final report

Project code: B.ERM.1100

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Date published: November 2018

PUBLISHED BY
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Design of the Dung Beetle Ecosystem Engineers project

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

Executive Summary

Australian livestock produce around 80 million tonnes of dung each year that has adverse effects on productivity and the environment. The dung, particularly from cattle and sheep eating lush pasture, smothers pasture and reduces its growth, encourages the reproduction of intestinal nematodes, which reduce animal productivity, encourages the reproduction of bushflies and increases the runoff of nutrients and pathogens into waterways. Dung beetles either bury or scatter the dung, increasing pasture growth and reducing the negative environmental effects. CSIRO has introduced into Australia numerous dung beetle species from overseas countries. However, many colonies, particularly in southern Australia were decimated during the long drought of the 2000s-2010s due to destocking of properties and the lack of dung for the beetles to eat.

MLA obtained in 2017 a Commonwealth Rural R&D for Profits project in the third round of the Program to widen the spread of existing and newly introduced dung beetle species in southern Australia and to quantify the benefits of dung beetles for producers, the environment and society. The project partners include three universities (Charles Sturt, Western Australia, New England), the Western Australian Department of Primary Industries and Regional Development, CSIRO, Landcare Research NZ, Dung Beetle Solutions International, Councils (Warren Catchments, Leschenault catchment) and the Mingenew-Irwin Farmer Group. The wide range of expertise from fundamental research, educational institutions to private companies, with experience in rearing and distribution of beetles, should lead to valuable outcomes for producers and society. There will also be a dedicated website at CSU for all information relating to dung beetles and access to models that will allow individual producers to identify the economic benefits of beetles to specific farms.

The dung beetle project was approved by the Commonwealth on the basis of high-level outcomes. This project was established by MLA to develop a detailed activity and budgeted project plan to meet the objectives of the dung beetle project.

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1 Background

1.1 This consultancy

MLA established this project to develop a detailed project plan for the Rural R&D for Profit Dung Beetle Ecosystem Engineers project. The project plan was to include detailed activities for each organisation, responsible personnel and a budget divided into salaries/personnel costs, operating costs and assets. The project plan was to ensure cash and in-kind expenditure matched the amounts available within the project and promised by individual organisations. The project plan was to be used to draft contracts for each collaborating organisation.

2 Project Objectives

The contracted project objectives were:

1. Work with project leaders and MLA to develop an overall program of work;

2. Incorporate adoption outcomes and outputs into the overall program of work;

3. Develop detailed individual project milestones, budgets, outputs and timelines;

4. Attend and present at a workshop with project partners to finalise the program of work;

5. Attend telecons with MLA and project partners as required;

6. Travel to project teams as required to complete the above tasks.

3 Methodology

3.1 Background update

Available documentation on the project was reviewed, including the original Rural R&DfP application, the draft contract between MLA and the Commonwealth Department of Agriculture and Water Resources (DAWR), previous dung beetle research reports from CSIRO and MLA projects and the spreadsheet developed following a Workshop in Adelaide in June 2017. This spreadsheet contained high-level tasks for the collaborating organisations and yearly budgets.

Several teleconferences and meetings were held to discuss how the project had been developed and people recruited as collaborators.

3.2 Workshops

A Workshop was held with all collaborating organisations in Melbourne on 11-12 September 2017 to refine tasks and budgets to fit the funds available.

An additional Workshop was held on 17-18 October 2017 at CSU in Wagga Wagga to resolve the distribution of tasks and budgets among the groups working on aspects of quantifying the benefits of dung beetles to farmers, the wider group of stakeholders and the public.

3.3 Project plan development

A logical quantified, time-bound and budgeted spreadsheet (Gantt Chart) was developed. The original proposal to the Commonwealth had four sub-projects areas:

Regional dung beetle service delivery to farmers via infield training and online educational packages, supported by a *smartphone App* supporting farmer decisions on which beetles they need and where to source them, while simultaneously augmenting a national citizen science database based on species already present (see subproject 2).

National to regional dung beetle distribution and impact monitoring program. Compile all historic and new field data cross farm sites into a new *National Dung Beetle Database* and associated analytical tools to i) underwrite the service delivery element, and ii) allow scaled regional evaluation of the multiple national benefits.

Field-based ecosystem service evaluation methodology development and implementation to develop methods and modules that allow all I-VI below-listed categories* of benefits and sub-benefits to be measurable from the paddock to national scale.

Selection, importation, release, mass rearing and distribution of a pipeline of existing and key new dung beetles to Australia, to fill scientifically justifiable dung beetle service gaps, including *two recently introduced spring-active species and new dung beetles* targeting, for the first time, sheep dung and associated flies and parasites.

* Six specified categories for ecosystem service evaluation

I. Increased pasture health and growth and sheep and beef productivity.

II. Improved soils through dung nutrient recycling, mixing and tunnelling, aeration, carbon sequestration and storage, deep profile water storage and reduced bulk density.

III. Reduced GHG emissions from dung, and nutrient loads in run-off water reducing pollution of waterways and estuaries.

IV. Breaking the livestock gut nematode worm infection cycle by processing, drying and burying dung infested with susceptible parasite larvae, reducing veterinary chemical drenching needs and increasing livestock health.

V. Reduced dung available to spring breeding of bushflies, improving rural lifestyles, Australia's BBQ culture and tourism potential.

VI. Reduced dung available to buffalo flies attacking livestock in northern NSW and QLD

A review of the four sub-project areas specified in the Rural R&DfP proposal showed overlap between sub-projects, a lack detail and clear logic in how the overall project would be constructed. Following discussions, primarily internally within MLA dung beetle management group and two external consultants, the approach was to breakdown necessary tasks into eight logical Themes:

1. Program Management
2. Beetle rearing
3. Beetle distribution
4. Database: data collection and collation

5. Training, education, information delivery
6. Quantifying economic value
7. Importation of new strains/species
8. Program legacy

The new project activity timelines were discussed with each organisation and budgets prepared.

4 Results

4.1 Outcomes from Melbourne Workshop

4.1.1 Evaluation of grazier uptake of dung beetles

Presently, there are only a small group of producers who are keen to do more with dung beetles. They largely believe the beetles offer many positive benefits, so continue to seek the opportunities to learn more about them and promote their contribution as part of a sustainable farming system. This includes passionate individual farmers, some researchers and some landcare / environmental groups. However, the majority of producers and many in the advisory and retail sectors are ambivalent at best to actively managing for dung beetles or at worse think dung beetles are a 'fringe' or 'green' issue and not a mainstream consideration in farming (not a big lever). They currently do not see the 'value' in investing time and energy to pursue dung beetles as an important component of their farming system despite claims made that dung is worth billions to the Australian livestock industry. In addition, the possible negative implications to other operations if managing for dung beetle survival e.g. only using certain drenches or avoiding certain herbicides is a disincentive. Put simply, the majority of farmers are asking 'where's the value'?

The difference in motivation and attitude between the producer groups is likely to be explained by their temperament. About 5% of livestock producers (NF types in Myers Briggs vernacular) have a temperament that would be naturally attracted to the value currently ascribed to dung beetles, with about a further 10% to 15% having some degree of interest (NT types). The majority (~80%) need a strong value proposition, with localised and sustained extension to be motivated enough to act. If this is not addressed, the project as submitted to the Commonwealth will only cater for the 'believers' and limit overall adoption and opportunity for improving productivity.

Most producers and advisors do not know much about dung beetles apart from the fact they exist and eat dung. Not surprisingly with limited knowledge, the interest to embrace the concept will be limited. A common response to a lack of knowledge is avoidance or maintaining ignorance.

This revelation of relatively low adoption levels across the grazier population led to the following propositions:

- Conduct **market research** to further understand the motivations and attitudes of the majority who do not currently embrace the spending time and resources on dung beetles. Use this to help direct the creation of extension and communication type activities required.

- Quantify the **net benefits** (primarily economic but also environmental and social) from having dung beetles in a diversity of farming systems.
- Create **new value propositions** (the hooks) for a range of producer temperament types informed by the market research.
- Conduct **research** to increase the quantifiable benefits (and possible disruptions) of dung beetles in different environments (regionally distributed), translating this to impact on net farm profit
- Support regionally distributed **local demonstrations and extension activities,** where the benefits of dung beetle introductions and ongoing favourable management can be captured *in a way that meets producer needs.*
- Create a **platform** (phone app, website) to enable citizen observations of the distribution, effectiveness and economic value of dung beetles in different environments and on specific farms.

An outcome from this analysis of grazier groups and their perceptions at the Melbourne Workshop was an emphasis within the project activities to involve a range of eight farmer groups across southern Australia. These farmer groups would first be exposed to the value of dung beetles in 'awareness' meetings and then used as 'focus-group' to determine attitudes to dung beetles and how they could be incorporated into farming practices for individual enterprises.

4.1.2 Platform for information delivery

Following a discussion at the Workshop, the team considered having all dung beetle information (currently available and new created by the project) as well as an interface for producers, the agribusiness industry and other stakeholders through a dedicated website at CSU was a more efficient delivery system and better allocation of funds. The website would house simulation models to allow individual producers or other stakeholders to determine the likely economic value of dung beetles to a specific enterprise if numbers and species could be identified. The website, housing all known information and the economic models of their benefits, in a single place at CSU could be maintained into the future and provide an ongoing legacy for the project after completion.

Several yearly citizen science campaigns could be run during school holidays in spring and autumn where all citizens are encouraged to find and photograph dung beetles in their area using an "App" (to be developed). The photograph, times and locations would then be known from the App and experts used to identify the beetle species from the photographs. This approach for using the App has two advantages for the project: i) an interest in dung beetles and their benefits would be generated across a wider range of the general population; and ii) the project would obtain a more complete view of the dispersal of beetles across southern Australia for the database than would occur from the specified monitoring sites.

4.2 Detailed project plan

The detailed project plan was developed with each outcome, activity, organisation, person responsible and time period for action as well as annual in-kind expenditure, cash allocation for salaries, operating costs and assets being detailed. These activities and budgets are identified also for every collaborating organisation.

4.3 Project governance

A governance and management plan was developed for the project.

5 Discussion

5.1 Project success

The project has brought together a range of organisations and personnel with widely different backgrounds, skills and goals from research groups to private companies focused on commercialising dung beetle services. This wide range of people has greatly increased the scope of the research and likely legacy for the success of dung beetle service to the grazing industry following completion of the project.

5.2 Importance of prior planning

This project has a great potential to improve productivity of grazing properties in southern Australia and improve welfare of the public by reducing the presence of bushflies. However, close cooperation of collaborating organisations and strict adherence to the project plan is essential to achieving these outcomes.

6 Conclusions

6.1 Conclusions

Increasing the species of dung beetles adapted to a range of southern Australian grazing environments and spreading more widely existing species will have large benefits in production and economic returns for graziers and social benefits for the community through reducing nutrient and pathogen runoff into waterways and reducing the prevalence of bushflies. These outcomes are now possible since MLA was granted a Rural R&D for Profits project on dung beetles in the third round of the Government program.

This consultancy was initiated by MLA to produce a detailed and logical plan of activities to meet the Rural R&DfP project Milestones and to ensure these were carried out within the constraints of the budget.