

5. Projects 1965-2008

This section outlines dung beetle projects that have operated in Australia and includes resources that they have developed.

Scope & limitations

Whilst every effort was made to contact past and current dung beetle projects, this section does not include every project that has operated in Australia. The short-term nature of projects, varying degrees of record-keeping, organisational changes and staff turnover have all provided significant challenges in documenting activities. The inclusion of information and resource materials was also dependent on the willingness and generosity of contributors. This section represents a beginning rather than an end.

Additions, Corrections and Updates

You are invited to send additions, corrections and updates to:

Dung Beetle Resource Package

C/- Belinda Pearce

Kergunyah Post Office

Kergunyah Vic. 3691

or by e-mail: abanas@bigpond.com

Using the Resource CD:

To locate an item from this section:

Double click on the folder labeled **“Projects 1965-2008”**



This will open a further seven folders with the following headings:



Double click on the State or National folder of interest

This will provide a list of Project folders

Double click on the folder of the Project of interest

EXAMPLE: To locate the report: *“Procedures for dung beetle harvests and releases”*
by Northern Tablelands Dung Beetle Express, NSW



Double click on:



A diverse array of bodies have funded and supported Projects, including:

- Advancing Agriculture Fund
- Agforce Queensland
- Australian Geographic Society
- Australia Post
- Bundaberg Rum Bush Fund
- Dairy Australia (formerly Dairy Research Development Corporation)
- Community Access to Natural Resources Information
- Envirofund
- Lake Macquarie Council
- Meat & Livestock Australia (formerly Australian Meat Research Committee)
- Mid North Coast Catchment Management
- National Landcare Program
- National Heritage Trust
- Orica Community Foundation
- Science and Technology Awareness Program
- Second Generation Landcare

CONTENTS: Dung Beetle Projects 1965-2008

National.....5.4

- CSIRO Dung Beetle Project; 1965-86
- Dung Beetles for Landcare Farming; 2006-08
- Australian Museum Dung Beetle Key; 2002

Queensland.....5.11

- Agforce Queensland; Improving Sustainable Land Management Systems in Queensland Using Dung Beetles; 2001-02

New South Wales.....5.15

Border -Gwydir & Northern Rivers Catchment Management area

- Northern Tablelands Dung Beetle Express; 2001-08

Northern Rivers Catchment Management area

- Ebor Landcare; Dung Beetles for Soil & Water Health; 2000-01
- Glen Morrison Landcare; Dung Beetle Project; 1998-99
- Medlow Landcare; Water Quality – Dung Beetles; 2001-02
- Nambucca Valley Landcare; Educational program to promote the role of dung beetles; 2000
- Oaky Landcare; “Dung Beetles: The quiet achievers for our river
- Wongwibinda Landcare; Dung Beetle Establishment Project; 1997-98

Namoi Catchment Management area

- Coocooboonah Valley Landcare; Dung Beetle Project; 2000-01

Hunter–Central Rivers Catchment Management area

- Lake Macquarie Dung Beetle Release Program; 1999-2002
- Rotary Club of Taree North – Manning Valley Landcare; Soil and Water protection; 1998-2008

Sydney Metro. Catchment Management area

- Warringah Council Dung Beetle Project; 1995

Hawkesbury–Nepean Catchment Management area

- Southern Highlands Landcare; Dung Beetle introductions; 1999
- Wingecarribee Landcare; Dung Beetle Release Program

Southern Rivers Catchment Management area

- Far South Coast Landcare; Co-ordinated Dung Beetle Release Project; 2001-02

Victoria.....5.21

Goulburn Broken Catchment Management area

- Goulburn Murray Landcare Network; Upper Goulburn Catchment Group; Goulburn Broken Soil Health–Dung Beetle Project; 2006-08
- Upper Goulburn Broken Dung Beetle Project, Home Creek-Spring Ck. Landcare; Dung Beetles for Sustainability; 2002-03

North East Catchment Management area

- Burgoigee Ck, Greta Valley, Oxley Milawa Landcare Groups; 2001-02
- Kiewa Catchment Landcare; 1999 & 2007
- Tallangatta Valley Landcare; 2007-08
- Mudgegonga & District Landcare; Scarabs for the Environment; 2008
- Lucyvale Better Beef Group Dung Beetle Project; 2006-08

East Gippsland Catchment Management area

- Cann Valley Landcare and Far East Victoria Landcare; 2006-07
- East Gippsland Landcare Network; Retaining Nutrients Naturally – Dung Beetle Project; 2006-07

West Gippsland Catchment Management area

- Lake Wellington Landcare Network; Soil Health and Nutrient Management Education Project; 2006-08
- South Gippsland Landcare Network; Managing Manure with Dung Beetles; 2002-03

Corangamite Catchment Management area

- Barwon Water Authority and Otway Barham Landcare Group; Dung Beetle Research; 2004-05
- Central Highlands Water; Dung Beetle Project; 2003-07
- Heytesbury and District Landcare Dung Beetle Project; 2008

North Central Catchment Management area

- Trentham and District Landcare; Dung Beetle Project; 2004-05

Tasmania.....5.29

- Tasmanian Beetle Introductions 1972-2002 incorporating:
- Dairy Research and Development Corporation; Cropping and Distribution of Beetles in Tasmania; 1990-92
- North East Coast Landcare; Dung Beetle Project; 1998-2002
- Tullendeena Landcare; Integrated Management of Introduced Dung Beetles within the State of Tasmania; 1997-98

South Australia.....5.32

- Meat and Livestock Association; The pasture growth and environmental benefits of dung beetles
- Dairy Research & Development Corporation; Cropping and Distribution of Exotic Dung Beetles in South Australia; 1991-93
- Dairy South Australia; Evaluation of Pasture Growth Research; 2004-06
- Watershed Protection Office of the EPA; Dung beetle and *cryptosporidium* research; 2002-04

Adelaide and Mt. Loft Ranges Natural Resource area

- Onkaparinga Catchment Management Board; Research methods for Identifying Release sites;
- Fleurieu Beef Group Inc.; Dung beetle research and releases; 2002-08

Kangaroo Island Natural Resource area

- Kangaroo Island Natural Resource Board; Identifying Optimal Release sites for *Geotrupes spiniger* on Kangaroo Island; 2005-07

Western Australia.....5.40

- Department of Agriculture WA and CSIRO; Western Australian Dung Beetle Project
- Department of Agriculture and Department of Education; BIOSCAN Educational package
- Dairy Research and Development Corporation; Cropping and Redistribution of Introduced Dung Beetles in south-western Australia; 1991-94
- Viacorp; Jim Heath; The Fly in your Eye; 1989
- Healthway; Bush flies, trachoma and enteric disease: 1994-97
- W. A. Water Corporation; Pasture growth field trials in the Margaret River region; 2006-07



National: CSIRO Dung Beetle Project 1965-86

Dr George Bornemissza and the CSIRO Dung beetle project

On the 1st of January 1951, a Hungarian émigré set foot on Australian soil. Little was it known then, that this young entomologist was to initiate one of Australia's most innovative and ambitious scientific undertakings. The Historical records of Australian science describes the CSIRO Dung Beetle Project as *"one of the most valuable and cost-effective programmes ever conducted in Australian agriculture"* (Day, et al., 2001)*.

Having observed how rapidly dung beetles disposed of cattle dung in Europe he suggested the introduction of bovine-dung beetles to Australia in order to clean up dung polluted pastures and to promote the return of nutrients to the soil (Bornemissza, 1960). Dung beetles would also control dung breeding flies and livestock parasites. The project was adopted by the CSIRO Division of Entomology and George Bornemissza spent nine years in Africa selecting and breeding suitable beetles and dispatching eggs to Canberra (adapted from George Bornemissza's World of beetles by Dr Ev Britton).



Dr George Bornemissza examining dung beetles in elephant dung – Botswana South Africa, Feb. 1972



Dr Borenmissza at the CSIRO Dung Beetle Unit, Pretoria South Africa, 1973

The project was funded by CSIRO and the Australian Meat Research Committee. A research unit was established in Pretoria, South Africa with the assistance of the South African Plant Protection and Research Institute. Facilities were later established in Montpellier, France and in Cordoba, Spain. They served as a collection base for European beetles destined for southern Australia.

An Australian facility was established in Canberra to receive egg shipments and mass breed beetles. Facilities were also established in Rockhampton and Perth to assist with mass releases of beetles.

A total of 150 species were selected to give effective coverage of Australia's widely variable climatic regions. Over 50 species were introduced during the course over the program. Due to changes in funding structures and research priorities, the funding to the project was ended before all of the desired species were introduced. In addition to dung beetles, the project also investigated the role of phoretic mites, as a biological control of fly eggs and larvae.



Armed guards were employed as a safeguard against local wildlife. Mozambique, January 1972



DVD “Dung Down Under”



1972: CSIRO film “Dung Down Under” 17 minutes 30 seconds

Domestic cattle drop 33 million tones of dung on Australian pastures each year. Pasture areas are reduced and fly pests, like the bush fly and the buffalo fly, thrive.

Between 1969 and 1984, CSIRO entomologists led by George Bornemissza sought a solution to these problems through dung beetles, which break up and bury dung pads. Selected species of bovine-dung beetles imported from Africa, Europe, the Middle East and the Mediterranean were mass bred in Australia for release in cattle breeding areas. They have proven an outstanding example of biological control.



Resource CD: The Australian Dung Beetle Project, 1965-1975



Bornemissza, G.F. 1976, *The Australian Dung Beetle Project 1965-1975*, Australian Meat Research Committee Review; No. 30. pp 1-30.

CSIRO Division of Entomology Canberra and Pretoria, South Africa

Contents include:

Concept and Rationale

Biology of Dung Beetles

- Feeding habits;
- Breeding habits;
- Reproduction and lifespan;
- Physical and biotic requirements;
- Seasonal distribution;
- Natural enemies

Benefits of Dung Beetles

- Improving the soil;
- Fly control;
- Worm control

Organisation of the Project

- Objectives;
- The pilot beetle;
- First successes

The Overseas Program

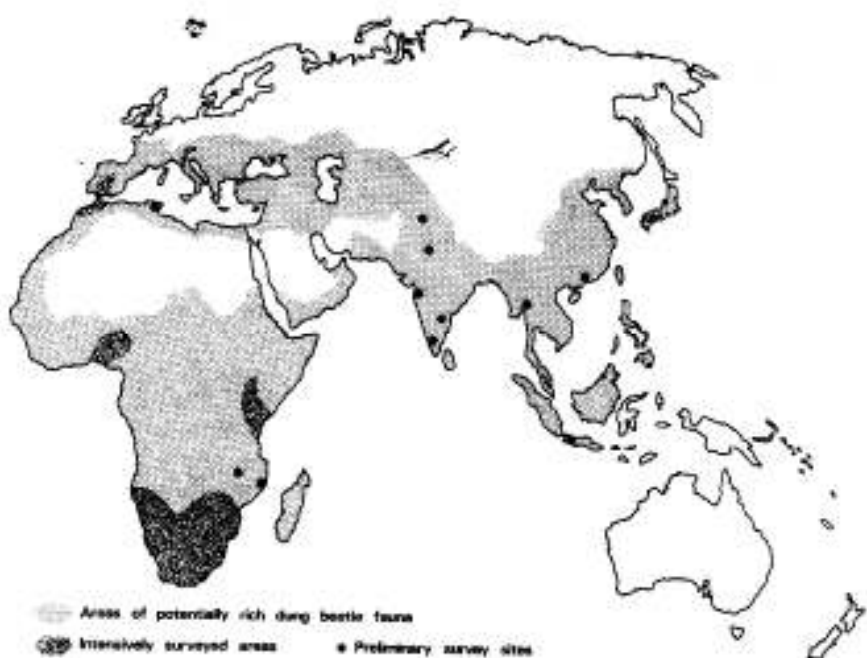
- Selection criteria;
- Nature of surveys;
- Transplantation

The Australian Program

- Quarantine and mass breeding;
- Strategy of releases;
- Follow-up studies

Conclusion and Prospects

The Search for Suitable Dung Beetle species



Areas of potentially rich dung beetle fauna – light shading
Intensively surveyed areas – dark shading
Preliminary survey sites - dots

* Day, M.F.C., Whitten, M.J., and Sands, D., 2001. Douglas Frew Waterhouse 1916-2000, *Historical Records of Australian Science*, 13:4. 495-519.



National: CSIRO Dung Beetle Project 1965-86



Resource **CD: Australia's Introduced Dung Beetles: Original Releases and Redistributions**



Tyndale-Biscoe, M. 1996, ***Australia's Introduced Dung Beetles: Original Releases and Redistributions***, CSIRO Technical Report Number 62. 149 pages

This document lists the original releases of exotic dung beetles made in Australia, some of the redistributions of established species into new, as yet uncolonised, areas and the recoveries of exotic beetles made by the participants in the CSIRO Double Helix Science Club's "Dung Beetle Crusade" during the summer of 1994-95.

Release information includes:

Property:	Name of property or site name
Location:	Kilometres and direction from nearest major town or significant landmark.
Town:	Nearest major town or significant landmark
Lat.	Latitude of site in degrees and minutes
Long.	Longitude of site in degrees and minutes
Map:	Map number in which site is located
Rel.	Date of release
Q'ty:	Number of beetles released
St.	Strain of species (if applicable)
Status:	Information on the establishment of beetles.
If:	
Found:	Date shown of first recovery of species at that site.
Not found:	Date shown is date of most recent check of species at that site (if known).
Blank:	Indicates that the site has not been checked for recovery of the species.



Available for Purchase



Tyndale-Biscoe, M. 1990, **Common Dung Beetles in Pastures of south-eastern Australia**, CSIRO Publishing Australia. 72 pages. Available from CSIRO Publishing

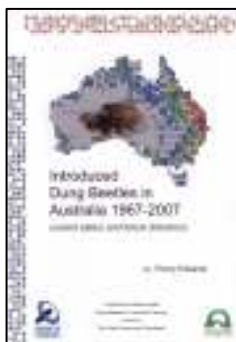
This is a colourful, useful and easy-to-read account of dung beetles in south-eastern Australia. The book tells why the CSIRO brought dung beetles to Australia, what they do, where they live, how to recognise them and how to help them spread. Seventeen species of imported dung beetles are described and illustrated in colour. Native beetles and beetles other than dung beetles are also described. Maps of the predicted and current distributions of each species follow the descriptions.

Available from CSIRO Publishing: www.publish.csiro.au Telephone orders: 1300 788 000

National: Dung Beetles for Landcare Farming 2006-2008



Resource CD: Introduced Dung Beetles in Australia 1967-2007



Edwards, P. B. 2007, *Introduced Dung Beetles in Australia 1967-2007: Current Status and Future Directions*, Dung Beetles for Landcare Farming. 66 pages

A Landcare Australia project funded by
“The Orica Community Foundation”



Table of Contents:

Acknowledgements

Scope of Report and Key Recommendations

Overview of Introduced Dung Beetles in Australia

- Release of dung beetles in Australia
- Establishment of dung beetles in Australia
- Redistribution of dung beetles within Australia
- Predicting dung beetle distributions in Australia

Introduced dung beetles established in Australia

- 23 species described

Dung beetles that failed to establish in Australia

- Species that came into quarantine but were not released
- Species that were released but failed to establish

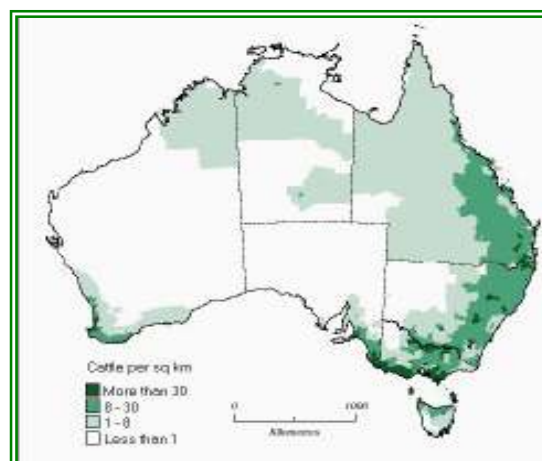
The Future

- Review and recommendations for the future

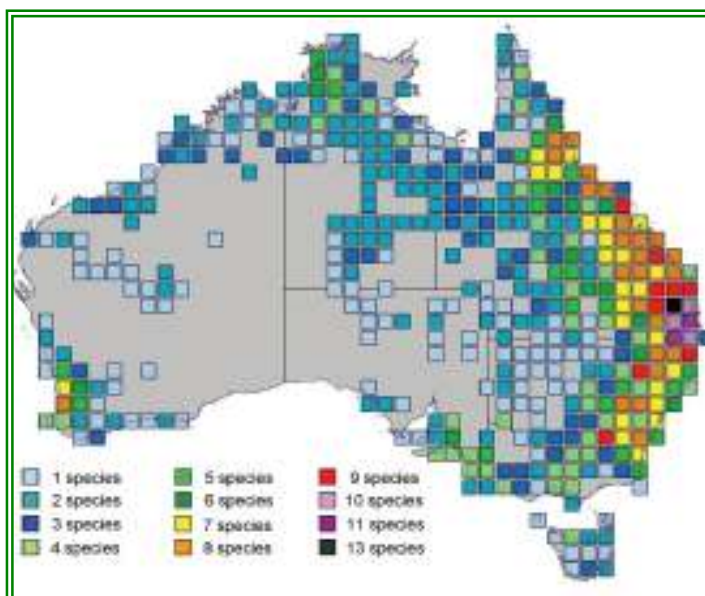
Discussion forum

- Dr George Bornemissza
- Dr Adrian Davis
- Dr Bernard Doube
- Dr Penny Edwards
- Mr John Feehan
- Mr Grant Flanagan
- Dr Alan Kirk
- Dr Angus Macqueen
- Ms Karen Olsen
- Dr James Ridsdill-Smith
- Dr Marina Tyndale-Biscoe
- Dr Keith Wardhaugh
- Dr Jane Wright

References and selected bibliography



Beef and Dairy Cattle in Australia
Source: Australian Year Book 2003



Number of species per degree of latitude



KEY RECOMMENDATIONS

To build on the information collated in this report, and to position ourselves to consider introduction of new dung beetle species, the following recommendations are made:

- Identify geographical gaps in distribution – conduct an Australia-wide sampling project, similar to the Double Helix project of 1994/95 to provide latest distribution data for introduced dung beetle species.
- Identify seasonal gaps in activity – undertake an Australia-wide annual survey of dung beetles (using the Qld 2001-2002 project as a model) in all climate zones of Australia.
- Clarify the role of native dung beetles in the burial of cattle dung – (i) include native dung beetles in the above surveys, (ii) undertake research on the nesting patterns of native dung beetles and (iii) investigate competition between native and introduced species.
- Undertake appropriate redistribution of introduced species – produce a brochure to provide a summary of the species recommended for redistribution, indicating areas suitable for such redistributions. Review success rate of recent redistribution programs.
- Identify a suitable repository (possibly CSIRO Entomology archives) for lodging unpublished data, reports, catalogues of introduced beetles. A history of the CSIRO dung beetle project could be commissioned.
- Commence planning for future introductions by addressing the following topics: demonstrating the need for further introductions, selecting candidate species, securing funding, organizing quarantine, planning release strategies, planning for monitoring establishment and impact.



Resource CD: **Great Australian Dung Beetle Challenge**

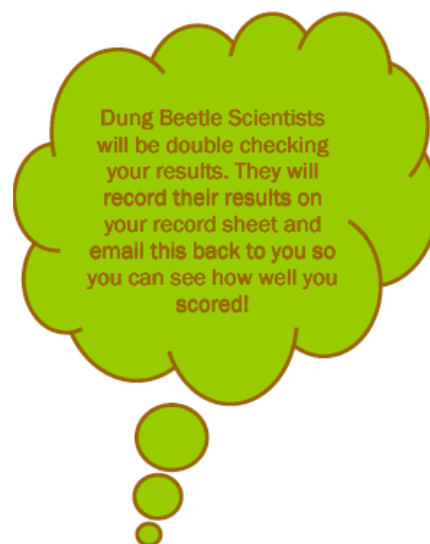
Junior Landcare

Great Australian Dung Beetle Challenge 2007- 08

Australia-wide sampling project

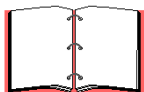


- Dung Detective Kit: 4 pages
- Recording Sheet: 2 pages
- Teacher resources: 9 pages



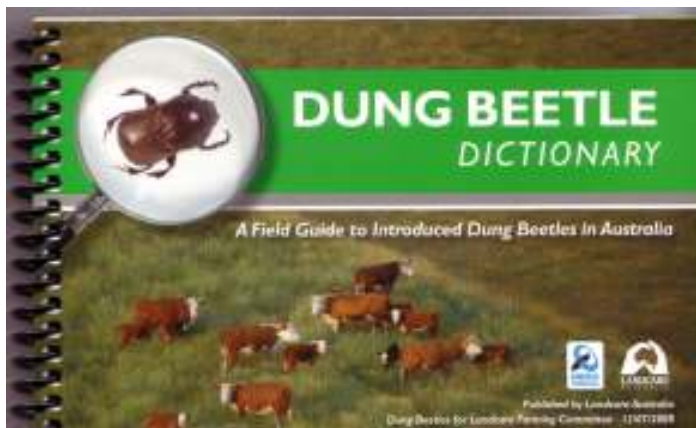
The Great Australian
Dung Beetle
Challenge





Resource Binder: Dung Beetle Dictionary

Sample pages from the “**Dung Beetle Dictionary**” compiled by “Dung Beetles for Landcare Farming”. The Landcare Project funded by the Orica Community Foundation has generously supplied 1000 copies of the dictionary for inclusion in this resource package. Copies will also be available for purchase.



The Dung Beetle Dictionary Cover

A Field Guide to Introduced Dung Beetles in Australia

Published by Landcare Australia and

Dung Beetles for Landcare Farming Committee

12/07/2008

The dictionary includes descriptions of 23 introduced species

Information includes:

- Beetle species
- Length
- Identifying features
- Distribution
- Additional information



There is also information on:

- Native dung beetles
- Predators and other beetles that may be found in cattle dung



Web page Landcare Farming: Why do we need dung beetles?

www.landcareonline.com/page.asp?plD=132



Australian Museum: Dung Beetle Mania Project and Dung Beetle Key

In March 2001, The “Dung Beetle Mania Project” worked with 106 schools and community participants to investigate the distribution of native dung beetles in disturbed environments throughout New South Wales.

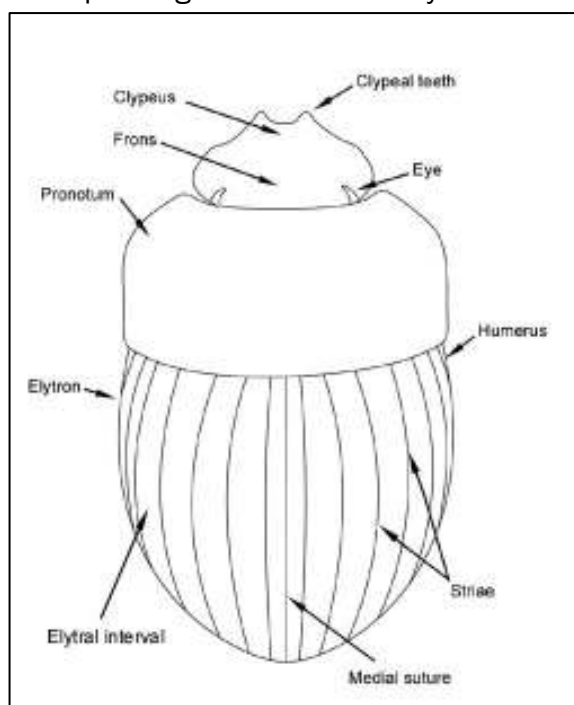
The Australian Museum was interested in obtaining more accurate knowledge about the distribution of dung beetle species in New South Wales for the following reasons:

- many species of dung beetles have small distribution ranges
- some species may be endangered
- some areas are rich in species while others are not;
- many areas have not been sampled

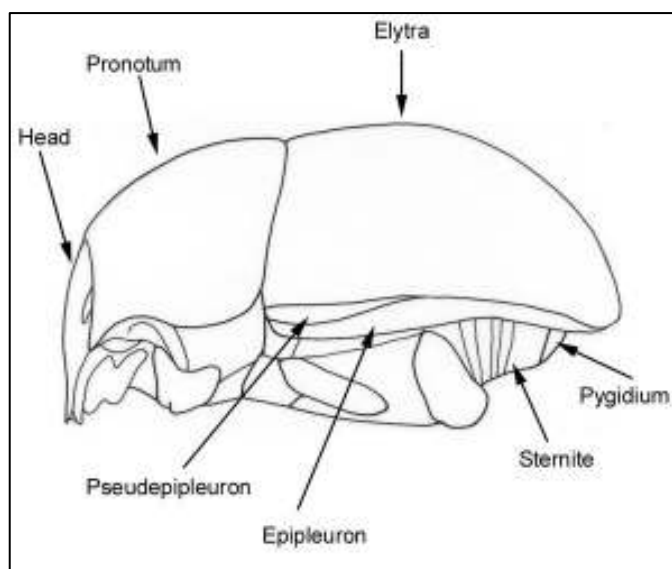
KEY: “Dung Beetles of New South Wales”

Authors Rebecca Harris and Dr. Chris Reid, Centre for Biodiversity and Conservation Research, Australian Museum, Sydney. The key was funded by the NSW Government’s Community Access to Natural Resource Information program. The focus is on eastern New South Wales and includes both native and introduced species.

Example diagrams from the Key

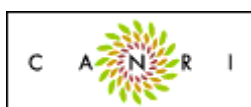


Dorsal view of a Scarabaeidae beetle



Lateral view of a Scarabaeidae beetle

The key describes 14 genera and over 90 species and has extensive accompanying images and notes



Copyright © Australian Museum 2002 Authors: Rebecca Harris & Dr. Chris Reid



Web pages

Dung Beetle Fact Sheet: www.australian.museum/factsheets/dung-beetles.htm

Key to Dung Beetles of New South Wales: http://faunanet.gov.au/faunakeys/dung_intro.htm

State: Queensland



Resource CD: Queensland Dung Beetle Project



Edwards, P. B. 2003,
Improving sustainable land management systems in Queensland using dung beetles;

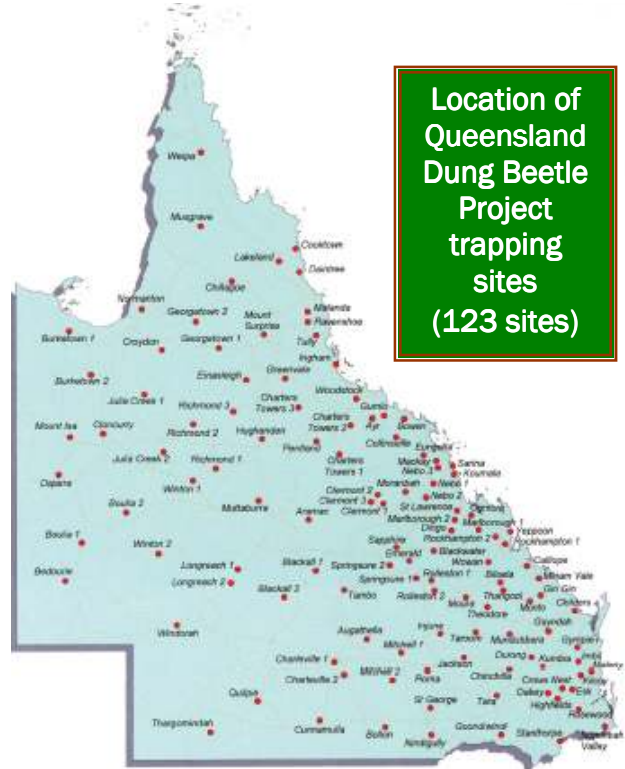
Final Report of the 2001-2002 Queensland Dung Beetle Project. Agforce Queensland. 55 pages

Contents include:

1. Introduction
2. Results of Dung Beetle Survey
3. Introduced Dung Beetles
4. Native Dung Beetles
5. Other Project activities
6. Concluding Remarks
7. References

This project had 3 main objectives:

- To survey and monitor the current distribution and abundance of dung species in cattle dung throughout Queensland
- To train 1000 landholders in dung beetle identification, biology and population management, and to educate them in the benefits of dung beetles for farm productivity and environmental sustainability
- To redistribute dung beetle species to climatically suitable areas requiring population enrichment.



Location of
Queensland
Dung Beetle
Project
trapping
sites
(123 sites)



Resource CD: Dungbusters educational resource



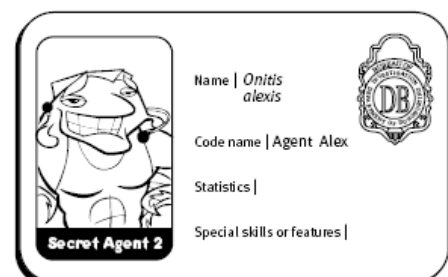
This educational package was written by Kirstin Kenyon on behalf of Queensland Dung Beetle Project Management Committee.

Funding and support was provided by the Natural Heritage Trust, Department of Primary Industries, the Environmental Protection Agency, Agforce Queensland, the Department of Natural Resources, Mines and Energy and Queensland landholders. 46 pages

© The State of Queensland (Dept. of Natural Resources, Mines and Energy) 2004

The Dungbusters education module includes:

- background information for teachers and students
- supporting information and references
- activities, resource sheets and background notes



Common Dung Beetles in Queensland

*Onitis viridulus*

- Large beetle, uniform dark metallic green/black
- Male with unequal double spur on hind leg

*Onitis alexis*

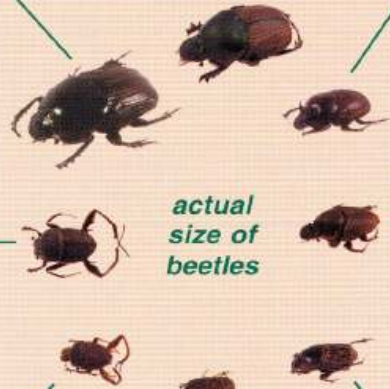
- Large beetle, two-tone colour (thorax green/red, wing-covers brown)
- Male with single 'rose-thorn' spur on hind leg
- Female with small 'bump' at rear of head

*Onthophagus gazella*

- Medium beetle, two-tone colour (thorax dark brown, wing-covers lighter brown)
- Rounded shape when viewed from above
- Male with a pair of horns at back of head

*Sisyphus spinipes*

- Medium dark brown/black beetle with long legs
- Male with dark spur at base of hind leg
- Male with sharp angle on rear of hind leg

*Onthophagus sagittarius*

- Medium/small beetle, uniform bronze/brown colour
- Male with two small horns at front of head
- Female with single horn on head and single horn on thorax

*Sisyphus rubrus*

- Small light brown beetle with long legs
- Male with pale spur at base of hind leg
- Male with rounded rear edge on hind leg

*Euoniticellus intermedius*

- Small beetle, elongated narrow shape, yellow/brown colour
- Faint diamond-shaped pattern on thorax
- Male with blunt horn on head

*Liatongus militaris*

- Small beetle, overall colour dark brown/black
- Pale yellow 'shoulder pads' (on sides of thorax)
- Black broken stripes on wing-covers

PHOTOGRAPHS © CSIRO

State: Queensland



Resource CD: Effects of Parasiticides on Dung Beetles



Alexander, M. & Wardhaugh K. 2001, *Workshop on the Effects of Parasiticides on Dung Beetles: Report of Proceedings* – Technical Report No. 89. CSIRO Entomology. 33 pages

The purpose of the workshop was:

- to review what is known about the rate and route of excretion of parasiticides commonly used by the livestock industry;
- to consider the evidence that residues excreted in faeces can have an adverse impact on the dung fauna, in particular dung beetles;
- to review the limited information available about seasonal and regional parasiticide usage patterns and to examine ways in which more informative data can be obtained;
- to consider the current requirements for product registration and the procedures used for assessing their likely environmental impact;
- to discuss the possible role of standardised bioassays and ecotoxicological models in the processes of drug registration and assessment;
- to provide a basis for the development of a Decision Support System to enable graziers to make best use of available parasiticides, conserve their efficacy and minimise their environmental impact.

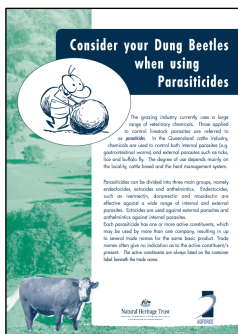
Workshop conclusions and recommendations (in order of importance):

- Identify specific chemicals for which data are currently lacking or inadequate. Liaise with the NRA and the pharmaceutical industry for the release of any relevant excretory data and/or information on residue effects. Compile and circulate to appropriate research institutions a list of chemicals requiring independent evaluation
- Lobby government agencies about the need to conduct regular surveys of veterinary chemical usage
- Liaise with NRA, EA and the pharmaceutical industry to expand and regularly update Contracted Report No. 56. Devise appropriate ways of disseminating this information. Evaluate the output of ecotoxicological models and make the results available to graziers.
- Form a consortium of interested parties comprising government agencies, the pharmaceutical industry, rural research and development organisations and other funding bodies to examine the feasibility of funding the development and validation of user-friendly Decision Support System for the management of livestock parasites.
- Liaise with NRA, EA and regulatory authorities in the OECD to develop internationally accepted protocols for the scientific testing of the effects of parasiticides on dung beetles and other important dung-feeding organisms, including appropriate indicator species. Standardise future product labelling to include information on the effects on beneficial organisms. Consider the use of ecotoxicological models as an integral and objective part of the registration process.
- Liaise with state agencies, Landcare groups, the Queensland Dung Beetle Project and ex CSIRO staff to develop and update a training package which extension officers and livestock industry groups could present within their regions. A package would be similar to "Farmsafe". "Prime Notes" or "Giddy Goanna".





Resource CD: Dung Beetles and Parasiticides

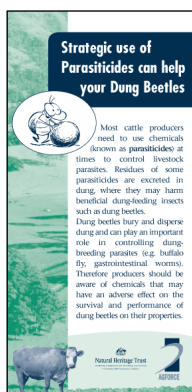


Consider your Dung Beetles when using Parasiticides

6 page A4 brochure - 2003

Each parasiticide has one or more **active constituents**, which may be used by more than one company, resulting in up to several trade names for the same basic product. Trade names often give no indication as to the active constituent/s present.

The active constituents are always listed on the container label beneath the trade name.



Tri-fold brochure: Strategic use of Parasiticides can help your Dung Beetles- 2003

There are seven factors to consider:

1. Choose lower risk chemicals based on available research information
2. Timing is critical
3. Reduce frequency of treatment
4. Selective use of chemicals to target specific groups of animals and specific parasites
5. Application methods can make a difference
6. Use the recommended dose rates
7. Other considerations eg drug resistance.



Web pages

Consider your dung beetles when using parasiticides

www.dreamachievers.net.au/dungbeetle/parasiticides.html

Strategic use of Parasiticides can help your Dung Beetles

www.dreamachievers.net.au/dungbeetle/strategic_parasiticides.html

“Dungbusters” educational resource model

www.nrw.qld.gov.au/education/teachers/dungbusters/index.html

Healthy dairy heifers: Managing external parasites: buffalo fly

www2.dpi.qld.gov.au/dairy/3214.html

Buffalo fly control

www2.dpi.qld.gov.au/health/3558.html

Delaying resistance: A multi-parasite approach to buffalo fly control

www2.dpi.qld.gov.au/dairy/13648.html

State: New South Wales

Northern Tablelands Dung Beetle Express 2001–08



Area: Northern Rivers, Border Rivers-Gwydir and South East Queensland

The Northern Tablelands Dung Beetle Express is a joint initiative of Granite Borders and Southern New England Landcare Committees and the Northern New England and Armidale Rural Lands Protection Boards. It is also supported by GLENRAC (Glen Innes Natural Resource Advisory Committee) and GWYMAC (Gwydir and Macintyre Management Resource Management Committee) Landcare Committees. The steering committee is made up of representatives from these project partners, landholders and dung beetle enthusiasts. The project area extends from Killarney in Queensland to Walcha in NSW, and from the coastal plains to the Western Slopes.



Resource CD: Fact sheets, monitoring guide, harvest and release protocols



FACT SHEETS

"Dung Beetles in Urban situations"

"Dung Beetles and Buffalo Fly"



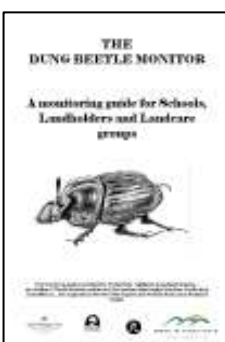
PROJECT BROCHURE



BEEBLE IDENTIFICATION GUIDE

10 Common Dung Beetle Species of the Northern Tablelands of NSW

Includes information and photographs on eight introduced species and two native species

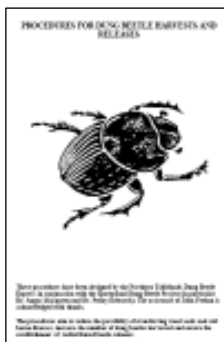


"The Dung Beetle Monitor"

This publication is for schools, landholders and community groups to monitor the status of dung beetle populations.

Instructions are included for the monitoring, collection and identification of dung beetles. Also included are detailed instructions about the information you should record. Additional information about dung beetle biology and suggested activities for use in schools is included. 31 pages





“Procedures for Dung Beetle Harvests and Releases”

Designed by the Northern Tablelands Dung Beetle Express in conjunction with the Queensland Dung Beetle Project (in particular Dr. Angus Macqueen and Dr. Penny Edwards). The assistance of John Feehan is acknowledged with thanks.

14 pages © Granite Borders Landcare Committee Inc. 2005

These procedures aim to reduce the possibility of transferring weed seeds and soil borne diseases, increase the numbers of dung beetles harvested and ensure the establishment of redistributed beetle colonies.

Harvesting: Guidelines are provided on various harvesting techniques (flotation, plastic sheets, pitfall traps, light traps, digging, trowelling and hand collection) and methods for cleansing beetles. The preferred harvest method for seven species is described.

Releases: Includes general guidelines for releasing beetles under average seasonal conditions and drought conditions. Release tips (timing, dung age, placement and number of beetles per pad) are given for six species.

SPECIES	RELEASES
<i>Bubas bison</i>	1000
<i>Euoniticellus africanus</i>	3000
<i>Euoniticellus fulvus</i>	16500
<i>Geotrupes spiniger</i>	8000
<i>Onitis alexis</i>	17000
<i>Onitis aygulus</i>	3000
<i>Onitis caffer</i>	13000
<i>Onitis pecuarius</i>	34000
<i>Onitis virdulus</i>	3000
<i>Onthophagus binodis</i>	93000
<i>Onthophagus gazella</i>	43500
<i>Onthophagus taurus</i>	27000
TOTAL	262000

 Species has established

Project highlights:

- Recovery of *Onitis caffer*
- The Barber's Pole – dung burial trial
- Working with others to learn the skills to undertake our own harvesting

Project challenges:

- Drought, drought and drought
- Floods and the weather in general
- Obtaining funding to enable project continuity

Awards: Winner of the Silver Award at the NSW Landcare Awards in the Telstra Country Wide Landcare Research Category



Web page: Northern Tablelands Dung Beetle Express: www.dungbeetles.com.au



Resource CD: “*Grazing activities comparison*”

Report by Pamela Kay Wilson – 2005 Churchill Fellow

“Improving the selection of foreign dung beetle species and enhancing their populations in Australia by comparing the effects of grazing activities in natural and transformed south African environments” 25 pages

The Project aimed to derive principles to improve the selection of foreign dung beetle species and enhance their populations in Australia by comparing the effects of grazing activities in natural and transformed South African environments. The results indicate that the further grazing management becomes removed from that existing in natural environments the greater the negative impact on dung beetle communities.

Southern New England Landcare - Area: Northern Rivers



- Glen Morrison Landcare (now GlenGRO Landcare), Dung Beetle Project, 1998-99
- Wongwibinda Landcare; Dung Beetle Establishment Project; 1997-98

Oaky Landcare; “Dung Beetles – The quiet achievers for our river”, 1997

The Oaky Landcare Group and Presbyterian Ladies College, Armidale have developed a unique and highly successful relationship. The students of PLC Armidale have been taking scientific measurements of dung beetle populations and monitoring water quality and pastures to measure the benefits to graziers and document the beneficial effects on the environment. PLC Armidale has taken the project beyond the science department with design and technology students working with Landcare members to develop a logo, a brochure and a stencil to produce signs, t-shirts and display materials. Computing students are working on an interactive computer program that will contain information on dung beetles and their benefits.

In 2000 the Rivercare funded project released 20 colonies of dung beetles across Oaky Catchment. A series of lectures was held to introduce farmers to the benefits of dung beetles in recycling nutrients.



Web page: <http://web.snelcc.org.au> Click on “GROUPS” on Main Menu

Other Landcare Projects from the Northern Rivers



- Ebor Landcare, Dung Beetles for Soil and Water Health 2000-2001
- Medlow Landcare, Water Quality – Dung Beetles, 2001-2002

Nambucca Valley Dung Beetle Education Program

The Nambucca Valley Landcare group and a local teacher have developed a “dung beetle kit” that includes dung beetles as part of all key learning areas. The aim of this project is not to “teach” about dung beetles but work them into the curriculum. Learning areas such as history, research, science and English are included. Although aimed at Primary School levels, the Program has been used successfully up to Year 8 and TAFE have also incorporated some units into their classes. All schools in the valley have a complete kit which includes a sample box.

Bellinger Landcare Incorporated: 2007Dung Beetle Survey



Resource CD: **Bellinger Dung Beetle Survey Results and Summary**

In February and March 2007, Bellinger Landcare conducted a dung beetle survey across 13 sites to assess the establishment of previously released colonies and to take a snap shot of beetle activity.

The survey area covered a number of climate zones including coastal, valley, plateau and tablelands. Ten exotic and three native species were recovered. The most abundant species were *Liatongus militaris*, *Onthophagus binodis*, *Onthophagus gazella*, *Onthophagus nigiventris* and *Onthophagus taurus*. The survey also includes a summary of 1999-2002 releases. Of the six species previously released, two were recovered (*O. binodis* and *O. taurus*).



Web page: www.bellingerlandcare.org.au/



Coocoofoonah Valley Landcare Dung Beetle Releases 2000-01 - Area: Namoi



Onthophagus taurus and *Euonicitellus fulvus* were released in the Gunnedah region in the Summer of 2001.

Species known to be established include: *Euonicitellus intermedius*, *Euonicitellus africanus*, *Onitis alexis*, *Onitis viridulus*, *Onthophagus gazella*, *Sisyphus spinipes* and *Onthophagus dandalu* (native).

Gowrie Landcare Dung Beetle Release Program 1998-99 - Area: Namoi



Species released: *Bubas bison*, *Euonicitellus fulvus*, *Onthophagus taurus*,

Species established: (results taken from survey undertaken in 1998): *Euonicitellus africanus*, *Euonicitellus intermedius*, *Onitis alexis*, *Onitis pecuarius*, *Onthophagus gazella*,



Resource CD: North West NSW (Liverpool plains) Dung Beetle Management Plan



Wildlife Management Planning - by Lorna McGilchrist. 2000 27 pages

A management plan for extending the distribution of dung beetles throughout the Liverpool Plains of north western New South Wales.

Section 1.1: The biology and ecology of dung beetles

Section 1.2: Species management and monitoring techniques

Section 1.3: Recommendations for future dispersal of dung beetles

Section 2.1: Management Plan

The Project included a survey of beetles at “Bonny Rigg”, southwest of Quirindi on the 23rd and 24th November 1999. The most abundant species was *Onthophagus gazella*, followed by *Euonicitellus intermedius*, *Onitis alexis* and *Euonicitellus fulvus*.

Rotary Club of Taree North & Landcare 2000-07 – Area: Hunter–Central Rivers



The Rotary club of Taree North in conjunction with Manning Landcare, Department of Primary Industries, the Gloucester Council and over 30 Landcare subgroups released 13 species of dung beetles in the Manning Valley. As of March 2006, 384,267 beetles were released on 120 properties, and the figure now stands at over 400,000 beetles. The Project has been very successful in reducing the number of flies, reducing soil erosion and improving water quality.

Main species released:

Bubas bison, *Euonicitellus fulvus*, *Euonicitellus pallipes*, *Geotrupes spiniger*, *Onthophagus binodis*, *Onthophagus sagittarius*, *Onthophagus taurus*

Species known to be established:

Euonicitellus fulvus, *Geotrupes spiniger*, *Onthophagus taurus*

Future plans include monitoring to establish which species have become established with the view to harvesting and distributing beetles to neighbouring Catchments.



Awards:

Rotary International:
“Preserve the Planet Earth Award”
two years in succession





Lake Macquarie Council Dung Beetle Release Program - Area: Hunter-Central Rivers



Resource CD: "An evaluation of the Lake Macquarie Dung Beetle Release Program"



Prepared for Lake Macquarie City Council by J. Parsons and R. Schimpf, February 2002.

This study was conducted for Lake Macquarie City Council (LMCC) to assess a dung beetle release program of *Onthophagus taurus* in parklands within the Lake Macquarie catchment to target dog faeces. Although other local government agencies have also used dung beetles to remove dog faeces from public areas, LMCC has been the first to identify that follow-up work is required to assess the beetle population survival and effectiveness of faeces removal.

The main findings of this survey were that no *O. taurus* dung beetle species were to be found in any of the previous release sites or the additional residential sites chosen. Results show that the most abundant species of dung beetles that exist around Lake Macquarie, within areas where an introduced species has been released, are the native beetles *O. dandalu* and *O. australis*.

Releases	<i>O. taurus</i>
Jan 1999	6000
Nov 1999	8000
Feb 2001	6000
TOTAL	20000

RECOMMENDATIONS:

1. Future release sites to be of a suitable habitat defined as wide-open areas with minimal tree cover
2. Further research to be carried out into the suitability of dog faeces as an appropriate food source for *O. taurus*
3. Surveys of local areas that contain the known preferred food source, cattle dung, to determine if previously released colonies have migrated to such areas
4. Regular surveys of any future releases on a temporal scale of no more that six months between surveys.

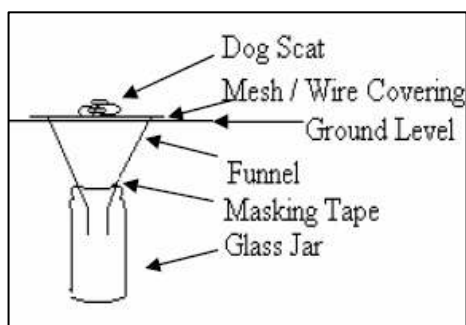


Diagram of pitfall trap



Trap above ground



Trap in situ with bait





Warringah Council Dung Beetle Project, 1995 – area: Sydney metro

Dung Beetle Release Program

Researchers have found that dog faeces contribute significantly to bacterial coliforms in storm water during heavy rains. If these levels can be reduced it can only improve the quality and health of waterways. Three species of beetle were selected and on 31st October 1995 the first of 40,000 beetles were released in the Curl Curl Lagoon area

Awards: Keep Australia Beautiful: Metro Pride Award

Landcare Dung Beetle Projects - area: Hawkesbury–Nepean



- Southern Highlands Landcare, Introduction of Dung Beetles throughout the Southern Highlands, 1999

- Wingecarribe Landcare Dung Beetle Release Project, 1999-2000

Approximately 45,000 beetles were released over four cattle properties:

Species released: *Euoniticellus fulvus*, *Geotrupes spiniger*, *Onthophagus binodis* and *Onthophagus taurus*



Far South East Dung Beetle Release Project – area: Southern Rivers

The Project was initiated due to higher than recommended levels of faecal coliform and nutrient levels in the Bega Catchment waterways. An initial survey conducted in September 2001 found that only one species of introduced dung beetle was abundant in the area. The Project involved six local Landcare groups and ten schools.

Between December 2001 and March 2002, the following species were released:

SPECIES	<i>Euoniticellus fulvus</i>	<i>Geotrupes Spiniger</i>	<i>Onthophagus binodis</i>	<i>Onthophagus taurus</i>	TOTAL
AMOUNT	18050	126	50	21000	39226



Resource CD: **Project Report** compiled by Caroline Beare, 2002, 18 pages



- Benefits of dung beetles
- Reasons for initiating the project
- Project design
- Dung beetle releases
- Publicity
- Budget and expenditure
- Recommendations
- Actions for 2002 – 2004



Beetle release at Tantawangolo

State: Victoria

Victorian Dung Beetle e-forum

The e-forum is an on-line community dedicated to improving contact and information flow among people interested in dung beetles. You do not have to live in Victoria to become a member or access the site.



Screenshot from the Victorian Dung Beetle e-forum web page

The e-forum provides an opportunity to:

- ask questions, describe dung beetle activity in your area, and participate in: **Forum** discussions
- introduce yourself by signing the **Guestbook**
- view upcoming dung beetle **Events**, or add your own
- View or place notices on the **Notice board**
- View or place photos in the **Photo gallery**
- Access a range of documents and files in the **Shared and Group files** section
- View the large number of **Links** to other dung beetle resources on the internet,



Resource CD: **Victorian Dung Beetle e-forum brochure**



To register: go to: mc2.vicnet.net.au and follow the prompts



Web page: Victorian Dung Beetle e-forum:

mc2.vicnet.net.au/home/beetles/index.html





Goulburn Broken Soil Health–Dung Beetle Project 2006-08 - Area: Goulburn Broken



Resource CD: Identification Guide & Project brochure



Dung Beetle Identification Guide & General information

Compiled by Bertram Lobert, 8 pages,

Content includes:

- What is a dung beetle?
- How can I tell if have dung beetles?
- Dung beetles of the Goulburn Broken Catchment'
- Other beetles found in dung
- Further information on dung beetles



Project brochure

Currently (2006) there are two species of introduced dung beetles that are widespread in the Goulburn Broken Catchment and both are summer-active. We aim to introduce many more types of dung beetles to our catchment (to spread dung beetle activity across all seasons), for the benefit of soil health, animal health, and water quality (not to mention reduced bush fly numbers and reduced harrowing!).

By releasing large numbers of colonies in a short time, we will help the beetles to spread into all catchments much more quickly.

Dung Beetle Research:

1. The impact of flood irrigation on dung beetles

The ability of the underground larvae to survive in flood-irrigated pastures is being investigated, with the survival of both summer and winter-active species being tested. Initial experiments conducted on a flood irrigated beef farm at Seymour and a dairy farm at Tatura suggest that the regular saturation of the soil (a 10 to 14 day watering cycle, over seven months) dramatically reduced the survival of the summer-active dung beetle *Onthophagus binodis* larvae, whereas no larvae of the winter-active *Bubas bison* appeared to survive the regular irrigation of pastures over summer.



Beetle cages at the Irrigation trial

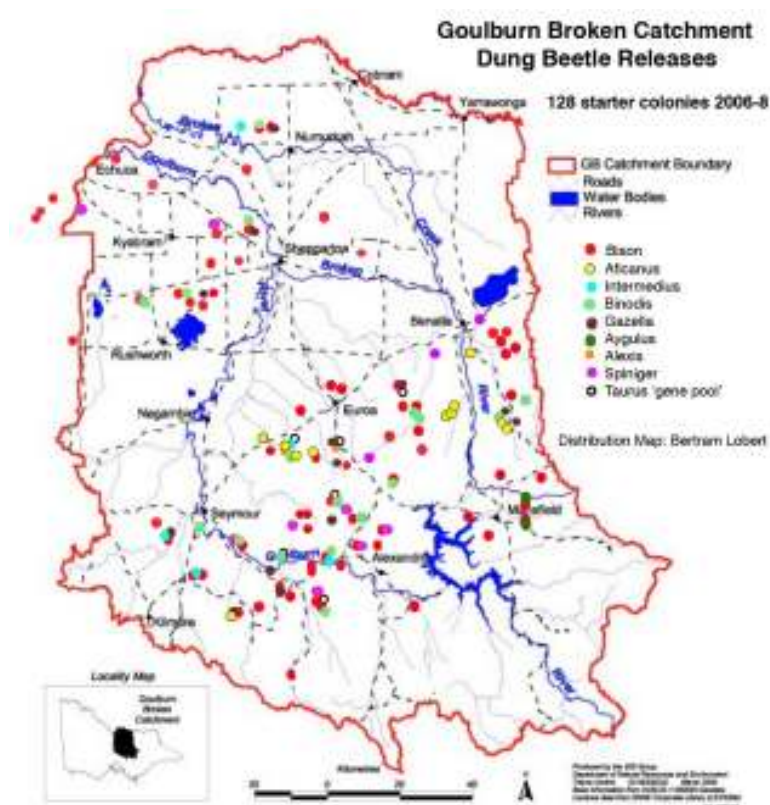
2. Effect of dung burial on soil health and pasture productivity

Whilst the beneficial impact of dung beetles on soil health and pasture seem obvious, there is little published and statistically valid information available. This experiment was conducted on "unimproved" pasture in Merton. Each plot was allocated to one of three treatments ("dung+beetles", "dung only" and control). The pasture at each plot was cut at ground level, bagged, dried and weighed.

The data shows that pasture growing on "dung + beetle" treatment plots has a significantly higher dry weight than pasture growing on the "dung only" or control treatment. All differences were statistically significant. Comprehensive soil testing will occur at the end of the experiment (Nov. 2008).

PASTURE CUT RESULTS - YEAR 1			
	Dung + beetles	Dung only	Control
Number of plots	18	18	18
Mean dry wt (g)	148.24	122.95	90.96
SD (variation)	25.44	22.29	27.22
= kg/ha dry wt	5929.6	4918	3638.4

DUNG BEETLE RELEASES IN THE GOULBURN BROKEN CATCHMENT 1969-2008



SPECIES RELEASED	1969-1994 (CSIRO)	2002-2003	2006-2008
<i>Bubas bison</i>		13200	6800
<i>Euoniticellus africanus</i>		1200	12000
<i>Euoniticellus fulvus</i>	193605		
<i>Euoniticellus intermedius</i>	500	2400	4800
<i>Geotrupes spiniger</i>	33726	3600	10800
<i>Onitis alexis</i>			2400
<i>Onitis aygulus</i>			2400
<i>Onitis pecuarius</i>	2236		
<i>Onthophagus binodis</i>	93466	1200	22800
<i>Onthophagus gazella</i>		2400	14400
<i>Onthophagus taurus</i>	73918		7200
TOTAL	397451	24000	153600



Resource CD: Updates & Maps

October, 2007 & April 2008 updates and Release maps

FUTURE PROJECTS: "Sustainable Practices for the Equine Industry"

This one-year project is funded by the National Landcare Program and will focus on best-practice sustainable farm management in horses, including dung beetles and parasite management in horses, in the southern part of the Goulburn Broken Catchment..



Upper Goulburn Broken Dung Beetle Project, 2002-03

Home Creek – Spring Creek Landcare Group - Area: Goulburn Broken CMA



Resource CD: Project Summary

The aim of this project was to establish colonies of additional species of dung beetles in this district, so that dung beetle activity is spread more evenly across the seasons.

RELEASES	<i>Bubas bison</i>	<i>Euoniticellus africanus</i>	<i>Euoniticellus intermedius</i>	<i>Geotrupes spiniger</i>	<i>Onthophagus binodis</i>	<i>Onthophagus gazella</i>	TOTAL
2002-03	13200	1200	2400	3600	1200	2400	24000

Prior to the project, four species of dung beetles had been recorded from the project area.

Euoniticellus fulvus

Onthophagus australis (native)

Onthophagus taurus

Onthophagus granulatus (native)

Beetles were released on 12 properties around: Yarck, Alexandra, Yea, Flowerdale and Glenburn.





Burgoigee Creek, Greta Valley, Oxley Milawa Markwook Landcare Groups

Area: North East



Resource CD: Dung Beetle Identification Guide & Project brochure



4 pages

The Greta Valley and Oxley Milawa Landcare Groups obtained funding from the National Heritage Trust for the introduction of dung beetles. In January and March 2002, *Geotrupes spiniger* was released on two properties in the Oxley Flats area and two properties in the Greta Valley area.

The Burgoigee Landcare Group obtained funding from the National Heritage Trust and the Meat and Livestock Australia, to survey the Murrumbidgee Basin and determine the species of dung beetles present. A variety of dung beetles were also released with overlapping activity periods to obtain year-round dung burial.



Two introduced species were found in the basin, *Euoniticellus fulvus* and *Onthophagus taurus*, in addition to the native species *Onthophagus australis*.

In January 2001, the project released approximately 14000 *Onthophagus binodis* on four properties. Also released in 2001 were *Geotrupes spiniger* and *Bubas bison*.

Awards: Burgoigee Ck. Landcare Group - Alcoa Landcare Community Group Award



Landcare Groups - Area: North East

- Kergunyah Landcare Group;
- Leneva Landcare Group;
- Talgarno Landcare Group;
- Tallangatta Valley Landcare Group

The summer-active species, *Onthophagus taurus* and *Euoniticellus fulvus* are widely established across North East Victoria. It is common to find several hundred beetles in a single dung pad with *O. taurus* generally outnumbering *E. fulvus*. The summer of 2004-05 was particularly impressive with complete dung burial within 24 hours. Due to ongoing drought conditions, subsequent seasons have not achieved the same level of activity, however the summer species are still present in strong numbers.

Landcare Groups in the area have been involved in releasing autumn and winter-active species (*Bubas bison* and *Geotrupes spiniger*). Releases have been made in 1999 and 2007-08. *B. bison* is establishing in some areas, however the fate of *G. spiniger* is currently unknown.

- Mudgegonga & District Landcare Group; Scarabs for the Environment 2008-09

This project was funded by the Advancing Agricultural Industries Ag fund. Over 50,000 beetles (4 species) have been released in 2008 on beef and dairy properties. The Project concludes in February 2009.

RELEASES	<i>Euoniticellus Fulvus</i>	<i>Geotrupes Spiniger</i>	<i>Onthophagus binodis</i>	<i>Onthophagus taurus</i>	TOTAL
2008	12100	12000	14200	12100	50400



Lucyvale Better Beef Group; 2006-08 - Area: North East

Improving nitrogen and phosphorus retention, soil productivity and water quality in the Upper Cudgewa Creek Catchment



Project Objectives:

- to introduce 8-10 species of beetles, that will be active all year round
- to invite all Lucyvale Landholders to participate in the project
- to provide field and training days
- to monitor beetle activity, soil health and water quality
- to promote the benefits of beetles to the wider community
- to encourage landholders to use beetle friendly practices.



Resource CD: Newsletters, Dung beetle Powerpoint Presentation and Lucyvale Photostory



Newsletters: Issue 1 (March 2006) to Issue 23 (August 2008). Includes the establishment of species trial tents, monitoring results and beetle releases.



Power Point (50 slides) – featuring the benefits of dung beetles



Photostories, 2006-08 and 2008 Update (.wmv files)
A photographic journal of the Lucyvale Dung Beetle Project

SPECIES RELEASED

SPECIES	2006-08 RELEASES
<i>Bubas bison</i>	24000
<i>Euoniticellus africanus</i>	1200
<i>Euoniticellus intermedius</i>	2400
<i>Geotrupes spiniger</i>	21600
<i>Onitis alexis</i>	1200
<i>Onthophagus binodis</i>	3600
<i>Onthophagus gazella</i>	3600
TOTAL	57600

Dung Beetle Resource Package

In 2008 the Lucyvale Better Beef Group received Federal funding to create a package that would bring together a wide range of dung beetle information and practical resources.

Project objectives include:

- to bring together the broad range of existing dung beetle information into a single, easily accessible package.
- to distribute the package to landholders, government agencies and groups with an interest in dung beetles
- to stimulate interest in dung beetles and Dung Beetle Projects.
- to identify future challenges



DVD “ABC Landline story - Dirty Work” 14/10/07



Web pages:

Lucyvale Better Beef Group - <http://mc2.vicnet.net.au/home/dung/web/index.html>

ABC Landline story “Dirty Work” www.abc.net.au/landline/content/2006/s2058060.htm



State: Victoria



Cann Valley and Far East Victoria Landcare Inc. Dung Beetle Project, 2006-07

Area: East Gippsland

Species Releases: 2006-07: Approx. 19,000 *Bubas bison* beetles across Far East Gippsland.
2008: Approx. 3,000 *Geotrupes spiniger* beetles

Species established: *Euoniticellus fulvus*, *Onthophagus binodis*, *Onthophagus taurus*



Resource CD: **Dung Beetle Survey**

Soilcam Dung Beetle Survey: John Feehan, Feb. 2002, 9 pages



East Gippsland Landcare Network Dung Beetle Project, 2003-04; Area: East Gippsland

The aim of this project is to increase the population size and species diversity of dung beetles in order to naturally consume cattle dung from dryland agricultural pastures and reduce nutrient loads entering the Gippsland Lakes.

Over 65,000 beetles have been introduced into the area.



Web page: http://eastgippsland.landcarevic.net.au/groups/far_east



Lake Wellington Landcare Network "Soil Health and Nutrient Management Education Project" 2006-2008, Area: West Gippsland

SPECIES	2006-08 RELEASES
<i>Bubas bison</i>	21600
<i>Euoniticellus africanus</i>	3600
<i>Geotrupes spiniger</i>	7200
<i>Onitis alexis</i>	1200
<i>Onthophagus binodis</i>	1200
TOTAL	34800

Lake Wellington Landcare Network is an umbrella group that supports three networks in Gippsland, Maffra & District Landcare, Central Latrobe Landcare and West Gippsland Landcare.

Species established in area: *Euoniticellus fulvus*, *Geotrupes spiniger*, *Onthophagus taurus*



Web page: <http://westgippsland.landcarevic.net.au/groups/lake-wellington>



South Gippsland Landcare Network; Managing Manure with Dung Beetles 2002-03 Area: West Gippsland

This project was funded by the National Landcare Program and operated between 2002 and 2003. No further details were available.

In 2008, the Strzelecki Landcare Group receiving funding from Australia Post to purchase and release dung beetles. Five colonies of *Bubas bison* were released on beef and dairy properties in the Strzelecki area (approximately 16 km for Korumburra).



Resource CD: Report: *Dung burial by the winter-active beetle *Bubas bison* and its impact on soil properties in the Barham River Water Catchment, Victoria.*

Bernard Doube, Dung Beetle Solutions Australia, Feb. 2005.



Principal aims of the project:

- To demonstrate the capacity of the introduced winter-active beetle *Bubas bison* to bury dung in the field in the Barham River Water Catchment during the 2004 winter.
- To assess at a small-scale plot level the impact of the dung beetles on the structure and permeability of soil and on water quality.
- To demonstrate these benefits at a field day and to produce a technical report outlining the benefits, to be distributed at the field day.

Results include:

Dung burial

Substantial dung burial by the beetle *Bubas bison* occurred over a period of 2-6 weeks in cold weather in June-July 2004. Dung beetle activity caused substantial disruption to the soil surface and left about half of the surface bare after 4 weeks. After 4 months, at the time of the spring assessment, no surface dung was evident in the dung+beetle treatments, whereas the pads in the dung-only treatments were still largely intact after 4 months (October 2004) and after 7 months (January 2005).

Substantial quantities of yellow soil (B-horizon) were brought to the surface from 30-45 cm deep in the soil as a consequence of dung beetle tunnelling.

Soil permeability

In Spring (October), the time taken for 0.6 litres to soak into the soil was about 10 times longer (median time 8-16 minutes) in plots without dung beetle activity than in plots with dung beetle activity (median time 1-2 minutes). In Summer (January 2005) the effect of dung beetle activity was even more pronounced, with 1 litre soaking into the soil in 0.4 minutes.

Soil hardness

Soil penetrometer readings indicated that dung beetle activity extended the median depth of soft surface soil from about 4-6cm to about 8-10cm when the soil was dry. In moist soil the depth of soft surface soil was substantially greater in all treatments, but the relative greater depth of soft soil in the dung +beetles plots persisted.

Earthworms

The dung beetle tunnels were lined with dung and contained numerous earthworms to a depth of 30cm. In the absence of dung beetle tunnels earthworms were restricted to the top 5-10 cm of topsoil

Dung Beetle Surveys

Two small dung beetle surveys were conducted in the Otway region. The first in winter 2004, failed to find evidence of winter-active dung beetles in Barham River Catchment. The second, in summer 2005 failed to find summer-active beetles in the Barham River Catchment, but two introduced and three native species were present on an isolated property on the Ford River.





Central Highlands Water – Dung Beetle Releases 2003-07 - Area: Corangamite

In order to reduce nutrients from entering local water ways Central Highlands Water initiated a dung beetle distribution program. This saw the release of 20,000 *Bubas bison* beetles throughout the Lal Lal reservoir catchment onto individual properties.

Research has also been conducted on:

- the distribution and abundance of summer-active dung beetles
- the impact of dung burial by *Bubas bison* and *Geotrupes spiniger* on earthworm populations
- the impact of the dung beetles *Bubas bison* and *Geotrupes spiniger* on pasture production.



Heytesbury & District Landcare Network Dung Beetle Releases 2008 - Area: Corangamite

SPECIES	RELEASES
<i>Bubas bison</i>	12000
<i>Euoniticellus africanus</i>	4800
<i>Euoniticellus intermedius</i>	4800
<i>Geotrupes spiniger</i>	20400
<i>Onitis alexis</i>	4800
<i>Onthophagus gazella</i>	4800
TOTAL	51600

The beetles were released as part of the Dairy Action Program, which aims to improve soil and water quality of the HDLN area by assisting dairy farmers balance environmental outcomes with productivity.

41 colonies, consisting of six species were released in the Lower and Upper Curdies, Mt Emu Creek and Scotts Creek catchment areas



Web page: www.heytesburylandcare.org.au/dungbeetle.html



Trentham District Landcare Group Dung Beetle Program, 2004-05 - Area: North Central

SPECIES	RELEASES
<i>Bubas bison</i>	9000
<i>Euoniticellus fulvus</i>	4500
<i>Geotrupes spiniger</i>	3000
<i>Onthophagus binodis</i>	4500
<i>Onthophagus gazella</i>	7500
<i>Onthophagus taurus</i>	4500
TOTAL	33000

The proposal assessed:

- the achievability of sustainable dung beetle populations in the cold, high rainfall climate (>800mm/yr) environment of the Trentham area (on the Dividing Range)
- the dispersion of dung beetles to other properties from those on which they are released.

The project provided community education on:

- the contribution of dung beetles to reducing fly and intestinal worm populations, increasing nutrient recycling and soil fertility and reducing greenhouse gas emissions.
- Adoption of sustainable farming practices compatible with dung beetles.



Resource CD: Trentham and District Dung Beetle Project Report

Report on the Trentham Landcare Dung Beetle Program, April 2005 10 pages

State: Tasmania



Between 1972 and 2002, there have been five separate projects to introduce exotic dung beetle species into the state. These efforts have imported a total of over 1,081,700 beetles comprising 12 species.

SPECIES	RELEASES 1972 - 2002
<i>Bubas bison</i>	71600
<i>Euoniticellus africanus</i>	500
<i>Euoniticellus fulvus</i>	739160
<i>Euoniticellus pallipes</i>	6900
<i>Geotrupes spiniger</i>	62400
<i>Onitis alexis</i>	600
<i>Onitis asynotus</i>	3700
<i>Onitis asper</i>	1150
<i>Onitis asynotus</i>	12100
<i>Onthophagus binodis</i>	38000
<i>Onthophagus gazella</i>	2600
<i>Onthophagus taurus</i>	143000
TOTAL	1,081,710

1. The earliest releases of exotic dung beetles to Tasmania was in 1972-73 with the introduction of four species at eight locations throughout the state by the CSIRO, in conjunction with the DPIWE.

2. A second series of releases, by the same proponents, were made between 1977 and 1981. These releases consisted of an additional 3 species released at a further 15 locations.

3. As a result of a field survey by D. Kershaw and G. Stevenson in 1989-90 an application for funds was made in 1990 to the Dairy Research Corporation. This grant resulted in an initial project that introduced 224,500 beetles which were released at four locations along the north-west coast in 1990. A particular effort was made to establish large populations of these species in the Pet River Catchment to reduce the faecal contamination of the dam, which is the domestic water supply for the city of Burnie. The Burnie City Council financially assisted the project.

The survey also identified the lack of a suitable winter-active species. In 1990-91 the grant further enabled the introduction of over 60,000 *Geotrupes spiniger* which were released on 42 properties around the state, primarily in dairying districts in the north.

4. In 1994 an application was made to the National Landcare Program to purchase an additional winter-active species (*Bubas bison*) and to facilitate the distribution of other species. This application was sponsored by Tullendeena Landcare Group.

5. Between 1998 and 2002, with funding from NHT (sponsored by the North East Coast Landcare Group), 47,100 *Bubas bison* were released at seven locations and 275,150 beetles were redistributed throughout the state.

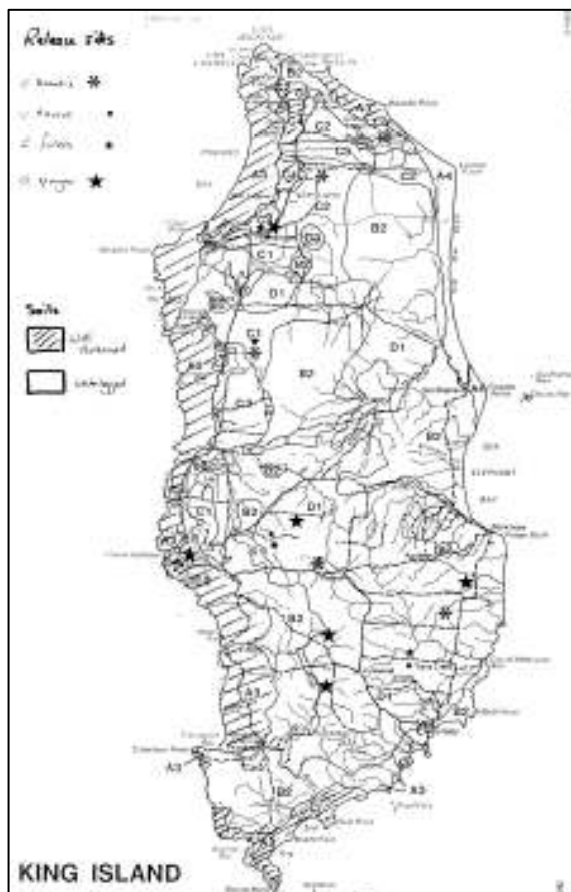
Assessments of species establishment:

a) From the observations made by D. Kershaw (1986-87) it was recognized that *Onthophagus binodis* was well suited to the North Eastern region of the state.

b) In 1989-90 a statewide assessment was made to determine the success of previous releases. The summer-active species *Onthophagus binodis*, *Onthophagus taurus* and *Euoniticellus fulvus* were identified as successful. Subsequent observations indicated that *E. fulvus* is more suited to areas with less than 1000mm annual rainfall.

c) In 1994 a survey was circulated to 150 landholders throughout the state to determine the spread of introduced species. Following on from the survey, 35 of the properties that indicated beetles were present were visited.





King Island releases

Between 1989 and 1991, over 70,000 beetles (*E. fulvus*, *G. spiniger*, *O. binodis*, and *O. taurus*) were released on the island giving a very high rate of release density and follow-up releases.

Assessments were made based on landholder information (including samples sent in for identification), Landcare group member feedback and traps set at the District school. As a result all three summer-active species have been identified as having established, although their numbers appear to be lower than densities commonly observed in Tasmania.

The failure of *G. spiniger* to establish is possibly due to the high water table on the island which may have reduced the establishment of the winter-active beetles in particular, as the brood balls would be constantly wet.

It has also been observed that *G. spiniger* has also failed to establish in parts of southern Tasmanian (following release at Cygnet in 1980). This may have been due to the poorly drained clay soils common at the release site.

Beetle redistributions:

As a result of observations of the success of *Onthophagus binodis* in late 1980's Doug Kershaw encouraged collections on his property in the North East of Tasmania. Busloads of farmers (the beetle bus) would arrive on the Kershaw's property to harvest beetles to take back to their own properties. By means of dairy farmer discussion groups initially, and individuals subsequently, it is estimated that well over 1,000,000 *O. binodis* were collected from the property and redistributed all over Tasmania and to the mainland between 1987 and 1994.

Between 1995 and 1997 further redistributions of mixed beetle species (*O. binodis*, *O. taurus*, *E. fulvus*, and *G. spiniger*) have been made from trappings in the Bridport area by D. Kershaw on a voluntary basis.

Estimate of number of beetles redistributed	
1987-94	1,000,000
1995	10,000
1996	36,200
1997	67,000
1998-2002	267,900
TOTAL	1,381,100



Dung Beetle Collection Traps

Dung Beetle Collection Traps:

Plastic containers (36cm x 30cm x 12 cm) with a group of small holes in each corner to allow for drainage in wet conditions.

A batten frame that fits around the container, fitted with either 1.5 cm sq. plastic mesh or small bird wire stapled onto the frame.

The size of the mesh will depend on the size of the species being harvested.

Fresh horse or cow manure (horse manure is preferred by beetles and easier to handle) is used as bait. The trap is set under a fence to avoid interference by cattle.

General observations

Species failures: Several released species do not appear to have become established. These include: *E.africanus*, *E.pallipes*, *O.alexis*, *O. aygulus*, *O. gazella* and, *O.pecuarius*

Colonisation rates: Observations based on known release data, and subsequent observations suggest the following colonisation rates:

- *Geotrupes spiniger*: 1km per year
- *Euoniticellus fulvus*: at least 6km per year

Predators: Observed predators include: ravens (crows), quolls, owls, plovers and egrets

Grain feeding: From casual observations it would seem that the feeding of grain to ruminants (particularly cattle) makes the dung less attractive to beetles.

The future

Further field assessments should be made to determine the success of releases of:

- *O.pecuarius* and *O. alexis* (Karoola, Tullendeena and Waterhouse)
- *E.pallipes* (Bridport and Elliot) and *B.bison* (Swansea, Stanley, Highclere and Elliot)

Additional releases should be made of those species shown as “potentials” by Tyndale-Biscoe, especially *O.caffer*, *O.pecuarius* and *O.gazella*.



Resource CD: Beetle Guide and Project Reports



- Beetle Guide: Dung Beetles for Tasmanian conditions: 4 A4 pages
- The Introduction of Exotic Dung Beetles in Tasmania 1972 – 2002, Doug Kershaw and Graeme Stevenson, 32 pages
- Final Report: Dairy Research & Development Corporation; Distribution of introduced dung beetles to Tasmanian dairying districts, G Stevenson 1992

Community education and awareness:

A school kit was developed consisting of:

- “Bioscan: Entomology in Schools” folder
- Common dung beetles in pastures of south eastern Australia- book
- A dung beetle farm (similar to an “ant farm”). A timber frame 100 x 300mm held two sheets of glass 15mm apart. The space between the glass was filled with soil and at the top was a “feed tray” holding sufficient dung for several days feeding. Dung beetle activity could be viewed through the glass as they buried dung and formed brood balls
- equipment for trapping beetles (wire mesh, bowl and trowel)
- Kits were distributed to 45 schools across Tasmania.



Doug and Dawn Kershaw with the school kit

Schools Presentation: “Dr Splutter Grunt and Sally the sick soil”



Developed by Graeme Stevenson as part of the dung beetle education and awareness program, Dr Splutter Grunt has both entertained and educated more than 1000 students from 40 schools on the importance of soil health, and the benefits provided by dung beetles.



DVD “Dr Splutter Grunt and Sally the Sick Soil”



State: South Australia



Meat and Livestock Association: The pasture growth and environmental benefits to the southern Australian cattle industry



Resource CD:



Meat and Livestock Australia

"The Pasture growth and environmental benefits of dung beetles to the southern Australian cattle industry"

Prepared by: Bernard Doube – Dung Beetle Solutions Australia

July 2008, 21 pages.

This Project assessed the pasture growth and environmental benefits of dung beetles to the southern Australian cattle industry using *Bubas bison* as one of four deep-tunnelling dung beetle species (including *Geotrupes spiniger*, *Onitis caffer*, *Copris hispanus*) introduced to Australia by CSIRO. These deep-tunnelling species are well suited to southern Australia but are currently established over only a small portion of their potential ranges. The environmental and agricultural benefits of such species have not been previously assessed and so the project was commissioned to examine *B.bison* in field trials.

The Project objectives were to:

- examine the impact of dung burial by *B.bison* on pasture production and key soil characteristics at two locations on the Fleurieu Peninsula, SA
- educate producers through field days and other extension activities
- produce a draft pamphlet on the impact of dung beetles on soil and pastures
- develop a scientific paper ready for peer review

Pasture Production

The pasture growth response over two years (Oct. 2005 – Nov. 2007) to the burial of one set of dung pads was substantial: +27% (4.11 t ha⁻¹) at Ashbourne and +25% (5.0 t ha⁻¹) at Kuitpo.

Soil Health, soil structure and subsoil chemistry

Dung burial resulted in elevated levels of nitrate, ammonia, phosphate, sulphur and soil carbon in the subsoil 20-45 cm below dung pads. Soil organic matter, pH and EC were also elevated. These effects were dramatic, particularly in the vicinity of the beetle tunnels, and have persisted for more than two years. The elevated levels of phosphate, sulphur, EC and soil pH moved from the tunnel contents and tunnel walls into the surrounding bulk soil.

Four earthworm species were recognized. Earthworm numbers and biomass increased under dung pads and increased further in soil where the dung had been buried by beetles, being found throughout the soil profile. Soil hardness decreased and the permeability to water increased where beetles buried dung.

Soil Carbon

The capacity of deep-tunnelling dung beetles to increase the levels of carbon stored in the soil as soil organic matter provides an opportunity to use deep-tunnelling species to sequester atmospheric carbon (carbon dioxide) in soil as organic matter (roots and dung) and so contribute to lessening the impact of the cattle industry on global warming. In time, producers may be able to claim credits for the additional carbon stored in soil as a result of dung beetle activity.



Dairy Research & Development Corporation; Cropping and Distribution of Exotic Dung Beetles in South Australia; 1991-93

During 1991-92, a survey of South Australia determined which species of exotic dung beetles have become established, where and in what numbers they were present. With the aid of the computer-driven climate matching program, CLIMEX, it was determined which species, available for collection in NSW, were suitable but missing in the various regions of SA.

Over the next and following season, beetles were collected and sent to officers in the Department of Agriculture, for release on local farms. Beetles were also sent to officers of the Department of Agriculture in WA and Tasmania, where the climate matching had already been done. As well, some beetles were dispatched, upon request, to individual farmers in Victoria and NSW, supplementing the redistribution program of 1988-91.

STATE	1991-92	1992-93	TOTAL
South Australia	635112	6172	641284
Western Australia	788	4912	5700
Tasmania	352660	79399	432069
Victoria	29339	28907	58246
New South Wales	88477	14913	103390

The total number of dung beetles harvested and redistributed for this Project was 1,240,689

Total number of beetles redistributed by state

Objectives:

- to survey South Australia, to determine the status of the original CSIRO dung beetle releases.
- to accelerate the spread of beetles by further releases of the same species, and by additional species where applicable.
- To prepare an addendum to the dung beetle book "Common dung beetles in pastures of south-eastern Australia, consisting of current and potential distribution maps for South Australia for each species of exotic and common native dung beetle.

The original CSIRO release sites were surveyed in Oct-Dec 1991. A number of species were found to be absent from areas indicated as suitable by CLIMEX. For the remainder of the 1991-92 season, and the whole of the 1992-93 season, *Onthophagus taurus*, *Euoniticellus fulvus* and *Onitis pecuarius* were collected in NSW, and sent to the Mt Gambier, Mt Barker, Renmark and Clare districts in South Australia.

SPECIES	1991-92 RELEASES	1992-93 RELEASES
<i>Euoniticellus fulvus</i>	588434	-
<i>Onthophagus taurus</i>	45541	-
<i>Onitis pecuarius</i>	1137	6172
TOTAL	635112	6172

Onthophagus taurus and *Euoniticellus fulvus* was mainly released into the Mt Gambier and Renmark regions, as they were already present in good numbers around Mt Barker and Clare. *Onitis pecuarius* has never been released in South Australia before, and releases were made at Clare, Mt Barker and Mt Gambier.



Resource CD: Report

Tyndale-Biscoe, M. 1994, *Final Report, Cropping and distribution of exotic dung beetles in South Australia*, Dairy Research and Development Corporation. 8 pages





Dairy SA: Evaluation of pasture growth due to the late summer/autumn active dung beetle *Geotrupes spiniger* at Flaxley SA, 2004-06

The Project was designed to evaluate alterations in pasture growth, soil permeability and the quality of run-off water in response to dung burial by the dung beetle *Geotrupes spiniger* at Flaxley SA.



Results:

- Dung burial by *G. spiniger* increased the permeability of soil to water and the effect persisted for two years.
- Dung removal by *G. spiniger* and other beetle species has a substantial capacity to reduce levels of nitrate and organic pollution in run-off water.
- Pasture production in this trial environment was not limited by soil nutrients and so neither dung nor dung beetle activity increased pasture production.

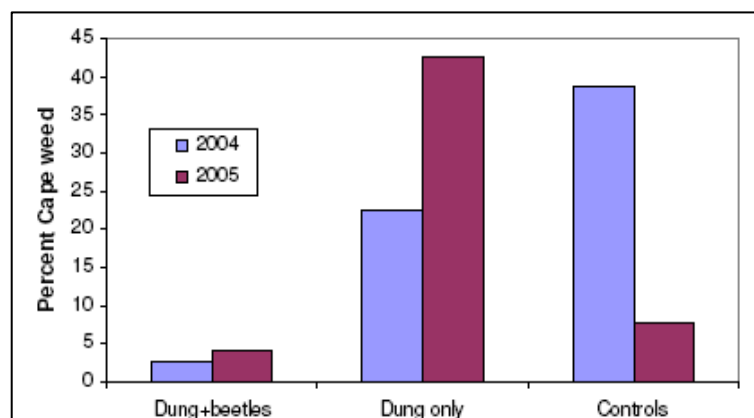
Experimental plots at Flaxley SA

The most important finding of the study was the profound effect of dung burial by *G. spiniger* on water quality. Dung beetle activity altered the chemical composition of the water that ran off the plots during winter (as the result of artificial rain applied 12 weeks after the trial was established), with substantially reduced levels (90%) of soluble organic compounds, DOC (dissolved organic carbon) and soluble N, compared with the dung-only plots.

The off-site consequences of farming activity (eg dung pollution of our waterways) are now recognised as a serious component of managing our agricultural industries and it is clear from the data reported for this project that autumn and winter-active dung beetles have the potential to substantially reduced levels of dung-derived nutrients in our waterways.

Direct observations of the plant composition on the plots suggested that Cape weed was virtually absent from the plots with dung and beetles but present in substantial amounts on the plots with dung-only and in the controls. This suggests that dung beetle activity caused substantial suppression of Cape weed.

Why this occurred is not clear but it may be related to seed burial by beetle activity.



The effect of dung and dung beetle activity on the presence of Cape weed (by dry weight) as a percentage of all plant matter on the test plots in mid-spring 2004 and 2005



Resource CD: Final Report & Dairy SA Project Update July 2006

- Doube, B. 2006, *Evaluation of pasture growth due to the late summer/autumn-active dung beetle Geotrupes spiniger at Flaxley SA*. Dairy SA, 9 pages
- Dairy SA *Project Update* July 2006 "Beetle battle pollution"



Watershed Protection Office of the Environment Protection Agency

Supported by: Onkaparinga and Torrens Water Board, Australian Water Quality Centre, SA Water, Fleurieu Beef Group, Creation Care and Dung Beetle Solutions Australia.



Resource CD: Dung beetle – *Cryptosporidium* research

Doube B., 2004, Dung Beetle – *Cryptosporidium* research: **Review and a pilot study on the recovery of *C.parvum* oocysts from dung buried by the dung beetle *Bubas bison***. Prepared for Watershed Protection Office. 29 pages

Dung beetle – Cryptosporidium research in SA, 2002-04

Over the past three years the Fleurieu Beef Group in South Australia has been promoting the introduction of dung beetles to the pastures of South Australia. This work has led to the recognition that dung beetles may have the potential to improve water quality in catchments by reducing the nutrient and dissolved organic matter (DOC) contamination of catchment waters and through biocontrol of human pathogens. Pathogens such as *Giardia* cysts and *Cryptosporidium* are a special problem because cysts/oocysts are resistant to conventional chlorination, can persist and remain infective for extended periods in the water column or sediments, are produced in large numbers in faecal matter, are difficult to detect in water, and cross-infect different animal species.

Report contents include:

- 1.1 Dung Beetle – *Cryptosporidium* research in SA 2002-04
- 1.2 Studies on water-borne pathogens in Australia
- 1.3 Recovery, enumeration and viability of oocysts from dung
- 1.4 The role of dung beetles in Australia water catchments
- 1.5 Impact of introducing dung beetles on other dung fauna
- 1.6 Interactions between dung beetles and pathogens in catchment waters
- 1.7 Key gaps in Information
- 2.0 The recovery of oocysts of *C. parvum* from dung buried by *Bubas bison*: A preliminary study
- 3.0 Recommendations



Onkaparinga Catchment Water Management Board



Resource CD: Final Report

Doube, B. 2005, **A comparison of two methods to identify optimal release sites for *Bubas bison* in South Australian water catchments**. Prepared for Onkaparinga Catchment Water Management Board. 6 pages



Four test plots in waterlogged soil

Two methods of recovering dung beetles from under dung pads were compared. In one, parent beetles were introduced to a 20cm deep PVC core containing 2 litres of fresh dung which was placed on undisturbed soil.

In the second method, parent beetles were introduced to a PVC core containing 2 litres of fresh dung which was placed over a reconstructed soil profile contained inside a water-permeable coarse mesh bag to a depth of 50 cm in the field.

Outcome: The mesh-bag soil cage is the preferred method for assessing the habitat preferences of *Bubas bison*.





Fleurieu Beef Group; Dung beetle research and releases 2002-07

Area: Adelaide and Mt Lofty Ranges

Beetle Releases

SPECIES RELEASES	<i>Bubas bison</i>	<i>Geotrupes spiniger</i>	<i>Onitis caffer</i>	TOTAL
2002-03	36000	28800	3600	68400



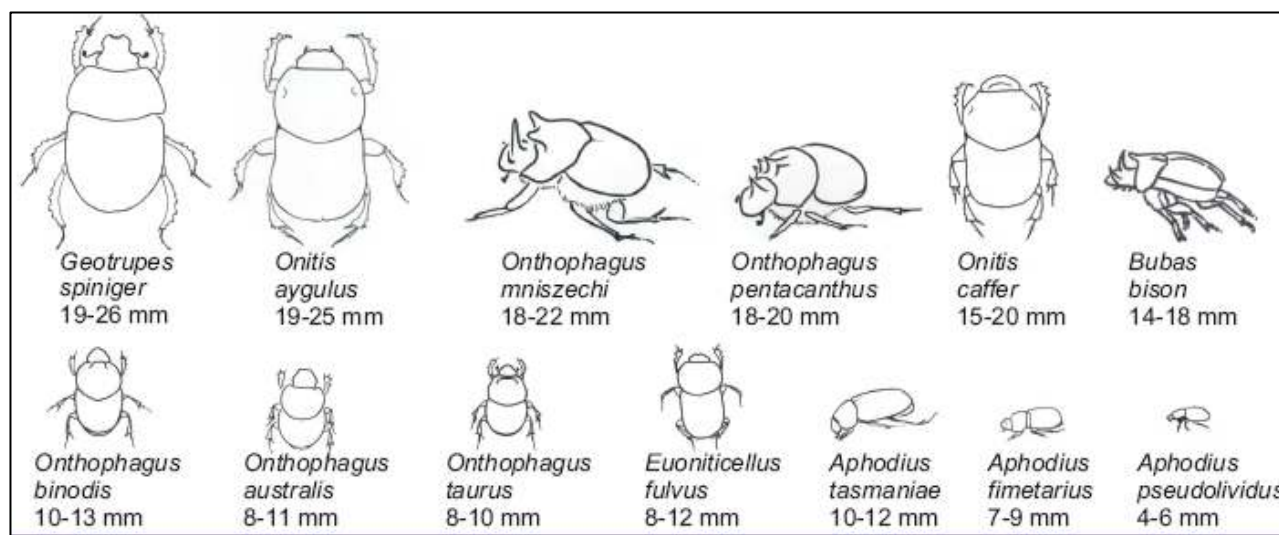
Resource CD: Identification Guide

Dr Bernard Doube and Greg Dalton, 2003 ***"Identifying dung beetles on the Fleurieu Peninsula"***
Fleurieu Beef Group, 8 A4 pages



Content Includes:

- size; key features; look alike species, major and minor specimens
- actual size chart
- examples of shoulder horns and ridges
- examples of head plates and ridges
- differences between the sexes
- benefits of dung beetles
- other species found in dung



Dung beetle size chart from ***"Identifying dung beetles on the Fleurieu Peninsula"***



Resource CD: Dung Beetles: ***"Transform a pollutant into an environmental and agricultural benefit – A practical guide to the benefits, behaviour, species, establishment, management and monitoring of dung beetles."*** Dr. Bernard Doube and Greg Dalton – 2003 20 pages



Content includes:

- Benefits: *pasture benefits, soil, pest & diseases, water quality*
- Behaviour: *types, life cycle, depth of tunnels, dispersal, seasonal activity*
- Species: *South Australian releases, native species, identifying beetles*
- Establishment & management: *releasing dung beetles, managing beetles*
- Monitoring: *beetle flight times, inspecting dung pads, trapping beetles*

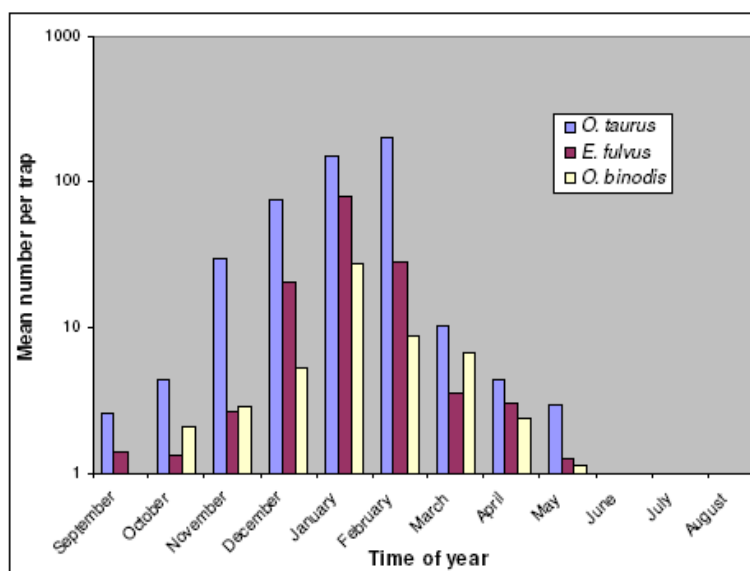


Resource CD: Monitoring Reports

- **Monitoring dung beetle abundance on the Fleurieu Peninsula, 2002-2003**
Bernard Doube and Greg Dalton, 2004. (abbreviated – 8 pages)
- **Monitoring of Fleurieu Beef Group 2002 and 2003 dung beetle releases – Monitoring from May 2004 to August 2005.** 100 pages Greg Dalton: Creation Care

The purpose of the research was:

- to detail the regional distribution and seasonal activity of four species of introduced summer-active dung beetles (*Onthophagus taurus*, *Onthophagus binodis*, *Euoniticellus fulvus* and *Onitis aygulus*)
- to monitor the establishment of three species of newly introduced winter-active dung beetle (*Bubas bison*, *Onitis caffer*, *Geotrupes spiniger*)
- to detail the activity of a number of indigenous species (*Onthophagus pentacanthus*, *O. mnischechi*, *O. australis*)



The seasonal pattern of activity of *O.taurus*, *O.binodis* and *E. fulvus* based upon the mean numbers of beetles per trap for each month



Resource CD: Soil core trial report

Suitability of *Onitis aygulus* for the Fleurieu Peninsula: A report on the 2006 core trial, Sam Dalton, 2006 14 pages

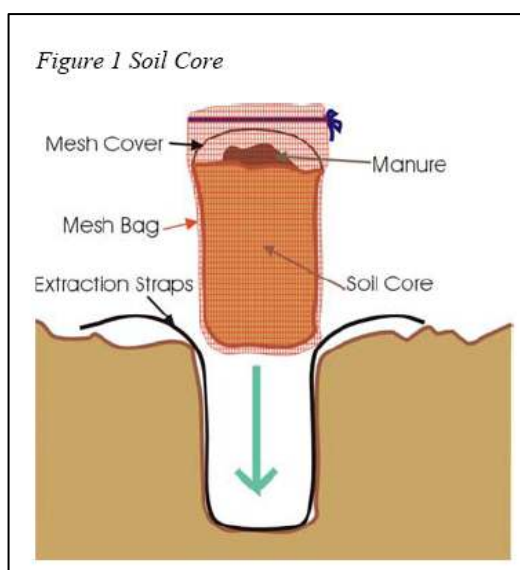


Diagram of soil core

Onitis aygulus was trialed using soil cores at four different locations to assess their potential for distribution.

O. aygulus was collected from a site on the Eyre Peninsula. To install the cores, soil was excavated to a depth of 40cm and separated according to soil type. A mesh bag was placed in the hole and backfilled with the excavated soil, with care being taken to match the original soil profile.

Two litres of dung was placed on the top of the soil core. Two adult pairs of beetles were released into the dung, and the tops of the bags tied off. The bags were excavated 10 – 11 months later and their contents assessed for the following attributes:

- number of beetles recovered, weight of beetles, survival percentage
- stage of beetle development (larvae, pupae, un-tanned adult, tanned adult)
- percentage of dung burial, depth, number and weight of brood balls





Resource CD: Optimal release site report

Optimal release sites for the dung beetle *Bubas bison* on the Fleurieu Peninsula, Prepared for the Fleurieu Beef Group by Dr Bernard Doube, Greg Dalton & Sam Dalton. 2006, (abbreviated form) 7 pages

It is important to choose release sites that will allow successful establishment of founder colonies of *Bubas bison*. Marginal sites in which beetles fail to breed, or in which there is high juvenile mortality, need to be identified and avoided in order to make optimal use of beetles used to establish breeding populations. The experiment was designed to test the suitability of contrasting soil types (sand, loam, clay) in three rainfall zones on the Fleurieu Peninsula.

Conclusions:

- the optimal release sites for the dung beetle *B.bison* on the Fleurieu Peninsula are clay and loam soils and duplex soils (sand over clay) with reasonable levels of drainage
- Sandy soil and regions that experience intense waterlogging should be avoided as release locations for founder colonies of *B. bison*
- Brood survival was inhibited by intense waterlogging.
- The beetle can have a one or two year life cycle depending upon environmental conditions. Cool temperatures probably impose a 2-year life cycle
- The reproductive success of *B.bison* in favourable soil appears sufficient to ensure that the beetle could become established and locally abundant 3 to 4 years after the releases of substantial numbers of adult beetles onto deep loam and clay soils



A diapausing third instar larva in a faecal shell



Resource CD: Dung beetle species evaluation

- **Evaluation of dung beetle species for introduction and dispersal over the Fleurieu Peninsula**, Prepared for the Fleurieu Beef Group by Dr Bernard Doube, 2007, 27 pages
- Four categories of dung beetles are recognised and 20 species examined.
1. Species not recommended for consideration (5 species)
 2. Low priority species for introduction or wider dispersal (8 species)
 3. Moderate priority species for introduction or dispersal (3 species)
 4. High priority species for introduction or dispersal (4 species)

The report includes a summary of the relevant characteristics of the discussed species.

- **Summary of recent dung beetle research in South Australia**



"Eucalypts as indicator species"

- Draft – **Tree species as indicators of the suitability of dung beetle release sites**, by Greg Dalton, Creation Care.

The dominant vegetation can provide an insight into the climatic conditions and soil properties at a particular site. Research is underway to use various Eucalypt species as potential indicators for suitable beetle release/establishment sites.

State: South Australia



Kangaroo Island Natural Resource Board
Area: Kangaroo Island



Resource CD: Identifying optimal release sites

Doube, B. 2007, *Identifying optimal release sites for Geotrupes spiniger on Kangaroo Island, South Australia using dung burial, juvenile mortality and adult-to-adult survival*. Kangaroo Island Natural Resources Board. 26 pages

Three factors were measured to assess the suitability of a location for successful establishment of *Geotrupes spiniger*.

1. *the impact of soil hardness on dung burial and breeding by dung beetles.*
If the soil is hard, the beetles may have difficulty tunnelling and so the breeding performance of adults may be seriously restricted.
2. *survival to the late instar in the soil*
This is likely to be affected by soil type, soil moisture and possibly soil temp.
3. *emergence of adult beetle.*
It seems that the mature third instar larvae and pupae may be particularly sensitive to environmental conditions in mid-summer, as the beetles are metamorphosing into the adult stage.



Developmental stages of *Geotrupes spiniger*, left to right: larva, pupa, untanned adult, tanned adult
Photo: Bernard Doube, Dung Beetle Solutions Australia

Report content includes:

- Results
 - o Weather patterns at the test locations
 - o Soil hardness and rates of water infiltration at test locations
 - o Field data from 2005 and 2006
- Discussion
 - o Seasonal patterns of development and activity, Soil type preferences
 - o Effects of rainfall and soil moisture, Dung type preference
- Overall conclusions and recommendation



State: Western Australia



Western Australia Dung Beetle Project – WA Department of Agriculture & CSIRO

In December 1989, a program was initiated to originally introduce three species (*Copris hispanus*, *Bubas bison* and *Onitis belial*) which was later expanded to four species (*Bubas bubalus*), of dung beetles from Spain into Western Australia to control bush flies. This was a collaborative program between CSIRO and Ag WA (Western Australia Department of Agriculture). CSIRO was involved with importing the species from Spain into Australia and the subsequent release of successive batches of eggs from Australian Animal Health Laboratories (Geelong). On receipt of eggs or pupae, Ag WA mass-reared and then released adult dung beetles at climatically selected sites in Western Australia.

Rearing difficulties and high mortality rates for two of the imported species meant that only *Copris hispanus* and *Bubas bison* were subsequently released in WA.



Resource CD: WA Project Reports

Dadour, I.R. & Allen, J.F. 1996, **Western Australian dung beetle project: Final report, Part one: Importation and rearing of Spanish dung beetles**, 23 pages

Contents include:

- General introduction
- Brief biologies of dung beetles selected for introduction and now established in WA
- Importation and rearing
- Quarantine insectary
- Culture notes for dung beetles in high security quarantine
- Summary and conclusions
- Acknowledgements
- References

Steinbauer, M. J. & Wardhaugh, K.G. 1993, **Western Australian Dung Beetle Project; Final Report to WADA**, CSIRO Division of Entomology, 81 pages

Contents Include:

- Introduction and brief biologies of dung beetles selected for Western Australia
- Collection and treatment of adult dung beetles
- The Australia Animal Health Laboratory insectary
- Dung and soil supplies
- Beetle feeding procedures
- Harvesting and treatment of brood masses
- Egg sterilisation and pupal dipping procedures
- Laboratory report on *Bubas bison*, *Bubas bubalus*, *Onitis belial*, *Copris hispanus*
- Other organisms in the insectary
- Summary, conclusion acknowledgements and attachments



Resource CD: **WA Project Reports (continued)**

Ian Dadour, Entomologist: Alan Peggs, Adviser: Beef marketing, Andrew Young, Adviser: Project Unit Evaluation Unit. 1993, **WA Dung Beetle Project – An economic evaluation**: 6 pages

The economic benefits of the dung beetle program to Western Australian agriculture are substantial and well justify the commitment of the Consolidated Revenue fund to it. The economic analysis indicates the program has the greatest benefit in the high rainfall agricultural areas, however, benefits are substantial in the medium and low rainfall agricultural areas and the Kimberley.

It needs to be borne in mind the dung beetle program has substantial off-farm benefits relating to human health, science education and tourism. None of these benefits have been incorporated into the economic analysis.

Five benefits are detailed in this analysis in the areas where improved pastures are grown.

1. reduced cost of harrowing (only in high rainfall area)
2. reduced fertiliser cost due to enhanced nutrient recycling
3. higher stocking rate due to higher pasture production
4. higher individual animal performance due to reduced nuisance effect of flies
5. reduction in anthelmintic chemicals due to gastro-intestinal worm reduction in cattle



Resource CD: **BIOSCAN: A dung beetle and bush fly monitoring program and Resource kit for upper primary and lower secondary schools.**



Sponsored by:

- The Science and Technology Awareness Program
- Department of Industry, Technology and Commerce
- Department of Agriculture Western Australia

Authors: John F. Allen, Peter St. Clair Baker, Ian R. Dadour

Editorial: Peter Watt

Graphic design: Rod Lewis

91 pages

The BIOSCAN project, using the BIOSCAN educational package, provides an opportunity for school students to participate in a “hands on” research program of real significance to scientists in the Western Australia Department of Agriculture, to West Australian farmers and to the Western Australian community as a whole.

Monitoring the effects of a control agent is extremely difficult. It requires numerous resources, especially in terms of labour and money. These factors have resulted in many follow up programs on biological control agents being incomplete. In many cases the researcher must rely on measurements in selected areas or on anecdotal evidence. To get an overall picture of the effect of a biological control agent is next to impossible. This is why school participation is so important.

From statewide sampling BIOSCAN will assist in:

- (i) identifying and mapping those regions with dung beetle activity and monitor the establishment and spread of introduced dung beetle species; and
- (ii) monitoring the prevalence of the bush fly (*Musca vetustissima*) in relation to the level of dung beetle activity in the State.

The resource kit includes a beetle trap, fly trap, items for beetle pinning, identification tools, instructions for bush fly and dung beetle monitoring, recording sheets, teaching text and worksheets.





Dairy Research and Development Corporation – Dung Beetle Releases 1991-94



Resource CD: Final Report

Dadour, I.R. & Cook, D.F., 1997, Cropping and distribution of introduced dung beetles in south-western Australia, Dairy Research and Development Corporation. 32 pages

Objectives:

- to determine which introduced dung beetles have become established and their abundance and distribution patterns in south-western Australia. This project was concurrent with the Dung Beetle Program in Western Australia.
- to examine the phenology of those species suitable for cropping and distributing into the dairy areas of the south-west
- to determine which areas are suitable (using CSIRO CLIMEX model) for the distribution of those species selected for cropping and release.
- to crop (and possibly mass rear) and liberate dung beetles both temporally and spatially in areas of the dairy industry where they are not currently present or common.

The dairy region of south-west Australia extends from Armadale (near Perth) southwards to Augusta and inland to Bridgetown and Manjimup. The most southern areas for dairying are along the south coast from Walpole to Albany. Dung beetles were released onto 58 dairies between 1991 and 1994.

LOCAL CROPPING	BEETLES RELEASED	INTERSTATE CROPPING	BEETLES RELEASED
<i>Bubas bison</i>	72412	<i>Geotrupes spiniger</i> (NSW)	24639
<i>Copris hispanus</i>	91	<i>Onitis aygulus</i> (SA)	4673
<i>Euoniticellus fulvus</i>	27215	<i>Onitis pecuarius</i> (NSW)	7274
<i>Euoniticellus pallipes</i>	4126		
<i>Onitis caffer</i>	2908		
<i>Onthophagus binodis</i>	47731		
<i>Onthophagus taurus</i>	146252		
TOTAL	300735		36586

Monitoring results 1990-1994 – Species mix (by percentage) at each site

LOCATION	<i>Euoniticellus fulvus</i>	<i>Euoniticellus pallipes</i>	<i>Onitis alexis</i>	<i>Onthophagus binodis</i>	<i>Onthophagus taurus</i>
Bullsbrook	-	31.0	3.0	15.0	51.0
Dardanup	7.0	10.0	-	13.0	70.0
Busselton	9.5	4.0	-	8.5	78.0
Margaret River	15.0	0.5	-	5.5	79.0
Albany	2.0	0.5	-	32.5	65.0
Manjimup	13.0	-	-	7.0	80.0
Kojonup	2.0	4.0	-	-	94.0
Walpole	53.0	-	-	47.0	-

Each location had two pitfall traps

Pitfall trap results for each site are displayed in appendix 2 of the DRDC report.



Bush flies and dung beetles – Jim Heath



Resource CD: *The Fly in your Eye*

Heath, Jim 1989,

The fly in your Eye, Viacorp,

Drawings and cartoons by Janet Baxter, 32 pages

Bush flies!

- Why they pester you and why the small flies pester you more
- Where they came from – or damn those cows!
- How bush flies get into the cities and when to expect them
- Temperature and other things that affect how many flies pester you
- How fly experts get their information
- Bush flies in the old days & Life cycle of the bush fly
- Bush fly habits and flight performance



Dung beetles vs Bush flies

- Why dung beetles cut down bush fly breeding
- Life cycle of the dung beetle and where they've been released and what they'll do



Bushflies and trachoma: Healthway (Western Australian Health Promotion Foundation)



Resource CD: *Bush flies and trachoma Project – Healthway; 1994-97*

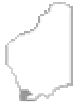
Dadour, I.R. & Cook, D.F. 1998, Final Report: ***Biological control of bush flies: vectors of trachoma and enteric disease***. 8 pages

Objectives and target Groups

- to determine *Musca vetustissima* (bush fly) as a vector of *Chlamydia trachomatis*, *Shigella* spp. *Salmonella* spp. and *Escherichia coli*.
- to establish whether *M. vetustissima* frequents eyes of humans and in doing so transmits trachoma
- to determine the presence of dung beetles amongst Aboriginal communities in the Kimberley's, mid-west Gascoyne and Eastern Goldfields
- to monitor *M. vetustissima* fly abundance amongst these Aboriginal communities
- to survey the prevalence of faeces in these Aboriginal communities
- to release and monitor dung beetles in two Aboriginal communities
- to monitor *M. vetustissima* activity in both experimental (1 community) and control (1 community) communities
- to correlate number of *M. vetustissima* and dung beetles in experimental and control communities with the incidence of *C. trachomatis*, *Shigella* spp. and *Salmonella* spp.

This project has the potential to reduce by a sustainable form of fly control, debilitating diseases such as gastro-enteritis, trachoma and possibly *Giardia* in Aboriginal communities. If the project was expanded in the future, then many other Aboriginal communities would benefit. This project has ascertained that *M. vetustissima* is a passive vector of *C. trachomatis*, *Giardia* spp. and *Salmonella* spp. Equally important is that dung beetles as they become established will decrease the amount of available faeces and hence reduce enteric diseases and possibly parasites in Aboriginal communities.





Doube, B. 2007, *Pasture growth benefits of the dung beetle *Bubas bison* in the Margaret River region of Western Australia: Interim report for June 2007*. 11 pages

An experimental field trial of the environmental benefits of the late-autumn-winter-spring-active dung beetle *Bubas bison* was established in the Margaret River region in early September 2006.

The experiment aims to demonstrate the following effects of dung beetle activity:

- complete burial of dung by dung beetles
- increased pasture production due to the effects of dung alone
- additional increased pasture growth due to the activities of dung beetles

Methods:

The experiment has four treatments

- dung + beetle in cages
- dung only in cages
- controls (no dung, no beetles), in cages
- controls (no dung, no beetles), no cages

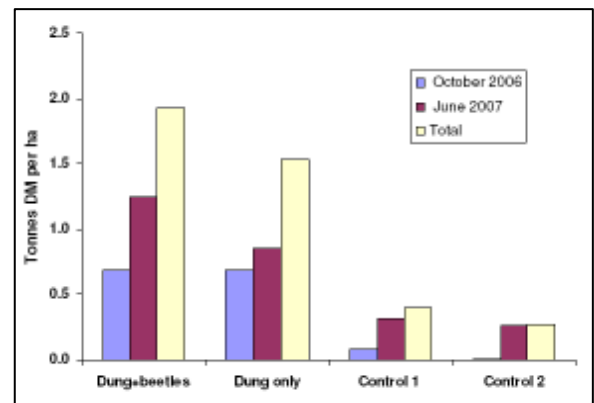


Experimental site showing 2x2 metre plots at the initial establishment stage (September 2006)

Results Summary:

Over the nine-month experimental period (September 2006 – June 2007), the “dung + *Bubas bison*” treatment showed a 0.40 t ha⁻¹ dry matter growth advantage over the “dung only” treatment (a 26% increase), which in turn showed a 1.20 t ha⁻¹ dry matter growth advantage over the pooled control treatments.

This represents a 4.6-fold increase on baseline production of 0.34 tonnes per hectare. Rapid burial of surface dung also benefits the quality of water run-off in water catchment areas.



*The effect of cattle dung & the dung beetle *Bubas bison* on dry matter production (kikuyu pasture)*



Experimental plots at Margaret River site, showing pasture growth after nine months (June 2007)