

## ***Interactive comment on “Thermo-erosion gullies boost the transition from wet to mesic vegetation” by N. Perreault et al.***

**Anonymous Referee #1**

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General comments Perreault et al. present in their manuscript entitled ‘Thermo-erosion gullies boost the transition from wet to mesic vegetation’ an interesting multi-approach studies relating changes in arctic vegetation to geomorphological processes in response to changing climate. The study definitively contents the material for a publication that should provide important insights in the understanding of cold ecosystem functioning and in the assessment of potential consequences of current environmental changes at high latitude. However, I think that the paper needs important revisions to reach these goals. I am particularly concerned by two points: - First, the presented results do not support in a clear way the conclusion highlighted in the discussion. P12202 L 5-7 the authors claimed that the soil moisture of disturbed sites is more responsive to rainfall while in the fig. 1 there is no significant habitat x date interaction and the author explained the difference in soil moisture date by summer rainfall. I assume that

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the not shown data give other view but the fig. 1 actually contradicts discussion claim. The authors confront the decrease in graminoid biomass following disturbance to the expected increase in biomass due to warming climate. However, there is no mention about the total above-ground biomass, even limited to vascular plants, meaning: What about the change in biomass when considering graminoids, forbs and more particularly shrubs? Is the decrease in graminoid biomass due to unsuitable conditions (less productive environment) or to the competition with mesic species (Similar productivity level but other functional dominance)? The authors present the results from the multivariate analysis as a clear discrimination of the vegetation of wet polygons from the other habitats (P 12203 L 1-3) while the fig.5 rather shows some sort of continuum with the wet polygons and mesic habitats clearly segregated and the intermediated disturbed habitats somewhere between. From my point of view, this gradual change in plant composition should be the core of the message. The authors underlined the rapid changes (in a decadal time, P 12201 L18, P 12203 L 28) in vegetation but to me this point remains underused. Moreover, the comparison between the immediate change in soil moisture and thaw front depth (undisturbed vs. disturbed habitats regardless the time since the beginning of the disturbance) and the gradual response of the vegetation represents by itself an interesting but unexploited result that should be linked to biological inertia or successional dynamics responses concepts. - Second the presentation of the methods, the justification of methodological choices as well as the presentation of the results remain unclear despite a visible effort from the authors to present exhaustive study. A first missing while crucial information is about the identification of the age of the disturbance for the intermediate habitats (<5, >5 years) as well as the mesic habitats. Can we imagine more accurate information about the age (from long-term monitoring?) that could lead to different habitat segregation analyses? The repartition of the habitats in each gully is also missing. Concerning this point I am also surprised to not retrieve the place of the gullies in the statistical models. Actually, the gullies look like true replicates and I assume that the four habitats occurred in each of them. While the presented analyses (the linear models) are based on unreplicated de-

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sign (meaning poor statistical value), perform the analyses on average values per gully would improve the representativeness of the study. The result section often repeats between brackets statistical results presented in the tables and the figures. Moreover the tables and figures also provide redundant information (the values in the table 1 are graphically represented in the fig 2 and 3). Such redundancy is at least unnecessary and can lead eventually to hide the message.

Specific Comments P12194 L5-9: It seems illogical to state that the vegetation response is unknown along with this response contrasts with literature. Rephrase P12196 L 7 to 19 The first habitat category is marked by (i) and the 3 other not. (ii), (iii) and (iv) are missing P12196 L23 Was the thaw front depth measured in each site in 2009 and 2010 or did the data collection start in 2009 and was completed in 2010? Clarify P12196 L 25 Why the determination of thaw front depth necessitated 3 measures in the mesic sites and not in the other? Justify. P12197 L 17-18 Why two different grid size for above ground biomass harvesting? Justify P12198 L15: The choice of statistical models is unclear: Why log transform the soil moisture and thaw front depth data to analyse them with GLM eventually (L3) while GLM are actually designed to analyse non-normal data set using link functions. P12198 L16 What is 'eco-terrain' P12198 L18 From where came the number of 66 species? I am not sure that it is a necessary precision, the list of considered environmental variables should be sufficient. P12198 L 20 I know soil moisture and soil water content but 'soil moisture content' sounds wrong. P12198 L17 for 'vegan' package, cite Oksanen et al. (2012) and for R, cite R development core team (2013) P1200 L1 Concerning this paragraph: I think the analyses of habitat effects for each plant groups (Shrub, mosses) can be useful and provide new lightening. P12200 L2 What about the 7 missing species, cryptogams species I presume, but why considered them for the CCA and not in characterisation of the plant community? P12200 L 17 What is B1 the authors refer to? P12201 L15-18 Check for sequence of tense P12202 L16-18 I don't see the interest of this sentence

Technical comments P12195 L 7 'landscape' instead of 'ladnscape' P12198 L 2 There

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is a weird redundant typing error with the double 'f' throughout the manuscript P12203 L25 'to' instead of 'and' P12204 L3 space between 'decrease' and 'in' P12205 L 9 missing closing brackets after Massé et al., 2001

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