

# Anecic earthworms and associated ecosystem services under pressure in a ley-arable crop rotation

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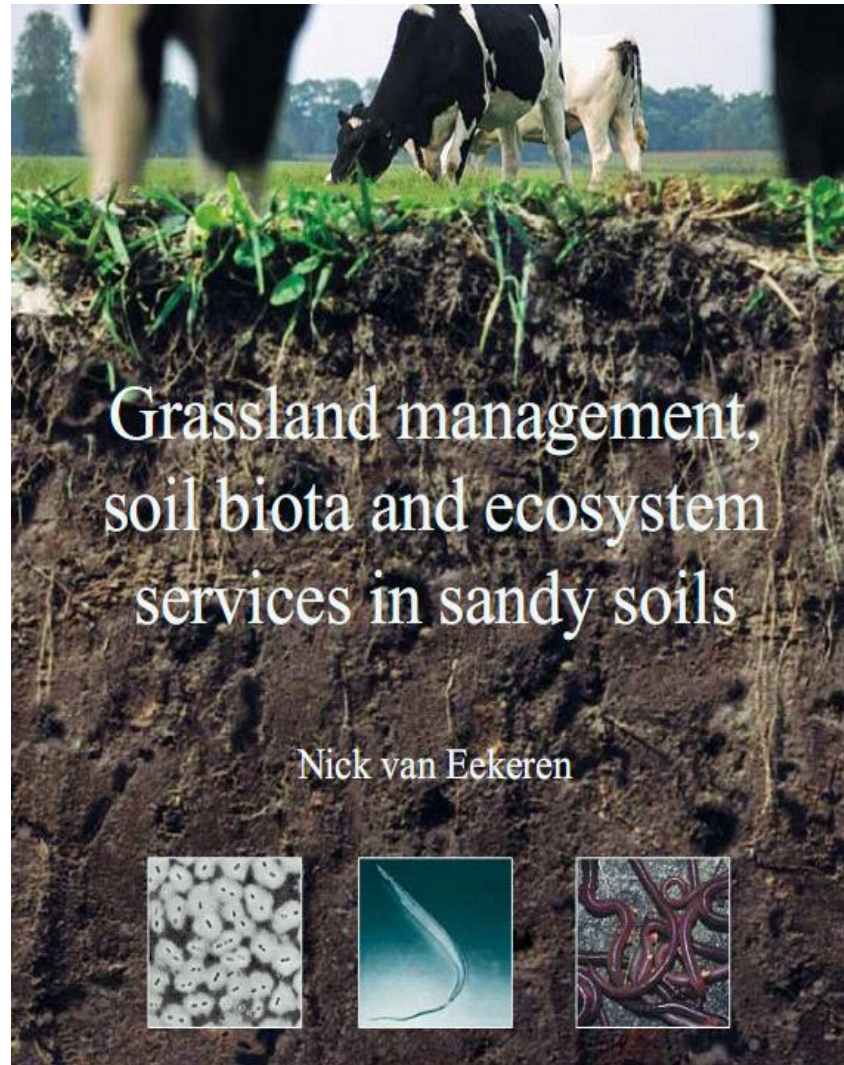
<sup>4</sup> Wageningen University, The Netherlands



# Content:

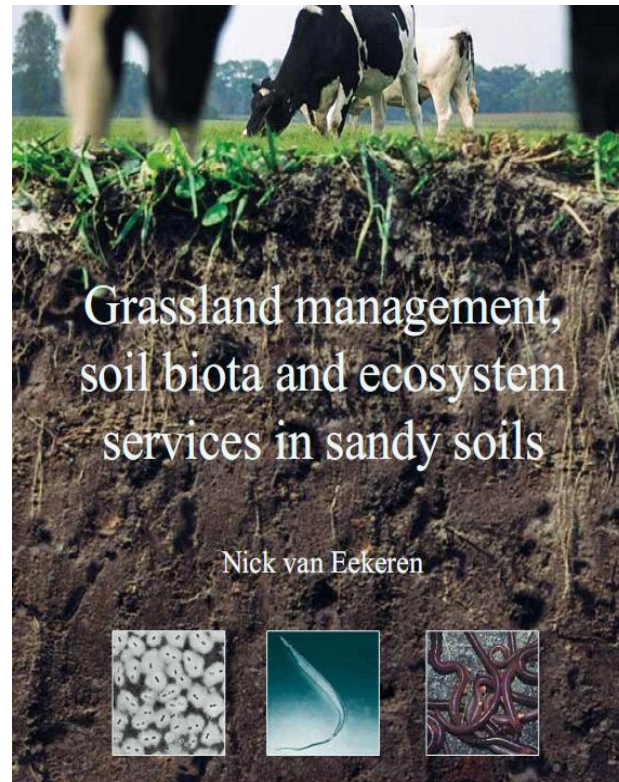
- Framework research
- Case study: Ley-arable crop rotation

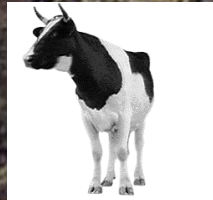
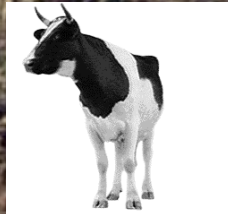
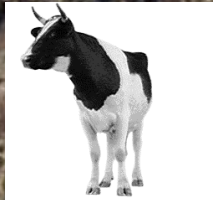
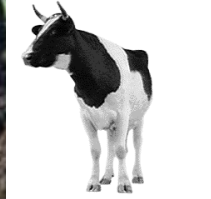
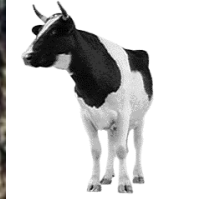
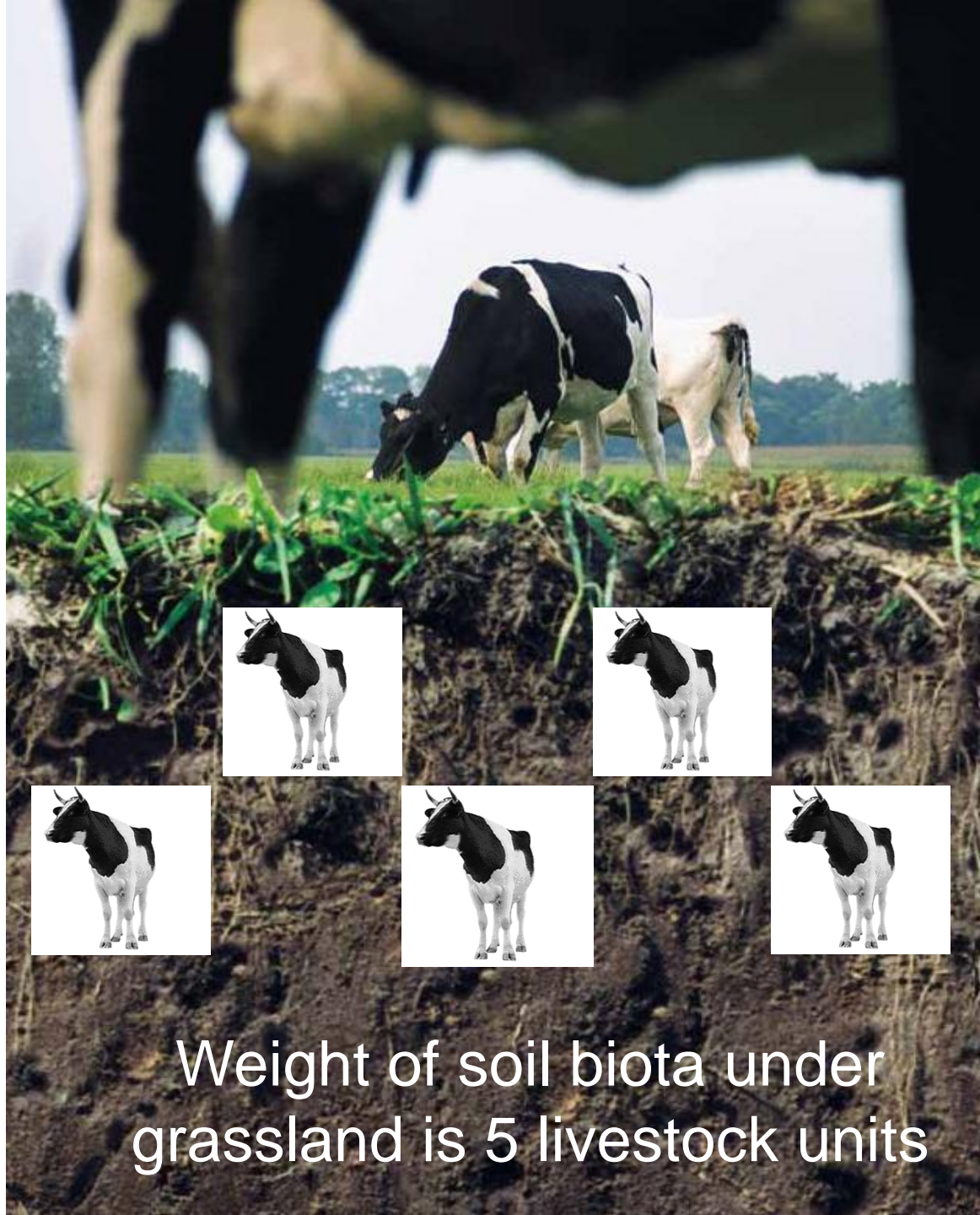
# Research part of PhD thesis



# Main objectives of thesis:

1. To gain insight into the effect of grassland management on soil biota
2. To explore the effect of grassland management on ecosystem services



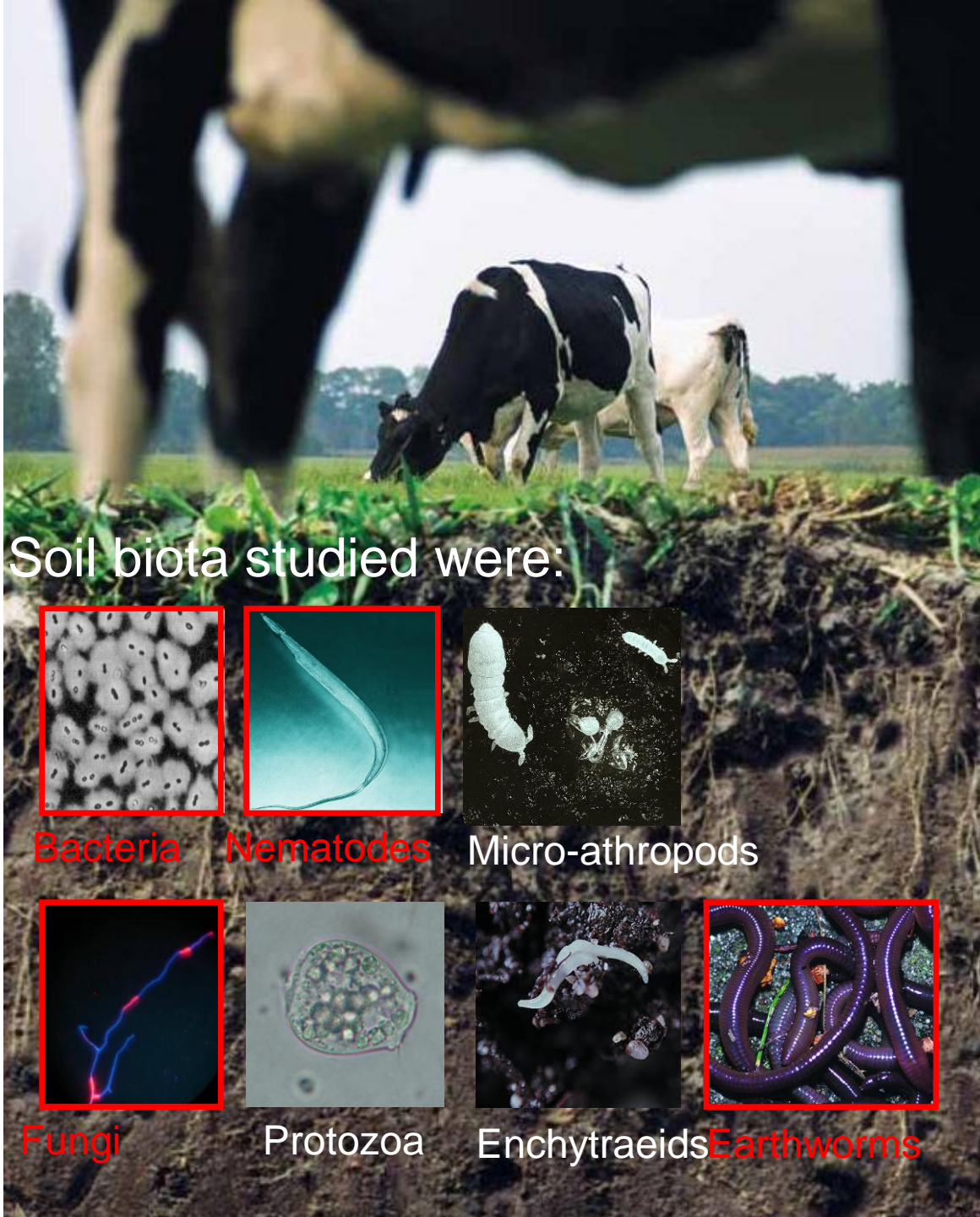


Weight of soil biota under grassland is 5 livestock units

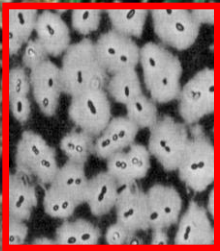


Management measures studied:

1. Cropping system (crop rotation)
2. Clover introduction
3. Inorganic and organic fertilizer type
4. N-fertilization level
5. Grass species and species mixture



Soil biota studied were:



Bacteria



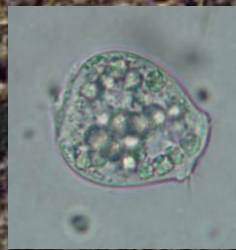
Nematodes



Micro-arthropods



Fungi



Protozoa



Enchytraeids



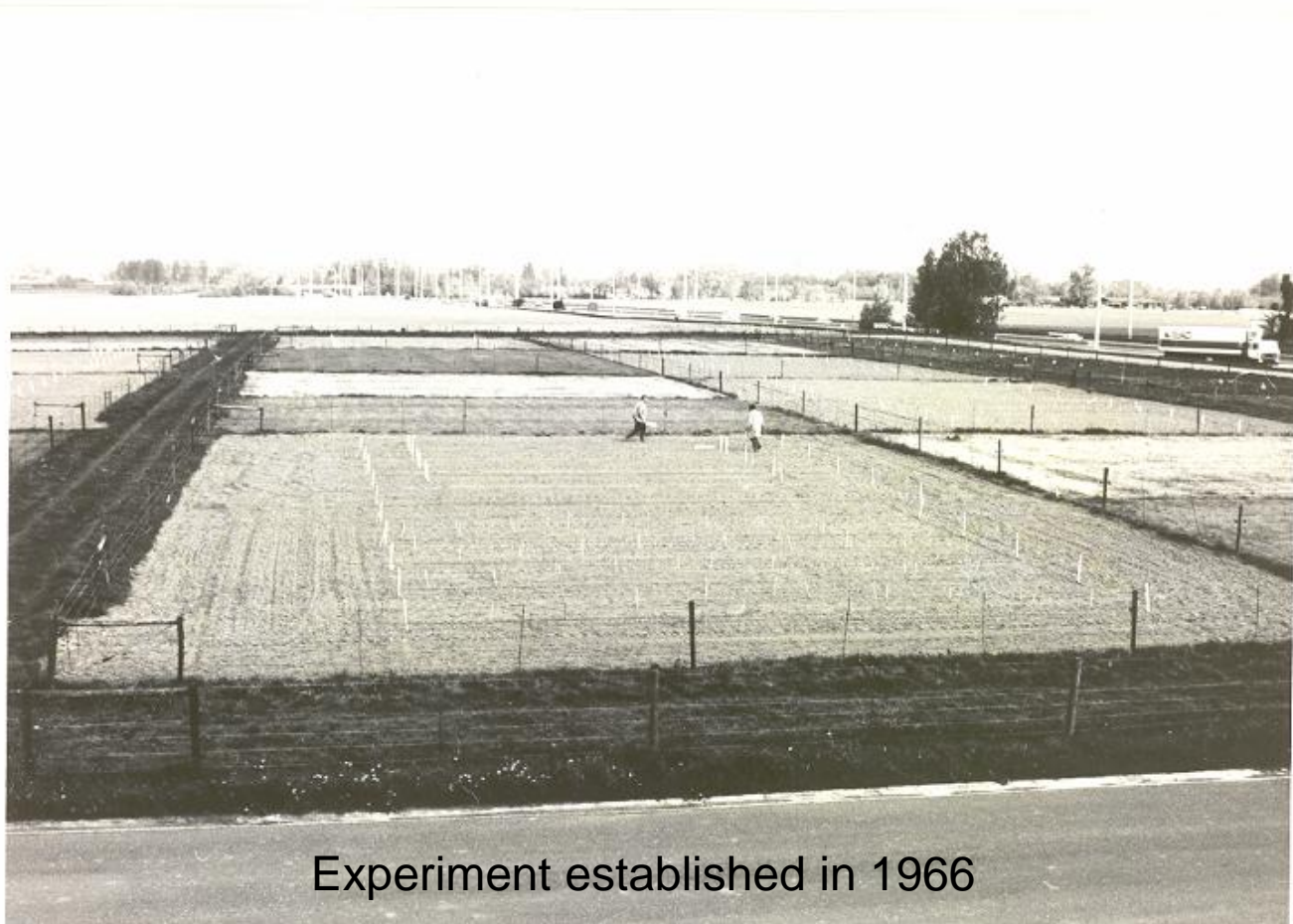
Earthworms



Ecosystem services studied:

- Soil structure maintenance
- Water regulation
- Supply of nutrients
- Grassland production

# Case study: effect of crop rotation on earthworms



Experiment established in 1966

# Four treatments:

1. Permanent grassland since 1966;
2. 3 years temporary grassland in rotation;
3. 3 years temporary arable land in rotation;
4. Permanent arable land since 1966.



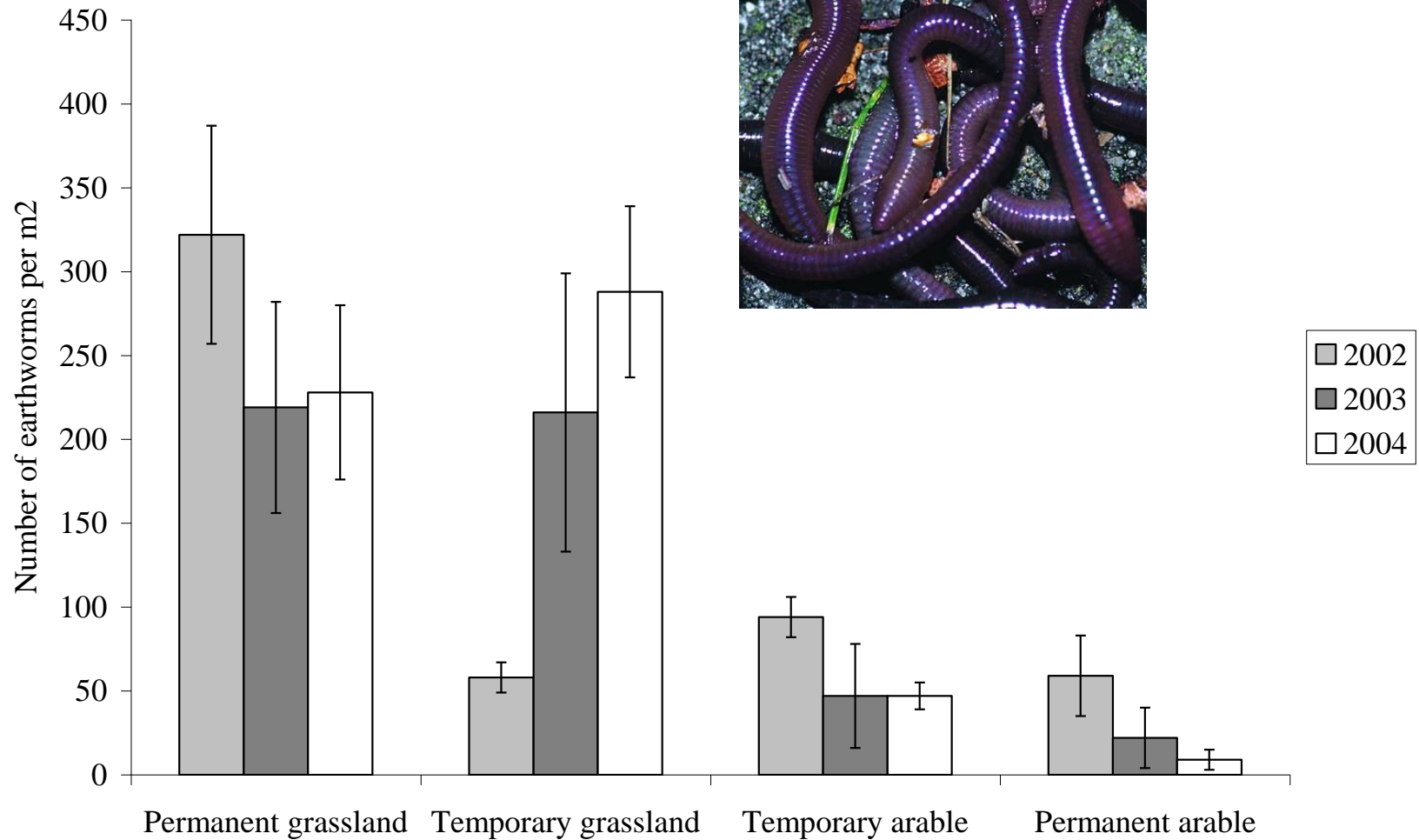
Temporary treatments established by rotavation

# Parameters measured (amongst others):

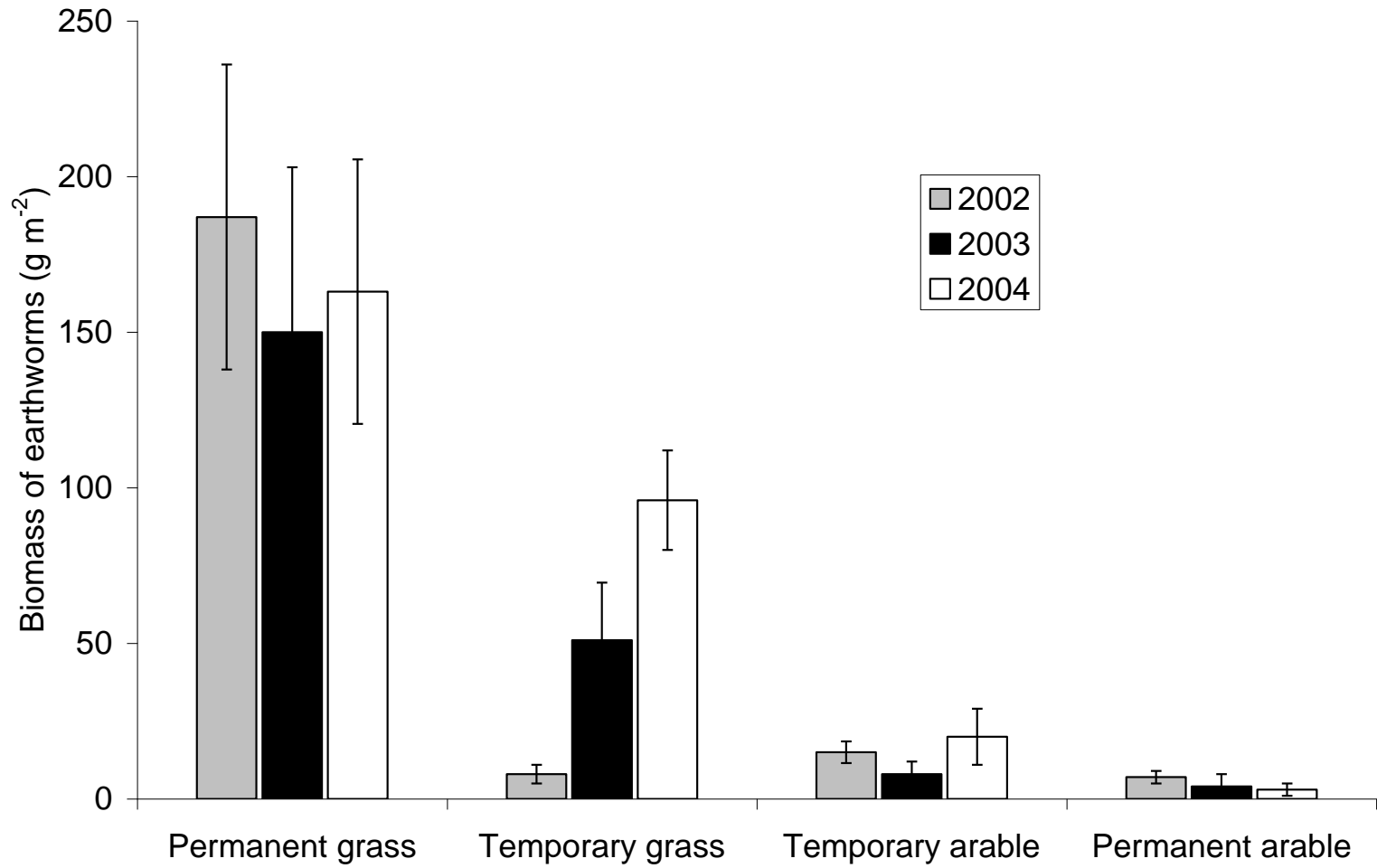
1. Earthworms in the autumn 2002, 2003, 2004 (first three years of the 7th rotation);
2. Field water infiltration in autumn 2004.



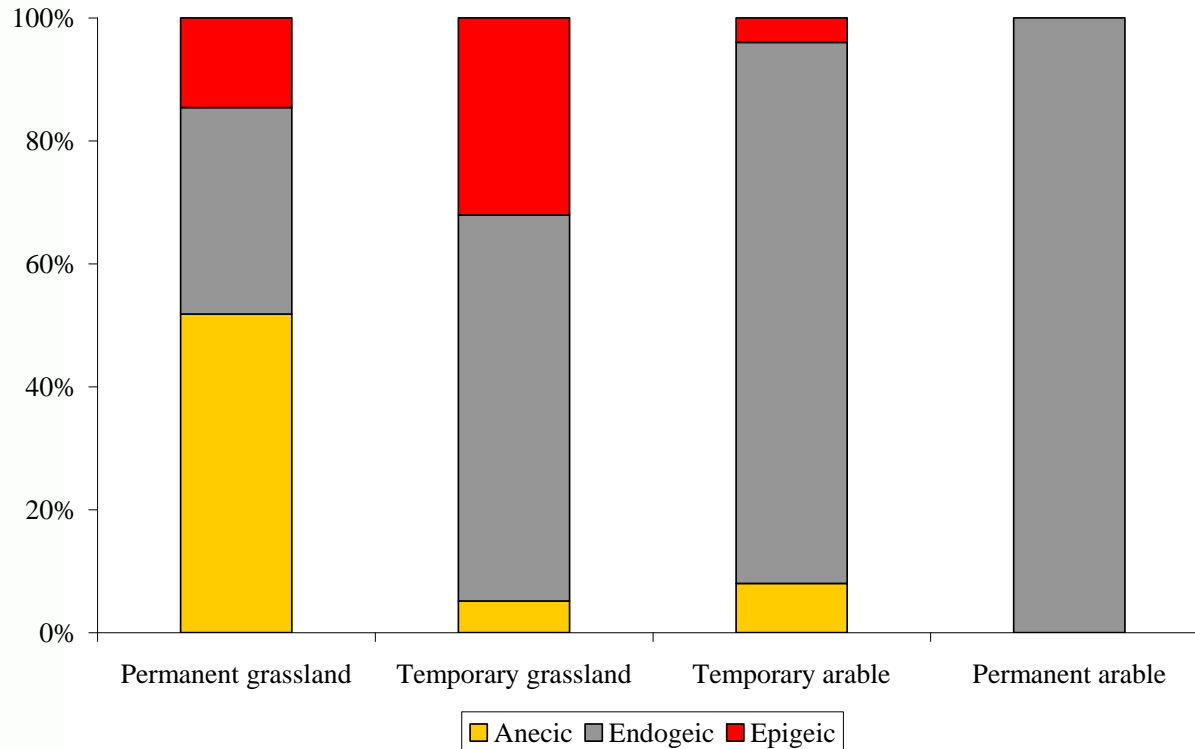
# Effect on number of earthworms



# Effect on earthworm biomass



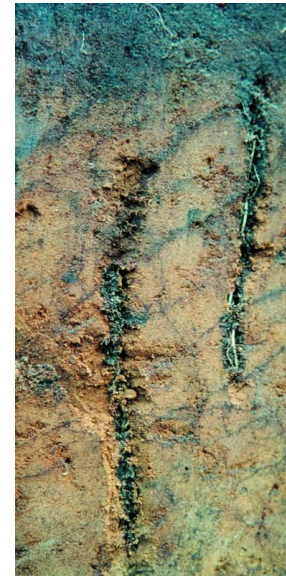
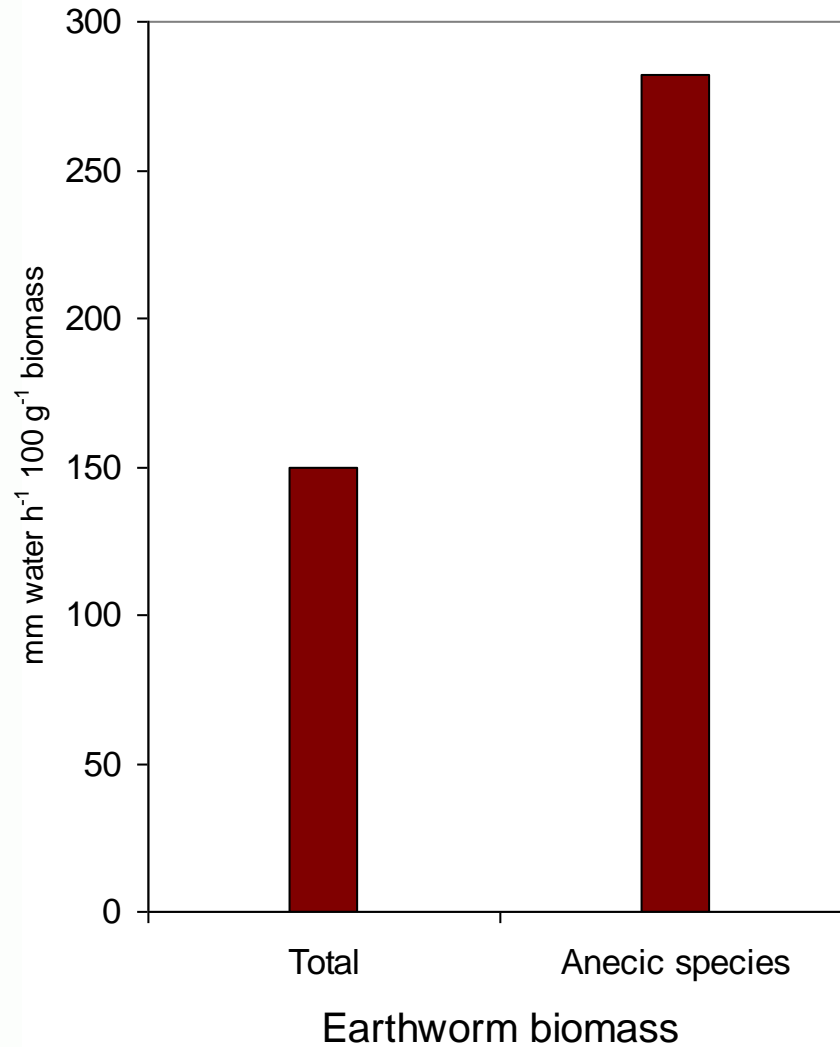
# Effect on ecological groups



Mechanisme: Stability of feed in permanent grassland

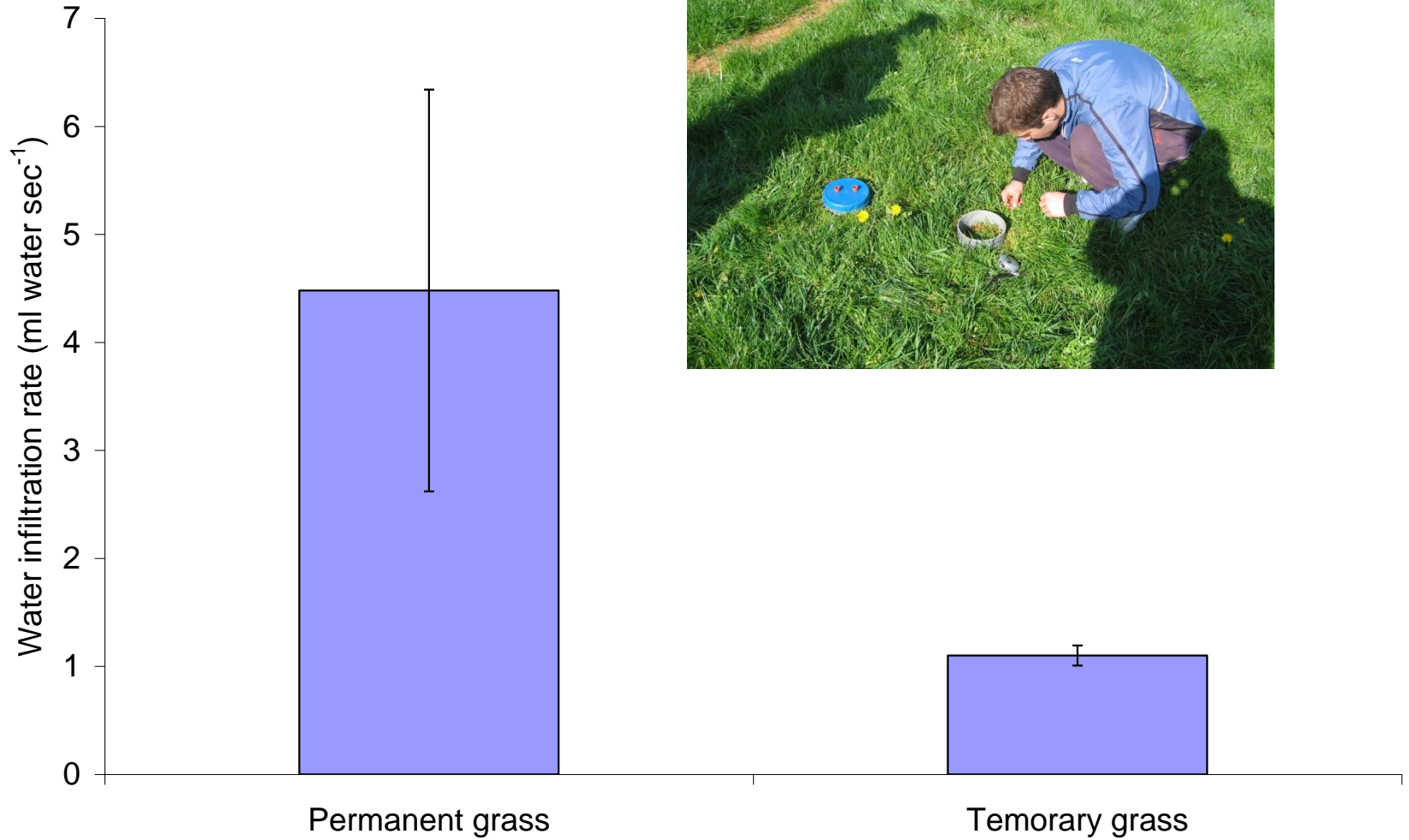


# Especially anecic species increase water infiltration



Bouche and Al-Addan, 1997

# Effect on water infiltration



# Conclusions (1)

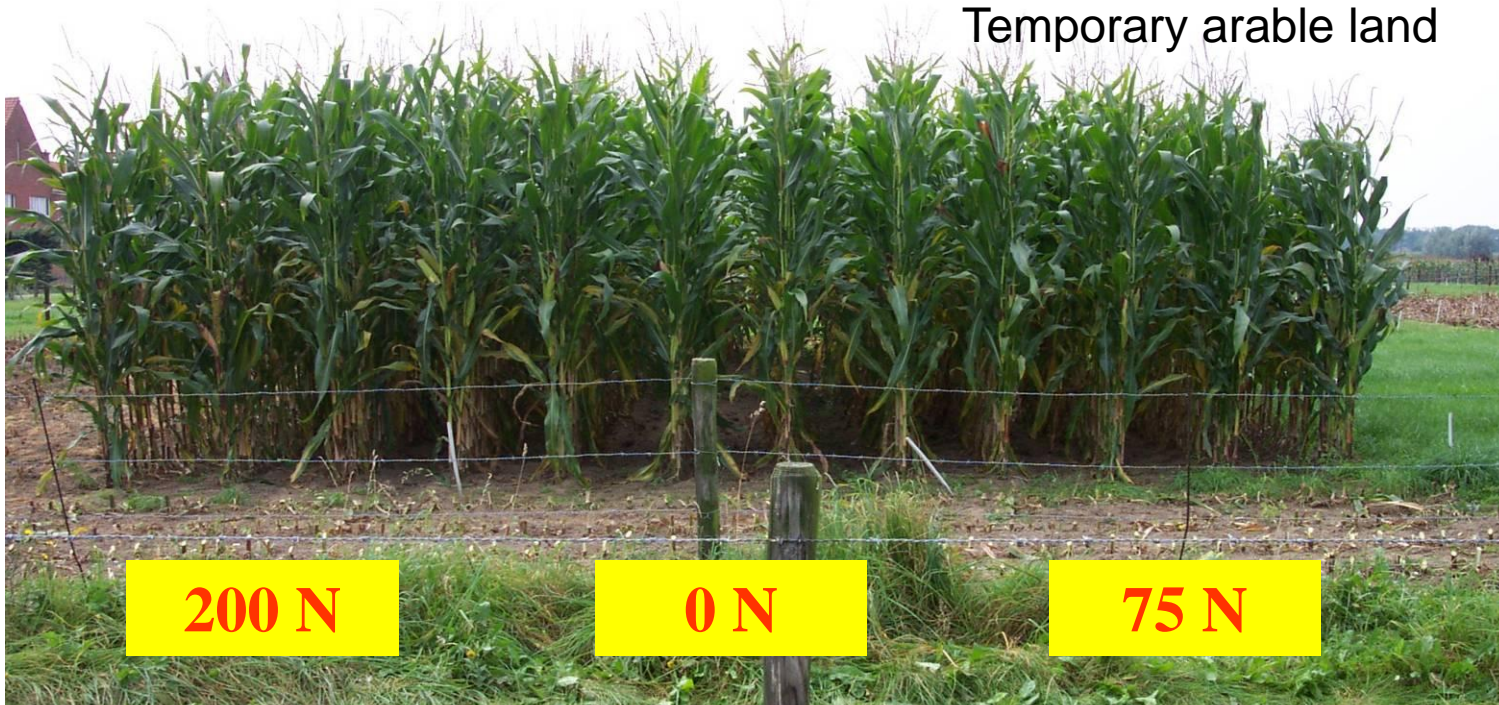
- In the grass ley, the abundance of earthworms returned to the level of permanent grassland
- The anecic species did not recover in the grass ley to the dominance they had in permanent grass.
- This has consequences for the ecosystem service of water regulation under futures grasslands.

# Nutrient use efficiency

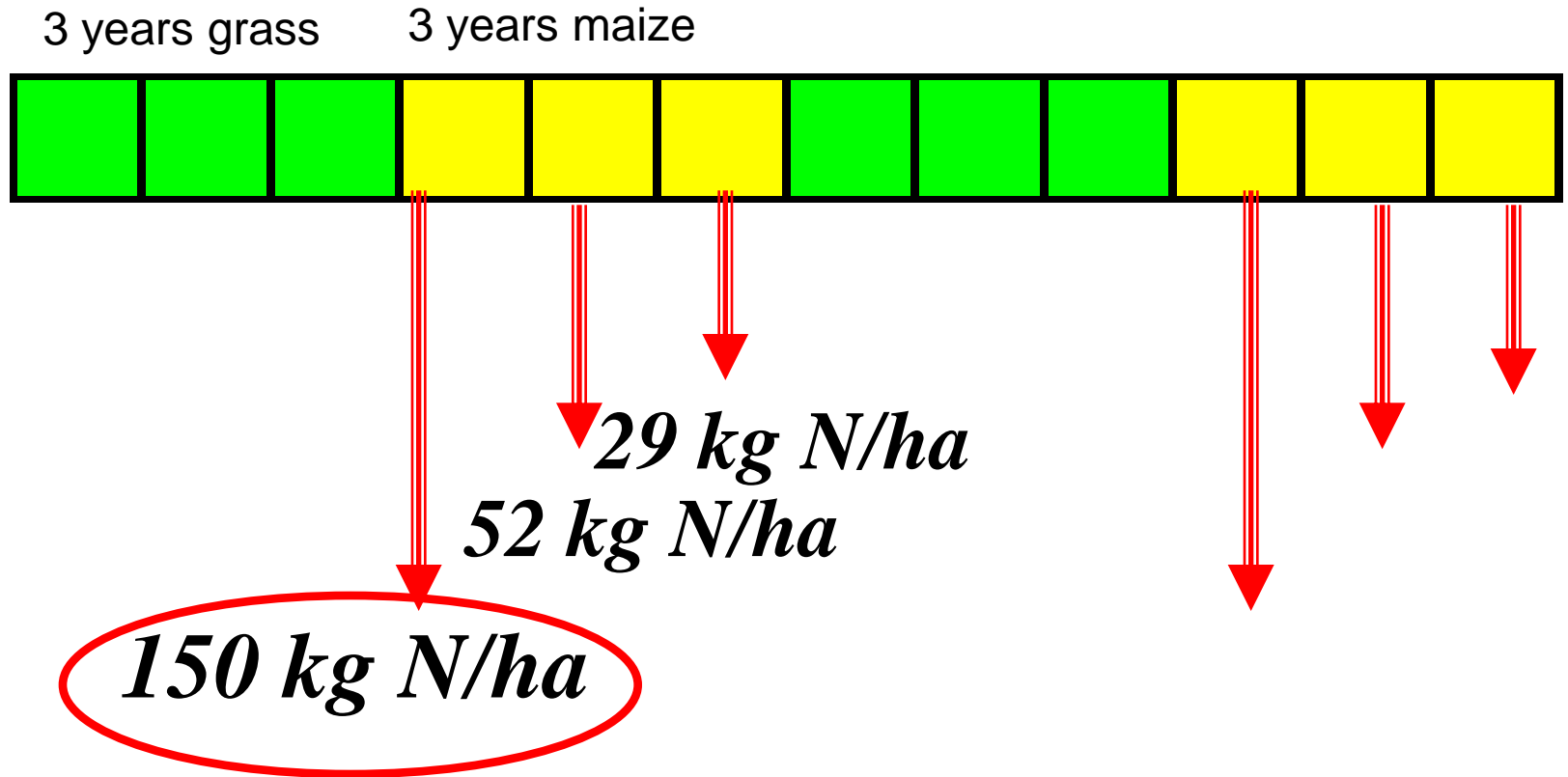
Permanent arable land



Temporary arable land



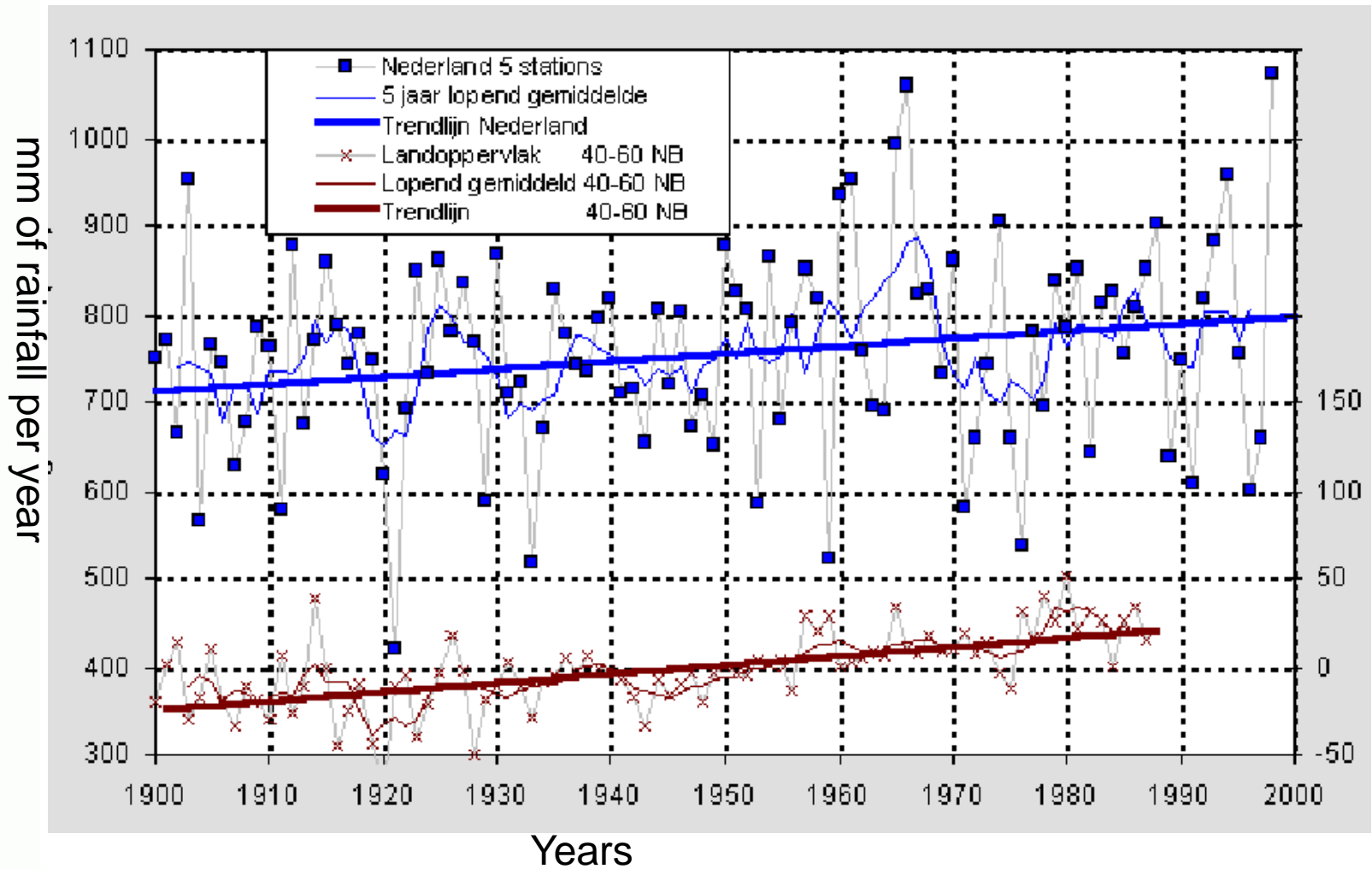
# Nutrient use efficiency



*Totally 231 kg N/ha in 3 years*

Nevens and Reheul, 2002

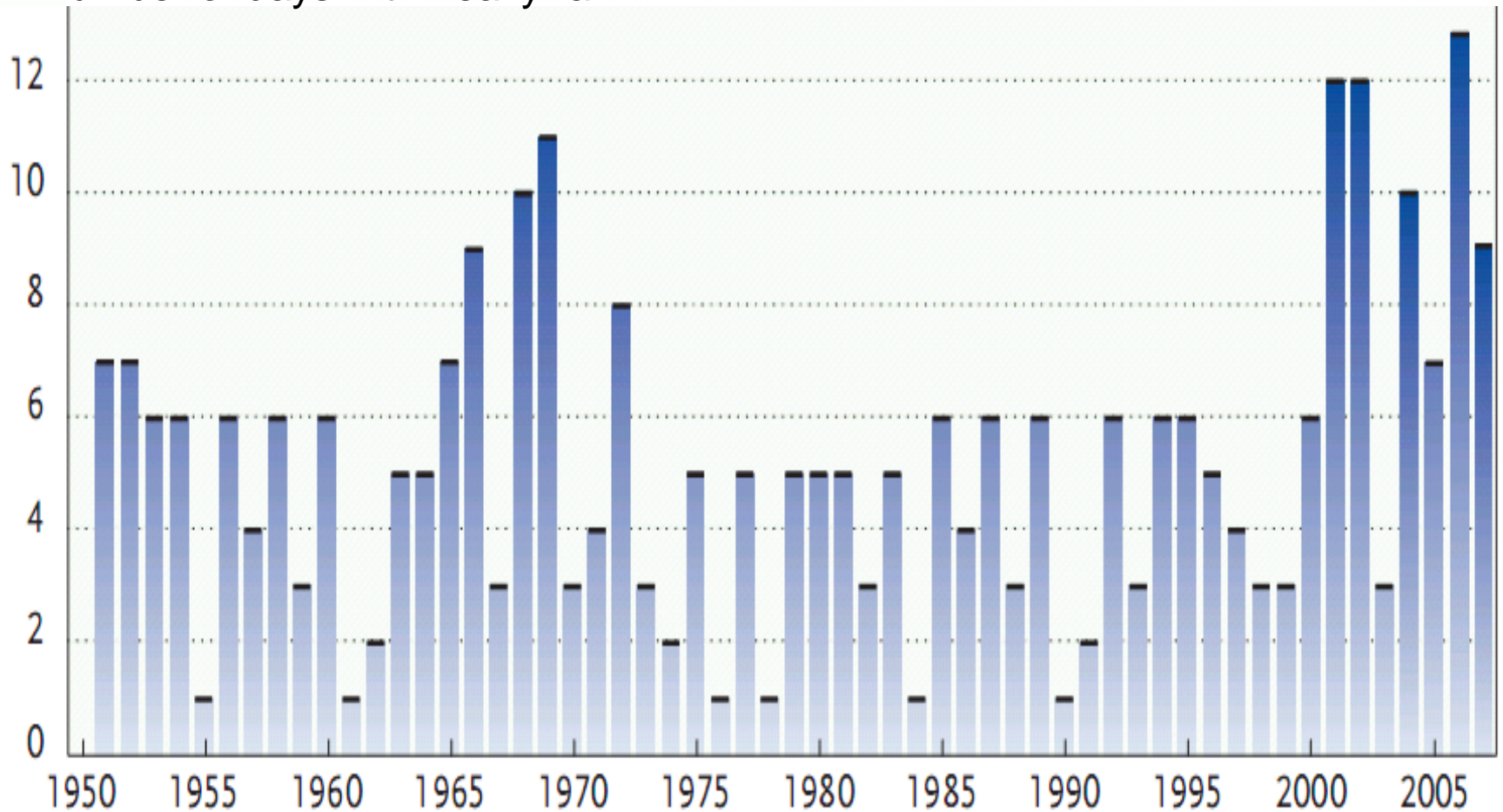
# Increase of rainfall in the Netherlands



Boxel and Cammeraat, 1999

# Increase number of days with heavy rain

Number of days with heavy rain



Anonymous, RNMI

# Conclusions (2)

- The crop rotation grass→maize can be sustainable in terms of efficient nutrient use.
- However effect of grass→maize rotation on anecic earthworms and service of water regulation makes it less sustainable than assumed especially with changing climatic conditions.

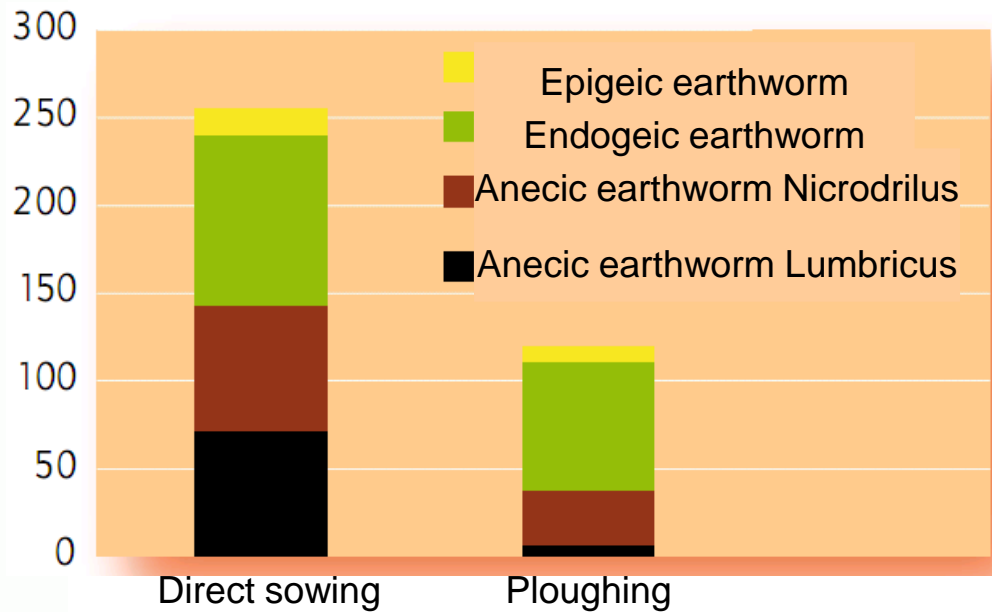
# Future of maize cultivation on dairy farmers

- Seek for alternative cultivation techniques
- Possibilities for direct sowing techniques of maize in grassland

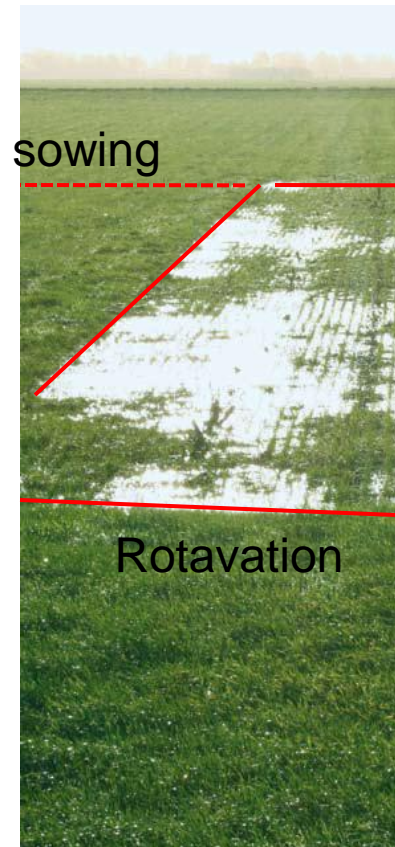


# Effect of direct sowing of maize on earthworms and water infiltration

Earthworm biomass g m<sup>-2</sup>



Direct sowing



Rotavation

Prins et al. 2007

Thank you for your attention