

Tablelands Farming Systems

Healthy Soils, Sheep Worm Control + *Beetles with Benefits*

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Beetles with benefits.



Rural Research and Development for Profit Program (RRDPP)

- Generating knowledge, technologies, products or processes that benefit primary producers
- Strengthening pathways to extend the results of rural R&D, including understanding the barriers to adoption
- Establishing and fostering industry and research collaborations that form the basis for ongoing innovation and growth of Australian agriculture



Beetles with benefits.



Project Partners



Beetles with benefits.



CSIRO Dung Beetle Project 1965-1985

AIM:

to import exotic dung beetles that are able to process cattle dung, returning it to the soil;

- Clear pastures – prevent smothering
- Improve nutrient availability
- Increase pasture growth
- Reduce dung-breeding flies



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CSIRO Dung Beetle Project

1965 -1985

Imported 55 species

Released 43 species

Established 23 species



1992-1995

Imported 4 species

Released 1 species

Established 0 species

2012 -

Imported 2 species

Released 2 species

Established 0 species



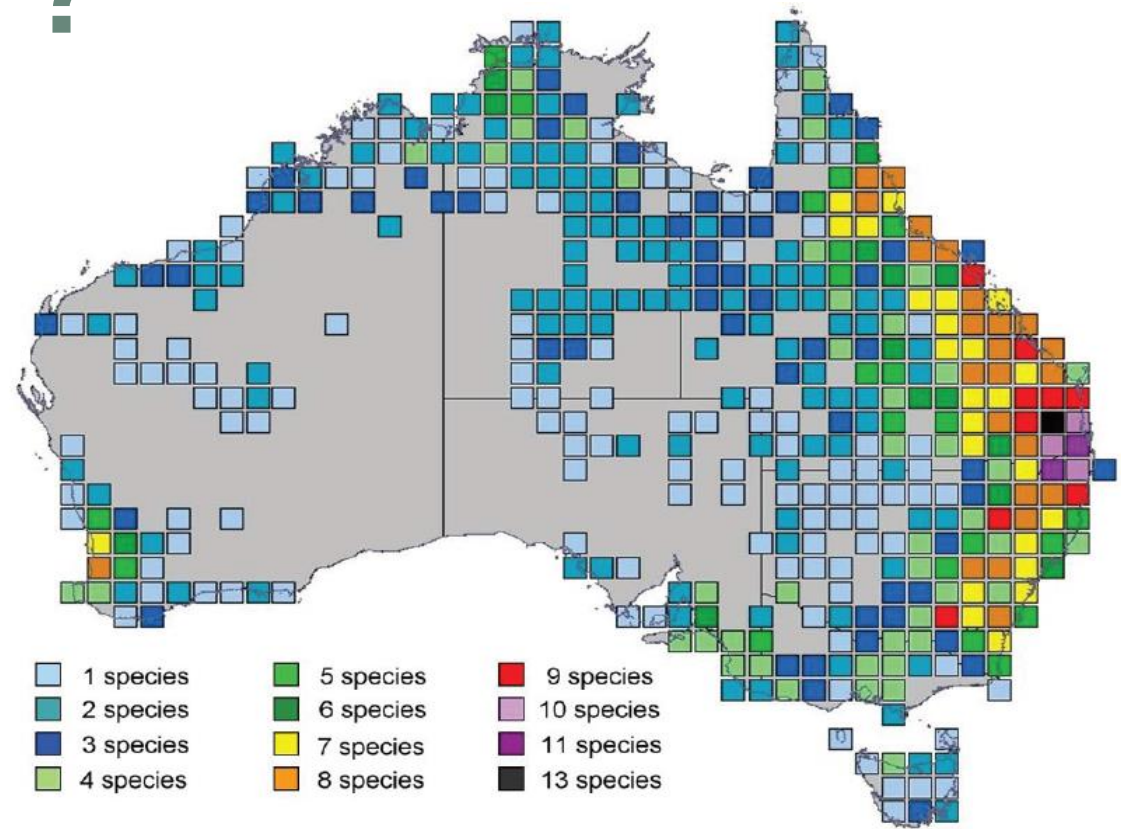
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Where were we now ?

- **Presence** vs Abundance
- Need multiple species on each farm to account for varying soil types and micro-climates
- Parts of southern Australia are not being serviced



Exotic dung beetle species distribution and diversity (Edwards 2007)



Beetles with benefits.



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DBEE Project Aims

- Identify the gaps in dung beetle services on farms across southern Australia
 - Find the soil type, climate, seasonal niches that support dung beetle activity
 - Educate producers to evaluate beetle performance on their own property
- Spread existing species to the extent of their potential ranges
 - Assist commercial operators to rear and service their clients (species specific skills)
 - Trap and spread where appropriate through local groups (e.g. Landcare groups like you!)
- Identify new species from Europe and Africa and introduce them to Australia
 - Study potential species in their natural habitat and gather knowledge on their potential
 - Bring new species through quarantine and learn to rear artificially
- Measure the total economic impact of dung beetles
 - Understand and value the total impact on-farm as well as more broadly
 - Present the case for long term investment by government and industry

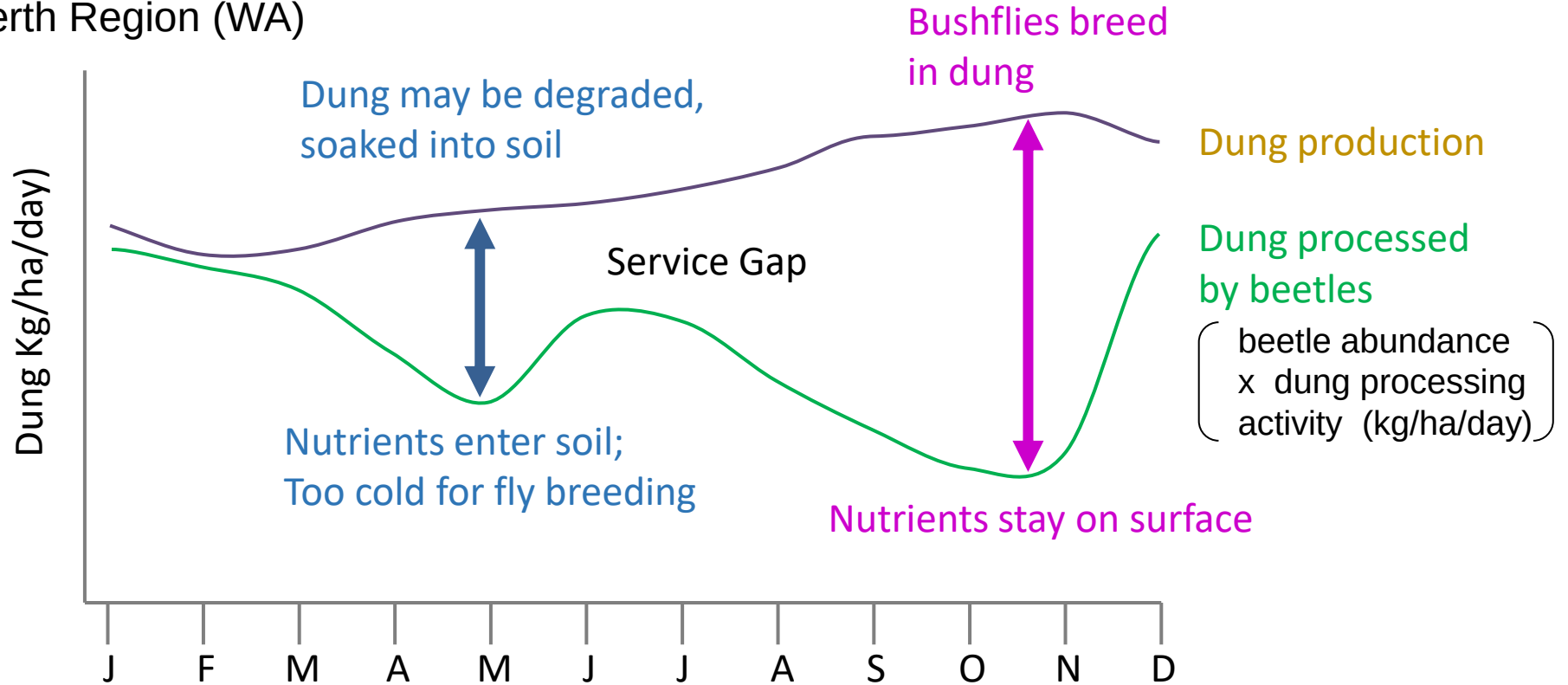


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Seasonal Gaps in Beetle Activity

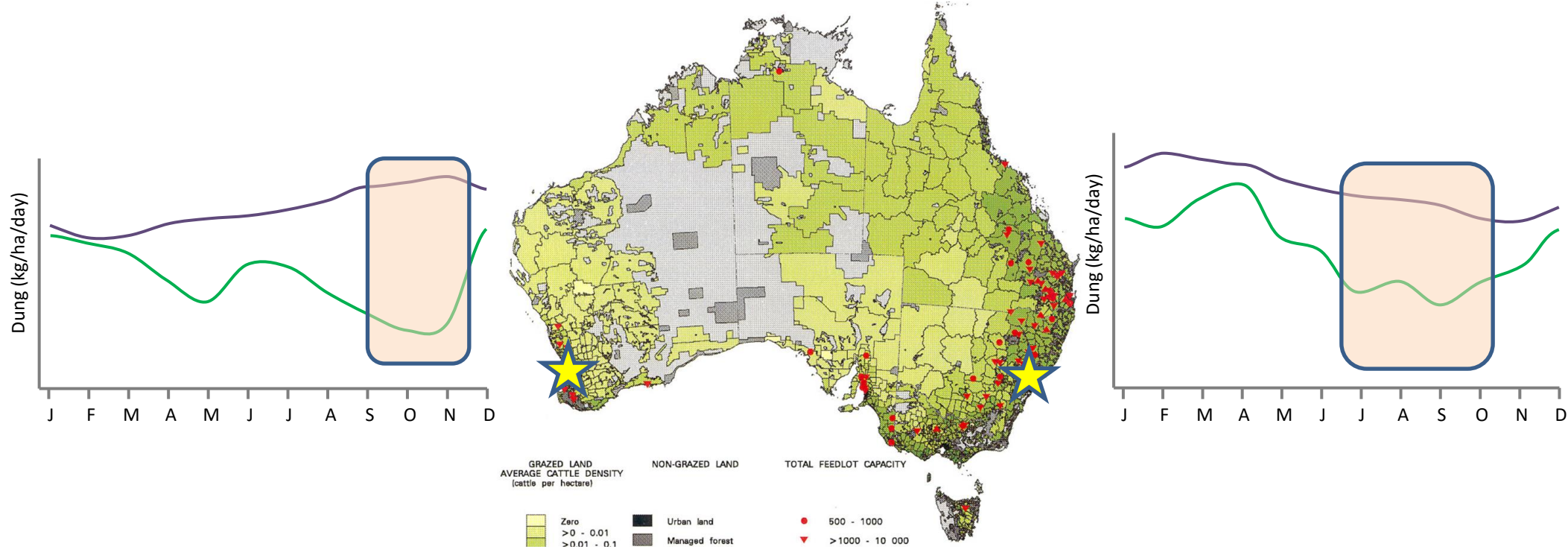
Perth Region (WA)



Beetles with benefits.



Identifying Gaps in Beetle Activity



Beetles with benefits.

DBEE Project Aims

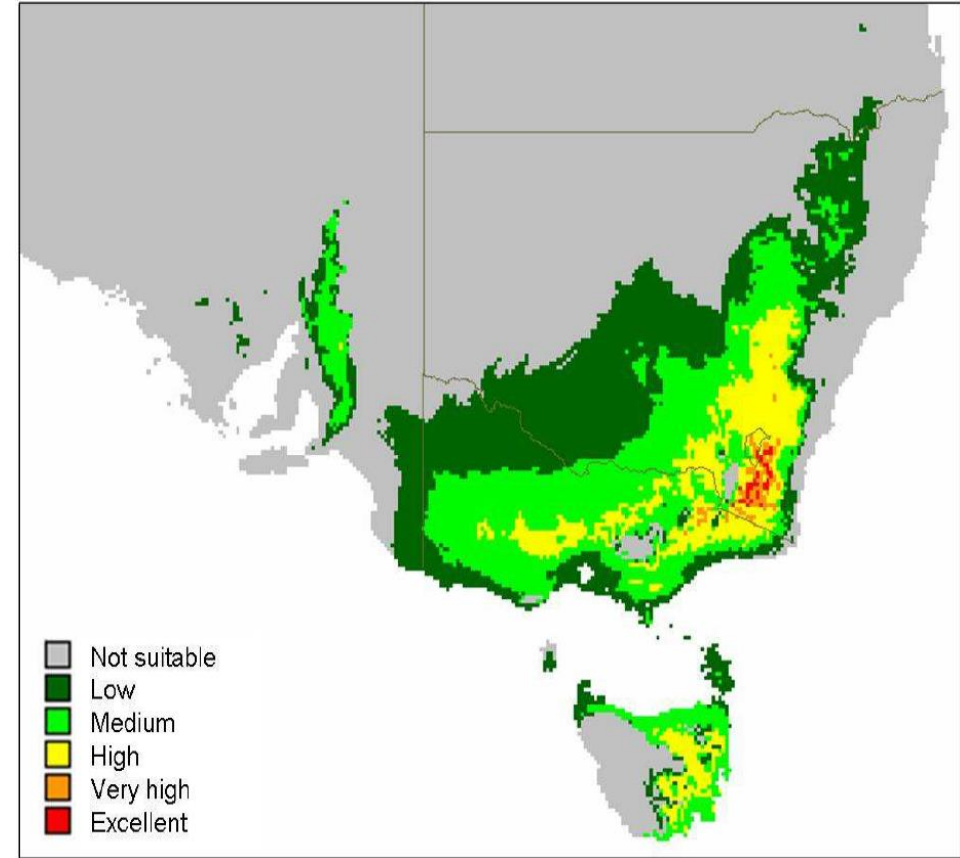
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Beetles with benefits.

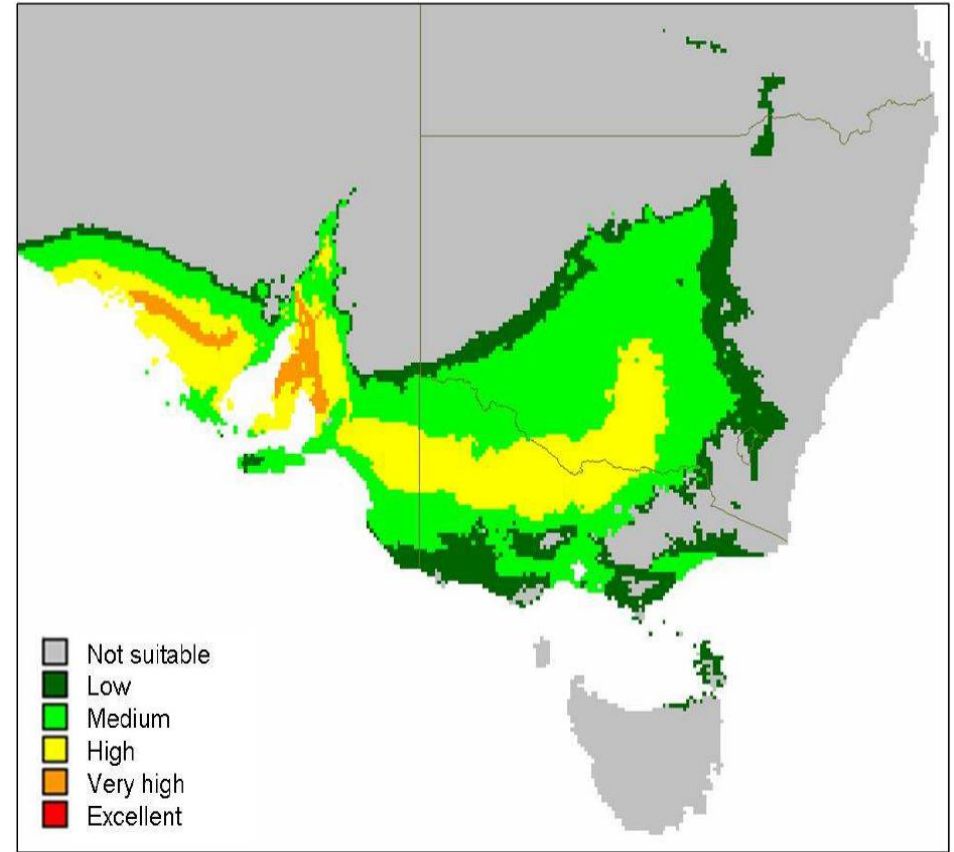


Example 1 : *Geotrupes spiniger*



Beetles with benefits.

Example 2 : *Bubas bison*



Beetles with benefits.

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Beetles with benefits.



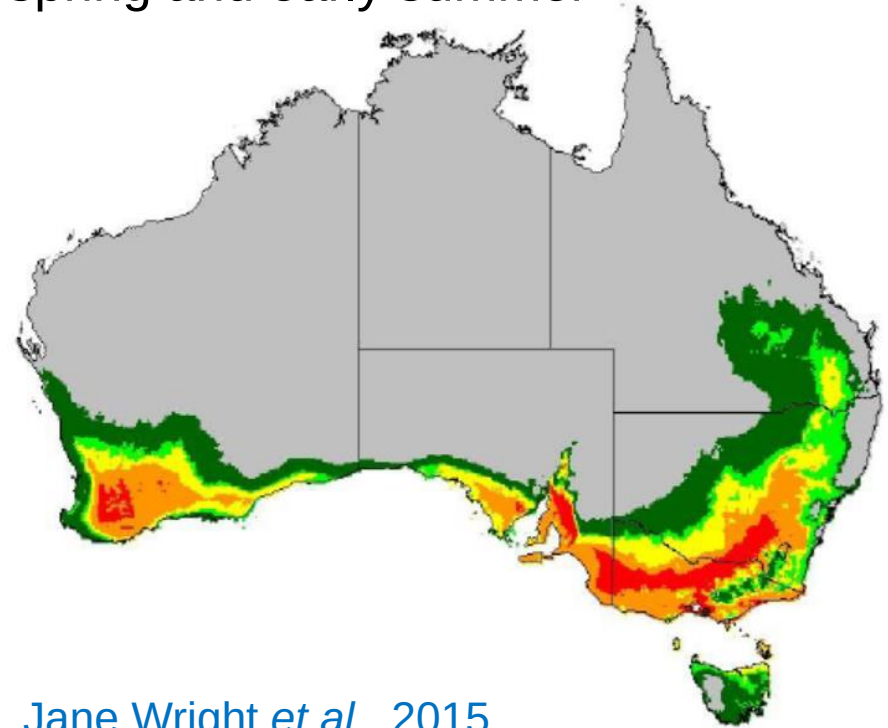
Onthophagus vacca

Emerge in early spring and active during spring and early summer

Male



Female



Jane Wright *et al.*, 2015



Beetles with benefits.



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Economic Impact



How much dung is buried?
What is the nutrient value?



How much more water is penetrating
the soil? How much less runoff?



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Monitoring ?

- Pitfall trapping
- Floatation
- Flipping dung



<https://www.dungbeetles.com.au/project-protocols>



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Monitoring

- Pitfall trapping
- **Flotation**
- Flipping dung



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Beetles with benefits.



Monitoring

- Pitfall trapping
- Flotation
- **Flipping dung**



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Beetles with benefits.



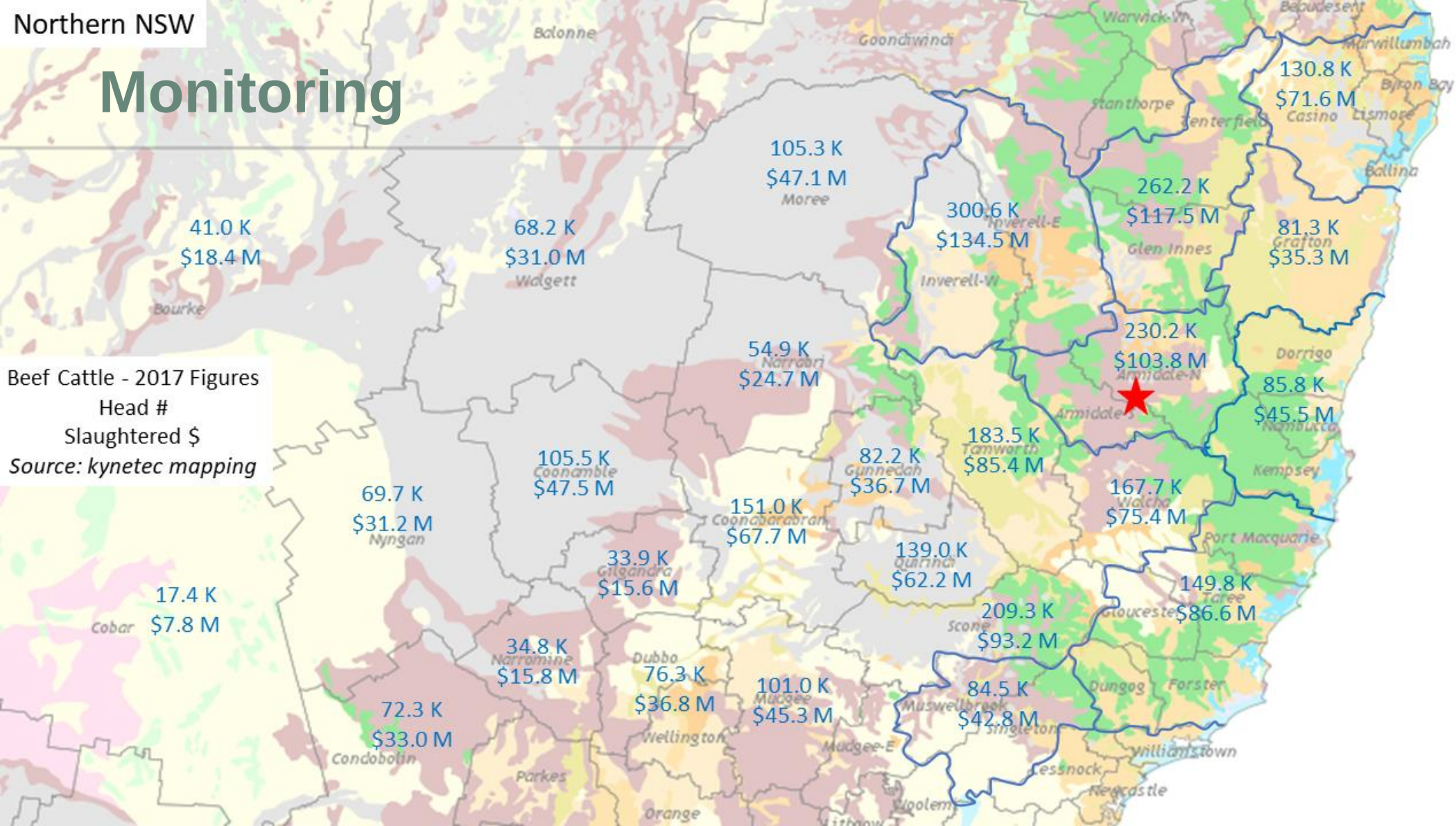
Monitoring

Beef Cattle - 2017 Figures

Head #

Slaughtered \$

Source: kynetec mapping



Beetles Near You ?

NRM: **Riverina**

STATE: **NSW**

Bubas bison (autumn, winter, spring)

Euoniticellus africanus (summer, autumn, spring)

Euoniticellus fulvus (summer, autumn, spring)

Euoniticellus intermedius (summer, autumn, spring)

Euoniticellus pallipes (summer, autumn, spring)

Geotrupes spiniger (autumn, winter, spring)

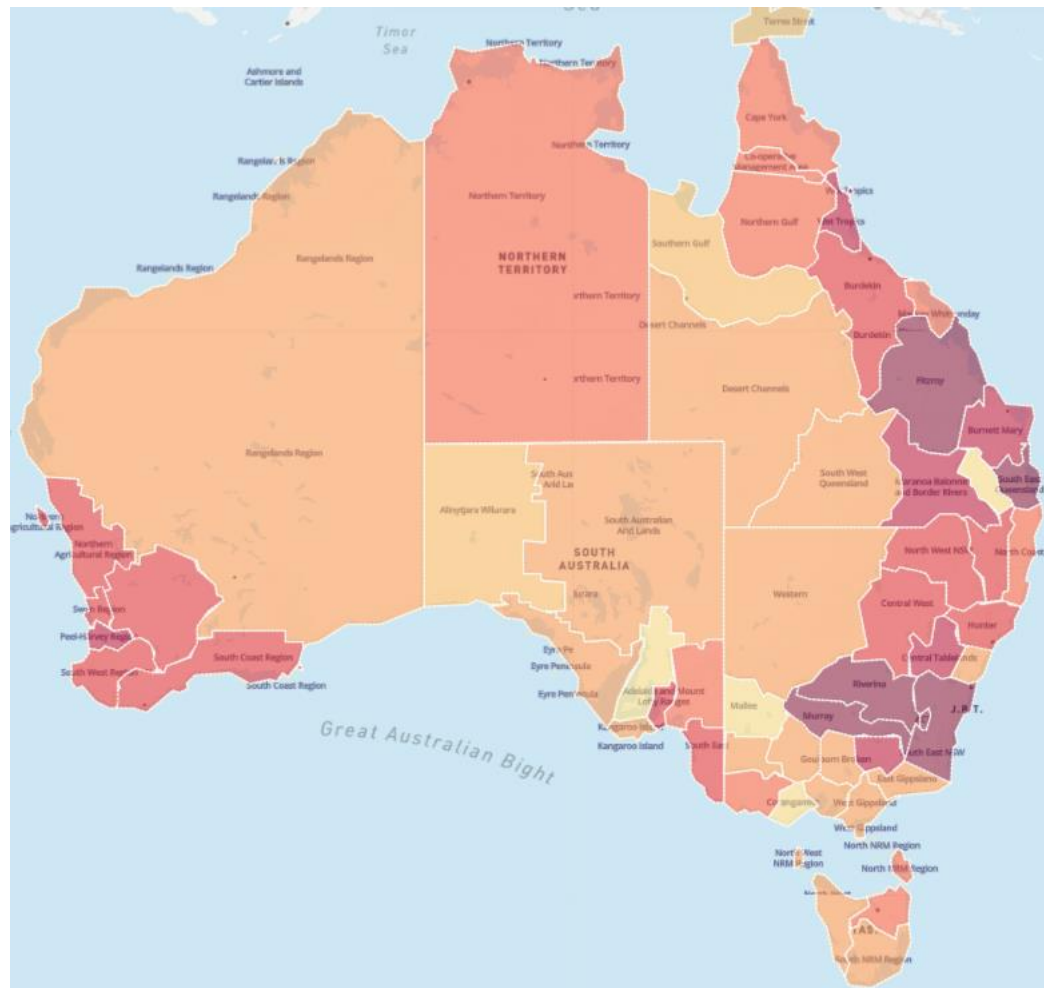
Onitis aygulus (summer, autumn, spring)

Onitis alexis (summer, autumn, spring)

Onthophagus binodis (summer, autumn, spring)

Onthophagus gazella (summer, autumn, spring)

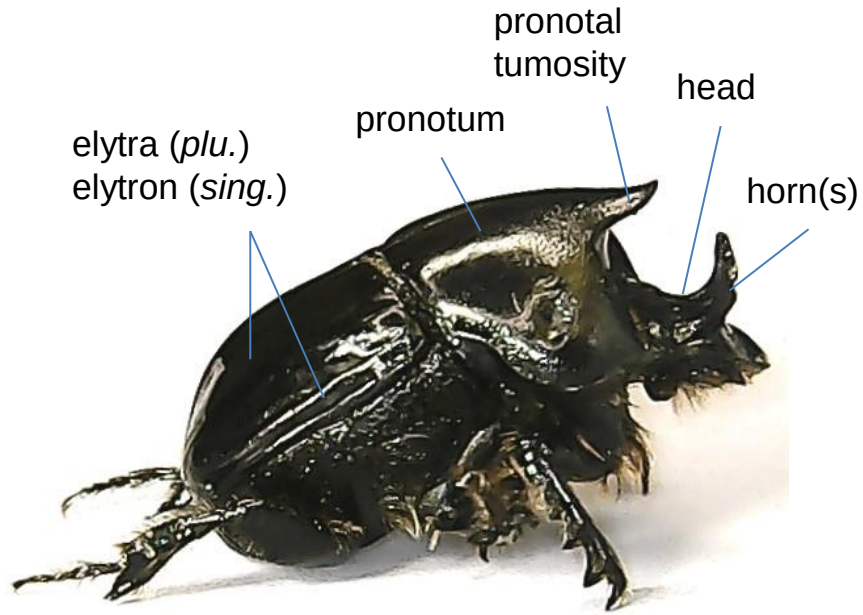
Onthophagus taurus (summer, autumn, spring)



Beetles with benefits.

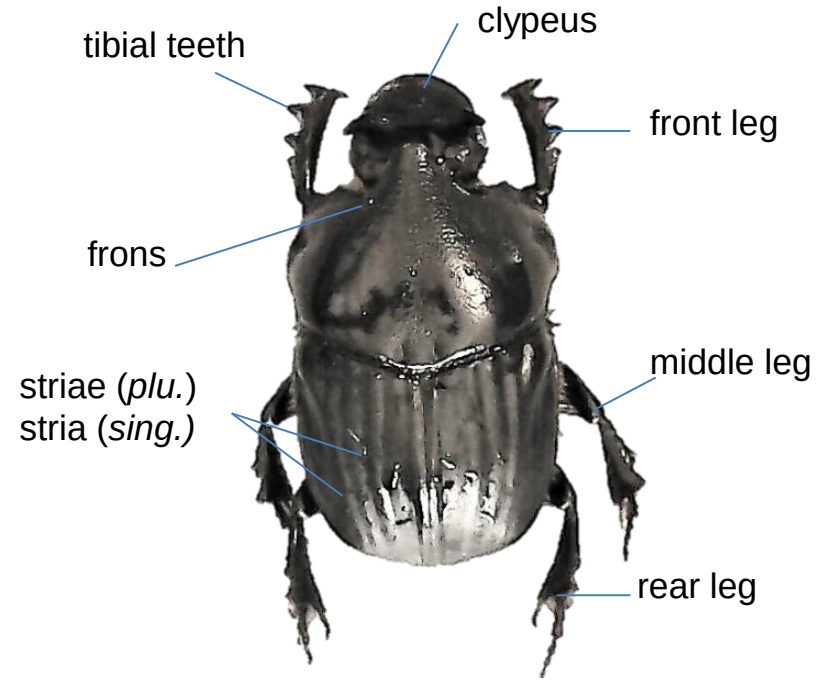


Introduction to Beetle Anatomy



5 mm

lateral view



dorsal view



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Bubas bison



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Onthophagus australis



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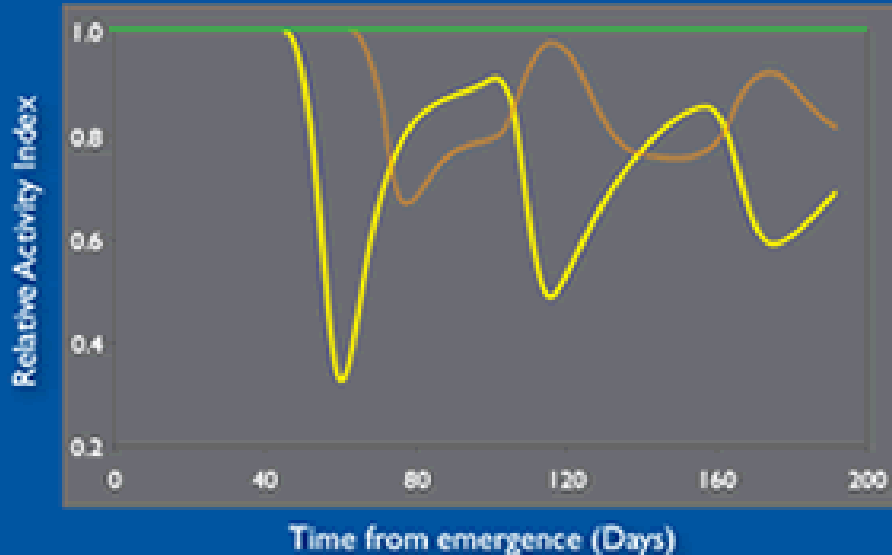
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**DUNG
BEETLE**

Ecosystem Engineers

CSIRO Dung Beetle Project 1968-1992



After emergence of a new generation of beetles, dung from cattle treated with Ivomec Eprinex Pour-On reduced dung beetle activity following treatment at 14 days (yellow) and 28 days (orange) after treatment compared to cattle either untreated or treated with Cydectin Pour-On (Green).

This graphs shows the expected activity in dung beetle species that produce batches of offspring in the breeding season, such as *Onthophagus gazelle*⁶.

<https://au.virbac.com/health-care/cattle-worms/how-dung-beetles-can-help>

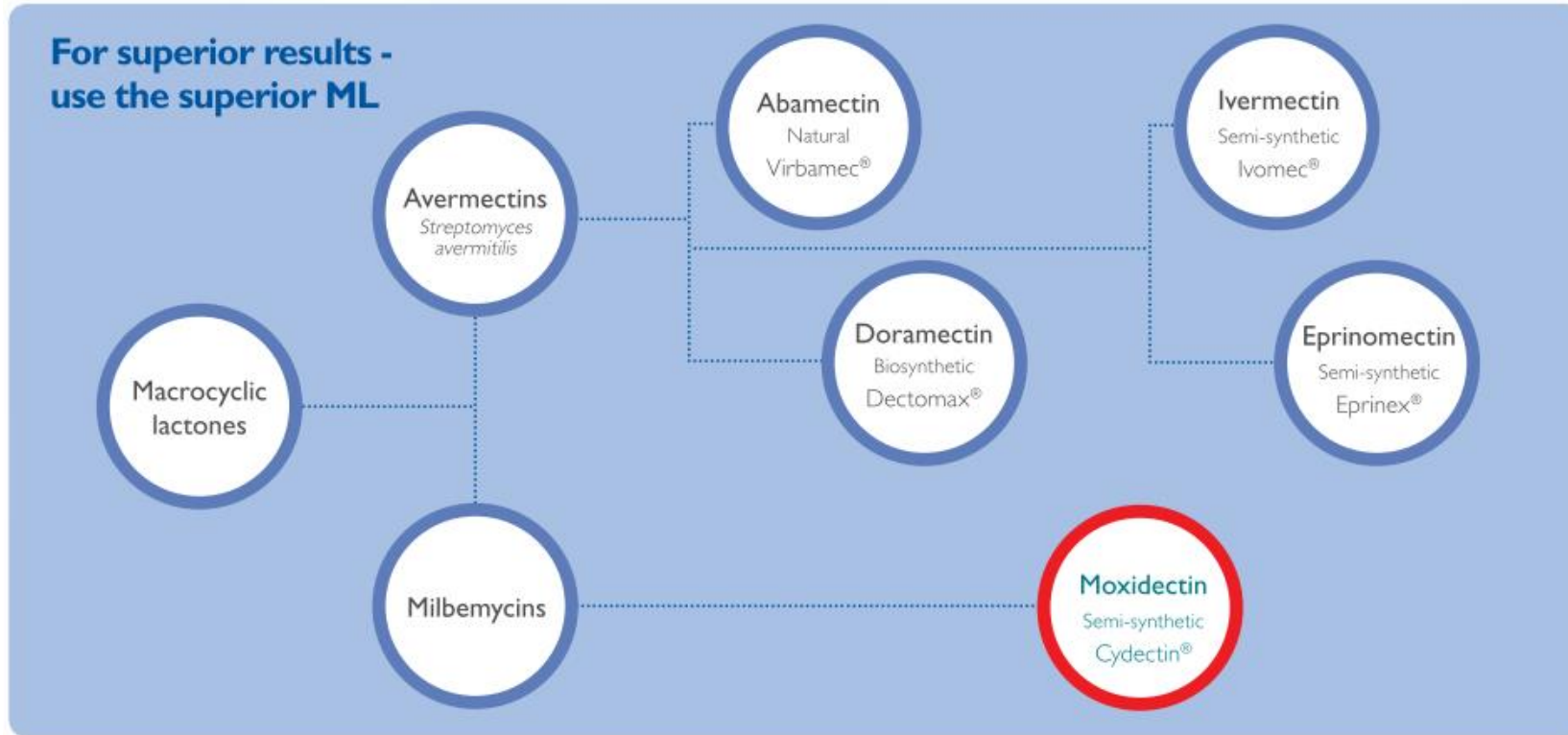


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Drenches



<https://au.virbac.com/files/live/sites/au-public/files/pdf/livestock/Dung-beetle-friendly.pdf>



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Drenches

CSIRO reported effect of ML's on dung beetles⁴

An independent trial conducted by the CSIRO reported the following effects of ML drenches as Pour-On or injectable application.

Dung Beetle Stages	Mature Adults	Young Adults	Breeding Females	Eggs/Larvae
Dectomax, Ivomec, Eprinex, Eclipse	No Known Effect	Increased Mortality	Reduced Breeding	Increased Mortality
Cydectin	No Known Effect			

<https://au.virbac.com/files/live/sites/au-public/files/pdf/livestock/Dung-beetle-friendly.pdf>



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Bubas bison



Male



Female



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Bubas bison

13 - 19 mm long



Male



Female



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Euoniticellus fulvus

8 - 12 mm long



Male: Two ridges
near front of the
head

Female: lack the
two ridges



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Onitis alexis

13 - 20 mm long



Male



Female



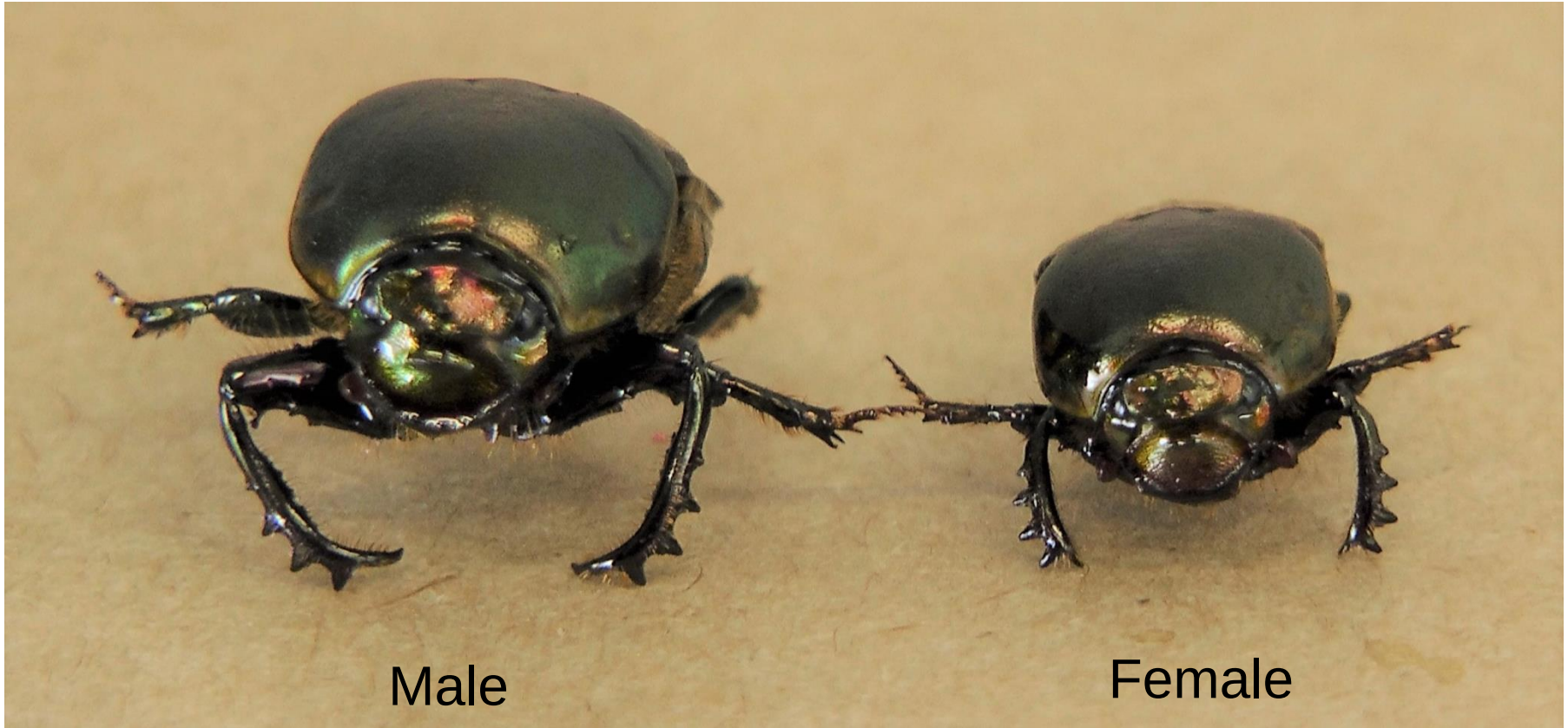
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Onitis alexis

13 - 20 mm long



Male

Female



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Onitis aygulus

20 - 25 mm long



Male



Female



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Onitis aygulus

20 - 25 mm long



Female

Male



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How to to *O alexis* from *O aygulus*



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How to tell *O alexis* from *O aygulus*



O alexis (male)



O. aygulus (male)



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Onthophagus binodis

11 - 13 mm long



Male



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Onthophagus taurus

8 - 10 mm long



Male



Female



Beetles with benefits.

Onthophagus mnischechi

20 - 25 mm long



Beetles with benefits.



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Onthophagus australis

8 - 12 mm long



Male



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Beetle activity in sheep dung



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