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Ecological properties of earthworm burrows in an organically managed grass-clover system

Paul Henning Krogh[1], Mathieu Lamandé[2], Jørgen Eriksen[2], Martin Holmstrup[1]

phk@dmu.dk

[1]DEPARTMENT OF BIOSCIENCE
[2]DEPARTMENT OF AGROECOLOGY

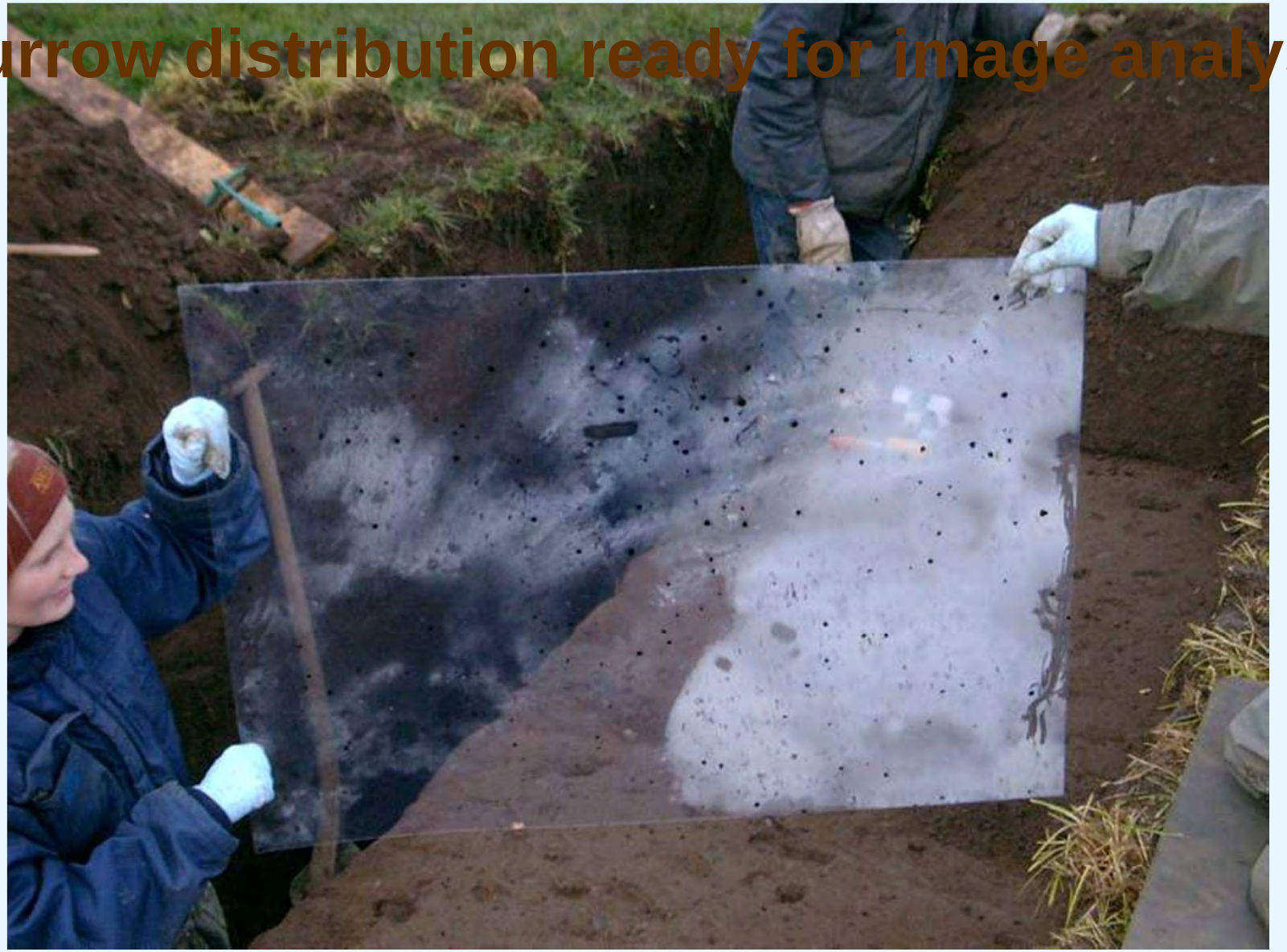
ICROFS
International Centre for Research in Organic Food Systems

Digging a whole

Vacuum cleaning the surface

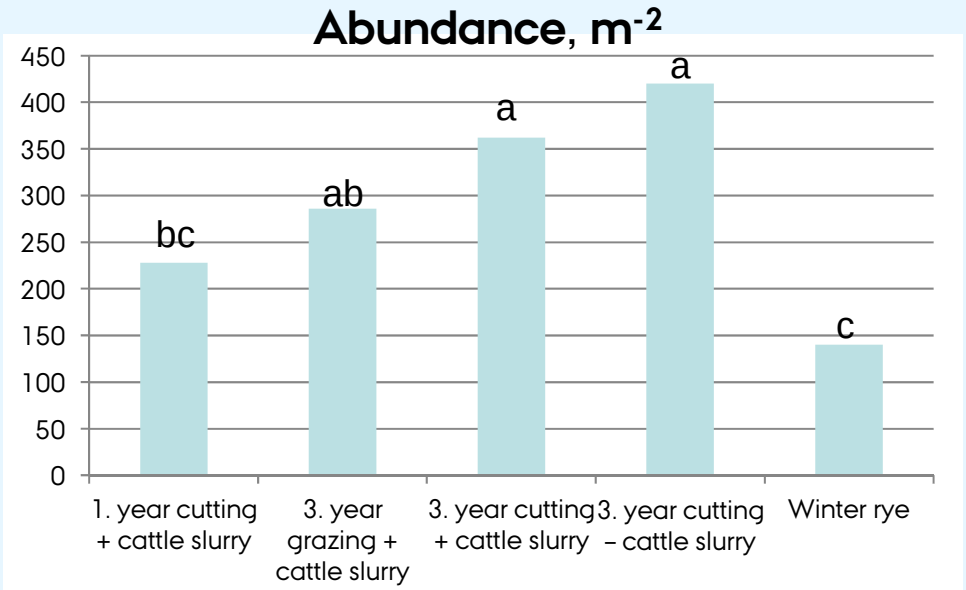
Delineating burrows

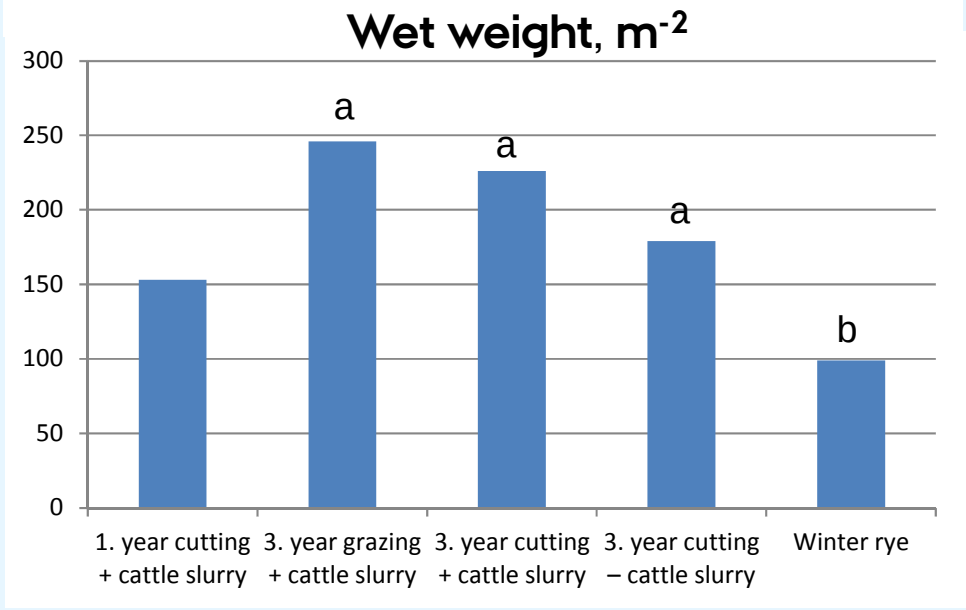
Burrow distribution ready for image analysis



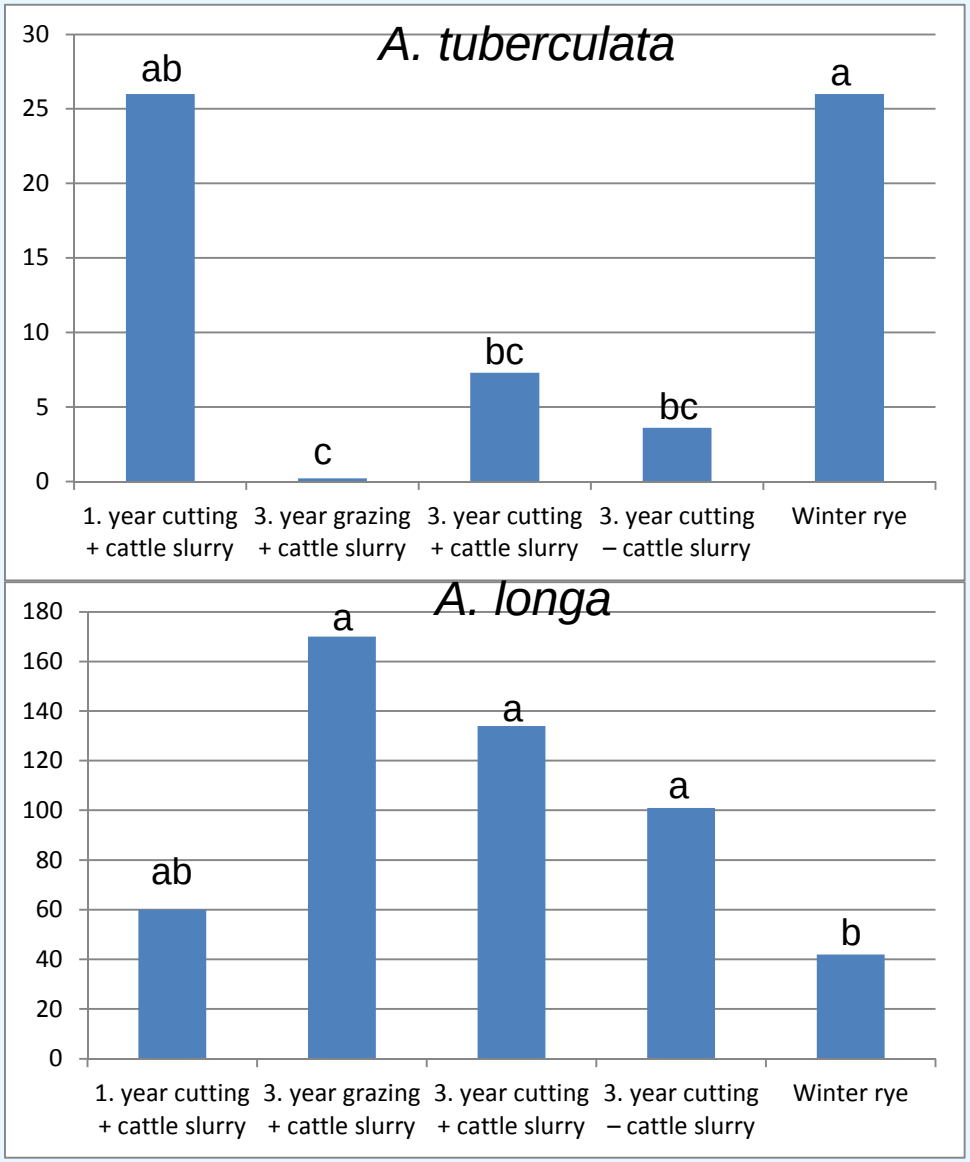
Total earthworm abundance and biomass

250 g earthworm biomass m^{-2}
= 2500 kg ha^{-1}





Biomass of two life-forms



Influence of agronomic elements of clover-grass cropping

	Species	Slurry	Clover-grass age	Grazing	Annuals
Endogeic	*A. tuberculata*	0	÷	÷	+
	A. rosea	0	+	÷	÷
Anecic	*L. terrestris*	0	0	0	÷
	A. longa	+	+	0	÷

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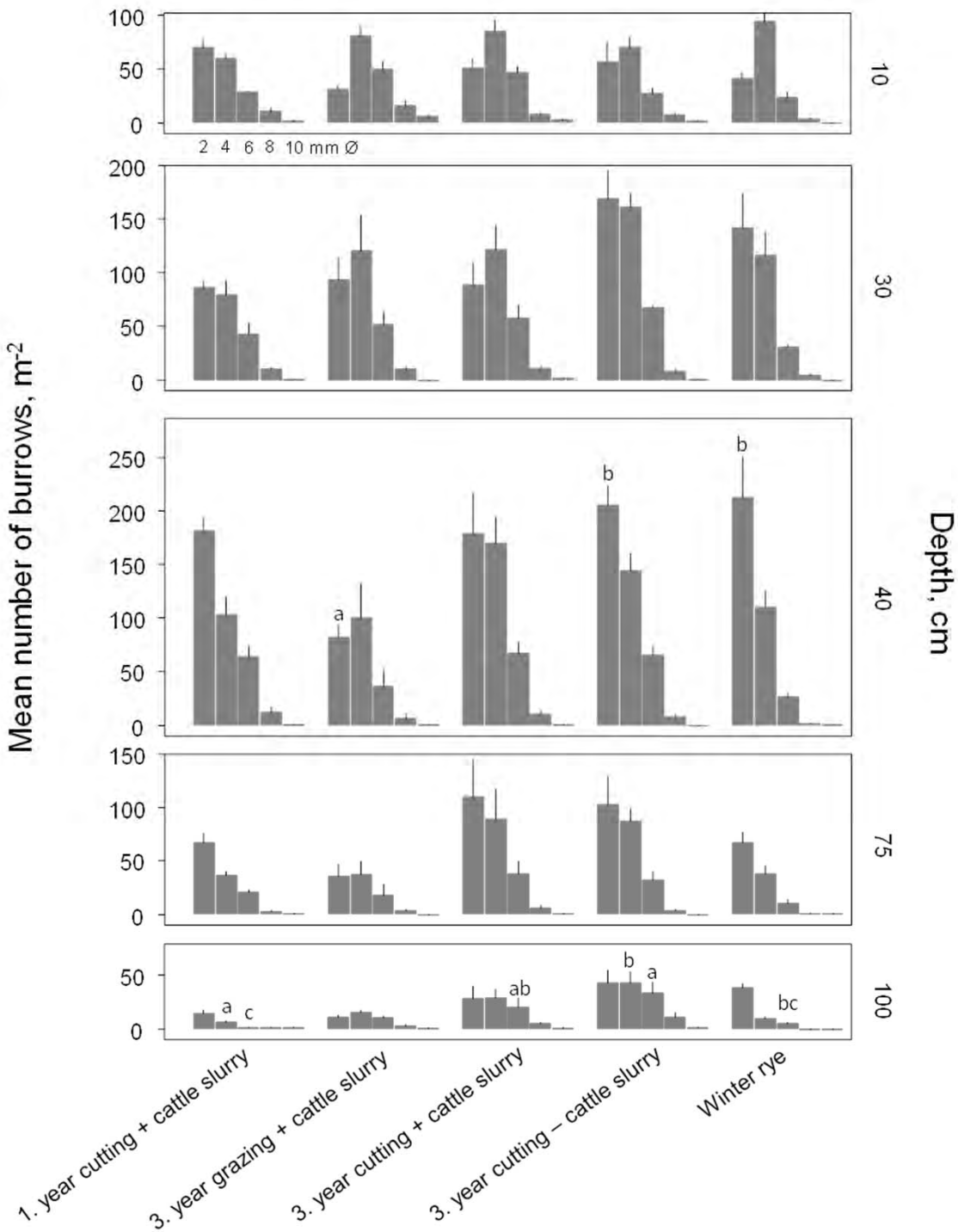
Burrow diameter size distribution

- **Grazing reduces macropore density at 40 cm**
- **Few large (<<10) macropores at 1 m in annual crops**

But even few could provide high water-flow



Correlations between burrows and earthworm species - summary

- **Anecic species and *A. rosea* are significantly positively correlated with burrows**
- **The endogeic *A. tuberculata* was consequently negatively correlated to macropores**
- **No correlation between small macropores, 1 mm Ø, and earthworms**

Addition of bromide to the soil – simulation of heavy rainfall

- **Irrigation for one hour of 18.5 mm bromide solution (moderate-heavy rainfall)**
- **Bromide is analysed down the soil profile after 24 hours**

Lamandé *et al.* (2010). "Cattle trampling reduces the risk of nitrate leaching in organic dairy rotations." ICROFS news **2010(2): 5-7.**

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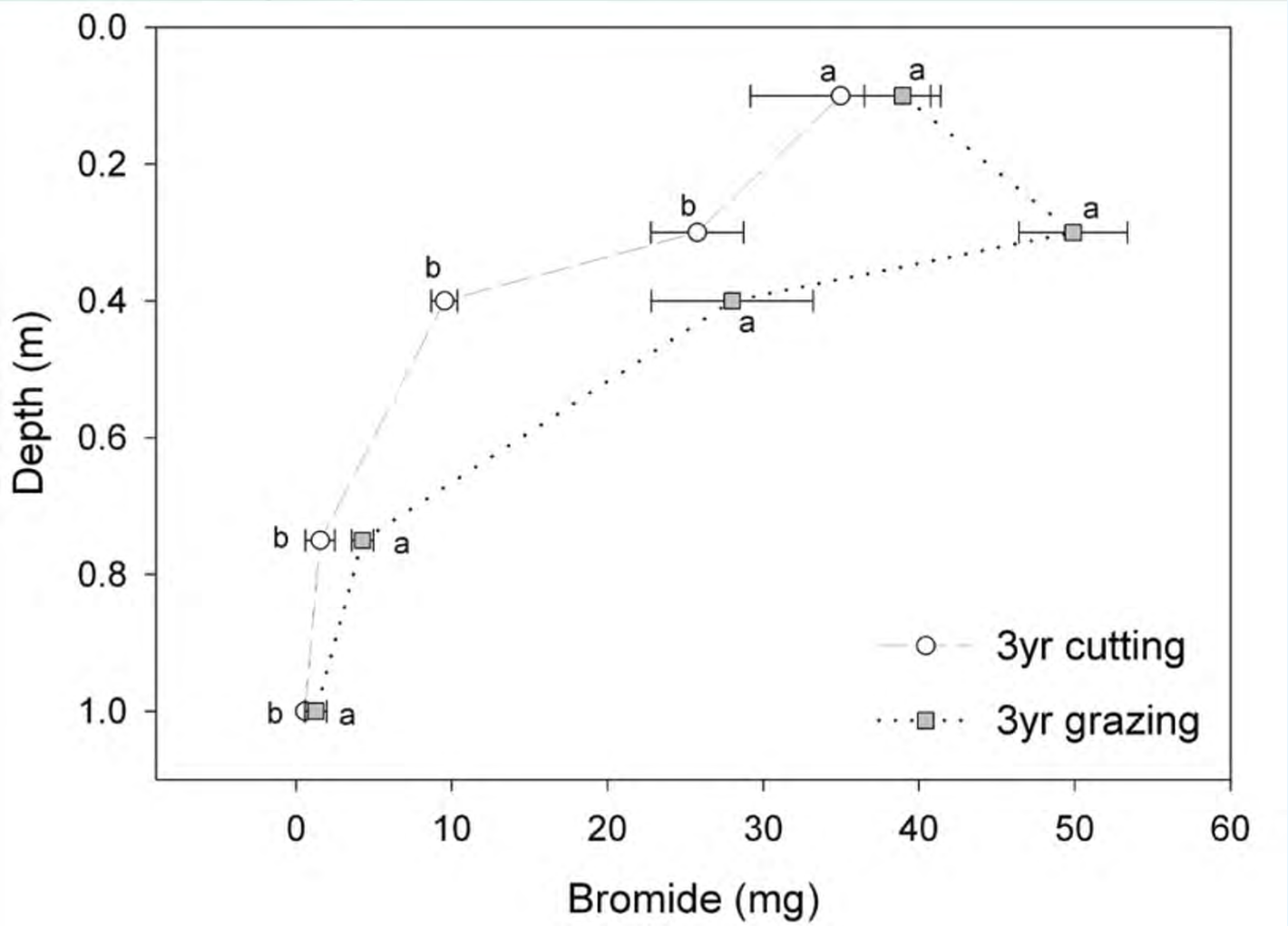
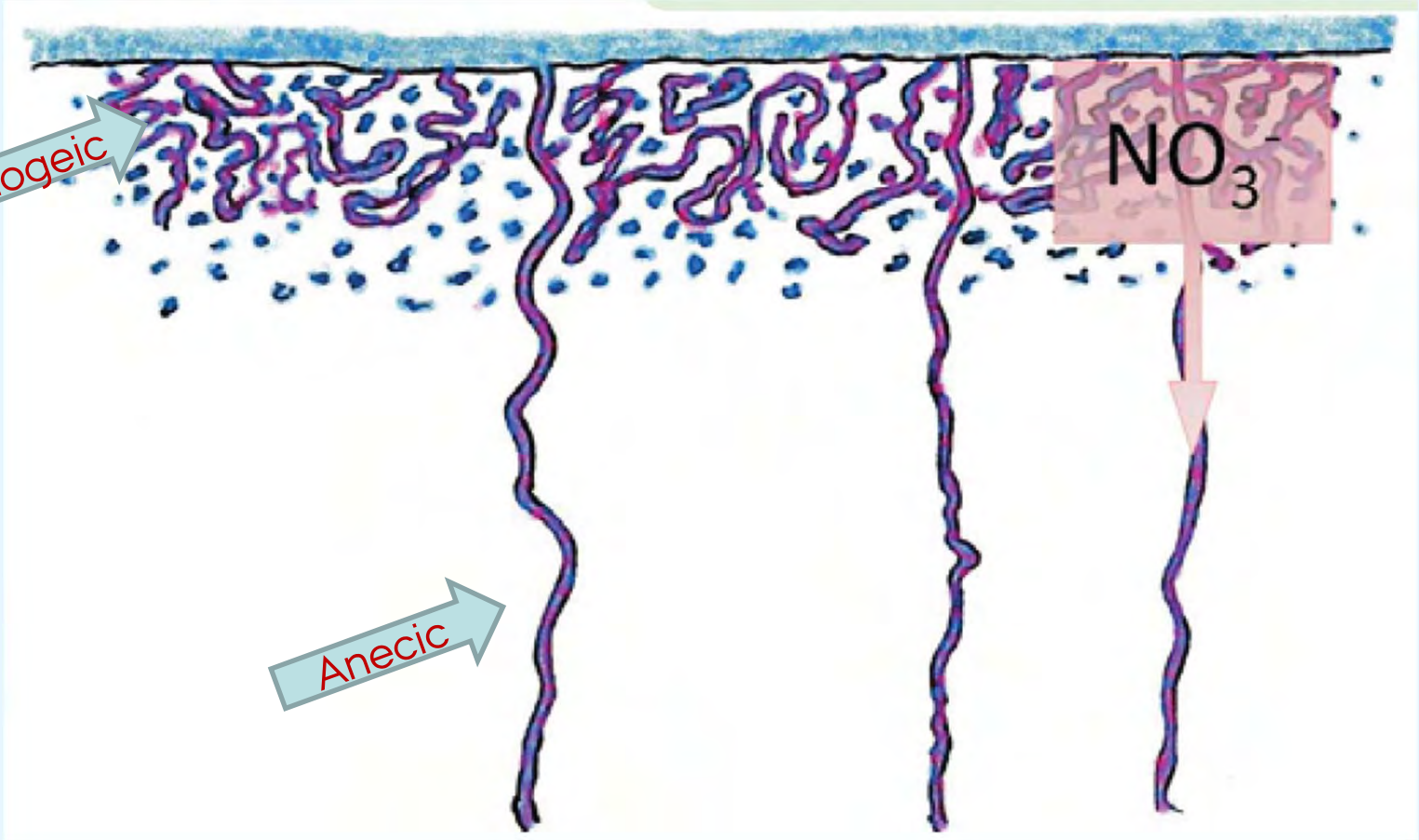
Water flow through the soil

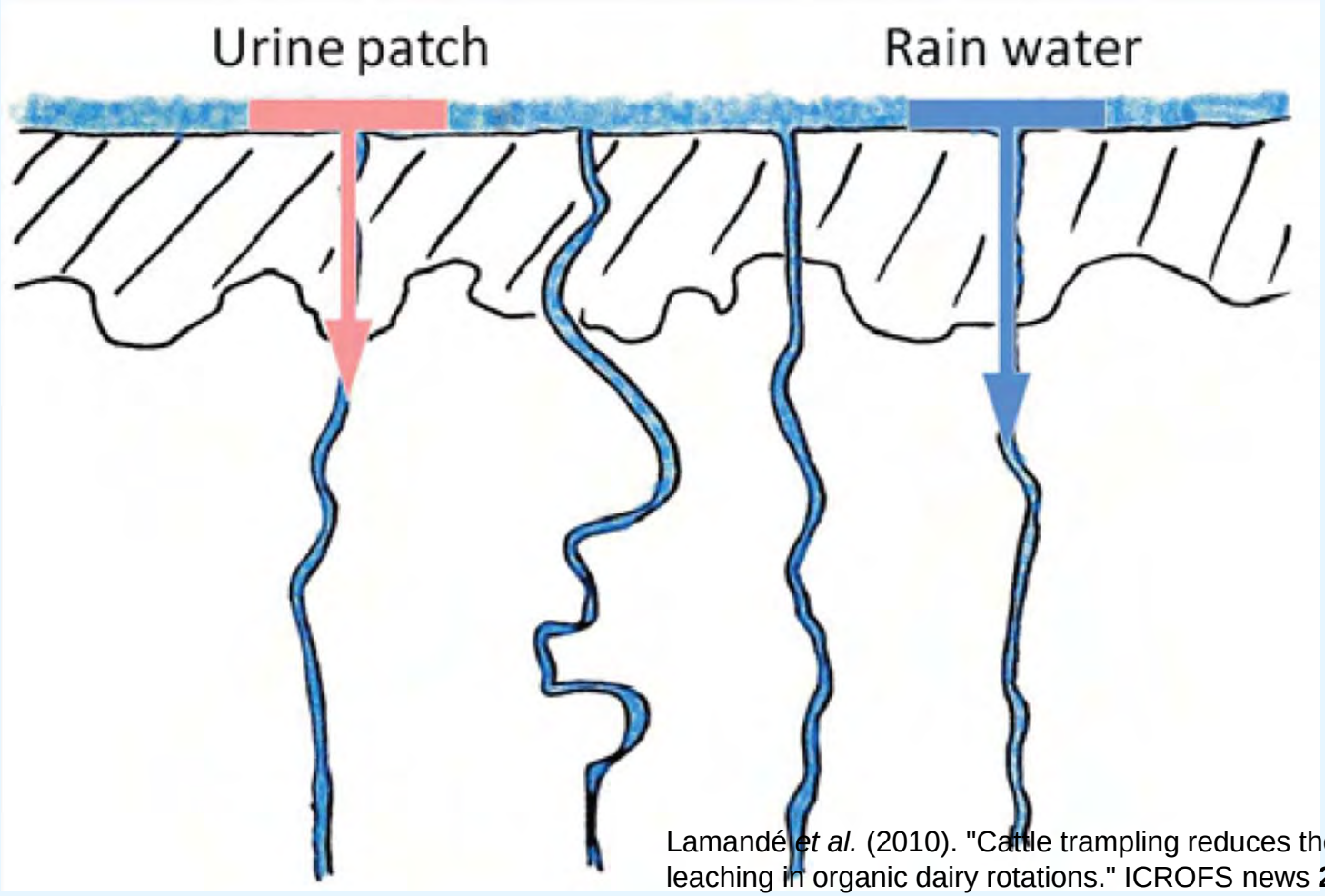


Burrow spatial distribution as made by endogeic and anecic earthworms



Lamandé *et al.* (2010). "Cattle trampling reduces the risk of nitrate leaching in organic dairy rotations." ICROFS news **2010(2): 5-7.**

Schematic presentation of water flow when cattle trampling has reduced top soil porosity



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Results of bromide application

- **Water velocity was higher with grazing**
- **Suggestion: due to less number of macropores water was flowing to the large macropores leading to higher velocity**

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Conclusions

- **All main element of clover-grass cropping affects earthworm communities as demonstrated just by our study:**
  - **Fertilization**
  - **Crop age**
  - **Grazing**

Agroecological consequences of earthworm burrows:

- **Leaching depends on the macropore density and size distribution**
- **Water can by-pass the bulk soil through large macropores and avoid leaching of nitrate**

New research activities

- **EcoFINDERS - EU FP7**
  - **Including earthworm ecology and burrow distributions in the JULES (Joint UK Land Environment Simulator) hydrological model including runoff and infiltration dynamics**

- **PESTPORE - Danish EPA**
  - **The occurrence and influence of deep biopores on pesticide leaching from land surface to chemically reduced ground water in glacial clayey till**