas where of key conservation value for the industry. A new 3 year CRDC project with EcoLogical, as part of a larger Natural Capital Accounting project, will address this knowledge gap.
- As a result of a 2016 grower panel request for more on-ground action in NRM I coordinated the development of a collaborative research project between CRDC, NSW DPI, University of Queensland and Murrumbidgee Irrigation to develop a bio-herbicide for the Noogoora Bur complex. Noogoora Bur is a significant environmental weed in riparian and wetland environments across Australia. It also poses a threat to the cotton industry, as it is a known host of Verticillium Wilt. The 2 year project commencing in July 2017 is funded through the Australian Governments' Department of Agriculture and Water Resources grant program "New and improved control technologies for established pests and weeds".
- Off-site impacts from spray drift management continues to be an industry and community high profile issue. The provision of technical spray drift training, information and advice provided through this project (Spray drift management workshop, vegetation barrier factsheet) and other industry projects, has failed to achieve practice change. Further R&D in this area including a new 3 year CRDC project under the Responsible Landscape management theme, "Quantifying the potential for off-farm impacts from pesticides (from cotton)", aims to better understand the industries risk and identify new innovative practice change methods. I am currently leading discussion between a number of NSW LLS's, CottonInfo and Cotton Australia about collaboration to address spray drift management at a regional level.
- Over the past two years I have held a number of conversations with fish ecologists in the QLD state government, regional NRM bodies, NSW DPI fish ecologists and cotton industry groups around the impact of pumping on fish

health. Fish screens may be a potential management strategy for the cotton industry. Further R&D on implementation of fish screens in-line with the National Carp Control Strategy was proposed to my program manager as a worthwhile future investment for CRDC's 2018-19 procurement round.

6. **Please describe any:-**
   a) **technical advances achieved (eg commercially significant developments, patents applied for or granted licenses, etc.);**
   b) **other information developed from research (eg discoveries in methodology, equipment design, etc.); and**
   c) **required changes to the Intellectual Property register.**

NA

Conclusion

7. **Provide an assessment of the likely impact of the results and conclusions of the research project for the cotton industry. What are the take home messages?**

Over the past 3 years there have been a number of achievements have been made as well as the identification of areas for future R&D investment.

Using social networks of women and their families to increase engagement of the cotton industry in NRM capacity building events is a very effective tool with over 300 people from cotton landscapes attending riparian management events over the past 3 years.

The drivers of riparian land management practice change on cotton farms ie the values and attitudes which underpin cotton growers long-term commitment to management practices, is very complex. To date the cotton industry has undertaken a fairly adhoc approach to NRM social research often incorporating social research outcomes into ecological research projects being undertaken by ecologists not social researchers. Also, the investment in these social research outcomes is often a minimal part of the overall project budget. Research to better understand the drivers of NRM change needs to be undertaken by qualified social researchers with allocation of appropriate budgets.

At a riparian monitoring meeting in 2014 at CRDC with industry and non-industry riparian researchers and ecologists, participants were asked to identify which of 4 higher level indicators of riparian health (vegetation, in-stream, geomorphology & water quality) best informs and evaluates land management practices on cotton farm. Riparian vegetation was ranked the second highest with in-stream health the highest. The milestones of this project, inline with CRDC 2013-2018 Strategic R&D

Plan, focused on identifying and extending the key indicators of riparian vegetation health that cotton growers influenced through their land practices. Discussion at the above mentioned workshop ranked extent (width & connectivity) as the most important. Over the past three years CRDC funded research undertaken by Dr Rhiannon smith and Dr Sam Capons group found that in addition to extent, canopy cover, litter Cover and shrubbiness within riparian vegetation where key indicators of riparian health that cotton growers influenced. Over the next two years through Dr Sam Capons CRDC project and the continuation of the NRM technical specialist project, case studies looking at land practice interventions for these key industry indicators, will be developed and extended to the industry.

CottonInfo's Cotton RiverCare program, in particular the Cotton RiverCare Champion project, has successfully increased the industry and non-industry communities awareness of good riparian stewardship on cotton farms. With almost 1200 followers on social media and one of the highest viewed CottonInfo YouTube videos 21/121, the use of growers themselves as the industries story tellers of good stewardship appears to be in effective engagement strategy. In the future the program would benefit from broadening its 'representative' stewards to include other cotton growers implement good practices on farm.

2016 Responsible Landscape Management forum was held to discuss the cotton industries R&D needs under this theme and to refine the direction of investment to meet future challenges and make a difference. A focus of the workshop was sustainability and how to create sustainable value to cotton businesses and identifying the pathways to impact. Participants of the workshop identified that sustainability means different things to different people, industries, organisations and sectors. For a cotton grower it means surviving economically, having a reasonable lifestyle and passing the farm onto your kids in a better shape without impacting on anyone else. However to achieve this and maintain the industries social licence to farm, inclusivity is essential. Industry needs to be working over the long-term with local communities and forging alliances with environmental groups so that there is real ownership of targets and less chance changing governments, CEO's etc. can derail these. A project currently being contracted by CRDC with EcoLogical will help the industry identify what is the extent and condition of the natural assets cotton communities utilise. The project will set the foundation for not only developing and reporting against ecological sustainability targets but also developing new collaborations with regional cotton communities and environmental groups that incorporate these ecological sustainability targets with regional social

and economic targets. A focus of the next 3 years for the NRM Technical & Extension specialist will be building these collaborations.

Extension Opportunities

8. Detail a plan for the activities or other steps that may be taken:
(a) to further develop or to exploit the project technology.
(b) for the future presentation and dissemination of the project outcomes.
(c) for future research.

The continuous improvement of best practice recommendations for natural resource management will be continued in a new project funded by CRDC. The new project provides the cotton industry with a Cotton NRM and extension specialist within the CottonInfo team for another 3 years (2017-2020). The new project will build on the outcomes achieved in this project, improve collaboration between the cotton industry and NRM organisations and lead the minimisation of off-site impacts within the cotton industry.

9. A. List the publications arising from the research project and/or a publication plan. (NB: Where possible, please provide a copy of any publication/s)

A list of all publications produced as part of this project are

B. Have you developed any online resources and what is the website address?

Yes online resources have been developed as part of this project. All reside either on the CottonInfo website's NRM page or within the supporting resources area of the Sustainable landscapes (natural assets) module of myBMP. A list of al publications is provided in Appendix 2. All publications have been uploaded to Centric.

Part 4 – Final Report Executive Summary

Provide a one page Summary of your research that is not commercial in confidence, and that can be published on the World Wide Web. Explain the main outcomes of the research and provide contact details for more information. It is important that the Executive Summary highlights concisely the key outputs from the project and, when they are adopted, what this will mean to the cotton industry.

This project built on the past decade of investment in NRM research by providing a National NRM technical specialist who lead and assisted the industry develop and implement annual national CottonInfo NRM campaigns, identify NRM R&D gaps and opportunities and facilitate the capture of NRM R&D into the cotton industries myBMP program, industry guidelines, tools and products.

Industry NRM research workshops such as the 2015 Riparian Researcher and the 2016 Responsible landscape Management forum provided important opportunities for researchers and industry leaders to discuss NRM research outcomes and workshop NRM R&D gaps and opportunities for CRDC investment.

The establishment of two long-term riparian vegetation condition/land management practice monitoring sites on a cotton property in southern QLD, provides an important longitudinal dataset on practice change as well as impacts on key riparian condition indicators identified for the cotton industry by CRDC riparian researchers.

Through Collaboration with CottonInfo's REO's, regional NRM bodies and industry groups (eg WINCOTT) an innovative initiative focusing on 'social network of women' implemented across 7 cotton valleys has resulted in over 300 people with improved knowledge of riparian BMP and the confidence to implement these practices.

The development and release in 2016 of a Birds on Cotton Farm App, provided the industry with an important tool for the identification, management and monitoring of birds in cotton landscapes, with almost 200 sightings of birds across cotton landscapes recorded to date by users.

The launch of the Cotton RiverCare program and appointment in 2016 of a National Cotton RiverCare champion has enabled the industry to extend 'good riparian stewardship' to industry and non-industry including 1200 followers on social media.

Extension of Cotton NRM R&D at CottonInfo industry meetings, forums and national and international conferences including the International River Symposium in Brisbane in 2016.

Over 50 CottonInfo extension tools and products on NRM BMP produced and residing on the NRM page of CottonInfo.