



# Grasslands as C sinks and their benefits for biodiversity & the water cycle

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# **Ecosystem services of extensively managed grasslands**

An aerial photograph showing a herd of approximately 15 cattle of various breeds (white, grey, brown) grazing in a lush green grassland. The cattle are scattered across the frame, with some standing and others lying down. Long, dark shadows are cast by the animals, indicating a low sun position. The grass is a vibrant green, and there are some darker patches of soil or manure visible.

## Extensive grasslands provide a range of ecosystem services

- Gene, species, habitats and landscape biodiversity
- Water supply and flow regulation
- Soil erosion control
- Health and wellbeing benefits
- Cultural traditions
- FOOD & survival strategy in many marginal rural areas

Conceptual clash!

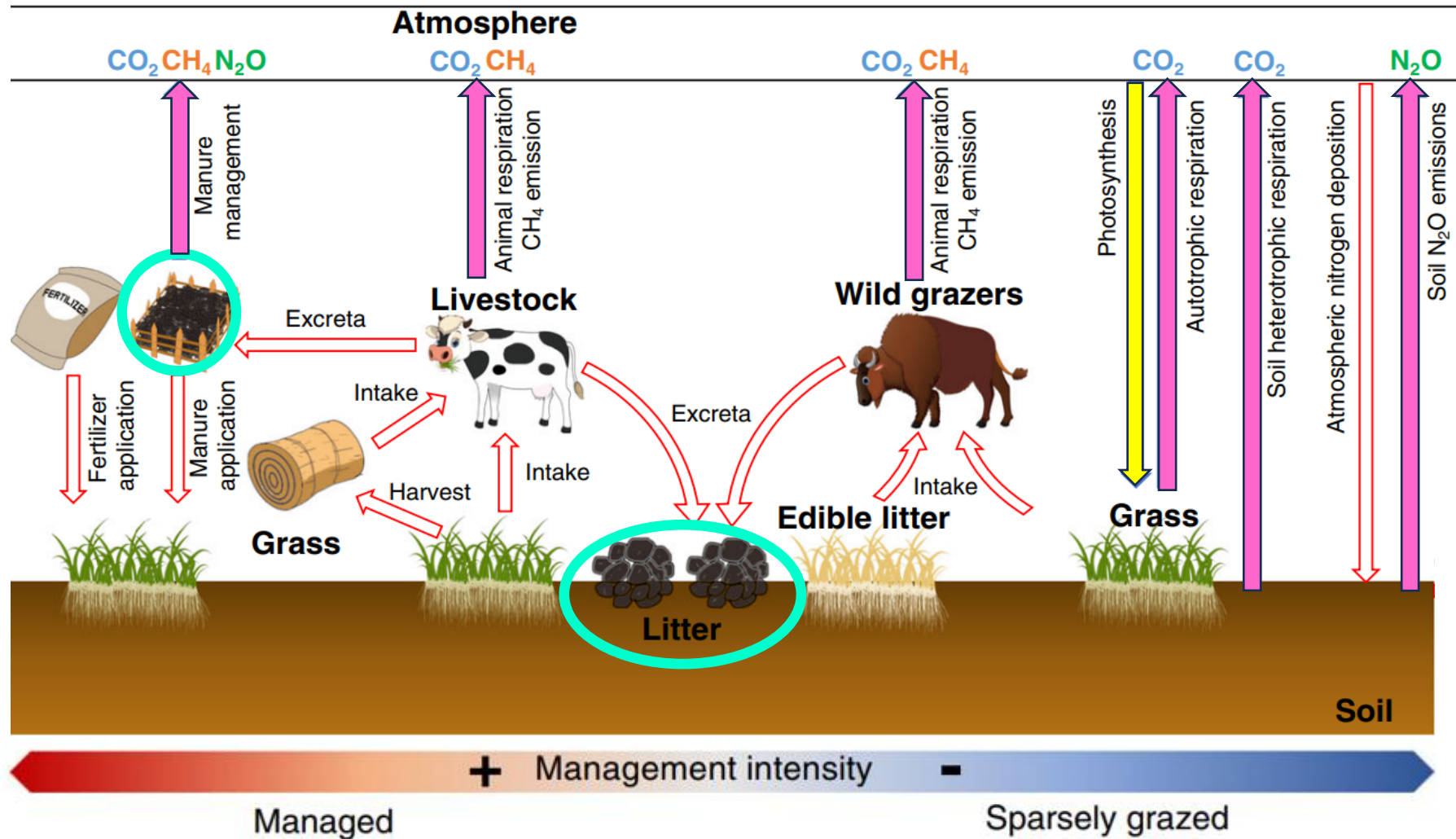


**Lab-grown meat instead of meat from grass-fed livestock**

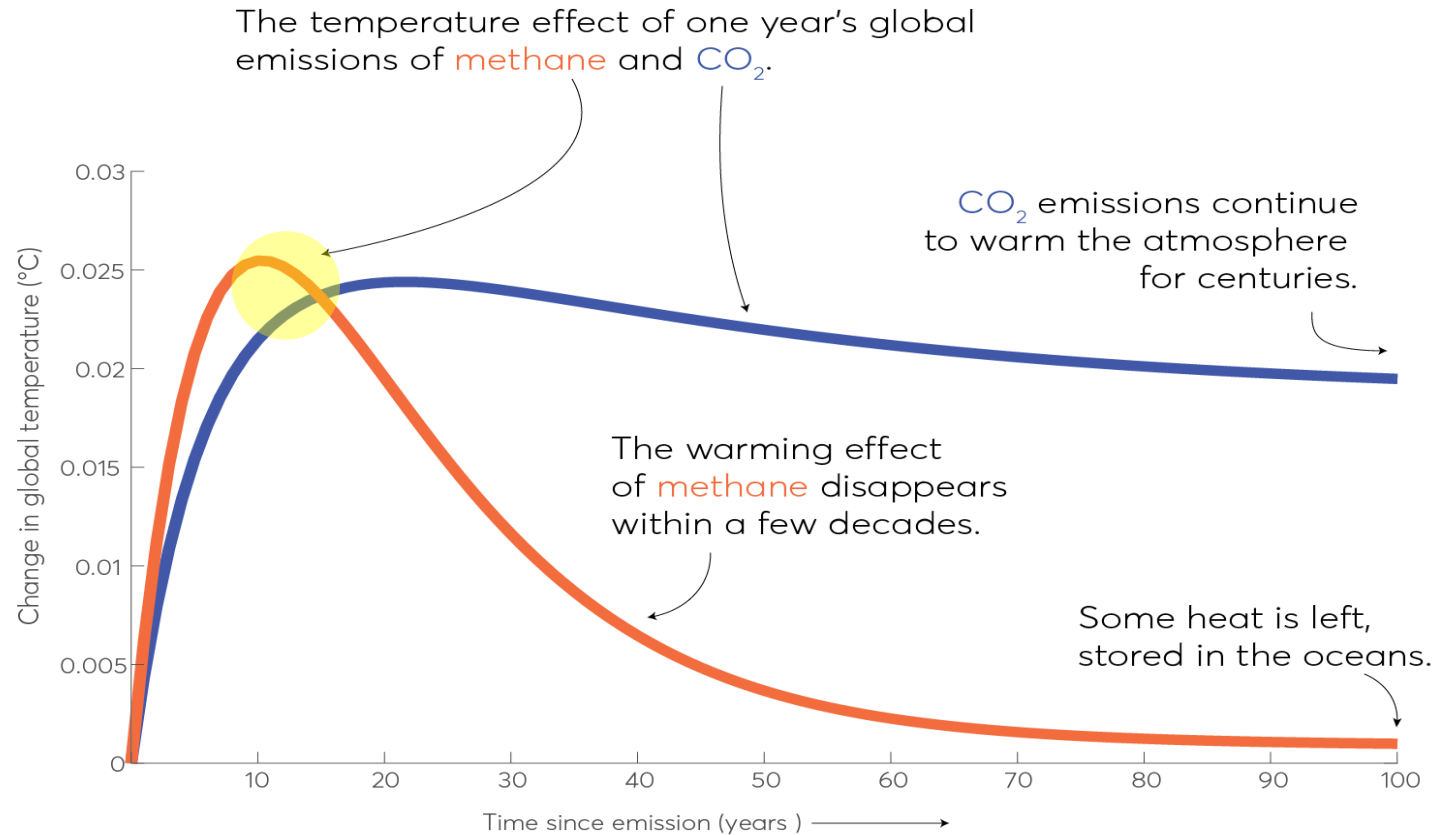


# **Extensively managed grasslands and climate change**

# Processes and the greenhouse gas fluxes in grassland



## Warming from methane decreases sharply after ten years.

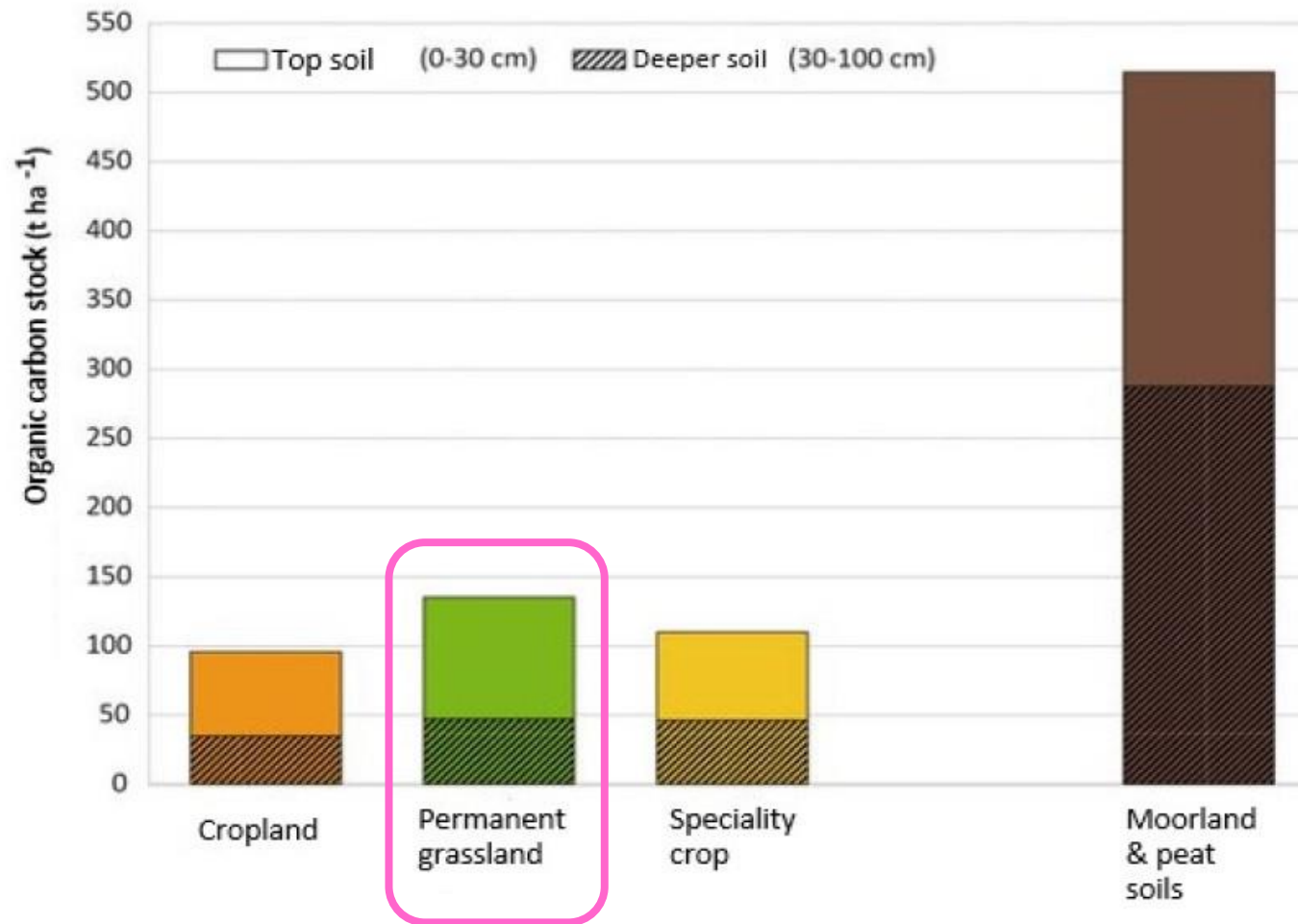




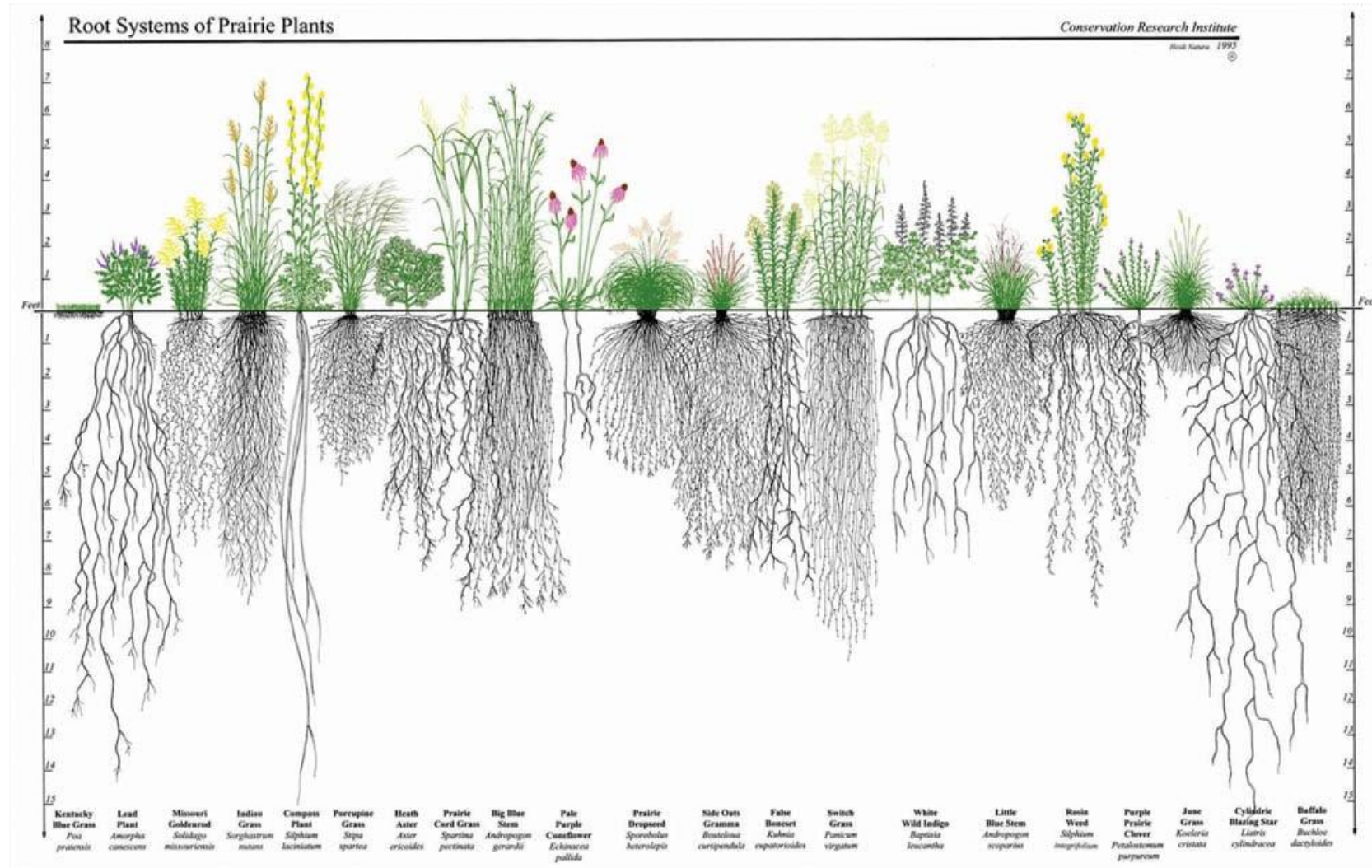
## Carbon sequestration in permanent grasslands

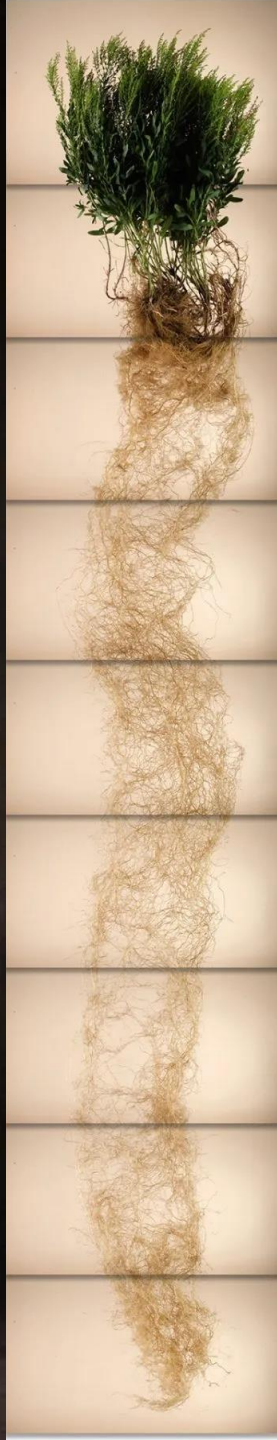
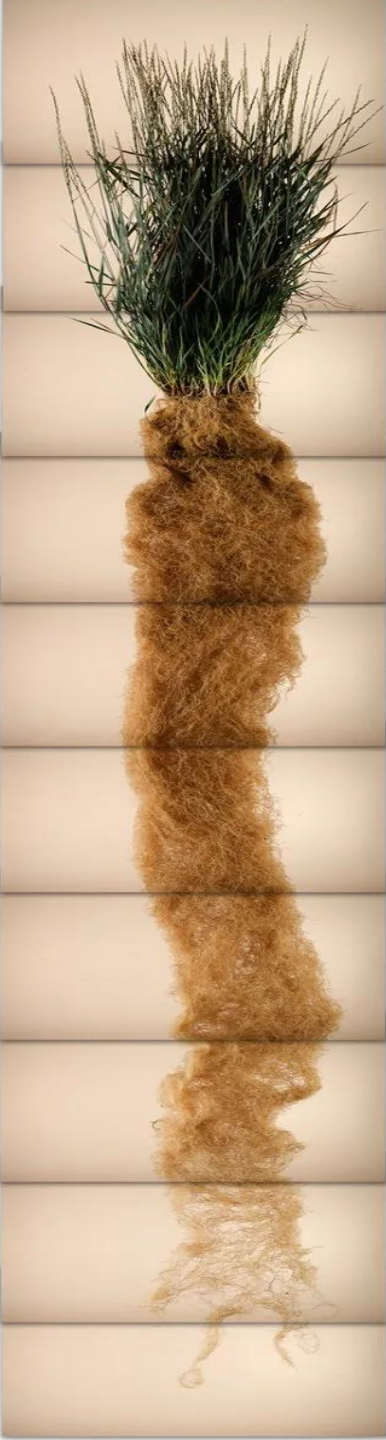
- Definite; equilibrium reached after 50-70 years
- 10 t organic matter is required for 1 t stable C

## Mean stocks of organic carbon in agricultural soils in Germany



# Increased species-richness in grasslands – particularly in communities of deep-rooting plant species and legumes increases carbon sequestration

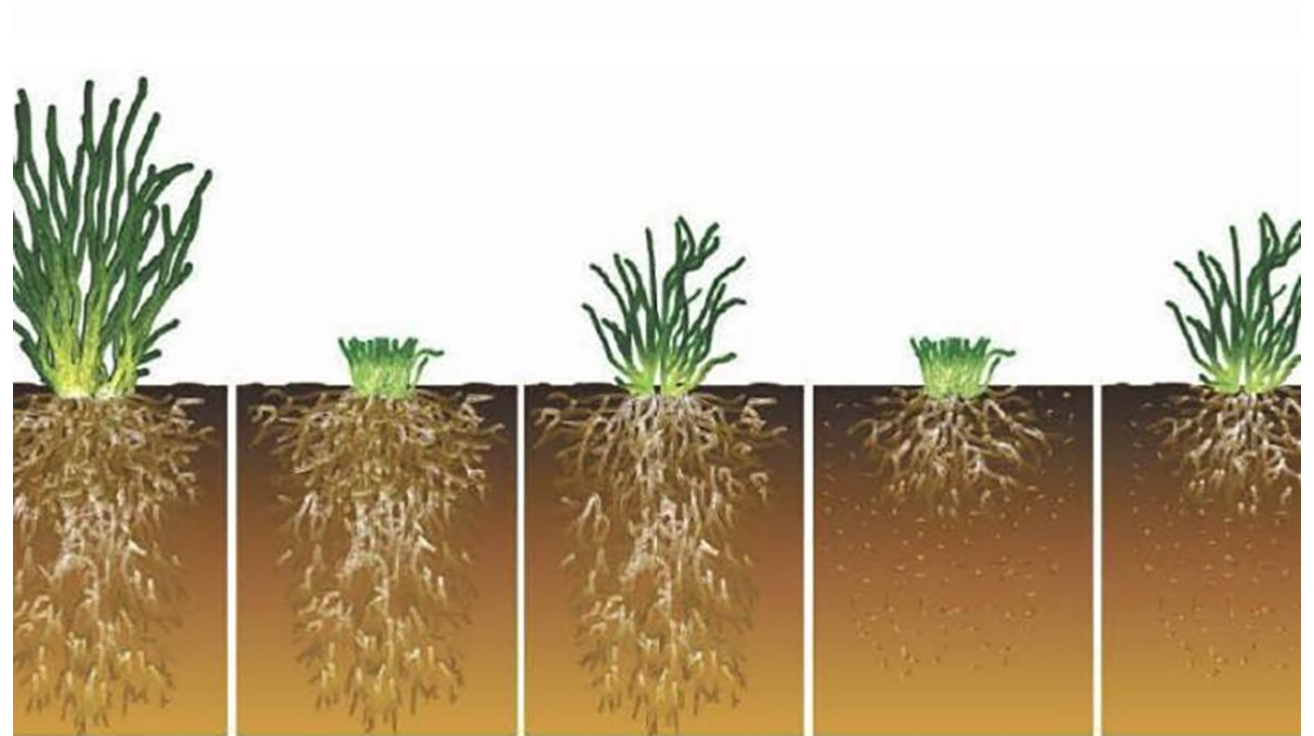
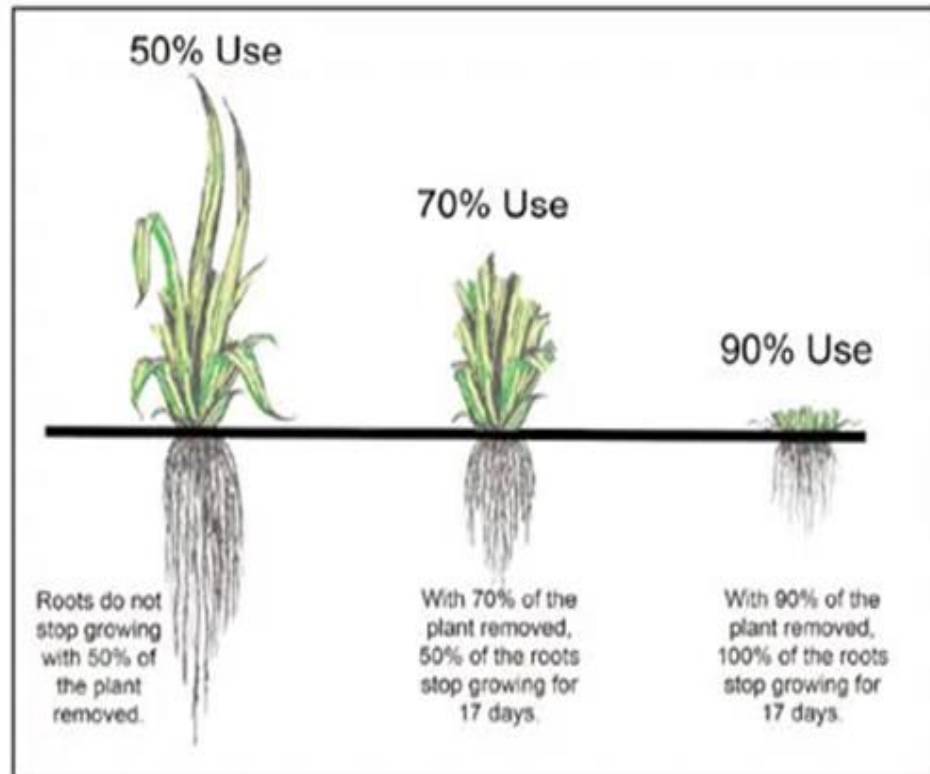




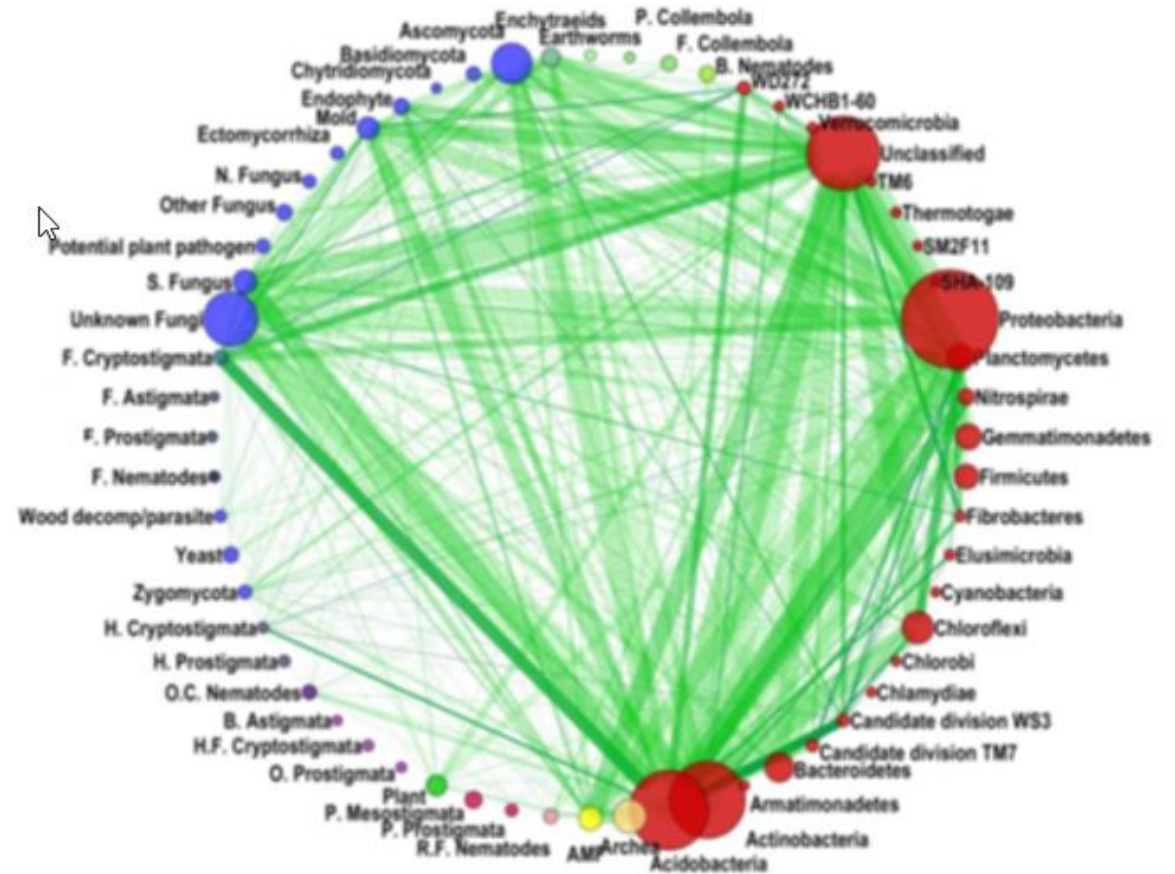
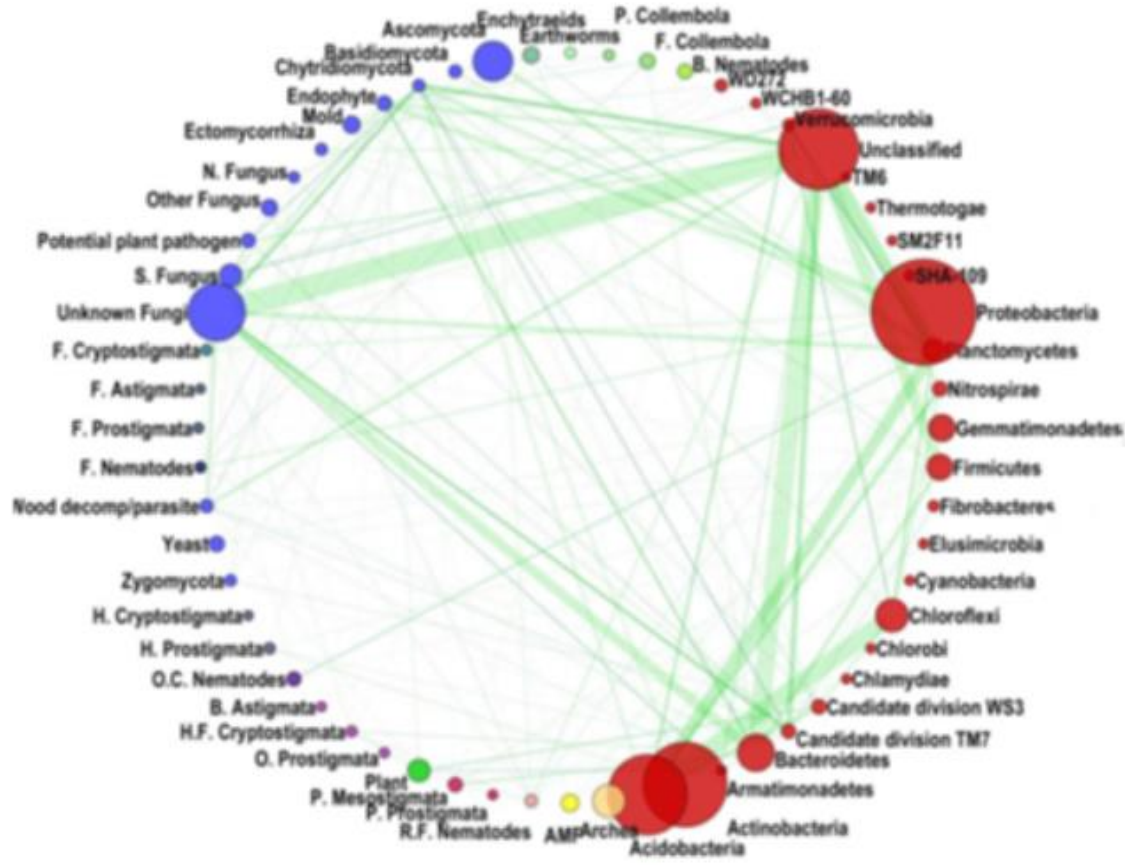
## Overgrazing

... is determined by the amount of time that livestock are allowed to graze

... not by the actual amount of forage that they utilise



## Soil microbiome species subgroups in poor (left) and healthy grassland soil (right)



A close-up photograph of a large, dark brown, moist pile of animal manure in a lush green grassy field. Several large, black, oval-shaped dung beetles are clustered on the top of the manure pile, working on it. One beetle is also visible on the grass to the left of the pile. The grass is vibrant green and appears to have some dew or moisture on its blades.

**Dung beetles: keeping pasture healthy and livestock happy**

## Negligible reduction of GHG emissions by dung beetles



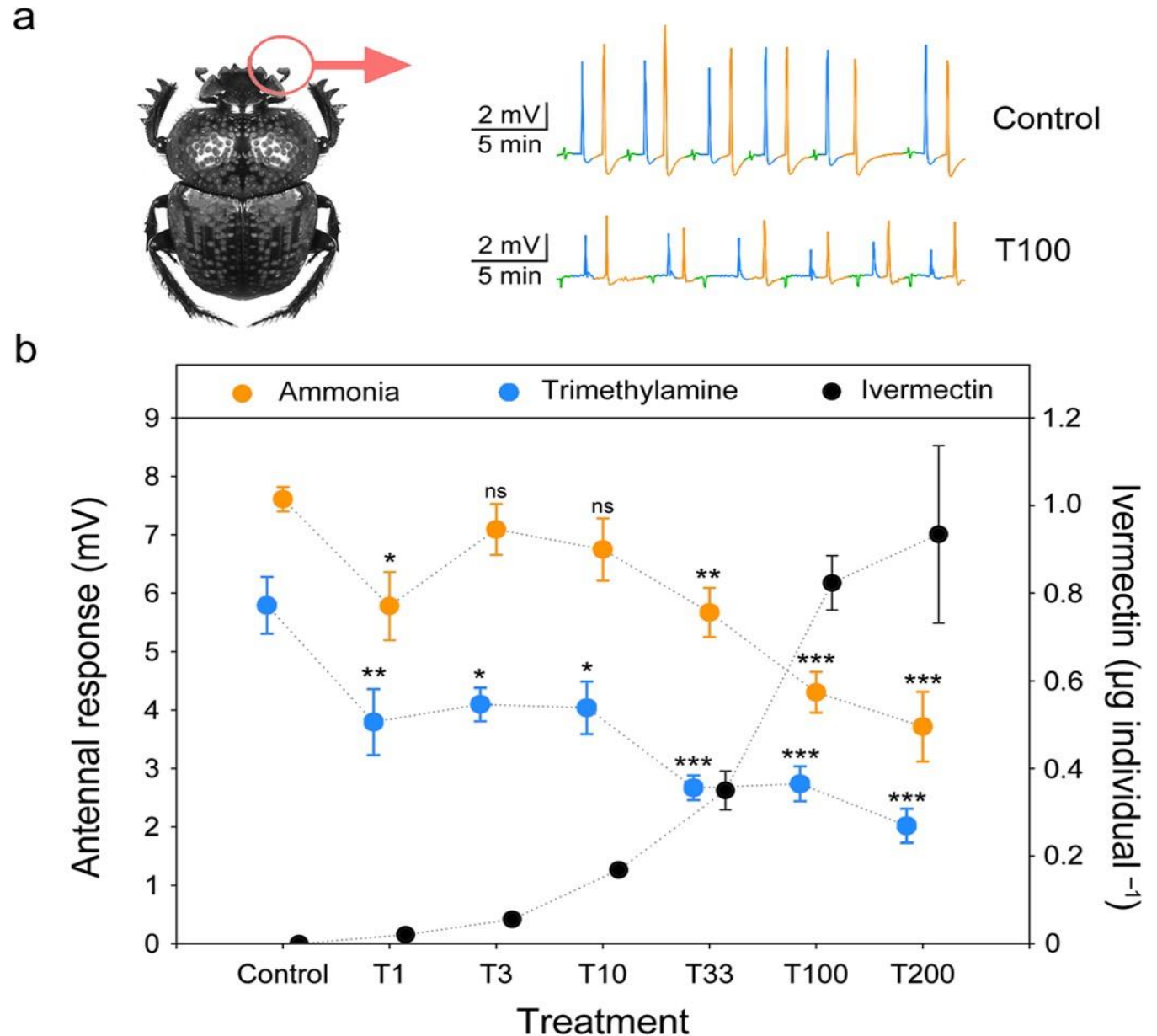
Source: Slade *et al.*, 2016

## Low doses of some vet medicines decrease sensory and locomotor capacities in dung beetles – the case of ivermectin

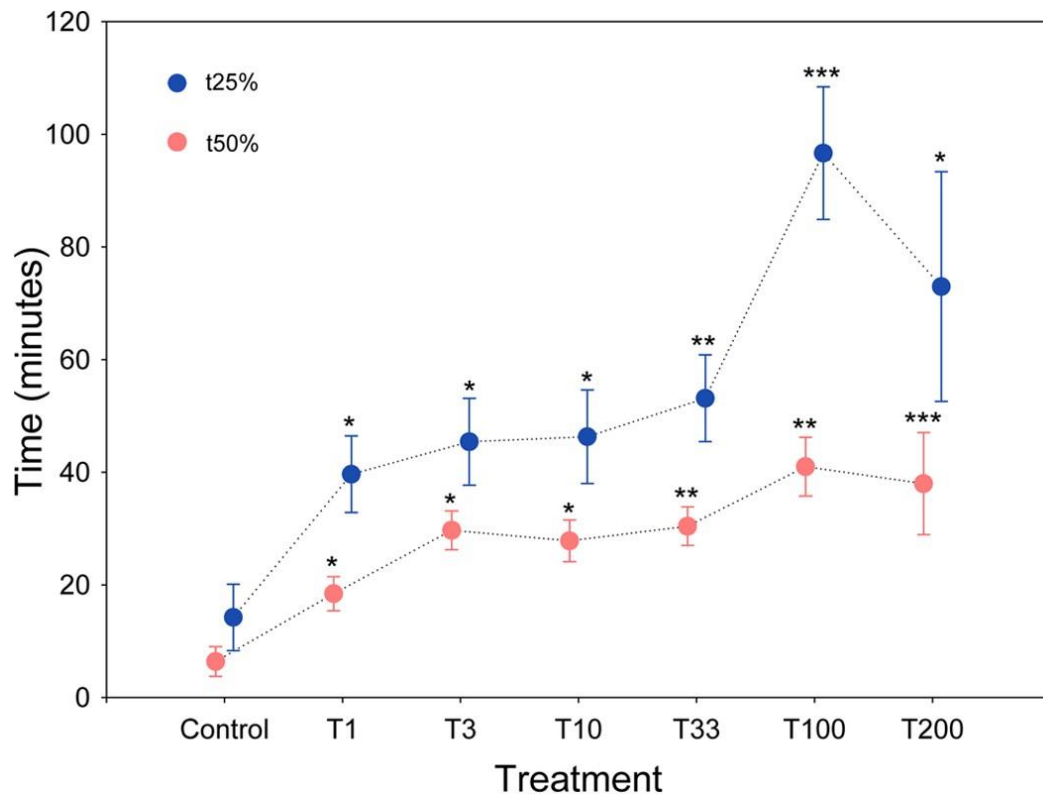
... preventing them from performing basic biological activities.

These effects are observed at concentrations lower than those usually measured in the dung of treated livestock.

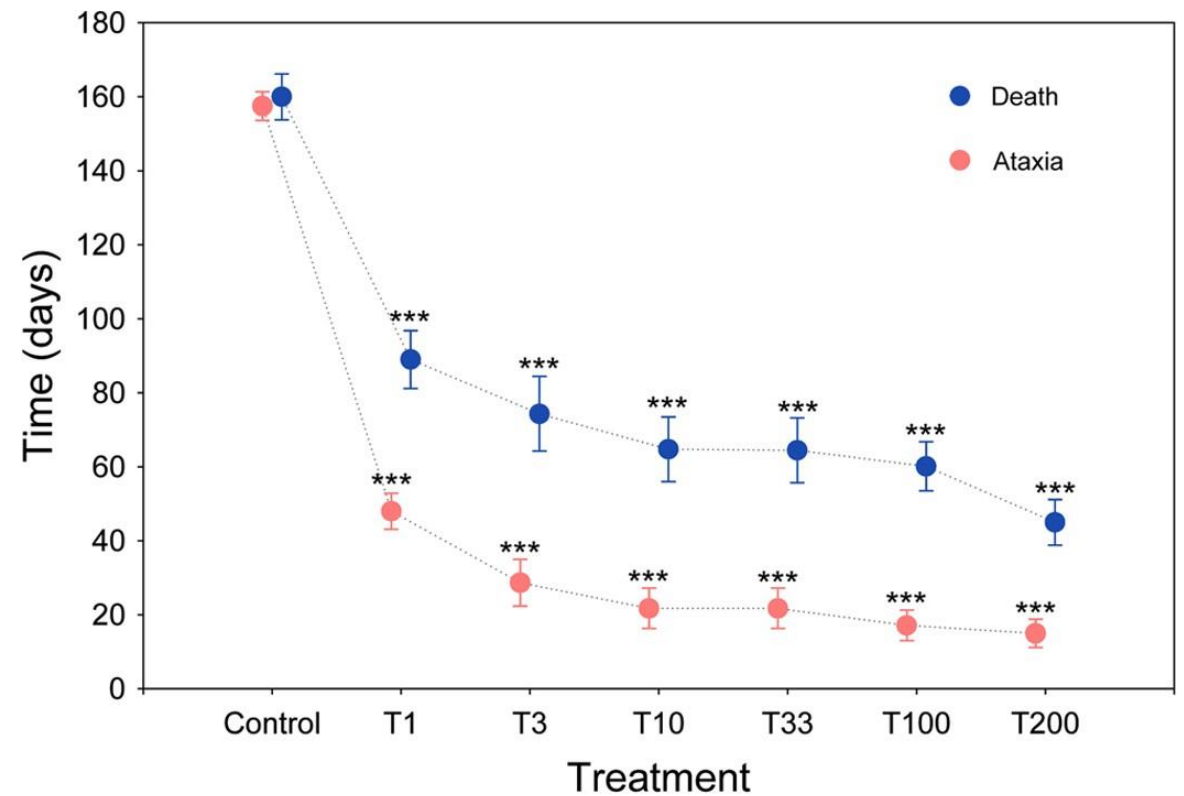
Source: [Verdú, et. al., 2015](#)



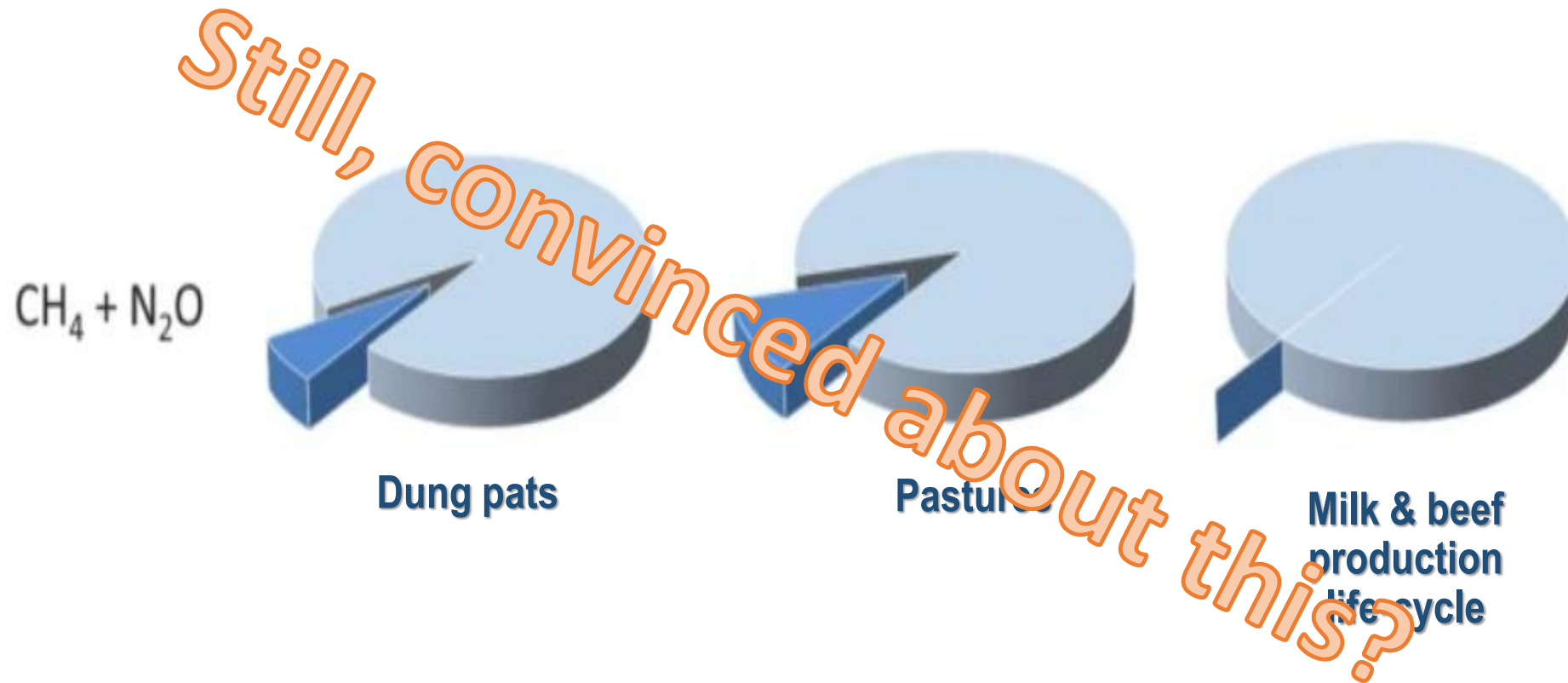
## Ivermectin alters the foraging behaviour of dung beetles



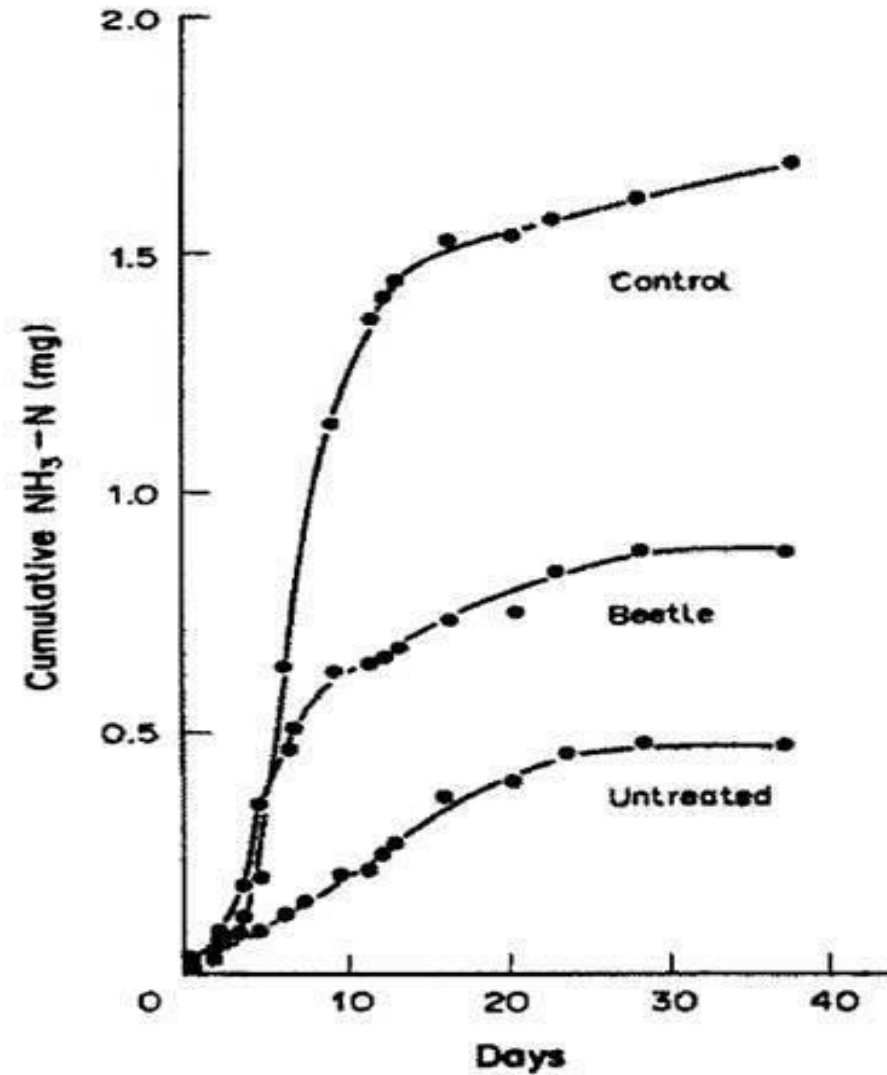
## Ivermectin causes paralysis and death of dung beetles



## Negligible reduction of GHG emissions by dung beetles



**Dung beetles reduce by about 50% ammonia emissions from grasslands!!!**



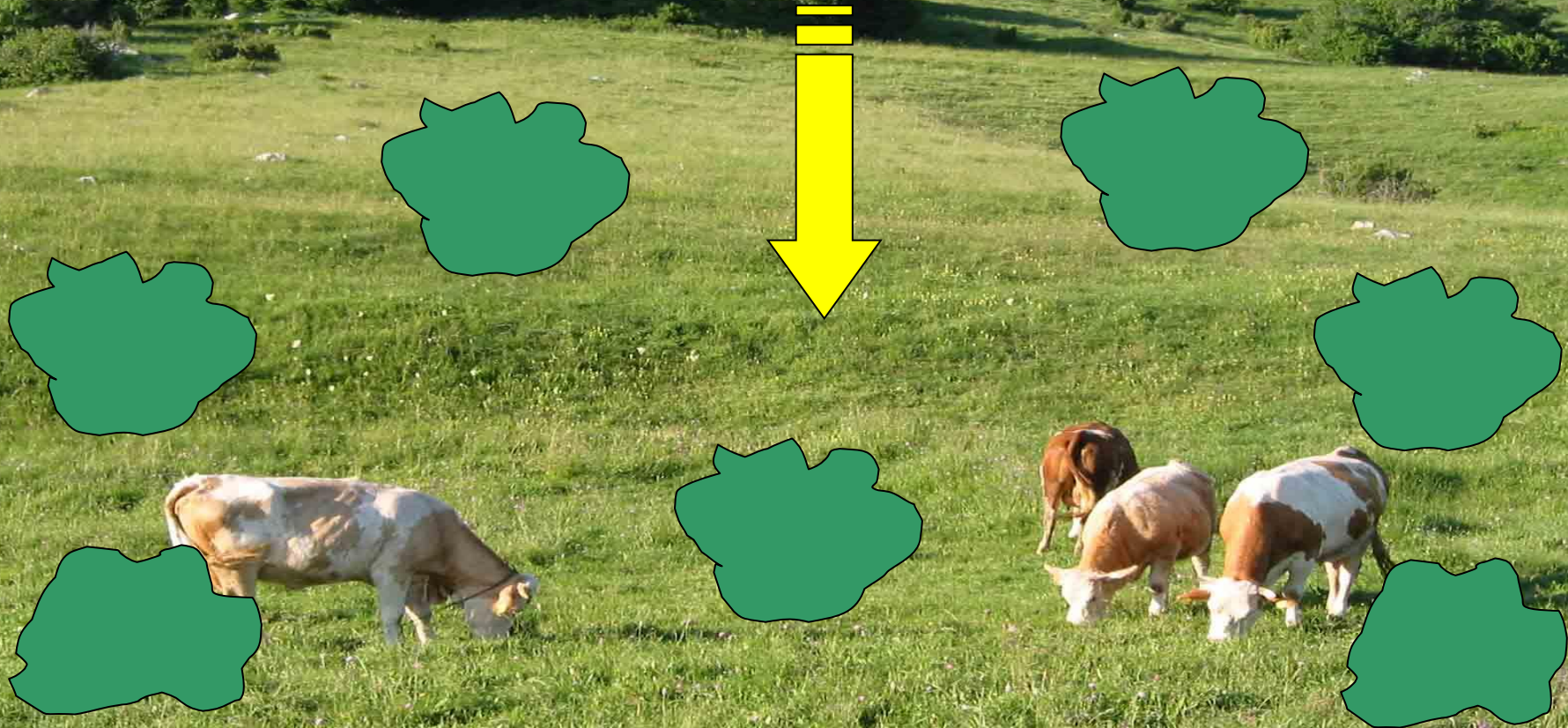
Source: Yokohama *et al.*, 1991

# **Extensively managed grasslands and biodiversity**



**Biodiversity benefits**

Abandonment leads to loss of biodiversity



## Result-based payments based on the scans of the mass of earthworm castings



# **Extensively managed grasslands and water cycle**



**Water absorption & retention**

# CONCLUSIONS

## **Key takeaway messages on AES of extensively managed grasslands:**

**Focus on those in white!**

- 1. Climate: C sequestration limited,** GHG emissions are lower
- 2. Biodiversity:** top & untapped!
- 3. Water regime: top – but old news!..** unless monetised
- 4. Air:** ammonia emission is lower
- 5. Others:** key for maintaining rural fabrics & population in marginal areas

**INSIST ON TRADE-OFFS!**

**Thank you for your attentive listening!**

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