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Intracellular energy storage and soil microbial resource stress

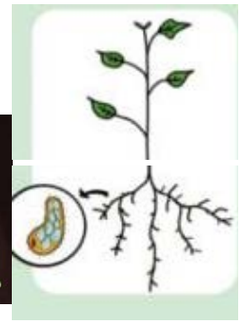
Yang Ding, Martin Komainda, Kyle Mason-Jones, Michaela A. Dippold, and Callum C. Banfield

23.05.2022
EGU2022 Vienna

Abstract link

Intracellular carbon storage in grassland soil:
An intermediate carbon reservoir

Soil microorganisms



(Olsson 1999; Wältermann et al. 2000; Becker et al. 2018; Mason-Jones et al. 2021)

Soil microorganisms

Resource fluctuation or deficiency
How to secure for future needs?

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Savings:
Storage compounds

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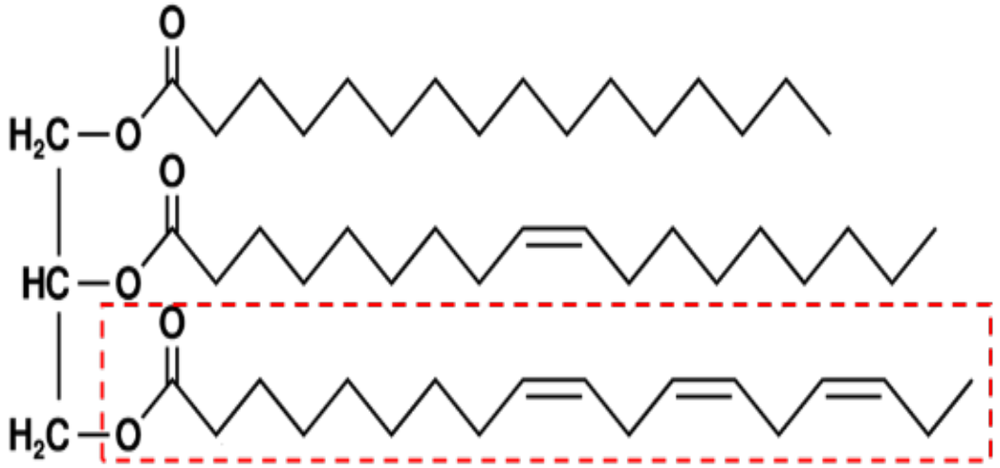
Carbon storage



- High energy density
- Storage function in soil bacteria, fungi, marine phytoplankton

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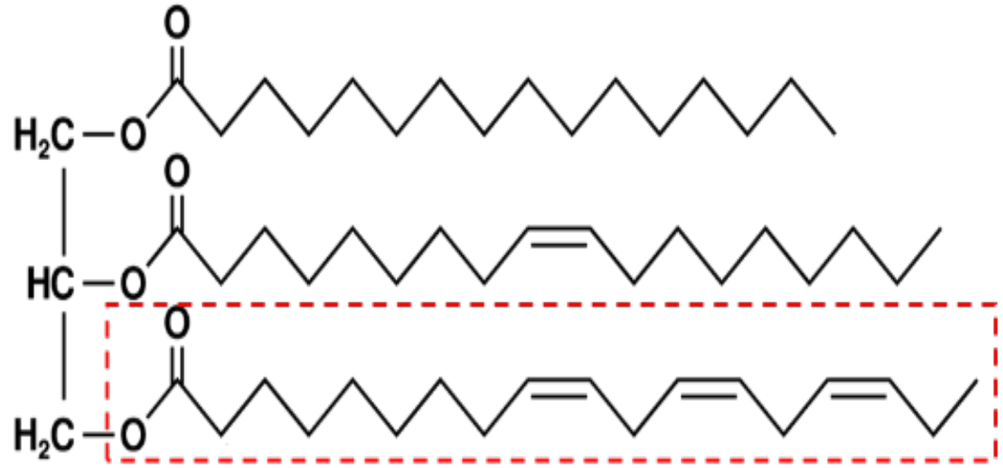

Triacylglycerides (TAGs)

- High energy density
- Storage function in soil bacteria, fungi, marine phytoplankton

1. Is storage widespread in grassland soils?
2. Under which conditions do microorganisms store more?

(Olsson 1999; Wältermann et al. 2000; Becker et al. 2018; Mason-Jones et al. 2021)

Hypotheses

1. Carbon storage occurs in grassland soil.
2. More carbon is stored when there is more available carbon.

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Soil and sample information

- December 2021-microbes preparing for winter
- Seven permanent grasslands
- Lower Saxony, Germany
- Same agro-ecological region-temperate

- Different managements: fertilization, cow or mown
- Different soil types, elevations
- (not considered as treatments)

- Depth 5-10 cm topsoil V.S. >30 cm subsoil

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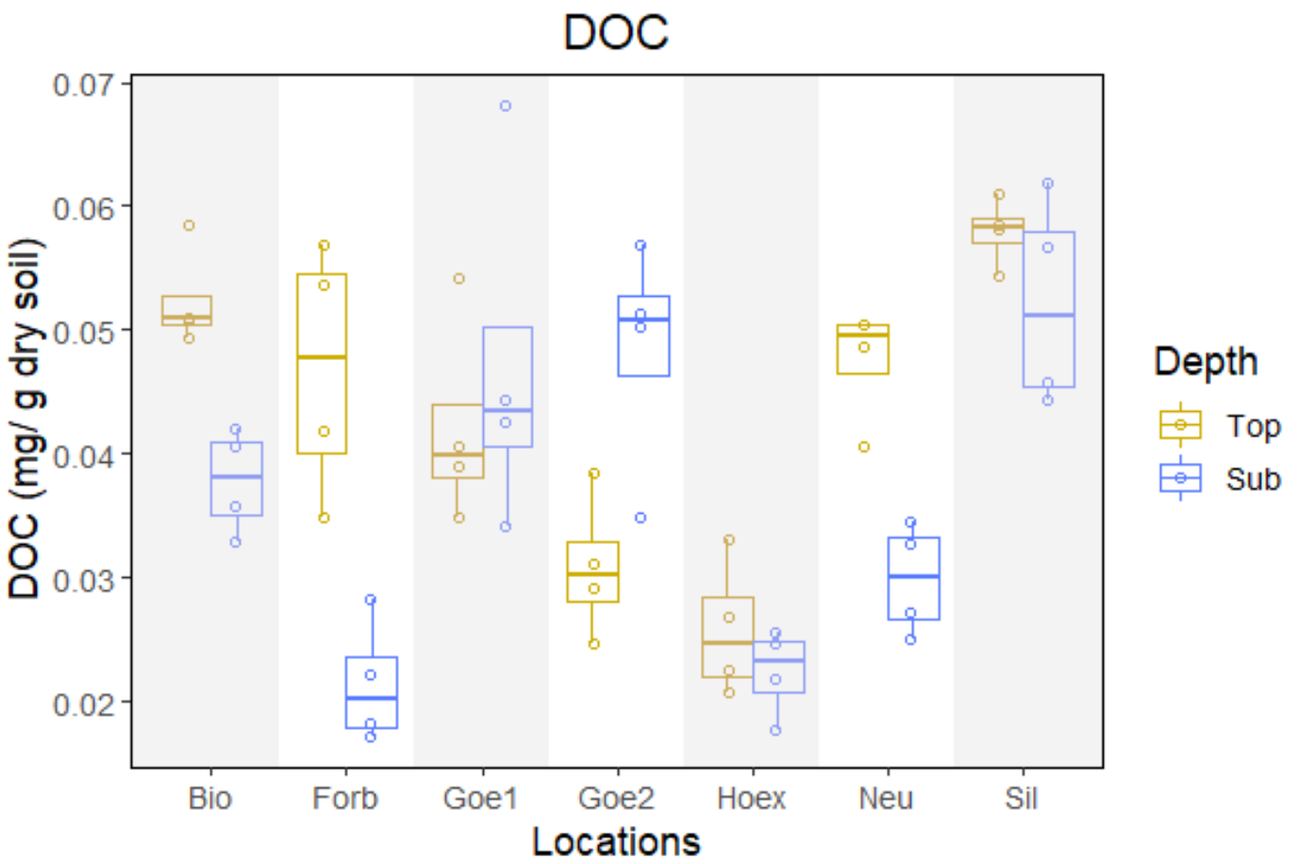
More root inputs → Top

Less root inputs → Sub

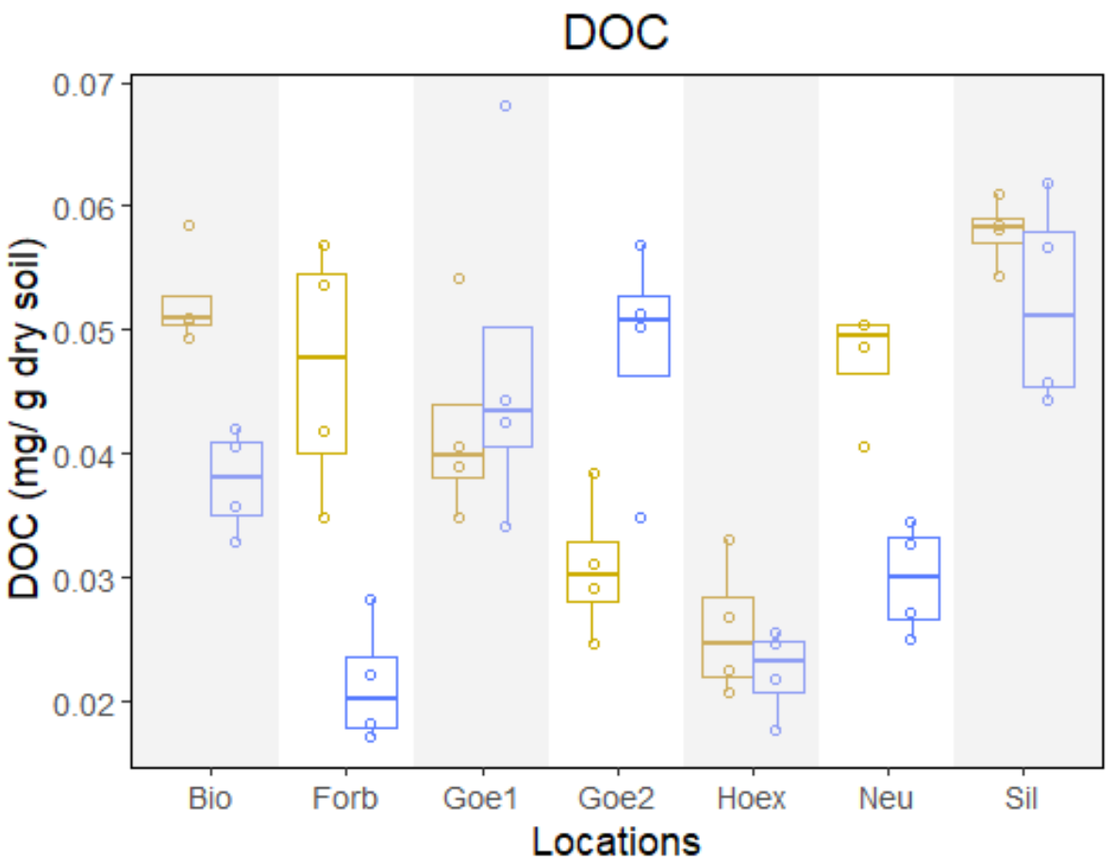
Available carbon to microorganisms: Dissolved organic carbon

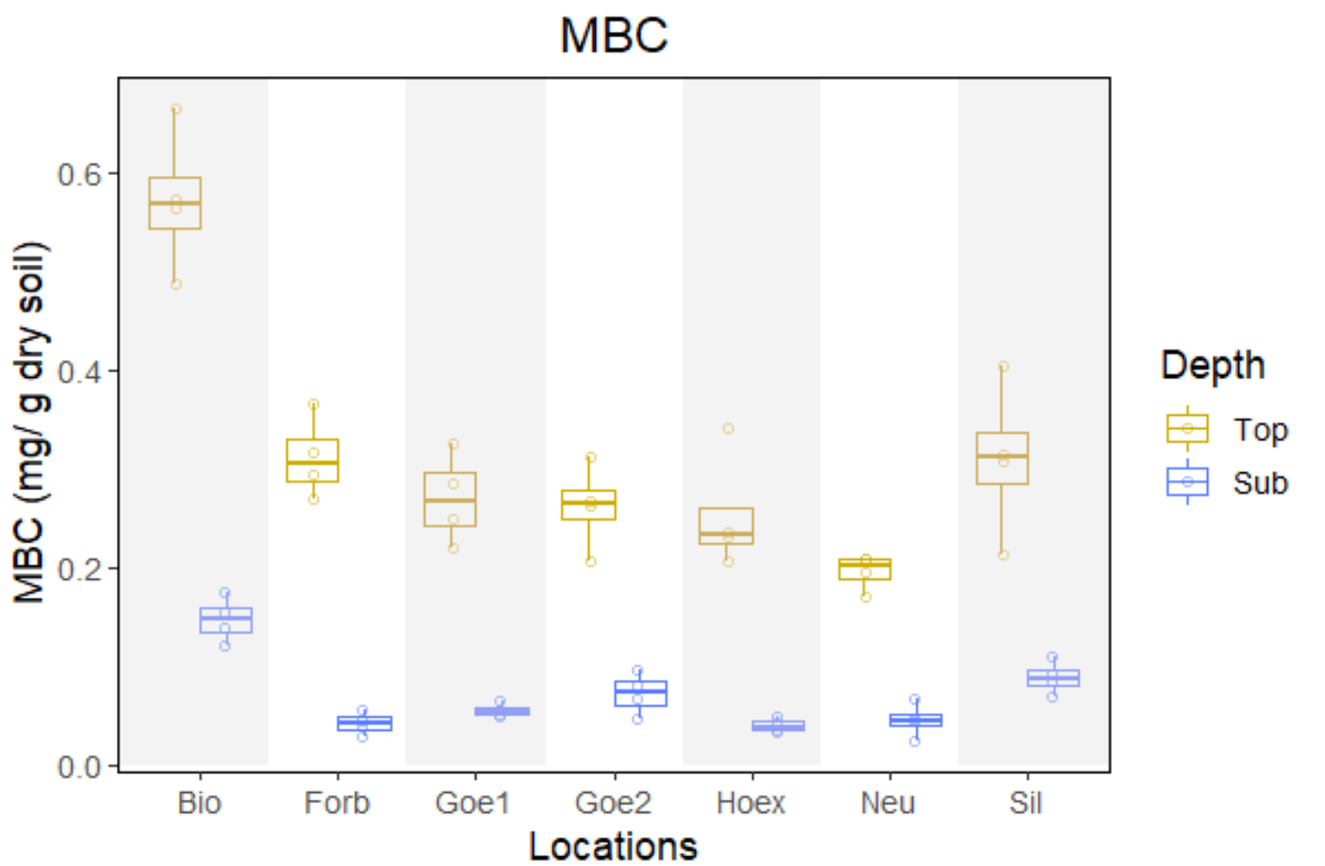


A snapshot of the soil

Available carbon to microorganisms:
Dissolved organic carbon

Microbial biomass carbon





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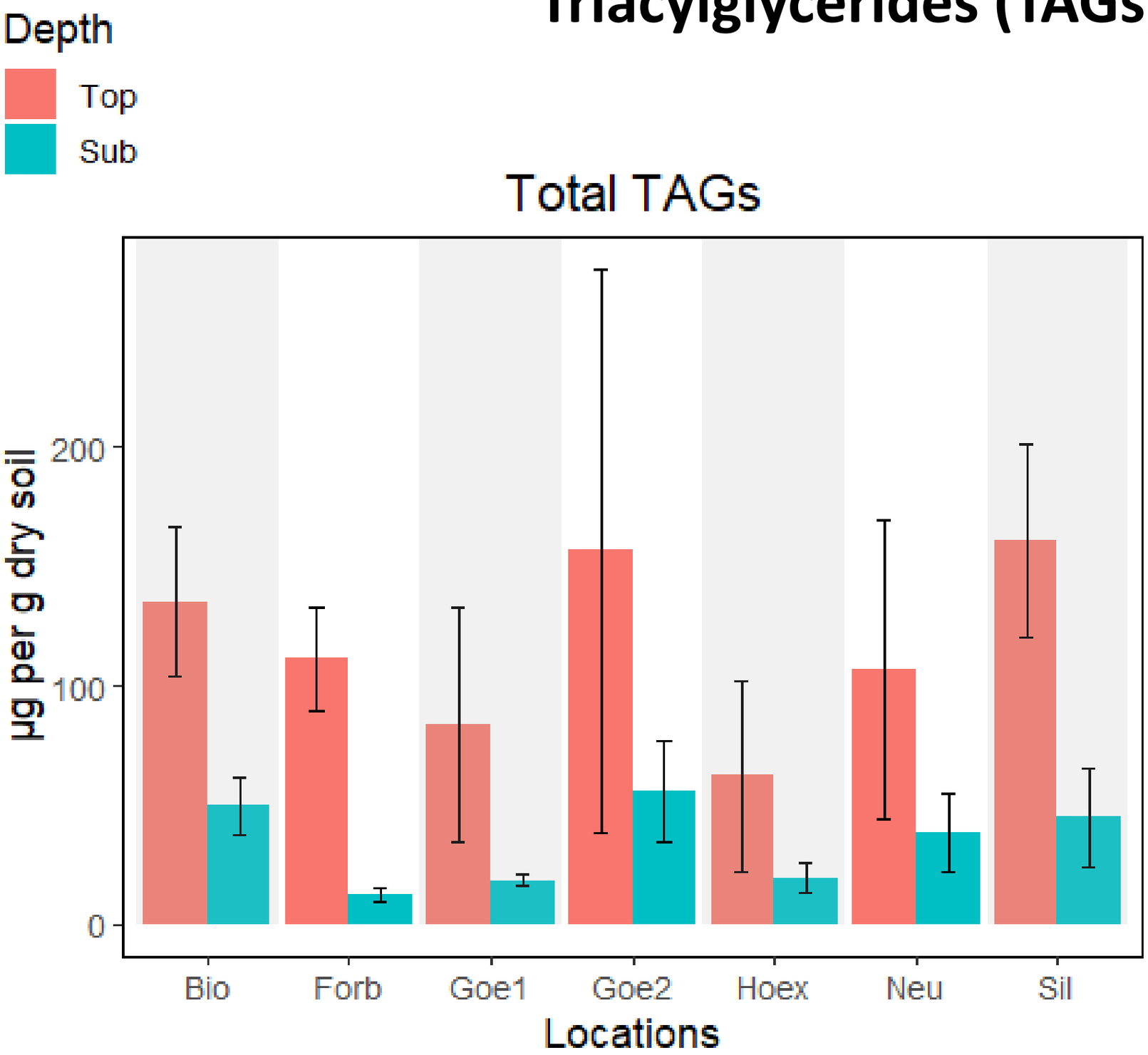
Triacylglycerides (TAGs)



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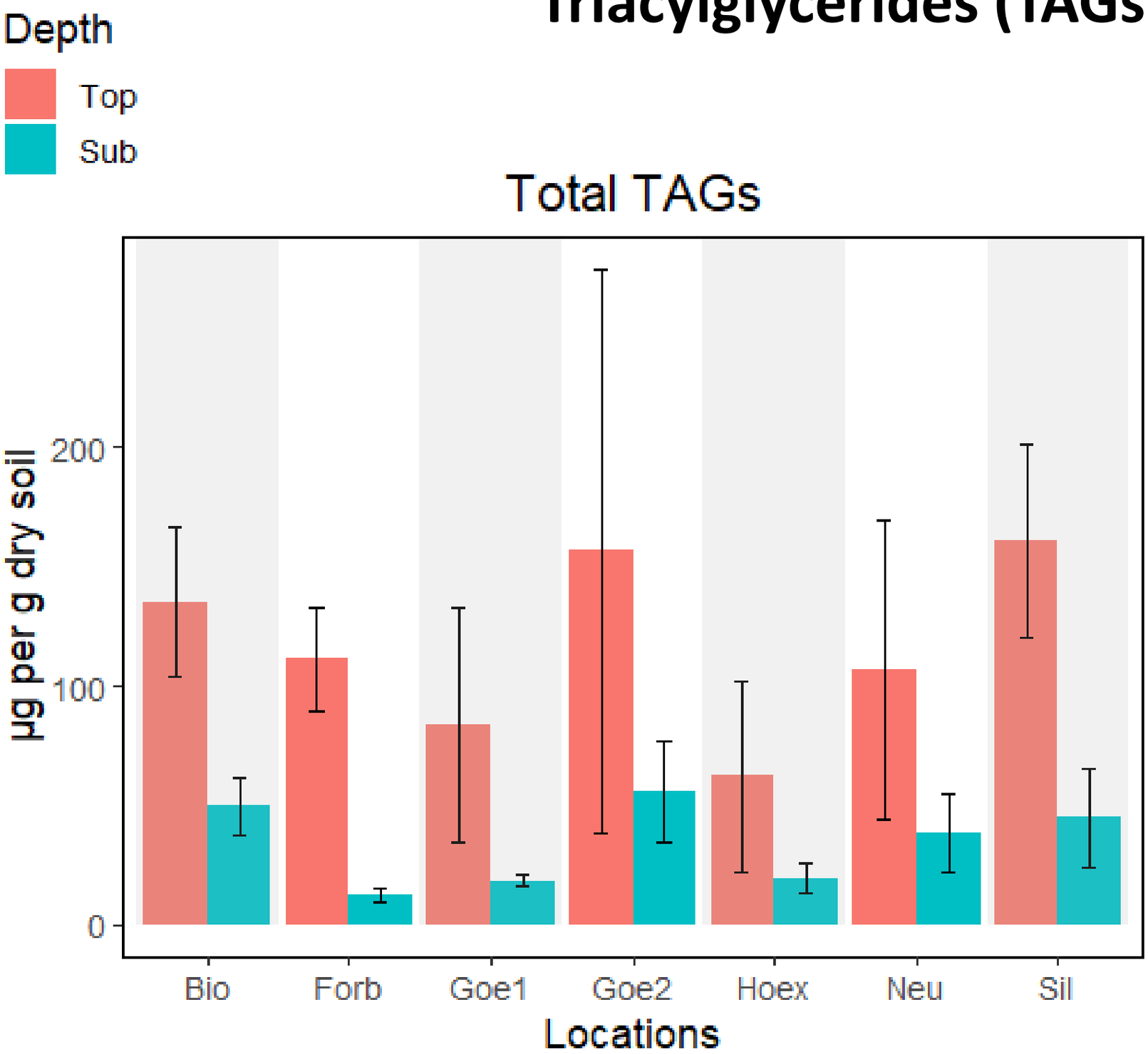
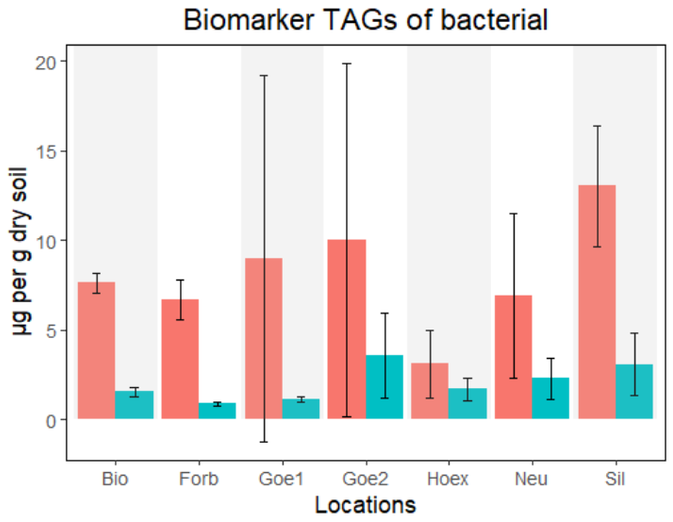
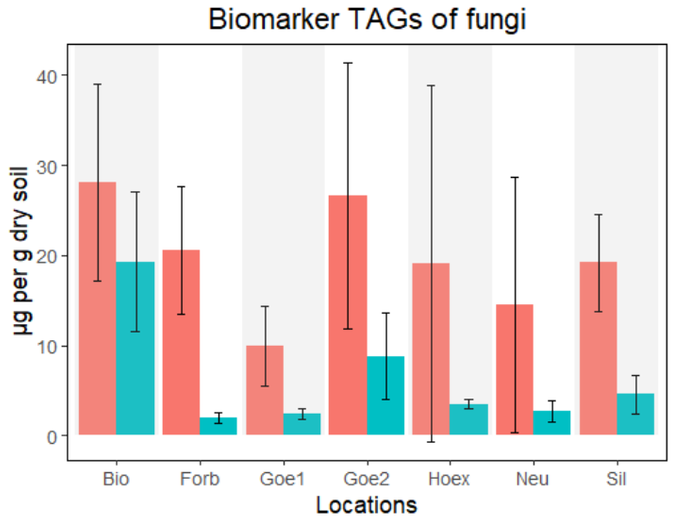
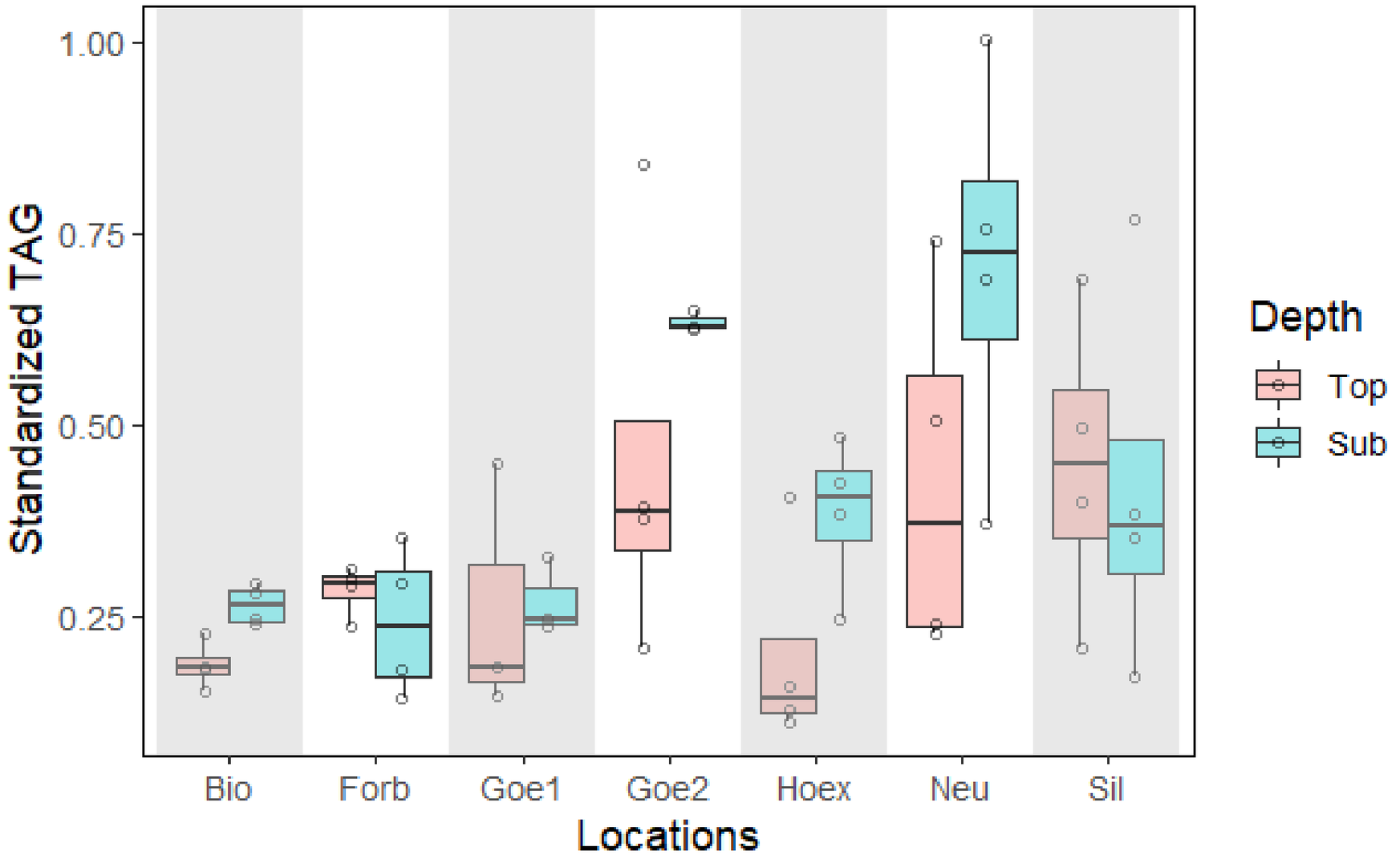




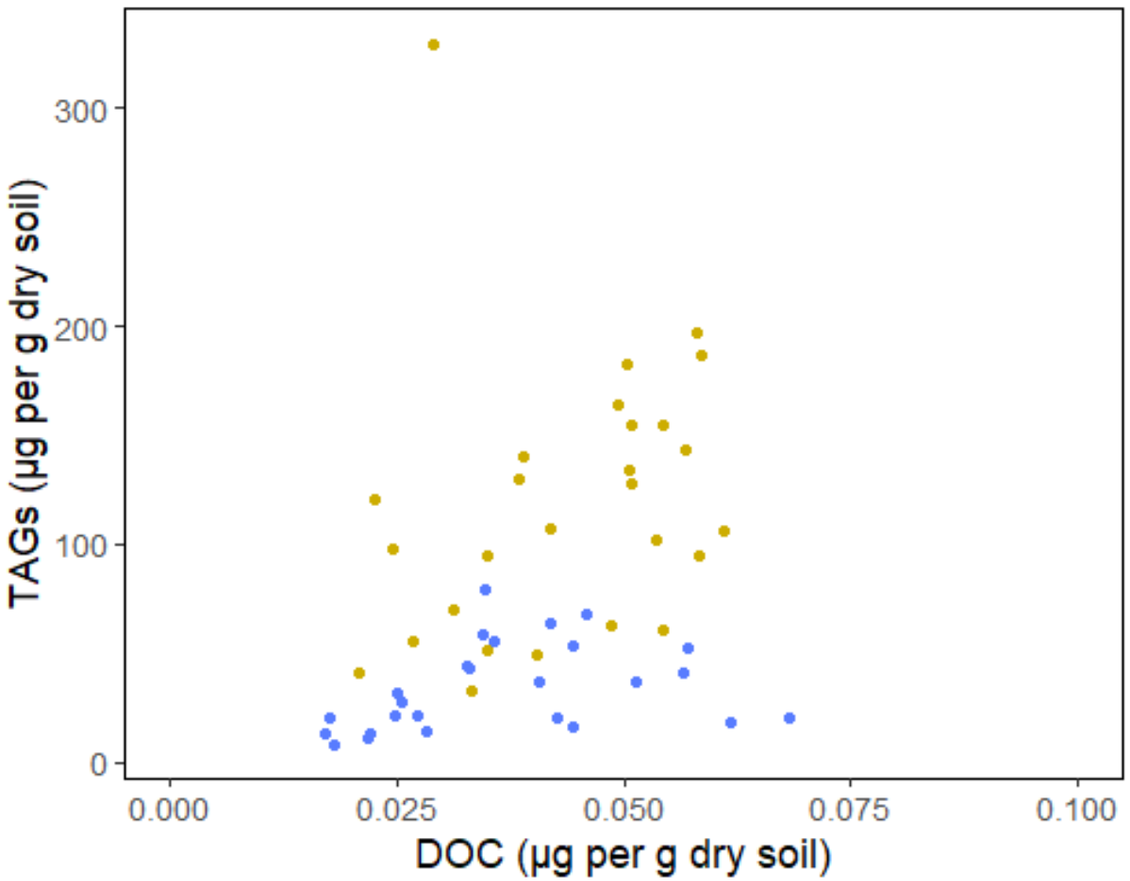


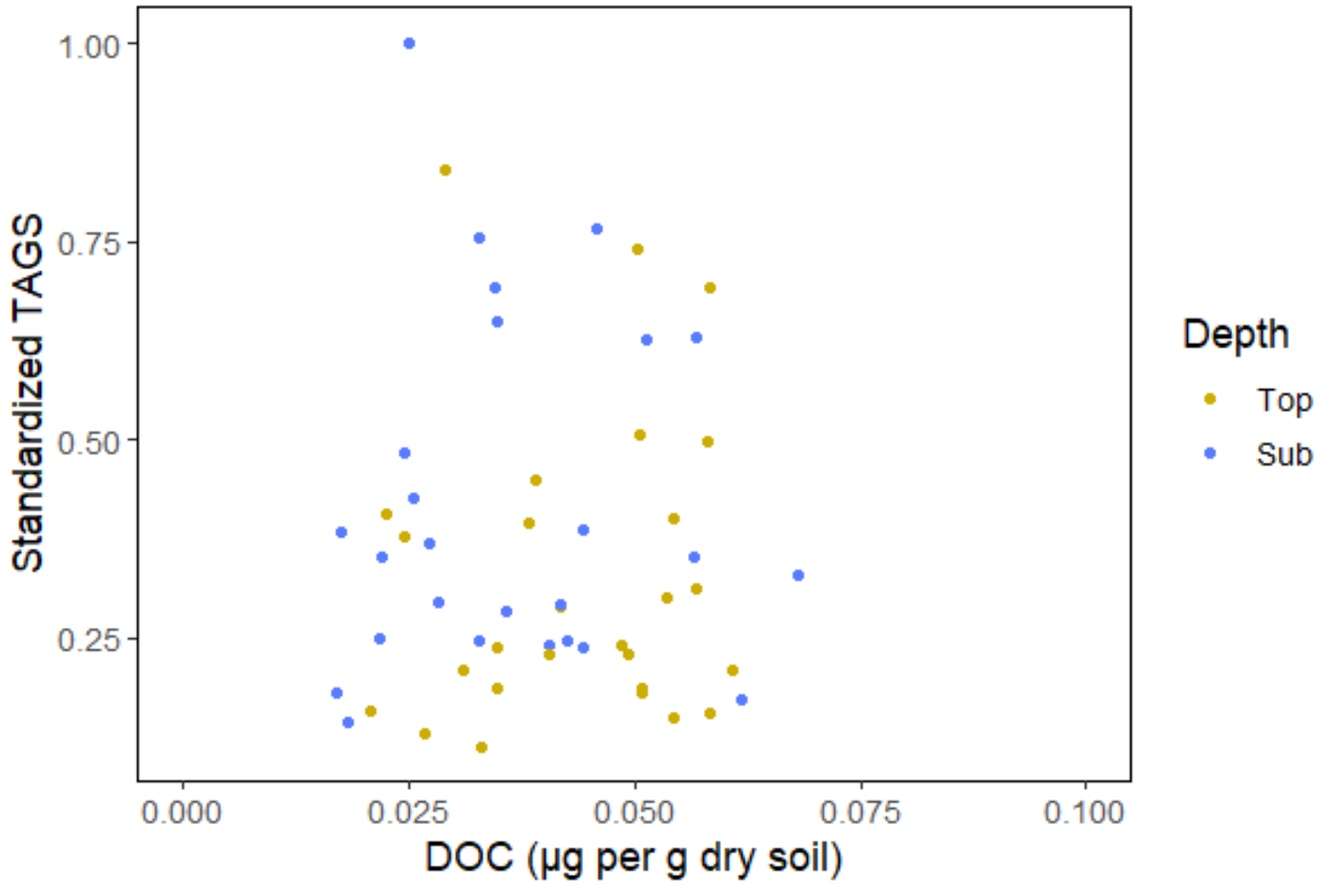
Standardized TAGs = TAG-Carbon/MBC



No relationship between depth and standardized TAG-Carbon

More available carbon more TAGs?





Conclusions

1. TAG storage occurs in ALL seven grassland soils.

2. Topsoil has more TAGs in total, but not necessary more TAGs in each individual microorganism.

Abstract link

Implication

1. More available carbon increases microorganisms storing carbon in total, but not in individual microorganism (no consistent physiological change).

2. Microorganisms have different strategies storing carbon. Some store when there is more carbon, but some store even under low carbon availability.

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Thanks to **Karin Schmidt** and **Xi Zhang** for assistance in the lab.

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Thank you ☺

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