Response to RC2

The manuscript by Niderkorn and others explores the effects of climate change and extreme events on forage quality. They find that the effects of CO2 fertilization and extreme drought on forage quality, especially the neutral detergent fiber:nitrogen (NDF:N) ratio, somewhat offset each other. The interaction between climate change and plant chemistry is important to understand; many studies seem to only want to study production quantity and not nutrient quality. From this perspective the study is highly timely.

AU: We thank the reviewer for revising our manuscript and helping us to improve it.

At the same time, the text seems to be put together rather haphazardly. As one of very many examples, the word 'associated' appears twice in one sentence on lines 19-20.

AU: One of the two words “associated” will be changed for “applied”.

Starting at the first sentence, 'the natural one' sounds awkward; this sentence could be rewritten 'This study was aimed at analyzing changes in botanical and chemical composition and the in vitro rumen fermentation characteristics of an upland grassland exposed to elevated carbon dioxide concentrations and drought'.

AU: This sentence will be rewritten by removing the reference to “natural” light intensity, not necessary here.

The text really needs quite a bit of work to become publication-quality and a simple automated grammar and language checker would go a long way toward improving the paper.

AU: We thank the reviewer for this suggestion. We propose to send the manuscript to a language editing service for an in-depth reading and improvement.

Section 4.1 demands a bit more explanation. How did the control treatment become drier and warmer than climatic conditions?

A: The aim of this study was to simulate future climatic conditions and to measure ecosystem responses to changes of elevated CO_2 and of an ECE. We have chosen to apply from the start of the experiment and for all treatments less precipitation and higher temperature compared to actual climatic conditions. This allows comparing effect of elevated CO_2 and ECE under these drier and warmer conditions.

On line 225, are the differences in digestibility due in (perhaps large) part to differences in species that dominated in the different treatments? The results section, which was rather terse, could benefit from more detail on species-level changes that may or may not have occurred in the experiment with large implications for digestibility. These findings need to be described in a bit more detail to help the reader understand if findings are dominated by plant chemistry responding to climate variability and atmospheric change, or simply by the plant community that was growing in the different treatments.

A: As said in the text, relative abundance of species is very variable within treatment, which cause most of the time absence of differences across treatments. This variability of species abundance is a specificity of grazed grassland. The most pronounced effects are written in the manuscript, i.e. decline of *Holcus lanatus* in the ECE treatments. As this species represented more than 28% of total species abundance of the community, the decline of this species should have an effect on forage quality including digestibility. For other species with significant changes (*Lolium* and *Ranunculus*), the abundances are smaller (on average: 5 and 3%, respectively). The case of *Alopecurus* (significant CO_2 x ECE) is interesting as its abundance increased in the 390E up to value of 34% compared to 390C, 520C and 520E. We agree that with such abundance change, it can affect the forage quality. Changes in community structure may have altered the content of biochemical compounds determining digestibility and nutritional value such as non-structural carbohydrates (Chatterton et al., 1989; Bonnett et al., 1997) as well as the content of proteins, polyphenols, tannin, lipid and lignin (AbdElgawad et al., 2014) which not only have great inter-specific variability, but are also modified by climatic conditions and atmospheric CO_2 concentration.

Chatterton, N. J. N., Harrison, P. a. P. A., Bennett, J. H. H., & Asay, K. H. K. (1989). Carbohydrate Partitioning in 185 Accessions of Gramineae Grown Under Warm and Cool Temperatures. Journal of Plant Physiology, 134(2), 169–179.

Bonnett, G. D., Sims, I. M., Simpson, R. J., & Cairns, A. J. (1997). Structural diversity of fructan in relation to the taxonomy of the Poaceae. New Phytologist, 136, 11–17.

AbdElgawad, H., Peshev, D., Zinta, G., Van den Ende, W., Janssens, I. a, & Asard, H. (2014). Climate extreme effects on the chemical composition of temperate grassland species under ambient and elevated CO2: a comparison of fructan and non-fructan accumulators. PloS One, 9(3), e92044.

I feel that there is enough material here that is novel to warrant eventual publication, but readers will want to know why plant community chemistry has changed (see also Lee et al. cited on line 55). Is it the community, the chemistry, or both? The information is available and whereas the authors note minor differences in species (Fig. 4) there are important differences among groups (Fig. 3) and I was not fully convinced - but could be - that these shifts make a minor impact on digestibility. Adding a relative abundance effect, or accounting for relative abundance to the statistics presented might help do so, or perhaps by simply expanding the results section to add more detail. Bonferroni corrections likely apply to the multiple statistical comparisons in Tables 1, 2, and 4.

A: The suggestions made by the reviewer are interesting and we will add random effect due to species abundance in our ANOVA mixed model. We also will complete with more description the results section, especially in the part 3.1 related to above-ground biomass characteristics and chemical composition.