

THE IMPACT OF BROWSING ON CARBON DYNAMICS IN REGENERATING NATURAL FOREST

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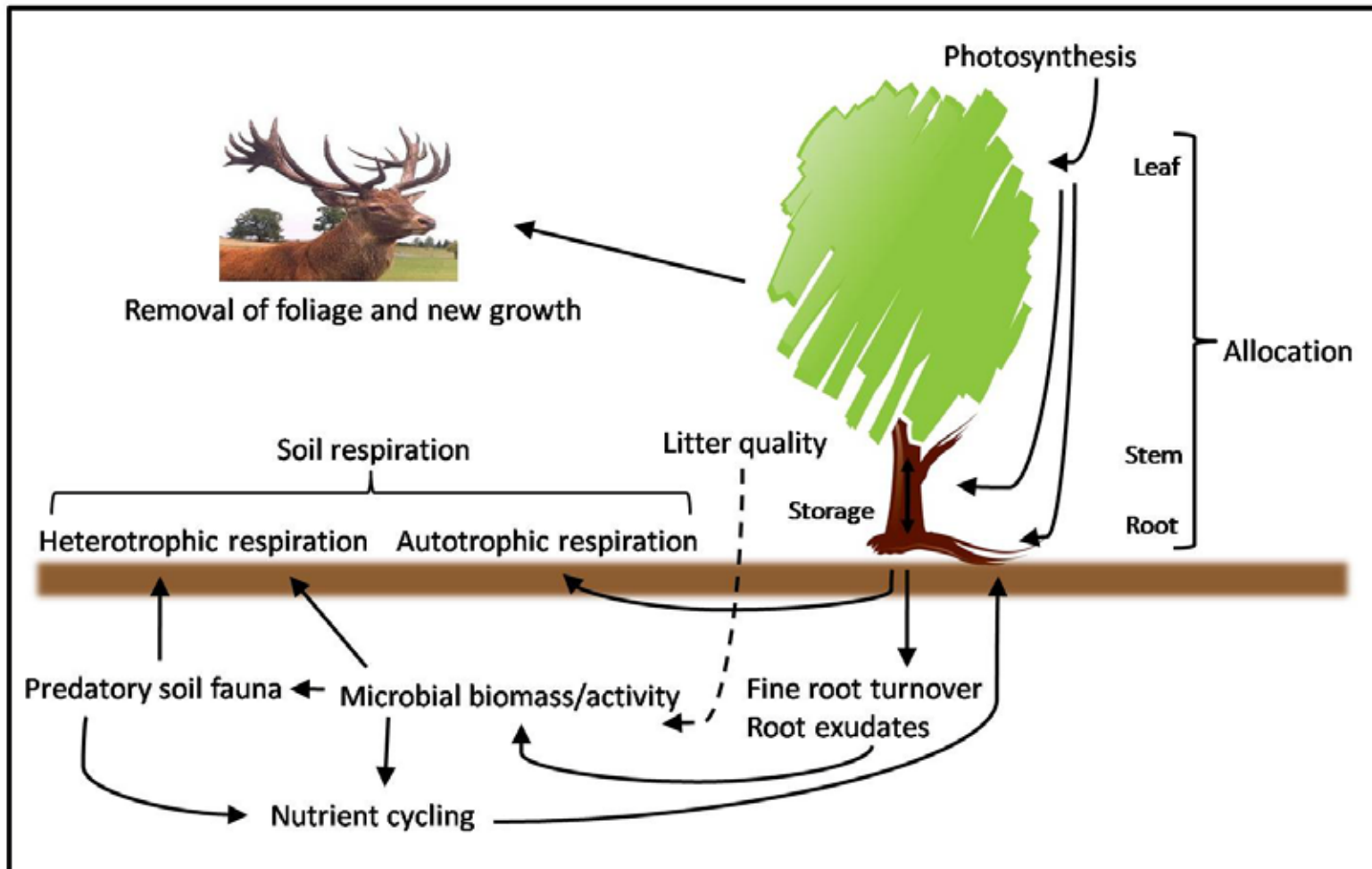
Content

- Overview of forest C cycling
- Browsing and C cycling
- Aims and Hypothesis
- Field study
 - Field results
 - Conclusions
- Mesocosm Study
- Questions

Forest Carbon Dynamics

- Forest ecosystems are a significant sink of C
- The onward flow of C is a balance of plant allocation
 - Above and belowground systems
 - Defence
- The ultimate fate of C
 - Leached
 - Sequestered
 - Soil respiration

Browsing and C cycling



Browsing and C cycling

- Birch capable of compensatory growth
Hester et al (2004)
- Decrease in above and belowground biomass *Carline and Bardgett (2005)*
- Limited/negative feedback on soil microbial biomass *Carline and Bardgett (2005), Harrison and Bardgett (2004)*
- Stimulation/depression of nitrogen mineralisation *Ayres et al (2004), Harrison and Bardgett (2004)*
- Depression of soil respiration *(Persson et al (2009))*

Aims and Hypothesis

- Aim to understand influence of browsing due to physiological plant responses
- Timing

- HYP: Browsing of trees alter C inputs belowground, causing a shift in the soil microbial community and therefore influencing soil respiration

Field Approach

- Long term browsing study
- 66% new growth removed

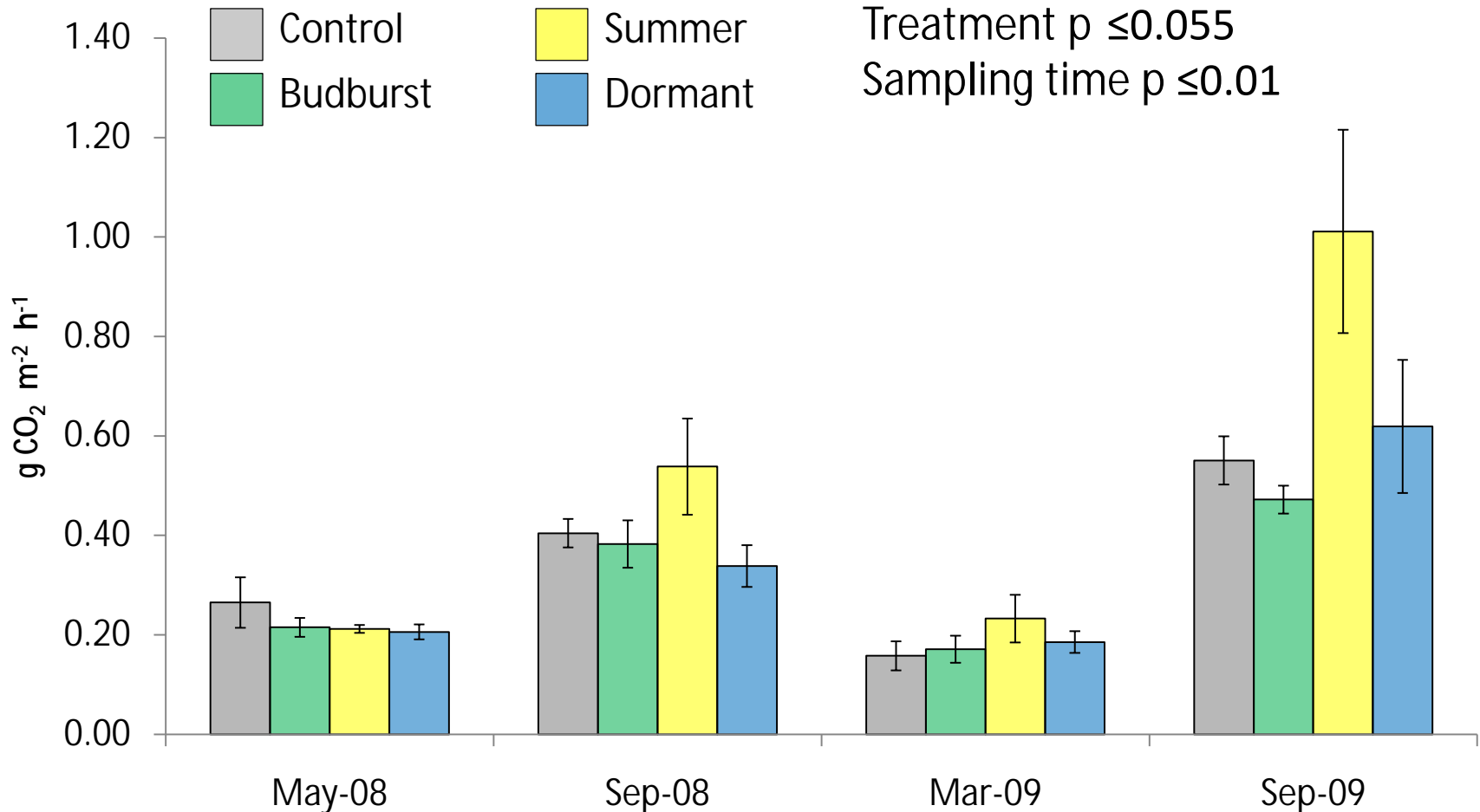
Treatment	Timing
Spring	At budburst
Late Summer	Before senescence
Winter	During dormancy

Field study



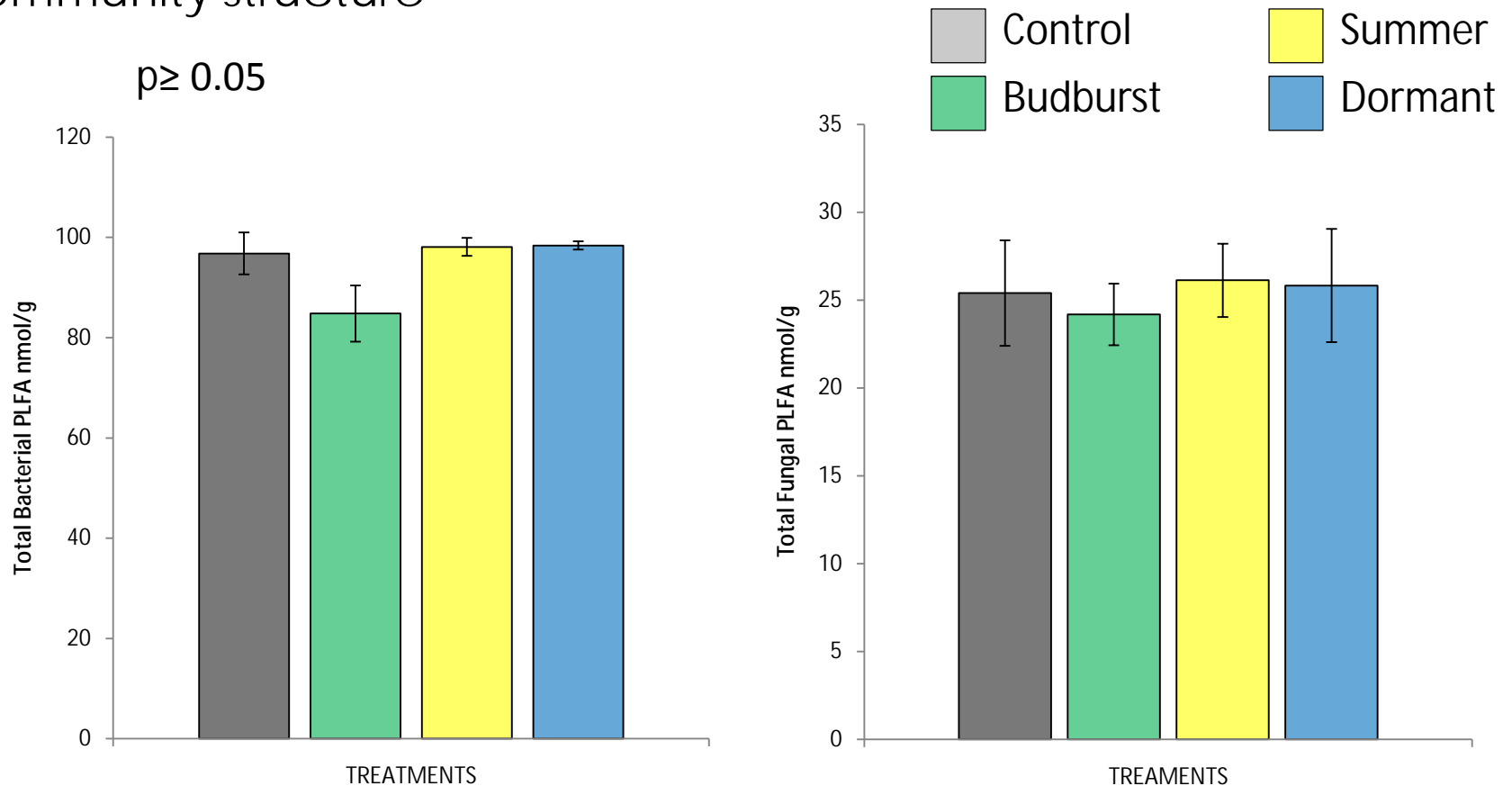
- Soil respiration measured in situ
- Rhizosphere soil sampled for lab analysis
- Foliage collected for decomposition and nutrient resorption analysis

Soil Respiration

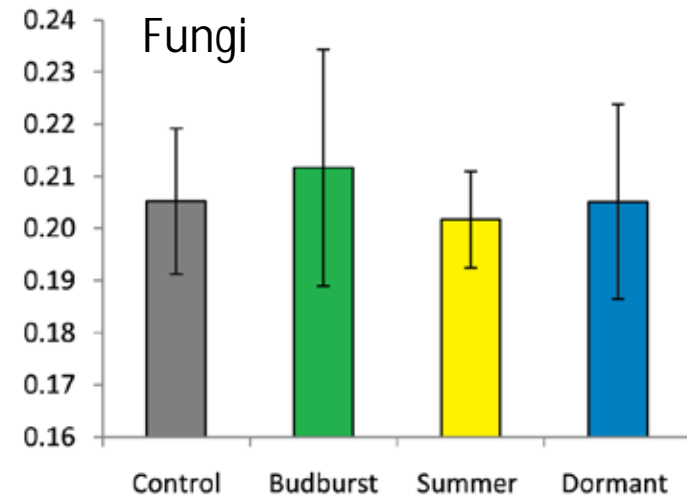
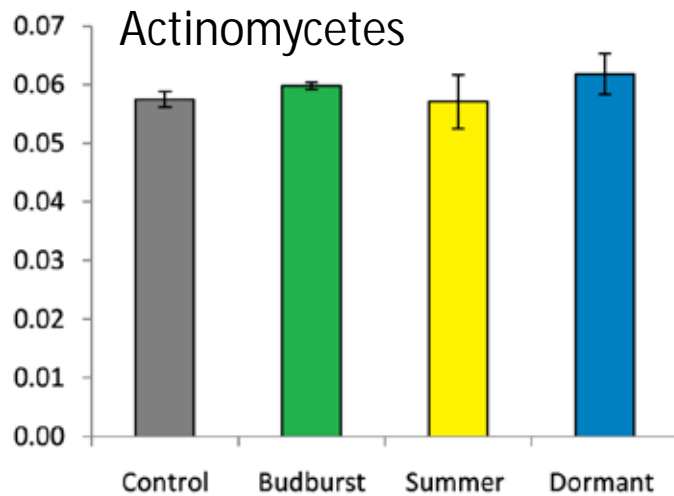
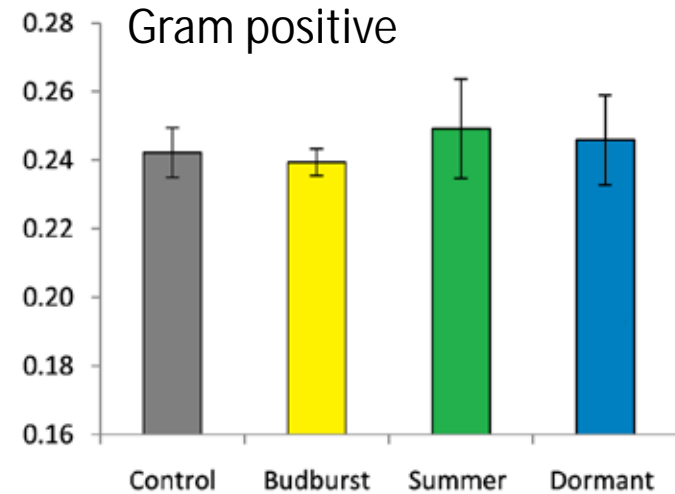
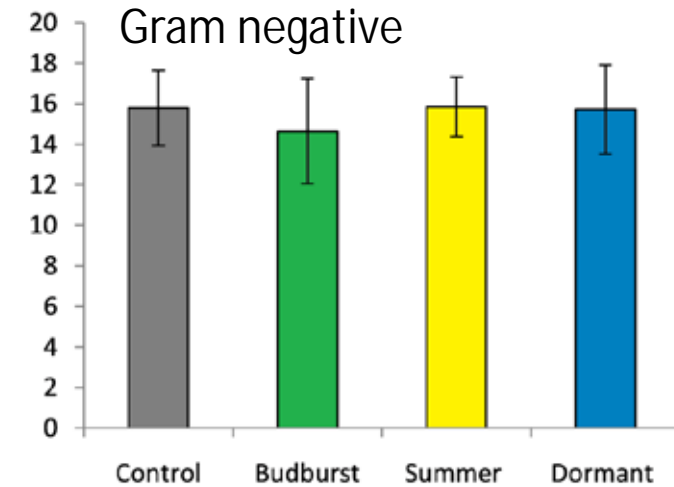


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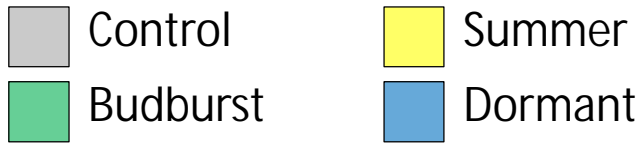
- Phospholipid fatty acid biomarkers assess microbial biomass and community structure



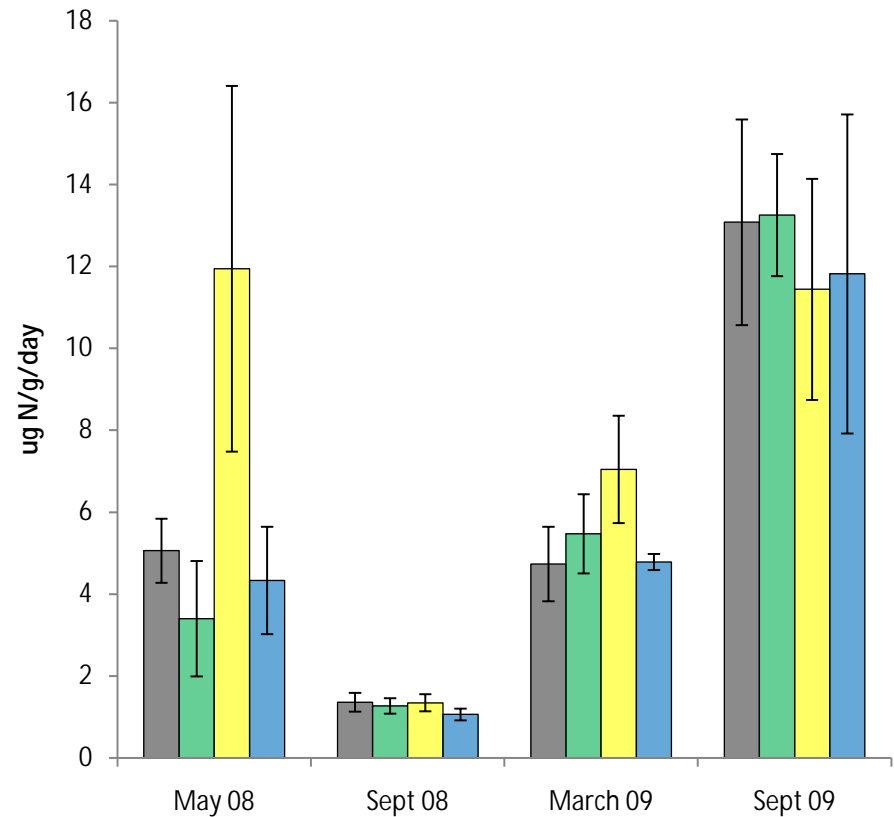
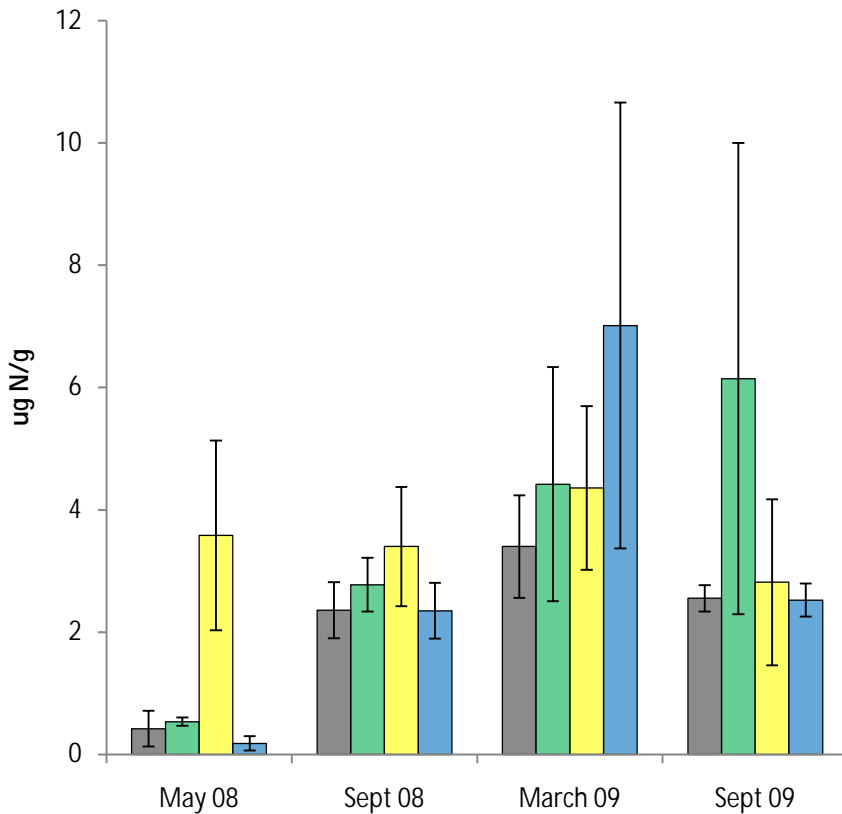
Microbial Community Structure



Nitrogen



Treatment $p \leq 0.049$
Sampling time $p \leq 0.01$



Conclusions

- Timing of browsing influences indirect feedbacks on soil C flux
- Limited effects on microbial biomass
- Simulation of nitrogen mineralisation
- Further evidence from field analyses may increase understanding of why

Mesocosm Approach

- Short term study over 2 growing seasons
- Treatments remove 66% growth during dormancy and late summer
- Saplings planted in C4 soil
- Ingrowth cores to separate contributions of mycorrhizae and microbes to respiration




Dome study



- Intensive measures of soil respiration
- Photosynthetic capacity
- Foliage nutrient status and functional traits
- Gas sampling for isotopic analysis
- 2 destructive harvests – June and September 2010

Acknowledgements

A photograph of a person wearing a blue jacket and a light-colored hat, leaning over and working in a field of dense green bushes. The person appears to be examining or tending to the plants. The background is filled with more greenery, suggesting a natural or agricultural setting.

Dan Tomes and Corrimony RSPB reserve for permission to access their site. Alison Hester, Richard Hewison, Dave Sim and Sheila Reid from Macaulay; Susan Ward and Sarah Dale from Lancaster University; Tim Hartley and Max Berridge all for their help in the field Helen Quirk for help and support in the lab

References

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