What controls microbial enzyme activity in wetlands?

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Everything

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activ gluc add grac cellu sew 200	on, phosphatase showed no ificant differences. Sulphatase vitieswere significantly reduced by ose, cellulose and sewage effluent tion. β -glucosidase activity lually increased in response to llose addition, and decreased after Activities of all enzymes were		Alkaline phosphatase activity was affected by P loading and was negatively related to soil P concentrations and microbial biomass and P. Arylsulfatase, β -d-glucosid protease, and phenol oxidase we affected by P loading and were no related to measured soil C, N, S, physical and chemical parameters	P P w e p ydrog omin nosp w ter	Phosphatase activity was suppressed P-addition plots under all salinity lev while activities of the remaining enzymes were higher in P-enriched lots (Reimánková and Sirová 2007 gen ion concentration was a ant controlling factor for the hatase activities. Waterlogging and mperature seem to restrict enzyme		Activities of β-glucosidase, phenol oxidase, protease and nitrate redu while affected by plant species rich were strongly depended on the presence or absence of plants. Activities of cellulase and acid phosphatase were strongly depend on plant species richness (Zhang et ted CO ₂ had no effect on β-	uctase, hness, ded et al.
200	significantly correlated with root activ		enzyme activities decreased with fa	ctiviti ctors	ies in fen and swamp sites, as bot s showed correlations with enzvme	glucos	sidase activity. However, NAGase	
	australis wetlands, but not in	.03	Enzyme activity was correlated with ac	ctiviti	es. A negative relationship	activit	y increased significantly in cores	
	Hymenocallis littoralis wetlands.		stoichiometry, N deposition, the ph	etwe nosp	en phosphatase activity and hate content was discernable.	was fo	bund in the gully mire for	
	enzyme activity, root biomass and roo	ot	agricultural stress gradient and	hen	compared on a spatial basis.	phosp	bhatase. Such changes were	
	growth were found in Cyperus	β-1,4	1-glucosidase, phosphatase, and	ang crea	and Freeman 1999)	norga	anic nutrients were abundant,	
	phosphatase and cellulase were hig	NAG	ase exhibited similar activity for all	Gas	se, phosphatase, and phenol	sugge	esting that enzyme activities ed in N or P mineralisation only	
A ati	in the top layer of the substrate that	of ph	henol oxidase and peroxidase was	idase I₄NC	e, and soil pH were observed with D_3 . Under alkaline conditions,	increa	ase under elevated CO_2 when	
and	phosphatase differed widely among	highe (Mer	er in sediments with no vegetation han no vegetation has had	argin: ditio	al changes in response to N	(Kan	All activities were significantly related	d to
spe	cies but were poorly related to litter	, Ov	verall, NAGase were the lowest in eff	lux, e	extractable DOC, simple		soil pH. Oxidative activities were more	re
spe	cies, phosphatase activity increased	bo	gs and much higher in freshwater sul	bst- drf E	Enzyme activities were different an	nong	increased with soil pH (Sinsabaugh e	a et
towa and	ards high litter N:P ratios (Güsewell Freeman 2005)	Th	e variations of the activity were	<u> </u>	vegetation types. Soil MBC content	t was	al. β-glucosidase, NAGase, and	
	Exposure to elevated salinity also	no e	t explained by a single	Ц,	3-glucosidase. DOC content was	3 01	phosphatase were stimulated un	nder
	decreased phosphatase and NAGase		O ₂ availability and the activities of som enzymes appeared to be related at		significantly correlated with the action of alkaline phosphomonoesterase	vities	activities under drving was relate	ed to
	on β -glucosidase. P addition had no		landscape scales after accounting for		(Shao et al. 2015)		Enzyme activity decreased with dept	th and
	impact on extracellular enzyme activit (Jackson and Vallaire 2009)	ty.	conditions and phenolic compounds di	g d	pH, temperature, soluble phenoli	cs,	growing season. Site-specific factors	ssuch
l		-	not appear to constrain soil hydrolytic		nitrogen significantly influenced e	, and enzym	as nutrient availability explain deviati	ions
		L	enzyme activity (Hall et al. 2014)		activities (Luo and Gu 2014)	Ē		

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compared to controls receiving no carbon, phosphatase showed no significant differences. Sulphatase activitieswere significantly reduced by glucose, cellulose and sewage effluent addition. β -glucosidase activity gradually increased in response to cellulose addition, and decreased after sew 200 Activities of all enzymes were	Alkaline phosphatase activity was affected by P loading and was negatively related to soil P concentrations and microbial biomass and P. Arylsulfatase, β-d-glucosid protease, and phenol oxidase we affected by P loading and were no related to measured soil C, N, S, physical and chemical parameters	Phosphatase activity was suppressed P-addition plots under all salinity levels while activities of the remaining enzymes were higher in P-enriched plots (Reimánková and Sirová 2007) drogen ion concentration was a ninant controlling factor for the osphatase activities. Waterlogging and temperature seem to restrict enzym	Activities of β-glucosidase, phenol oxidase, protease and nitrate reductase while affected by plant species richness were strongly depended on the presence or absence of plants. Activities of cellulase and acid phosphatase were strongly depended on plant species richness (Zhang et al.	
significantly correlated with root activity	enzyme activities decreased with	vities in fen and swamp sites, as bot	μ	
in Vetiveria zizanioides and Phragmites	Enzyme activity was correlated with acti	vities A negative relations with enzyme a	ctivity increased significantly in cores	
Australis wetlands, but not in Hymenocallis littoralis wetlands	sediment and water chemistry and betw	ween phosphatase activity and from	om the bog, whilst a similar response	
Significant correlations between	stoichiometry, N deposition, the pho	sphate content was discernable,	as found in the gully mire for	
enzyme activity, root biomass and root	agricultural stress gradient and whe	en compared on a spatial basis.	hosphatase. Such changes were	
growth were found in Cyperus	1 4-ducosidaso, phosphataso, and	ng and Freeman 1999)	organic nutrients were abundant.	
tlabelliformis wetlands. Activities of P	AGase exhibited similar activity for all	reases in activities of β -glucosidase, since a phosphatase, and phopoles is β_{1}	uggesting that enzyme activities	
in the top layer of the substrate that ve	getation treatments, while the activity xid	ase, and soil pH were observed with in	volved in N or P mineralisation only	
Activities of B-glucosidase chitobiase	phenol oxidase and peroxidase was H_4	NO ₃ . Under alkaline conditions,	crease under elevated CO_2 when utrient limitation is strongly exerted	
and phosphatase differed widely among (M	In sediments with no vegetation are	ginal changes in response to N	(an All activities were significantly related to	
species but were poorly related to litter	Overall NAGase were the lowest in Lefflu	tions were observed in the soli CO_2	soil pH. Oxidative activities were more	
nutrient concentrations. Within some	bogs and much higher in freshwater subs		variable than hydrolytic activities and	
species, phosphatase activity increased	marshes and flooded grasslands. and	Enzyme activities were different amor	increased with soil pH (Sinsabaugh et	
and Freeman 2005)	The variations of the activity were	significantly correlated with activities	β_{of} $\beta_{\text{glucosidase, NAGase, and}}$	
Exposure to elevated salinity also	not explained by a single	β -glucosidase. DOC content was	phosphatase were stimulated under	
decreased phosphatase and NAGase	O_2 O ₂ availability and the activities of some	significantly correlated with the activiti	es drying condition. Increase of enzyme	
activity by almost 20%, with less effed	_ enzymes appeared to be related at	of alkaline phosphomonoesterase	Enzyme activity decreased with depth and	
impact on extracellular enzyme activity	differences in organic matter. Reducing	(Shao et al. 2015)	showed significant variation over the	
(Jackson and Vallaire 2009)	conditions and phenolic compounds did	total organic carbon phoenterus	growing season. Site-specific factors such	
· · · · · · · · · /	 not appear to constrain soil hydrolytic 	nitrogen significantly influenced enz	as nutrient availability explain deviations	
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and Freeman 2005) Exposure to elevated salinity also decreased phosphatase and NAGas activity by almost 20%, with less effe on β-glucosidase. P addition had no impact on extracellular enzyme activ (Jackson and Vallaire 2009)	The variations of the activity were not explained by a single e O ₂ availability and the activities of some enzymes appeared to be related at landscape scales after accounting for differences in organic matter. Reducing conditions and phenolic compounds did not appear to constrain soil hydrolytic enzyme activity (Hall et al. 2014)	vegetation types. Soil MBC content was significantly correlated with activities o β-glucosidase. DOC content was significantly correlated with the activitie of alkaline phosphomonoesterase (Shao et al. 2015) pH, temperature, soluble phenolics, total organic carbon, phosphorus, ar nitrogen significantly influenced enzy activities (Luo and Gu 2014)	as fal. β-glucosidase, NAGase, and phosphatase were stimulated under drying condition. Increase of enzyme activities under drving was related toesEnzyme activity decreased with depth and showed significant variation over the growing season. Site-specific factors such as nutrient availability explain deviations (Pinsonneault et al. 2016)	

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Does wetland vegetation type control microbial enzyme activity in Gulf Coast wetlands?



Rietl et al. 2016. Microbial community composition and extracellular enzyme activity associated with Juncus roemerianus and Spartina alterniflora vegetated sediments in Louisiana saltmarshes. Microbial Ecology 71:290-303.

Enzyme activity was influenced by site more than vegetation type





Rietl et al. 2016. Microbial community composition and extracellular enzyme activity associated with Juncus roemerianus and Spartina alterniflora vegetated sediments in Louisiana saltmarshes. Microbial Ecology 71:290-303.

Vegetation did not influence the activity of β-glucosidase, phosphatase, or NAGase in wetland mesocosms



Menon et al. 2013. The influence of vegetation on microbial enzyme activity and bacterial community structure in freshwater constructed wetland sediments. Wetlands 33:365-378.

Why is it so hard to determine what controls enzyme activity in wetlands?

Carbon? Vegetation? Abiotic factors? Nutrients? Microorganisms? Site-specific?

Analysis of enzymes in wetlands focuses at an ecological level







How does carbon affect β-glucosidase activity?



Analysis of enzymes in wetlands focuses at an ecological level



The phenome is the phenotypes expressed by a cell, tissue, organ, organism, or species (ecosystem?)



Acknowledgements

Former students and collaborators:

Anthony Rietl Rani Menon

Current students:

Eric Weingarten Bram Stone Sarah Russell





