



- HOW TO USE DUNG BEETLES TO SEQUESTER CARBON IN YOUR SOIL -

THE HUMBLE DUNG BEETLE IN AUSTRALIA ●●●

Australia has several hundred dung beetle species which have adapted to processing the small, dry dung of our native marsupials.

Native dung beetles are active in winter, which unfortunately, doesn't coincide with summer breeding local flies.

When sheep, horses and cattle were introduced to Australia, native dung beetles were not well adapted to deal with these animals' large, wet dung pats which sometimes persisted in place for more than a year and led to new or exacerbated environmental issues.

Fly populations increased because their larvae developed in the dung which led to an over-abundance in the use of pesticides to control flies.

Other environmental issues included increased disruption of the nutrient cycle and an increase in the number of dung borne pathogens. More importantly, in the context of carbon emissions, an increase in greenhouse gases (CO₂ and N₂O) occurred, lost from the dung as a gas into the atmosphere.

Since the 1970s CSIRO has tackled these problems by importing 23 exotic species of dung beetle adapted to process cattle and sheep dung. Twelve species have been introduced to WA with 10 types doing well along the South Coast and in the south-west.

Species found across much of the south-west include *Onthophagus taurus*, *Onitis aygulus*, *Euoniticellus pallipes* and *Bubas bison* as well as *Onthophagus binodis* and *Euoniticellus fulvus* along the lower coastal district (DAFWA).

DUNG BEETLES & THE CARBON STORY ●●●

Dung beetles play a critical role in breaking down dung and returning nutrients to the soil, but you may be unaware these beetles also play a role in carbon sequestration.

By moving balls of dung into the soil they directly contribute to carbon burial and sequestration. This helps to reduce the loss of greenhouse gases to the atmosphere as well as improving soil structure and nutrient content.

The 2008 Australian Government Carbon Pollution Reduction Scheme green paper indicates that beef cattle produce 11.2 per cent of Australia's greenhouse gas emissions and dairy cattle produce 2.7 per cent.

Sixty-five per cent of this is attributed to enteric (gut) fermentation in ruminants. Other livestock is responsible for another 4 per cent of the total. These emissions are primarily methane and N₂O from stored dung (for example, in feed-lots and piggeries).

There has yet to be an attempt to quantify carbon emissions from decomposition of livestock dung. Currently, the estimated worldwide 1.6 billion head of cattle produces 11 billion tonnes of fresh dung annually, which contains the carbon equivalent of 4 billion tonnes of CO₂.

Soils store substantial amounts of carbon – two to three times more than the atmosphere and four times more than terrestrial vegetation. Increasing the store of soil organic carbon will help fight global warming (*Doube and Marshall, 2014*).

THE LIFE CYCLE OF A DUNG BEETLE

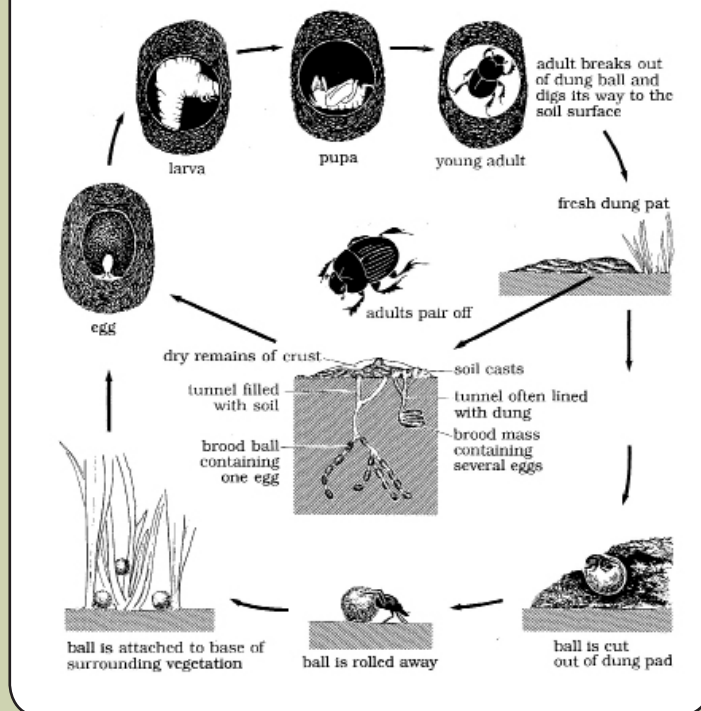


Diagram reproduced courtesy of CSIRO Publishing (*Tyndale-Biscoe, 1990*).

Tunnelling beetles bury dung throughout a soil's profile (up to 0.5m below the surface), where it decomposes and produces CO₂ which builds the store of soil organic matter. This promotes pasture root growth, which further increases the amount of carbon stored in the soil (*Doube and Marshall, 2014*). However, at present there is no methodology for claiming the carbon sequestered by dung beetles.

Recycling at its best!

THE SIDE BENEFITS OF DUNG BEETLES ●●●

The dung beetle doesn't just sequester carbon back into the soil profile, but also contributes many other benefits to the land manager by:

- Reducing the nutrient run-off into dams, streams and waterways.
- Reducing algal blooms in waterways.
- Increasing water infiltration into soil.
- Burying dung and thus nutrients into plant root zone.
- Increasing soil fertility.
- Reducing the need for chemical fertilizers.
- Reducing pasture fouling.
- Tunnelling activity of beetles aerates soil.
- Reducing bushfly and buffalo fly numbers.
- Reducing parasite loads on livestock.
- Rapid burial of dung pads removes fly breeding habitat and reduces water content in the dung preventing larval incubation from occurring.



Birds and foxes often prey on dung beetles and it's not unusual to see fragmented dung pads in an area where predators have gone in search of them. However, dung beetles have evolved to escape by rapidly crawling into their tunnels when the dung is being disturbed. The beetles also carry carnivorous mites which feed on small larvae and eggs in the dung pad in which they also reproduce and are carried by beetles from one pad to another.

QUICK GUIDE TO ESTABLISHING A DUNG BEETLE COLONY ●●●

If your livestock dung is sitting in your paddocks for an extended time, you may have lost your dung beetles or they may be in a dormant state.

Your farm will benefit from re-establishment of these beetles. A quick web search will give you much information on the topic, however we have added seven simple steps for success.

- Research which species have already been released in your area.
- Source your beetles, making sure the seasonal conditions are favourable. A quick web search will identify appropriate Australian suppliers (check current biosecurity restrictions).
- Release the beetles as soon as possible after transportation.
- Choose your release site carefully:
 - Avoid waterlogged areas and areas that have a high water table.
 - Avoid rocky or very sandy areas.
 - Avoid bushland.
 - Release in open pasture.
 - Avoid sites sprayed with pesticides (see below for further details).
- Do not widely disperse your beetles, keep them to an area no larger than 1/2 ha, this ensures sufficient population density to increase the chance of pairing during breeding season.
- Ensure there is adequate food (dung) available for the beetles.
- Check which drenches have been used on stock to ensure the dung is not toxic to beetles.

THREATS FACING DUNG BEETLES ●●●

Dung beetles are very susceptible to pesticides and other synthetic chemicals such as drenches. The timing of treatment can be critical; if possible don't use harmful chemicals during the season when the dung beetles are active. Primarily, avoid using drenches whose active ingredients can kill or interrupt the beetle's life cycle.

Drenches that will kill dung beetles include *Pyrethroid ectocides*, used to kill flies, lice and ticks. Common brands that fall under this category includes *Cypermethrin*, *Deltamethrin* and *Flumethrin*.

Also avoid drenches that are harmful at different stages of the dung beetles life cycle (eggs, larvae, young adults and breeding females) from the *Avermectin* group including *Ivermectin*, *Doramectin*, *Eprinomectin* and *Abamectin*. Drenches tested by CSIRO that have no harmful effects on the dung beetles at any stage are from the *Anthelmintics* group. These include *Albendazole*, *Fenbendazole*, *Mebendazole* and *Oxfendazole*. Products from the *Zole* group (such as *Triclabendazole*) have also been reported as non-harmful to dung beetles. The *Clear* group has also been said to be safe (*Morantel and Levamisole*, 2015).

Animals, including foxes, ibis, ravens and magpies, prey on dung beetles and are known to make populations unviable when newly established. The highest risk is for new or starter colonies where insectivorous birds need to be discouraged for the first few days. Once established, dung beetle populations generally withstand animal predation. There's no evidence fertilisers are toxic to dung beetles and may increase the efficiency of fertilizer penetration in your paddock.

RESOURCES ●●●

- www.dungbeetleexpert.com.au/climate-change, *Doube and Marshall (2014)*.
- *Dung Down Under - Dung Beetles for Australia*, www.dungbeetlesolutions.com.au/buy-dung-down-under
- www.agric.wa.gov.au/land-use/control-bush-flies-dung-beetles
- www.northeast.landcarevic.net.au/dungbeetle/projects/do-it-with-dung/dung-beetle-resource-package/3-Step-by-Step-Guide.pdf, reference by *Morantel and Levamisole (2015)*
- www.candelosalers.com/web/Dung_Beetle_Facts.html
- *Tyndale-Biscoe, Marina (1990). Common Dung Beetles in Pastures of South-eastern Australia*. Copyright CSIRO 1990. Reprinted 2001. Published by CSIRO Publishing, Melbourne Australia - <http://www.publish.csiro.au/pid/43.htm>. Reproduced with permission.

ABOUT THE EMISSIONS REDUCTION FUND (ERF) ●●●

The Emission Reduction Fund (ERF) is an Australian Government program allowing individuals or entities to access Australian Carbon Credit Units (ACCU) by conducting approved projects that either sequester carbon or reduce the emission of greenhouse gases. For a detailed explanation of the ERF, visit: www.cleanenergyregulator.gov.au/Carbon-

Farming-Initiative/Pages/default.aspx. The WA Government's Royalties for Regions program and the Department of Agriculture and Food WA, have produced fact sheets which analyse and capture current and emerging carbon farming information related policy, legislation and science to identify carbon farming opportunities and its associated risks.

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