Relationships between cattle grazing, soil microbiology and nutrients cycle in highland pastures

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Highland pastures and agroecology

- Agroecology: approach based on applying ecological concepts and principles to agriculture while taking into consideration the social aspects that need to be addressed for sustainable and fair food systems (FAO, 2018).

- Highland pastures: agroecosystems which could offer several Ecosystems Services, classified as High Nature Value Famland (HNVF)

Introduction

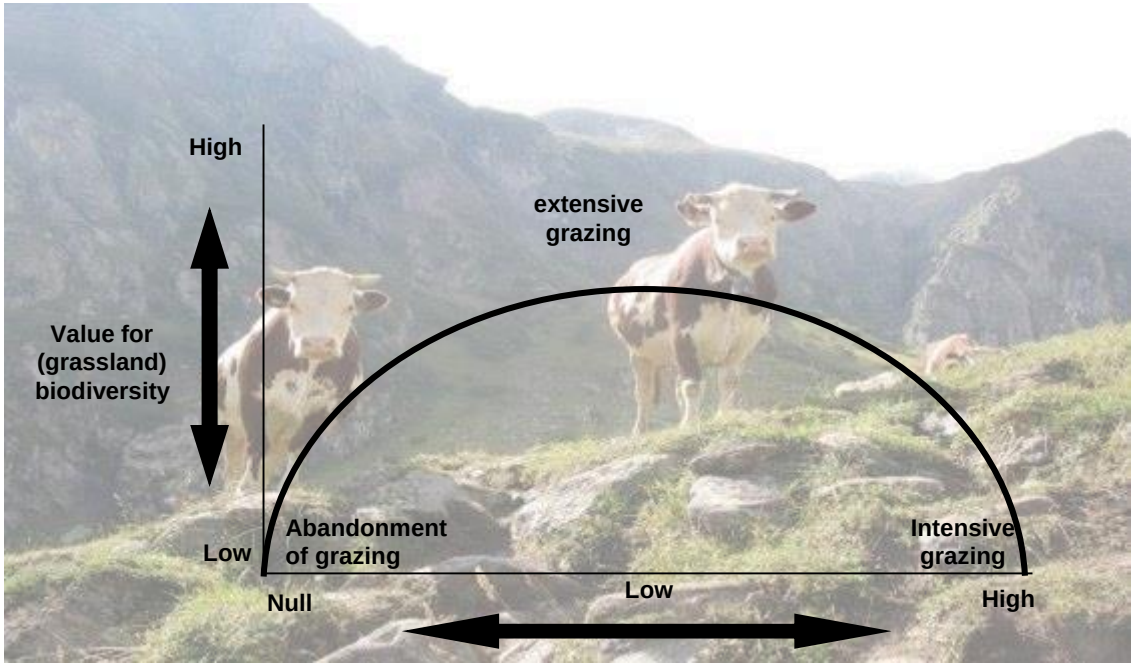
- **Permanent farm**

- **Summer farm**

Summer farms are temporary units where the livestock herds are moved during summer to graze on highland pastures

Aim

to characterize the agroecological relationships among grazing animals-plants-microorganisms in alpine summer pastures.



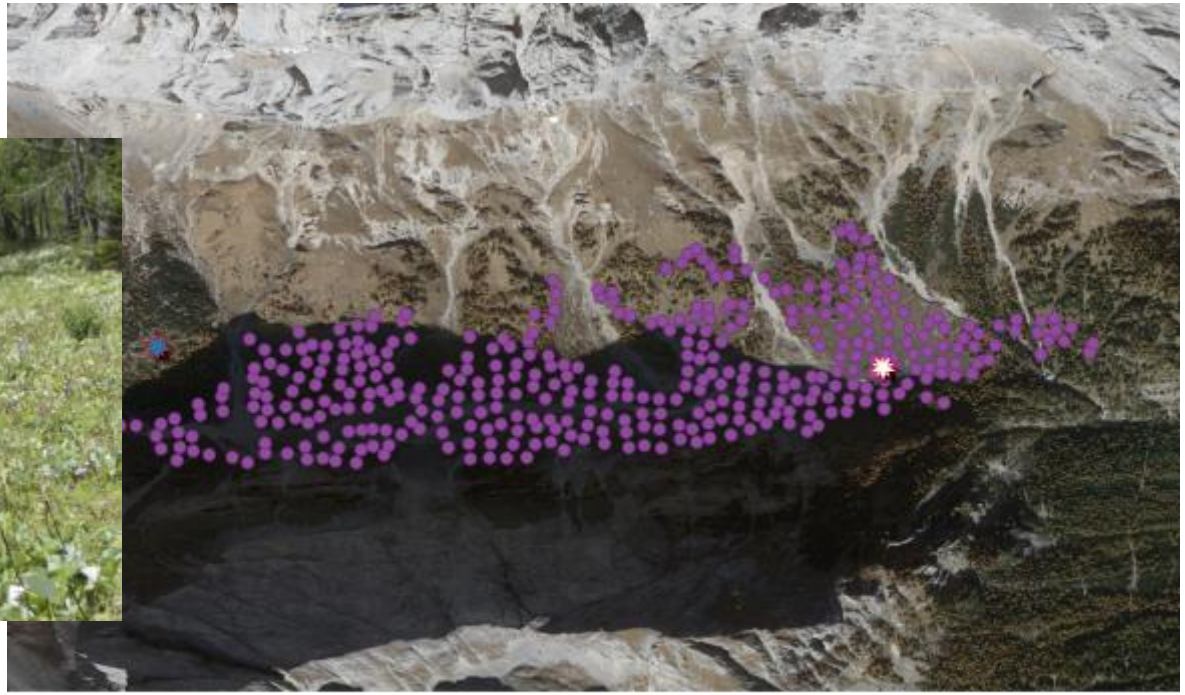
Study area

Malga Juribello
- 1900 m asl
- 160 dairy cows (mixed breeds mainly Brown Swiss)
- 180 ha - high stocking rate

Malga Ombretta
- 1904 m asl
- 30 dairy cows
- (mixed breeds mainly Alpine Grey/Simmenthal)
- 80 ha - low stocking rate

Monitoring of dairy cattle spatial patterns

- GPS tracking



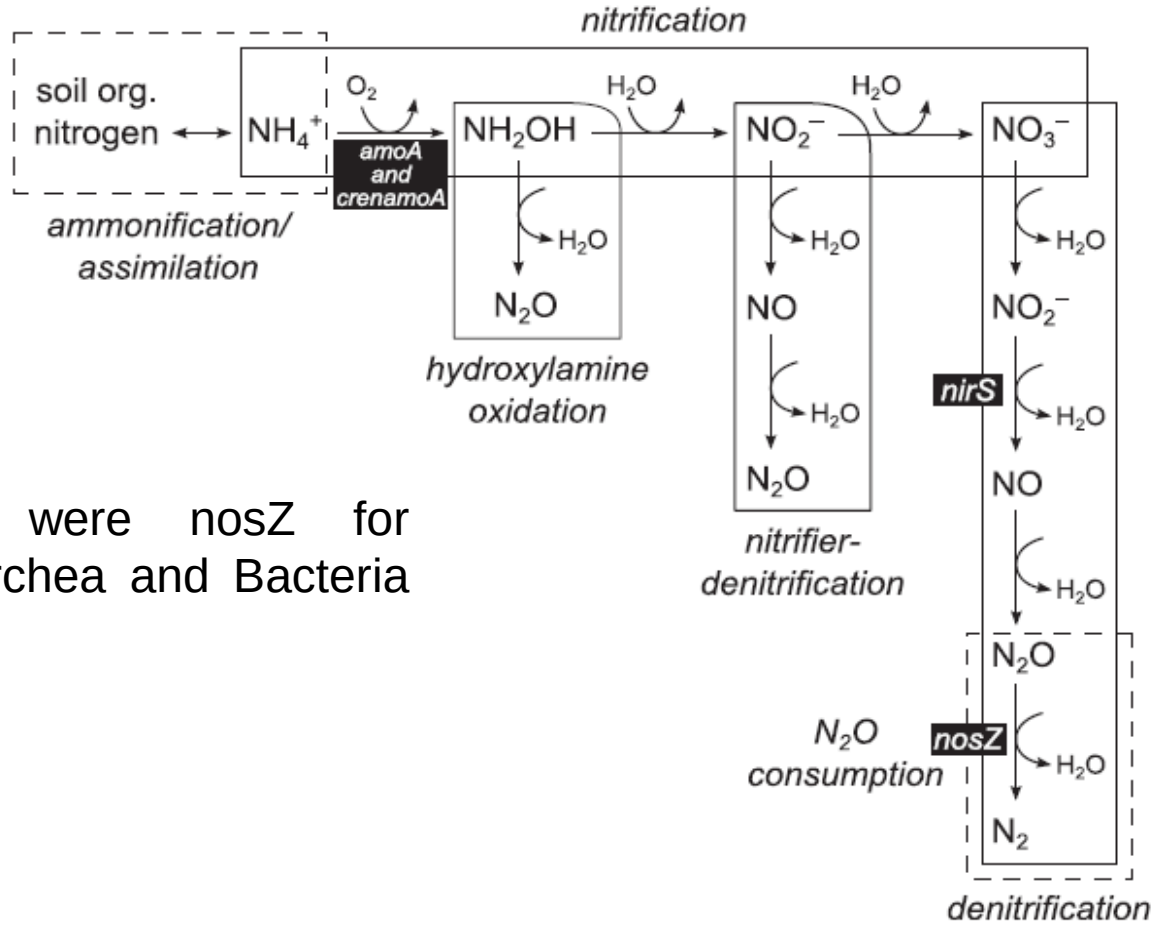
Rappresentation of grazing activity in Ombretta's pasture.
Each point rappresents a group of 10 GPS points, the positions of the cattle

Soil sampling and analysis

To assess the impact of dairy cattle grazing on the functional microbial biodiversity:

- topsoil cores before (“point zero”) and during the grazing period.
- patches representative of different vegetation types and stocking rates (3 repetition x point)
- molecular ecological approach to analyse microbial communities in terms of abundances relative to copies of target genes (real-time PCR)

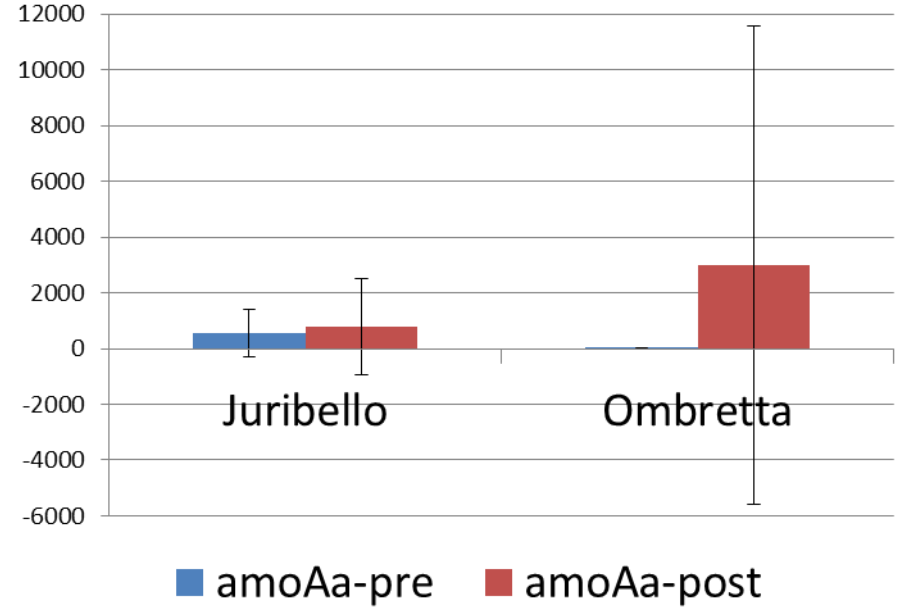
Genes studied

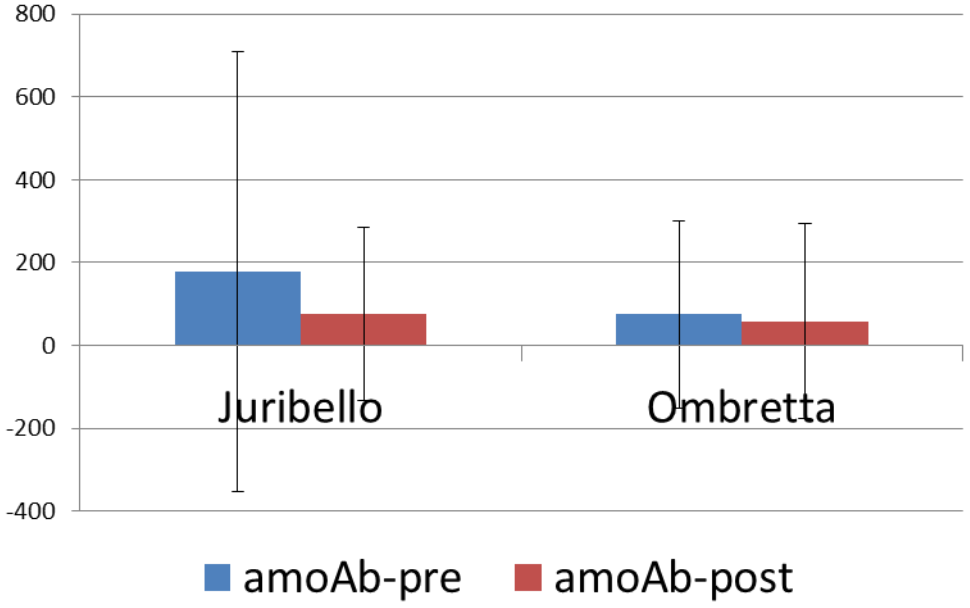


The studied genes were nosZ for denitrification, amoA Archea and Bacteria for nitrification

Results: descriptive statistics

Variation of Gene copies for each gene types in the two periods





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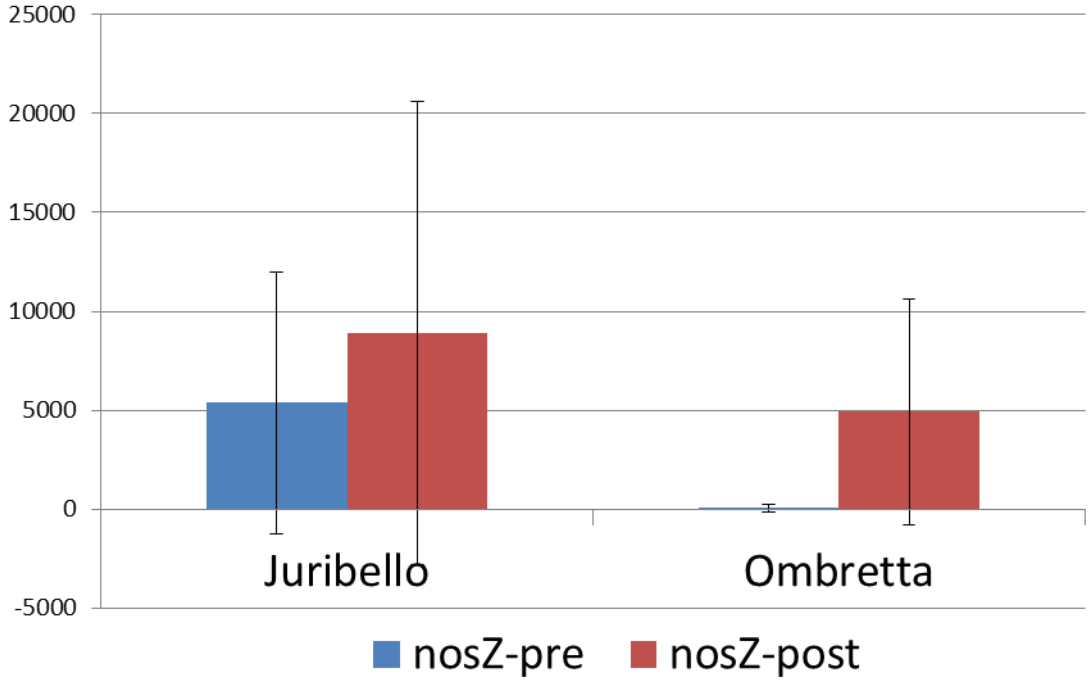
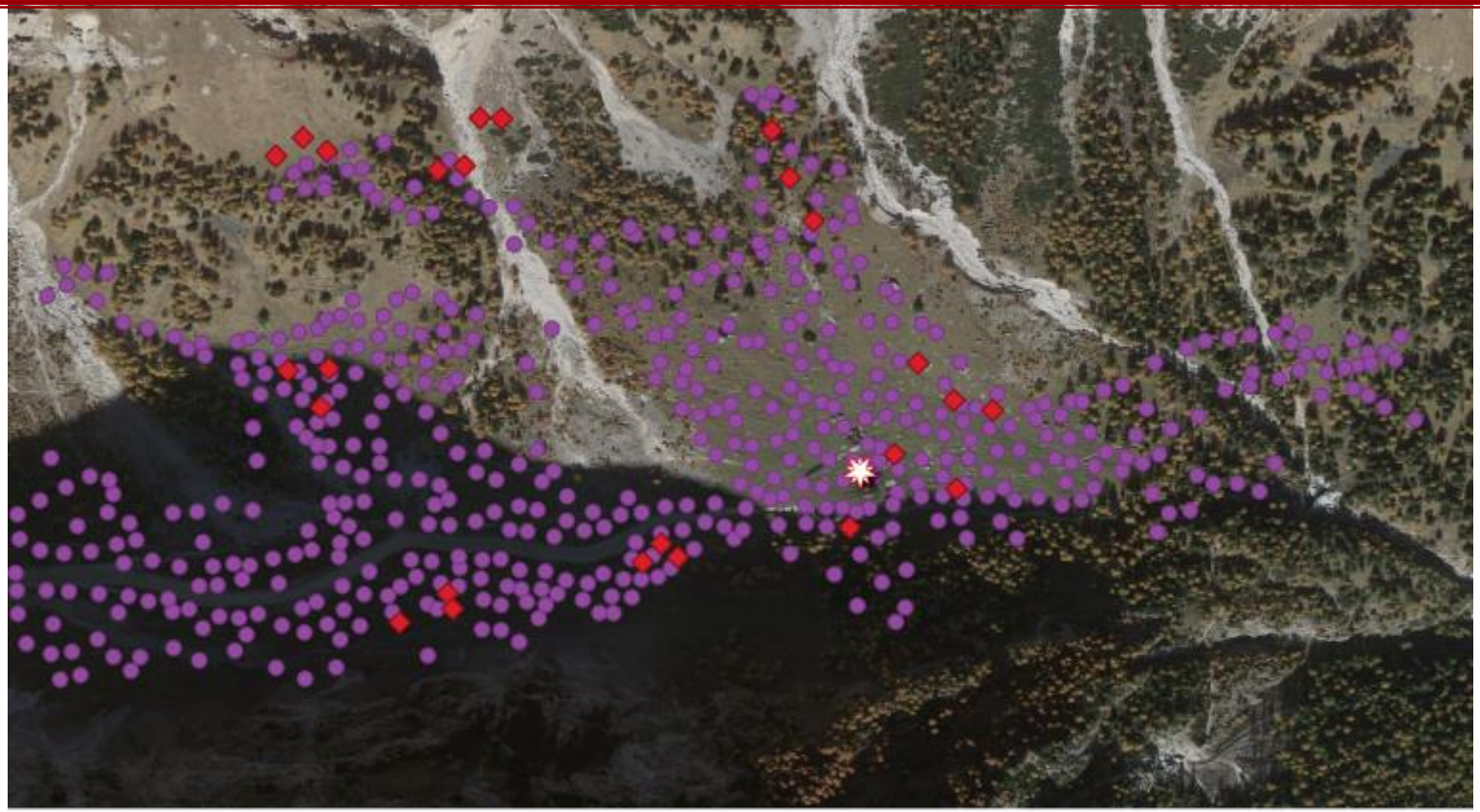


Variability within the same pasture



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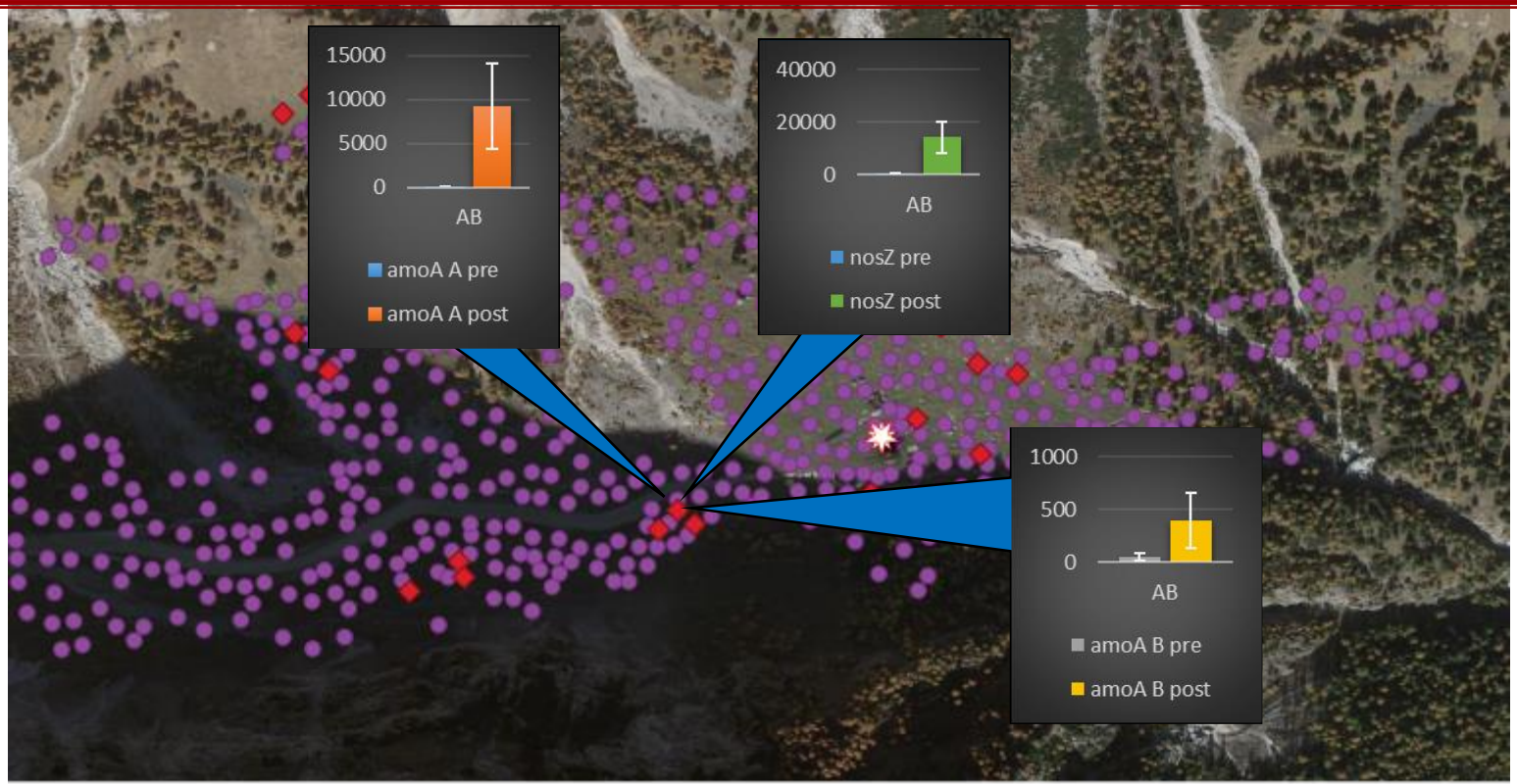

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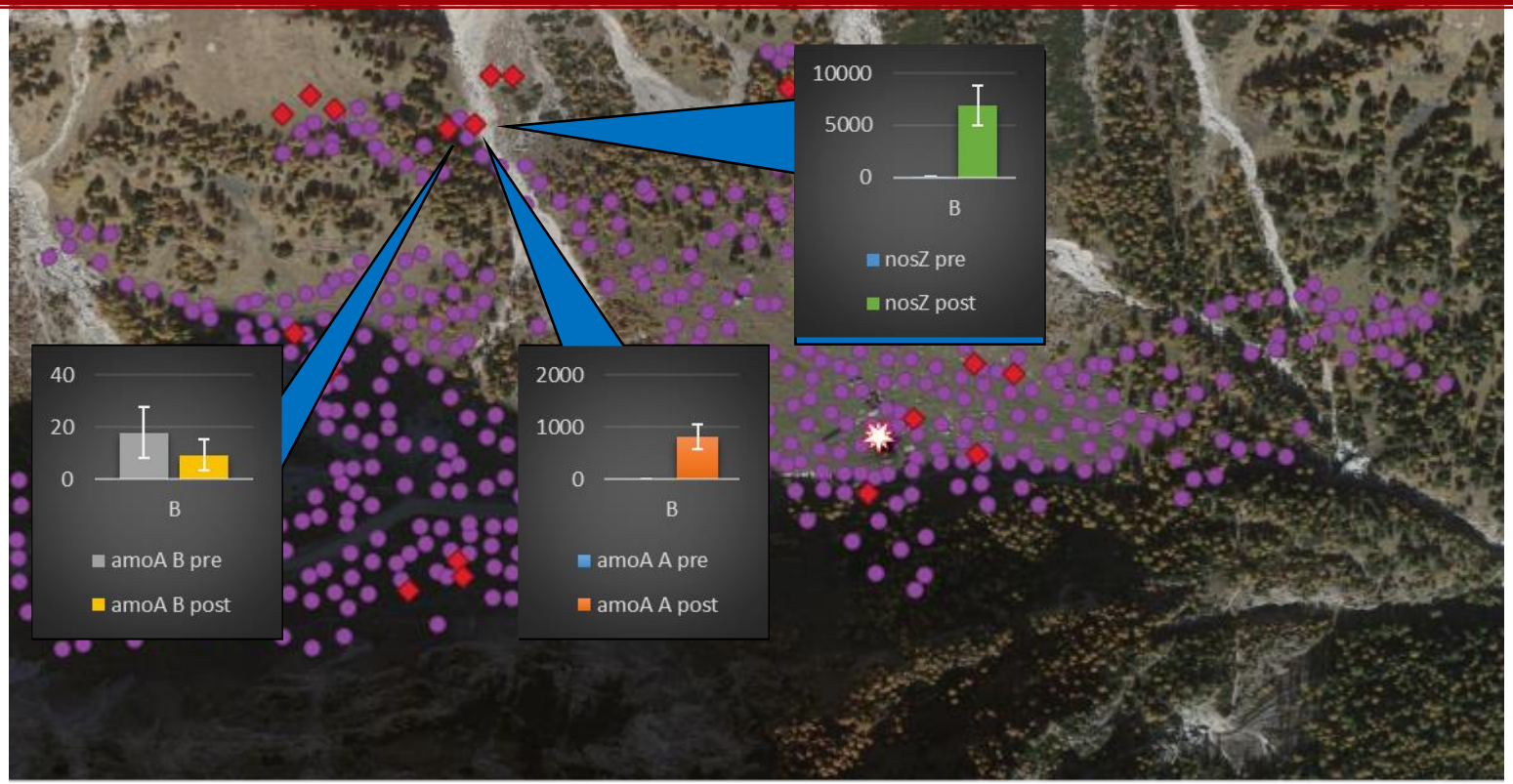

Conclusions

- The abundances of microbial communities studied varied clearly during the grazing season, but also between and within summer farms: this suggests an effect of grazing on microbial communities but in different terms depending on the local pedoclimatic and vegetational conditions and on the cattle stocking rates.

- These preliminary results could be used to develop specific and minimally-invasive biophysical indicators of supporting (and regulating) ecosystem services.

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Next steps: animal monitoring Project Smartalp

PSR 2014-2020
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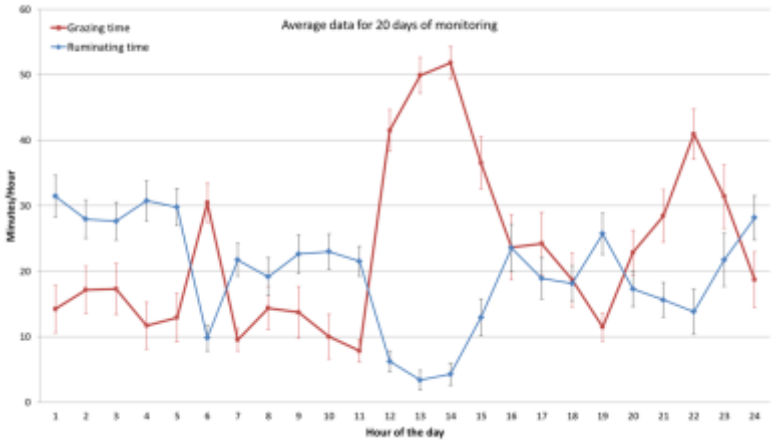

Next steps: carbon sink

Take home messages

- Livestock systems based on highlands pastures are particularly adapted to agroecological transition
- An equilibrium between productive performances and non provisioning ecosystem services could be reached trough targeted management (and policies) strategies
- A multi-indicators approach is strongly recommended to support this transition process