An antimethanogenic index (AMI) for meadow plants consumed by ruminants

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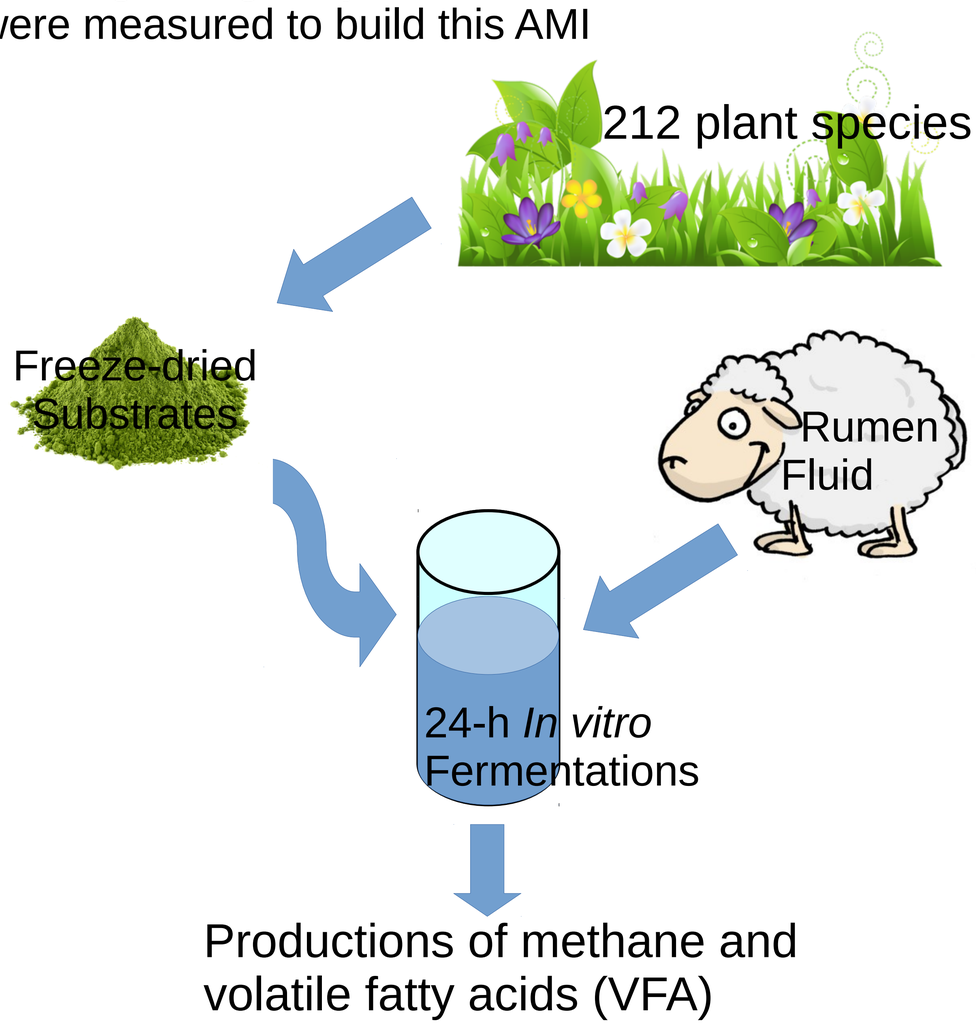
- Permanent meadows, especially in mountain areas, have numerous advantages over temporary meadows in terms of ecosystem services, as they help protect biodiversity and have a better resilience to climate stresses
- In addition, certain plant species have the ability to reduce methane emissions when grazed by ruminants
- We built an antimethanogenic index (AMI) that characterizes this mitigatng effect of wild plants while taking into account their nutritive value
- Plants growing not just in the meadows but also in neighbouring environments like hedges, borders, under-brush, and ditches were measured to build this AMI



OBTAINING FERMENTATION DATA

- 3 True repetitons in time for each plant incubation
- 48 repetitions for perennial ryegrass (PRG) used as control
- Methane and VFA productions (µmol/g OM) were normalized and expressed as a ratio of mean PRG values for each period to eliminate inter-period drift
- Regression between methane and VFA productions calculated after discarding outliers, namely 16 very particular plants that had a big effect on methane (1 methanogenic activator [*Chenopodium bonus-henricus*] and 15 antimethanogenic)
- Regression equation :
  CH_4 = 1.06 VFA -0.12 (R2=0.80 ; RSE=0.08)
- A plant was declared antimethanogenic (p<0.01) when its methane production was lower than the value fitted to the methane=f(VFA) linear regression, minus 2.58 times the standard deviation (s.d.) of PRG, with s.d. assumed as uniform on the experimental domain.

BUILDING THE AMI

AMI was calculated from *in vitro* rumen fermentation data as :

- AMI=(Af-Am)/Amax, where
- Af is the CH_4 value fitted to the CH_4 =f(VFA) linear regression minus 2.58 times the PRG standard deviation
- Am is measured CH_4 value
- Amax is maximum (Af-Am) value observed among the 212 plant samples

RESULTS

AMI < -0.20 : 44 plants activated methanogenesis (over the yellow zone)

- -0.20 ≤ AMI ≤ 0 : 104 plants with a normal stoichiometry of fermentation (Demeyer, 1981) in the yellow zone (Figure 1)
- AMI > 0 : 64 plants with a significant anti-methanogenic effect in the blue zone
- The strongest effect observed with *Bidens tripartita* (AMI=1)
- Numerous other plants had a promising positive AMI : *Origanum vulgare* (0.60), *Scrophularia nodosa* (0.55), *Serratula tinctoria* (0.49), *Succisa pratensis* (0.19), *Polygonum bistorta* (0.17), *Hypericum perforatum* (0.16)...

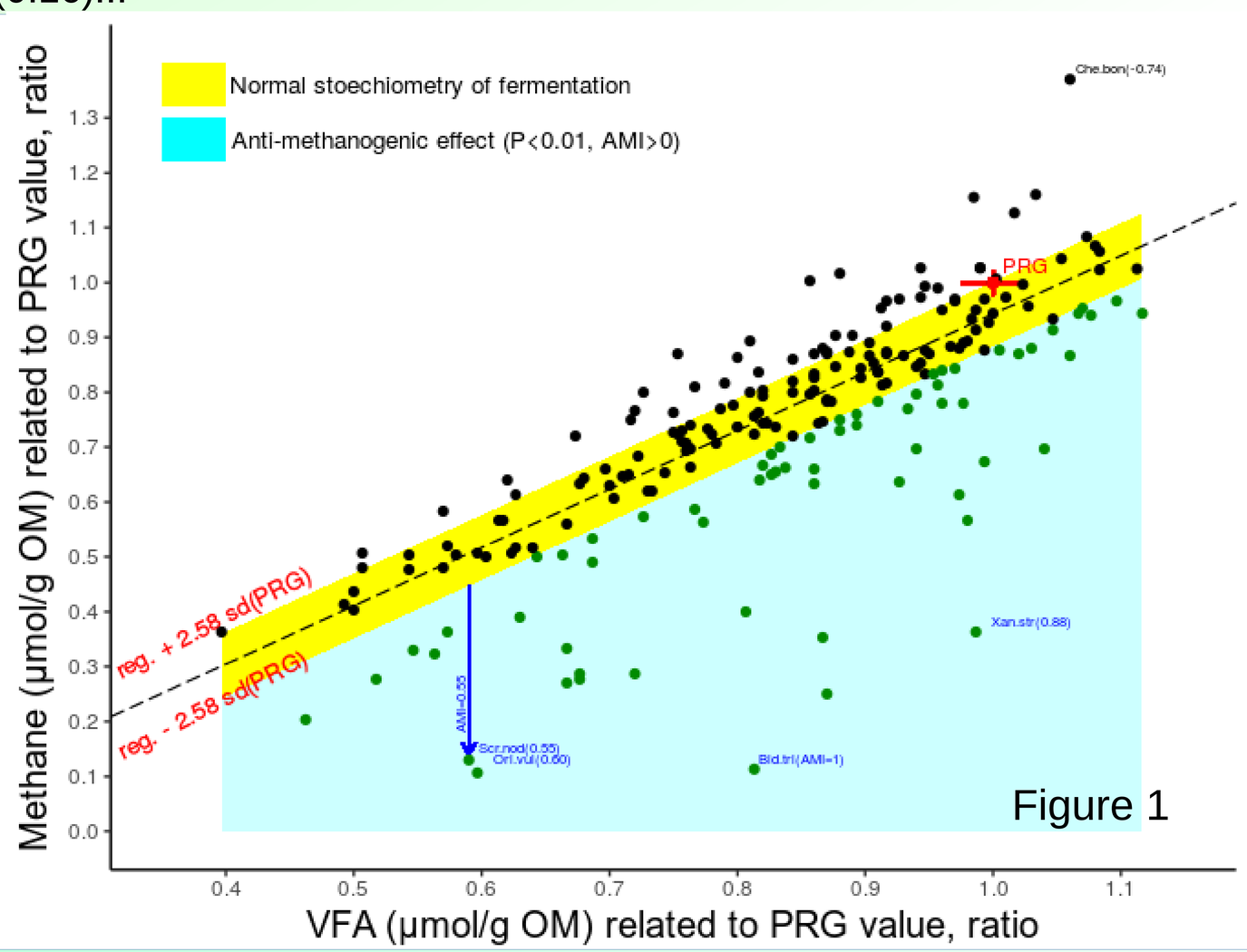


Figure 1

CONCLUSION

This simple AMI was able to classify plants according to their antimethanogenic potential while taking into account their nutritive value through *in vitro* VFA production from pure plant incubations.
AMI may rehabilitate some plants that had become marginalized and also highlights the importance of keeping certain species in the meadows.

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