

## Supplementary materials

**Table S1: Activity of  $\beta$ -glucosidase (GLU), cellobiosidase (CEB), chitinase (CHI), and leucine-aminopeptidase (LAP) as well as decomposition rate constant ( $k$ ) and stabilization factor ( $S$ ) in unplanted soils exposed to three different flooding frequencies (monthly, weekly and daily), values are means and SE ( $n = 4$ ). Values not connected by the same letter within one column are significantly different at  $p \leq 0.05$  based on Tukey's HSD tests. Corresponding one-way ANOVA results are included below (p-values bold typed at  $p \leq 0.05$ ).**

Flooding	GLU	CEB	CHI	LAP	$k$	$S$
Monthly	27.20 $\pm$ 2.67 a	14.24 $\pm$ 2.37 a	12.21 $\pm$ 2.09 a	63.97 $\pm$ 3.61 a	0.016 $\pm$ 0.003 a	0.17 $\pm$ 0.02 a
Weekly	24.26 $\pm$ 4.93 a	12.30 $\pm$ 1.86 a	11.32 $\pm$ 2.51 a	55.09 $\pm$ 10.53 a	0.012 $\pm$ 0.003 a	0.17 $\pm$ 0.01 a
Daily	32.32 $\pm$ 10.78 a	12.29 $\pm$ 3.48 a	11.95 $\pm$ 2.65 a	56.40 $\pm$ 8.16 a	0.010 $\pm$ 0.000 a	0.10 $\pm$ 0.02 a
<i>One-way ANOVA results</i>						
	F	p	F	p	F	p
Flooding	0.338	0.722	0.179	0.839	0.036	0.965
	F	p	F	p	F	p
Flooding	0.338	0.722	0.179	0.839	0.036	0.965

**Table S2: Correlations between soil microbial C- and N-enzyme activities and litter-breakdown parameters. Shown are Pearson correlation coefficients ( $r$ ). Significant ( $p \leq 0.05$ ) correlations are highlighted in bold font.**

	C activity	N activity	$\Delta$ C activity	$\Delta$ N activity
Decomp. rate ( $k$ )	<b>0.49</b>	0.20	<b>0.52</b>	<b>0.29</b>
Stabilization ( $S$ )	-0.10	-0.08	-0.04	-0.04
$\Delta k$	<b>0.39</b>	0.04	<b>0.41</b>	0.20
$\Delta S$	-0.22	<b>-0.34</b>	-0.22	-0.27

Notes: C activity = sum of C-acquisition enzyme activities ( $\beta$ -glucosidase + cellobiosidase); N activity = sum of N-acquisition enzyme activities (aminopeptidase + chitinase); Decomp. rate ( $k$ ) = decomposition rate constant (*sensu* Keuskamp et al. 2013); Stabilization ( $S$ ) = stabilization factor (*sensu* Keuskamp et al. 2013);  $\Delta$  = activity values in relation to the unplanted control (i.e. percentage change of planted vs. unplanted mesocosms) reflecting plant effects independent of direct (i.e. non-plant mediated) flooding effects.

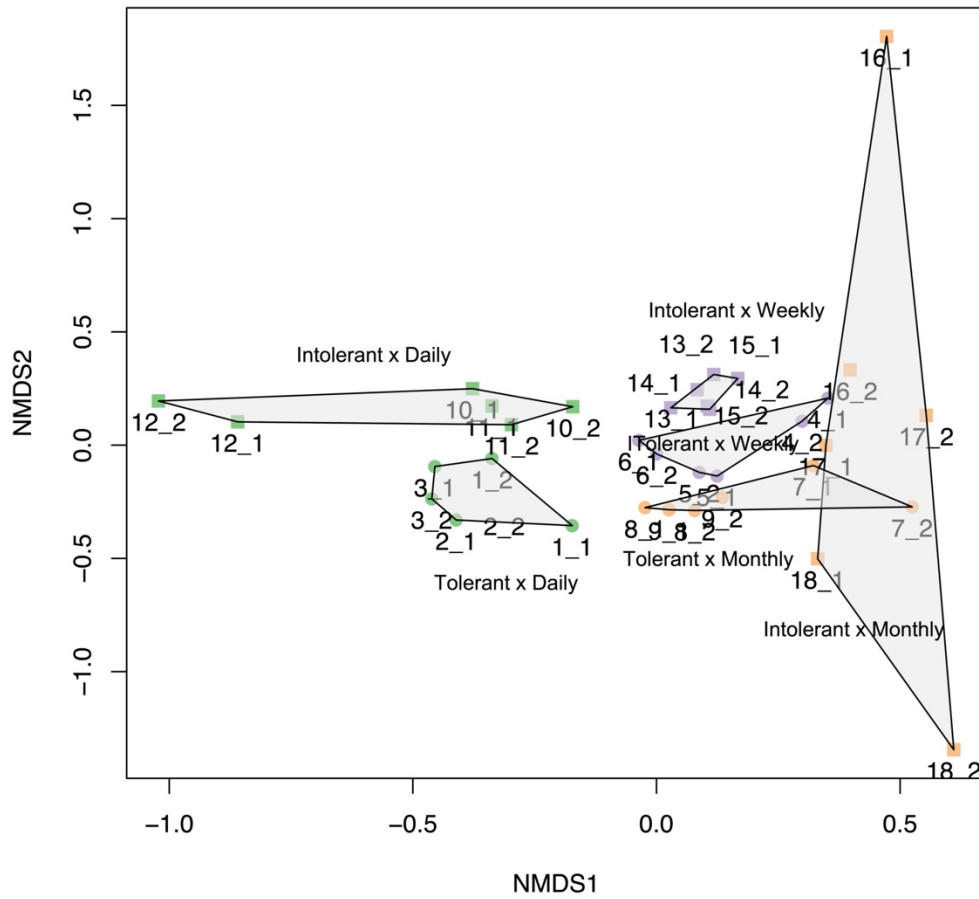
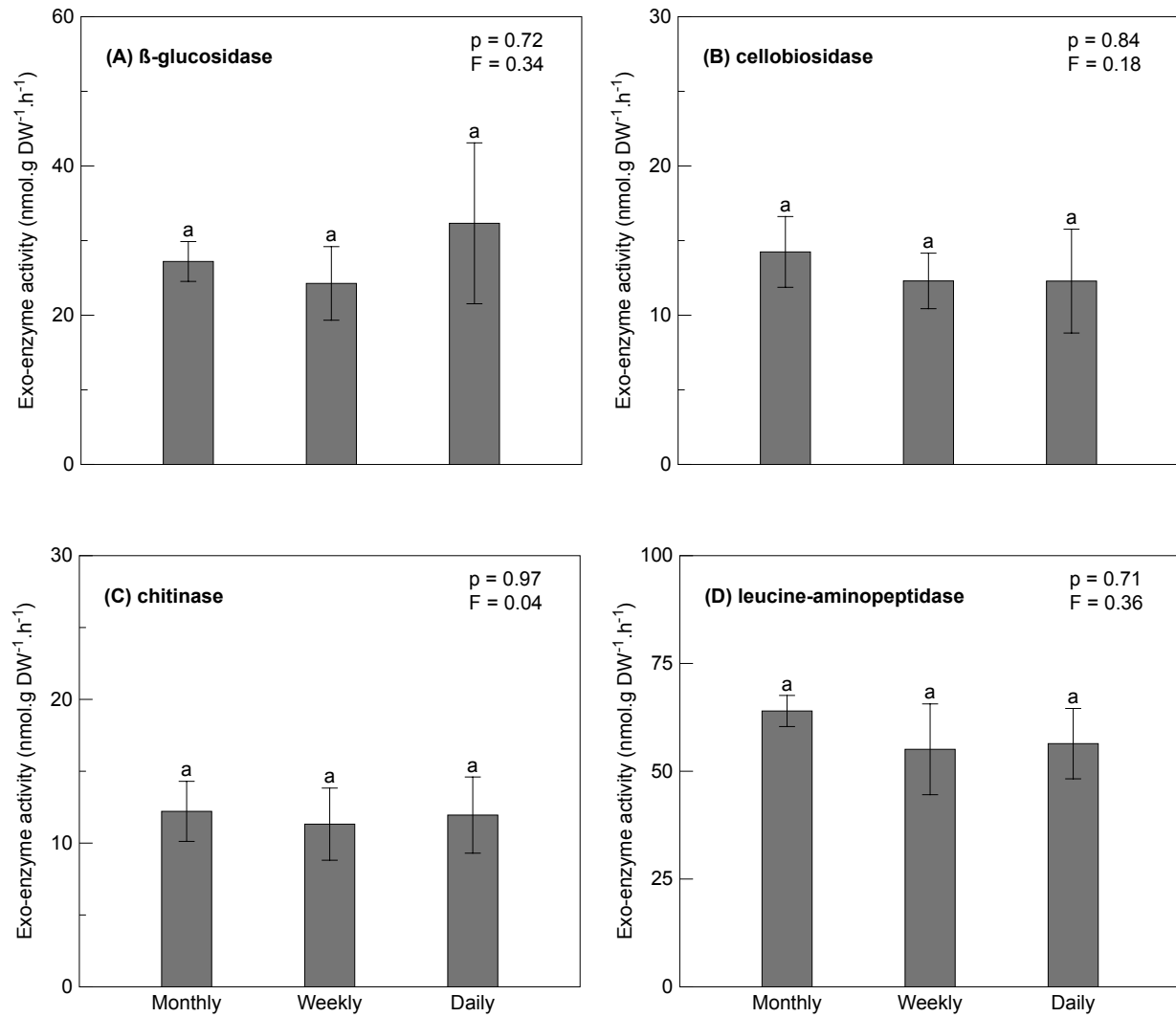
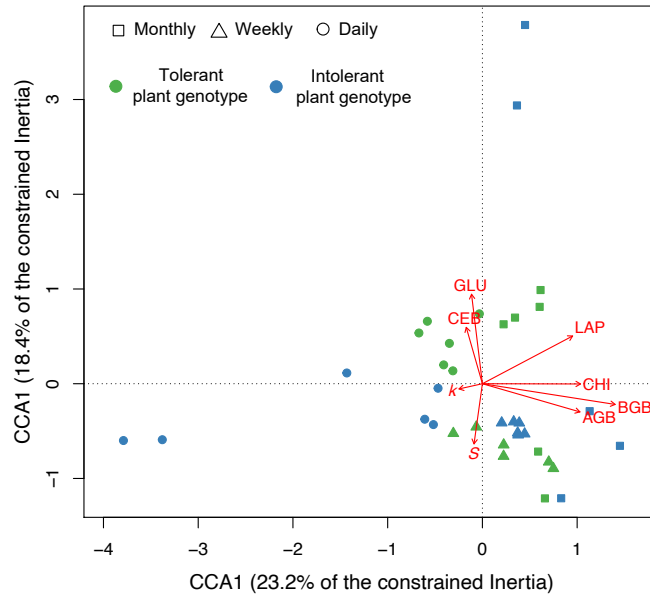


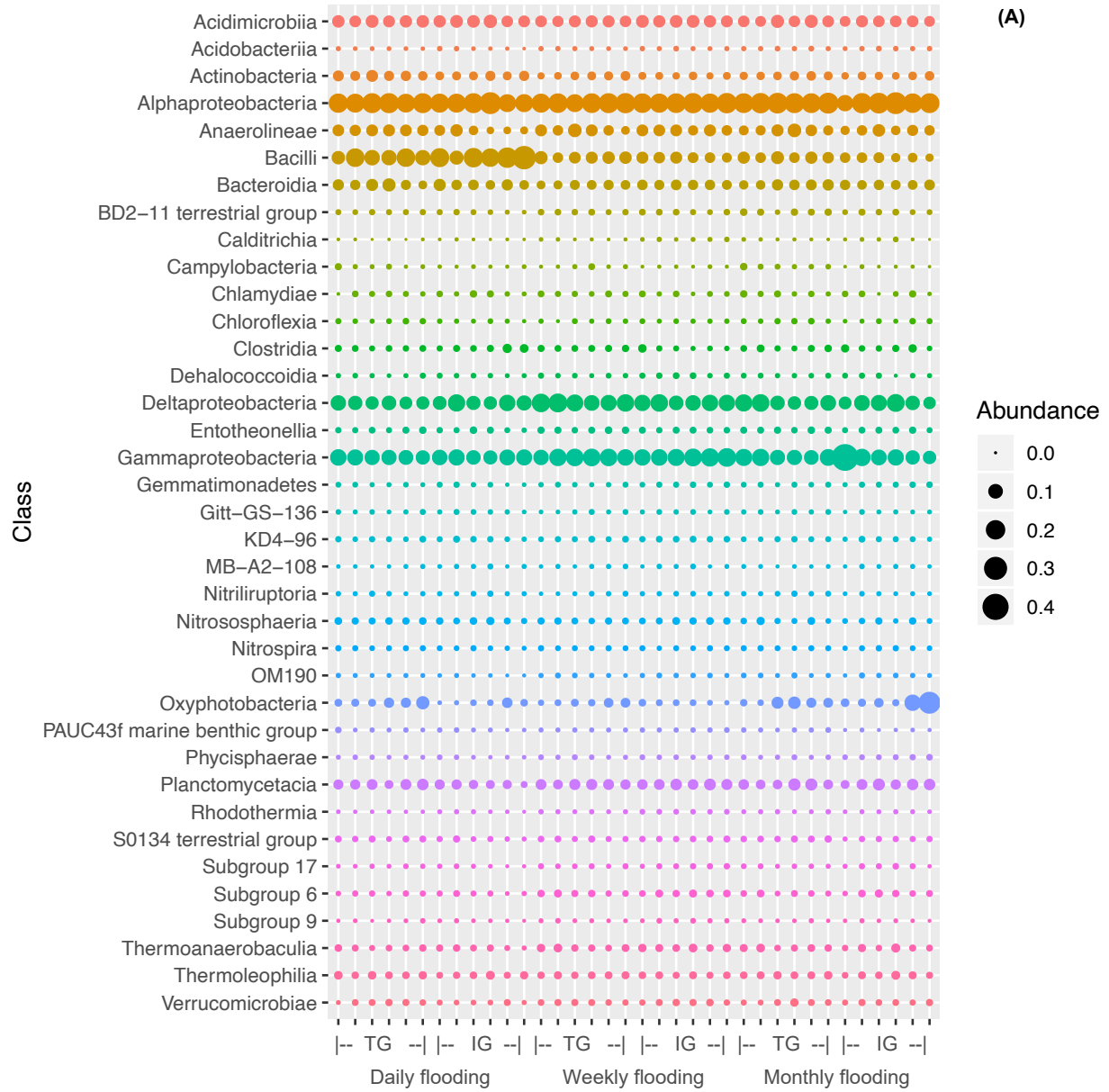
Figure S1: NMDS plot showing prokaryotic (bacterial + archaeal) community composition in soils planted with intolerant and tolerant plant genotypes of *Elymus athericus* exposed to three different flooding frequencies (monthly, weekly, and daily). Plot shows all technical replicates (i.e. two samples from  $n = 3$  mesocosms). The ID showing labels (1-18) and technical-replicate labels (\_1 or \_2).

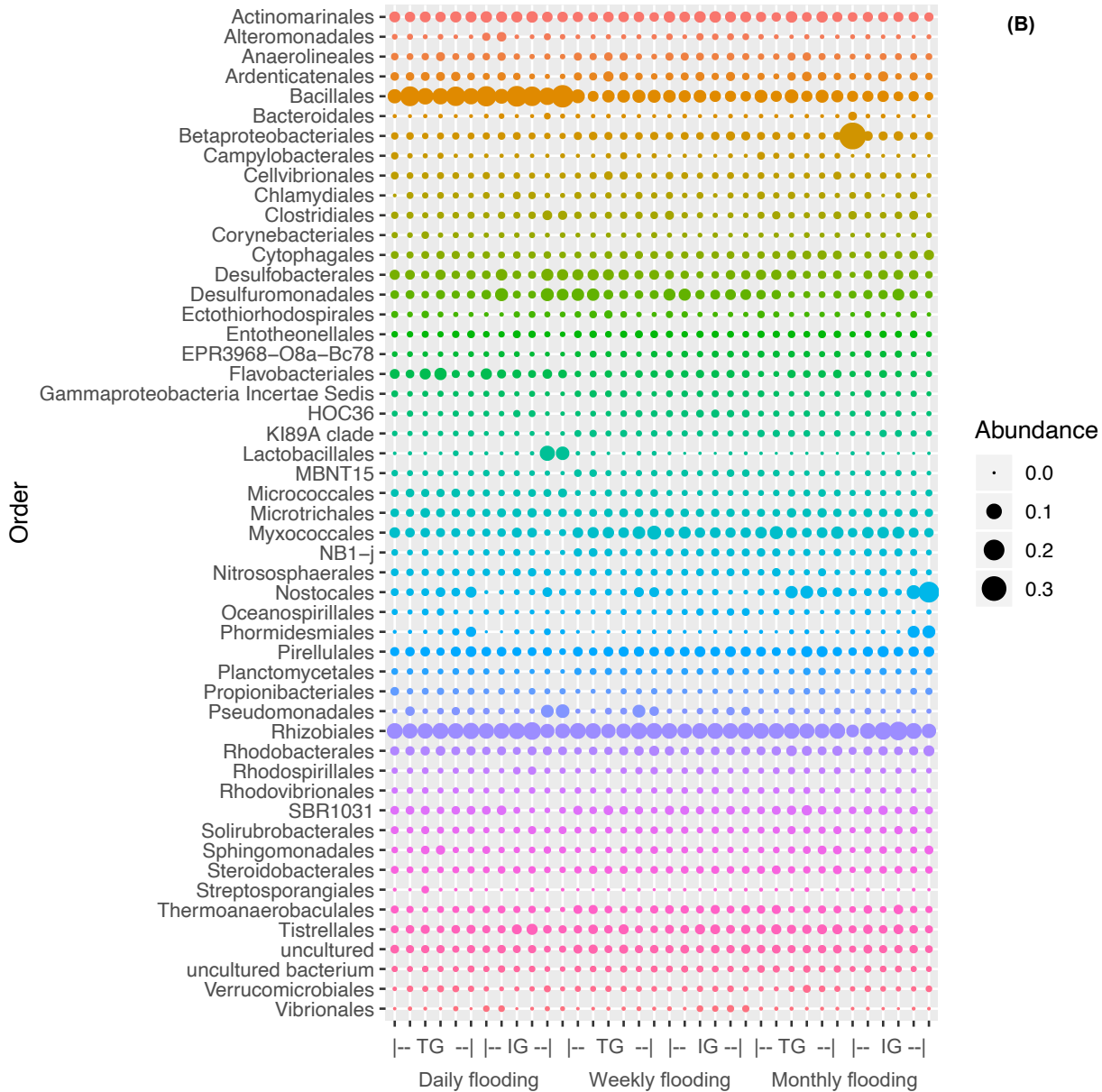


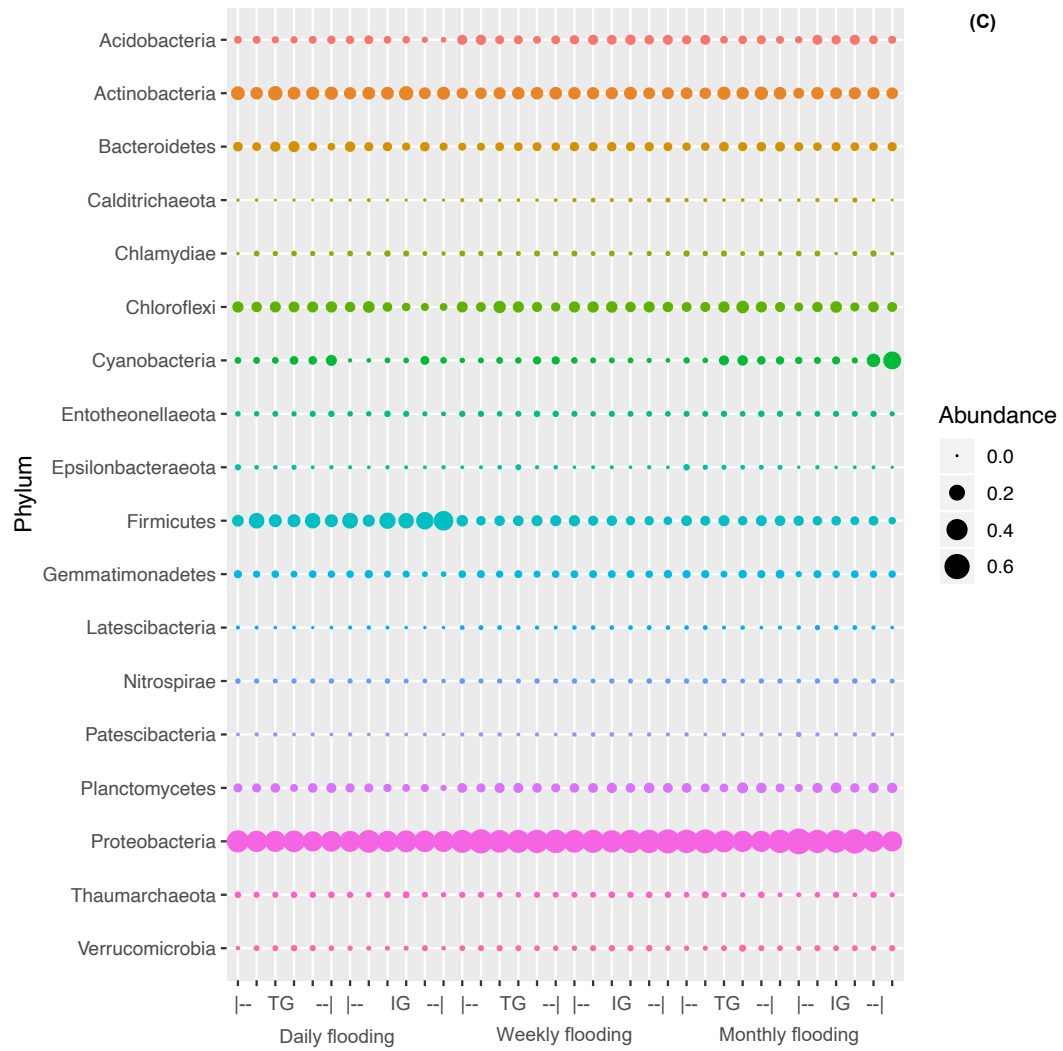
**Figure S2: Activities of the exo-enzymes  $\beta$ -glucosidase (A) and cellobiosidase (B) (microbial C acquisition) as well as chitinase (C) and leucine-aminopeptidase (D) (microbial N acquisition) in mesocosms containing soils without plants exposed to three different flooding frequencies (monthly, weekly and daily). Values are means and SE (n=4). No significant differences at  $p \leq 0.05$  based on Tukey's HSD were detected.**



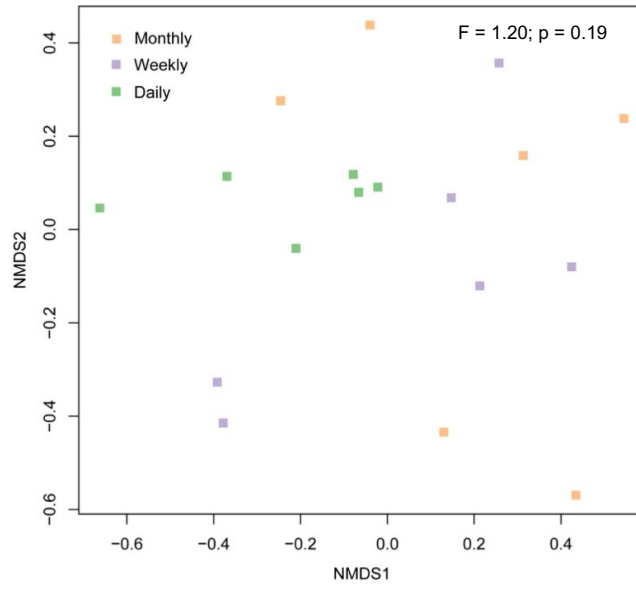
**Figure S3: CCA plot showing the relation of microbial community composition to plant biomass, microbial enzyme activity, and litter decomposition parameters. Notes: AGB = aboveground biomass, BGB = belowground biomass, GLU =  $\beta$ -glucosidase, CEB = cellobiosidase, CHI = chitinase, LAP = leucine-aminopeptidase,  $k$  = initial decomposition rate constant,  $S$  = stabilization factor. ANOVA-like permutation tests for Constrained Correspondence Analysis: AGB:  $F = 1.72$ ,  $p = 0.001$ ; BGB:  $F = 1.70$ ,  $p = 0.001$ ; GLU:  $F = 1.41$ ,  $p = 0.003$ ; CEB:  $F = 1.18$ ,  $p = 0.073$ ; CHI:  $F = 1.44$ ,  $p = 0.001$ ; LAP:  $F = 1.35$ ,  $p = 0.005$ ;  $k$ :  $F = 1.31$ ,  $p = 0.015$ ;  $S$ :  $F = 1.42$ ,  $p = 0.003$**







**Figure S4: Relative abundance of different microbial lineages. Along the horizontal axis samples are arranged according to tolerant (TG) and intolerant (IG) plant genotypes of the *Elymus athericus* exposed to three different flooding frequencies. The rank order along the vertical axis is shown for the class (A), order (B) and phylum (C).**



**Figure S5: NMDS plot showing prokaryotic (bacterial + archaeal) community composition in mesocosms containing soils without plants exposed to three different flooding frequencies (monthly, weekly and daily). One-way PERMANOVA results are included.**