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# Variability of methane emissions from coastal ecosystems in Northern Germany

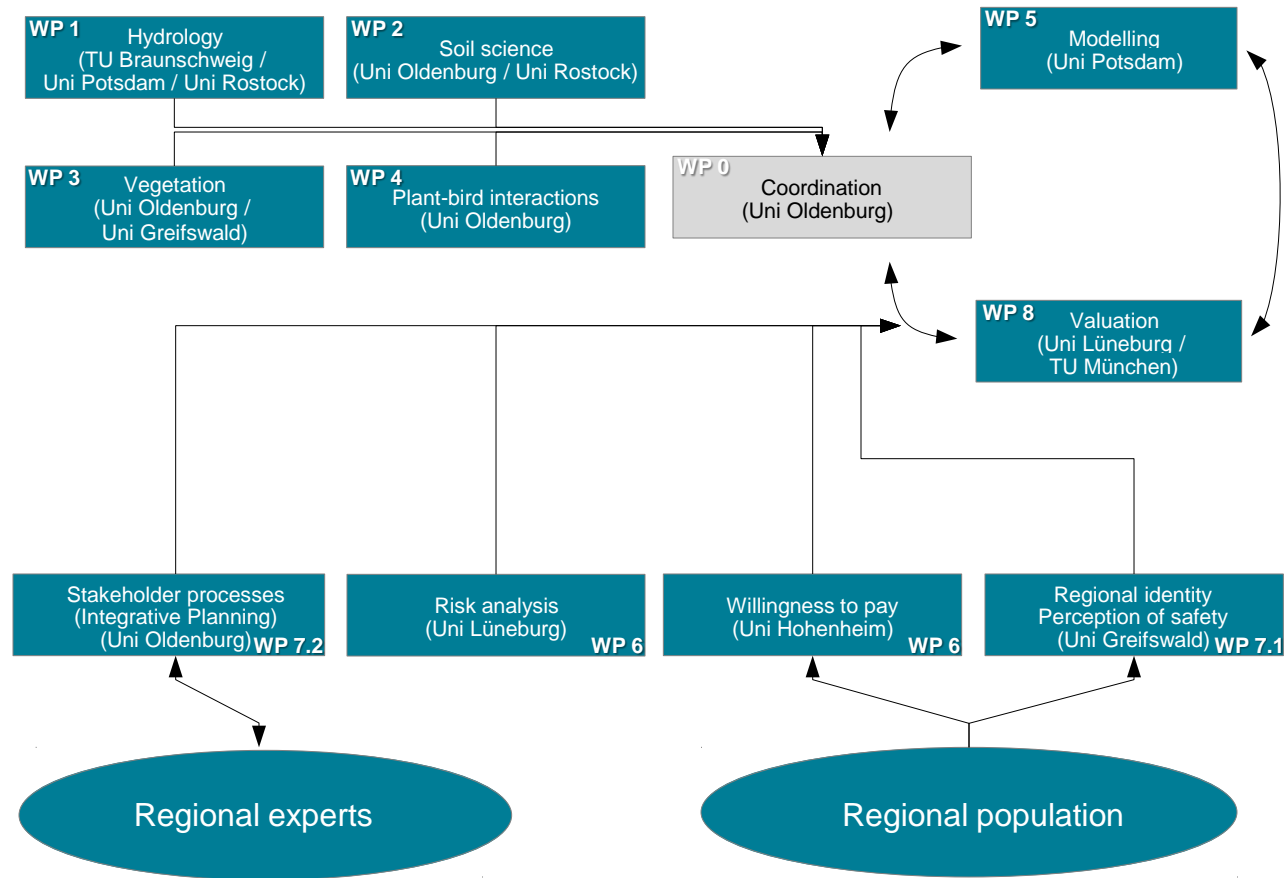
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# Presentation outline

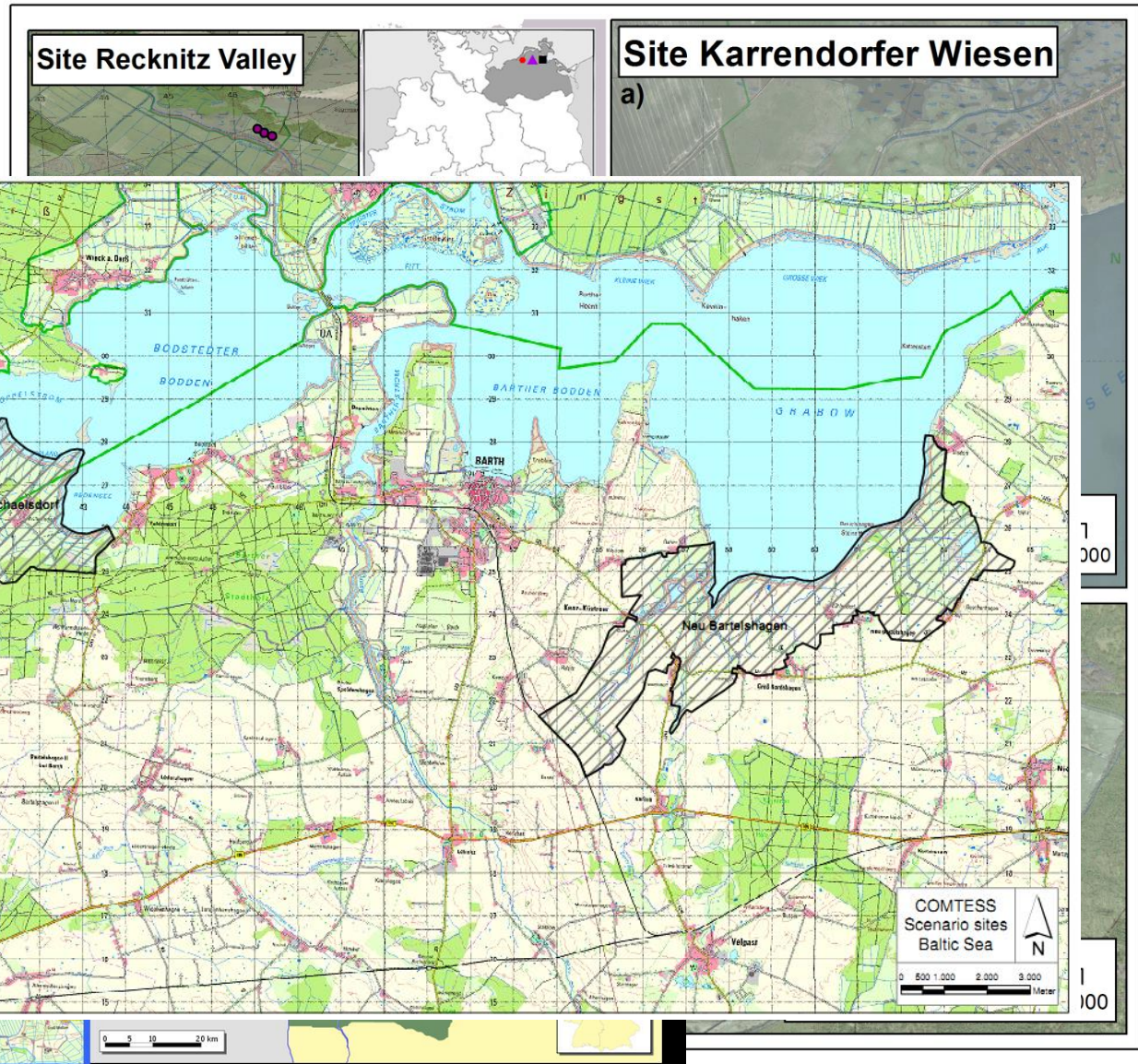
- COMTESS – Project Overview
- COMTESS WorkPackage 2: Greenhouse Gas Emissions (and Carbon Sequestration)
  - Study Sites and Project Design – Greenhouse Gas Emissions
  - Preliminary Results
  - Summary and Conclusion
  - Problems and challenges

# Project structure





# Study sites – Greenhouse Gas Emissions



# Project Design – Greenhouse Gas Emissions

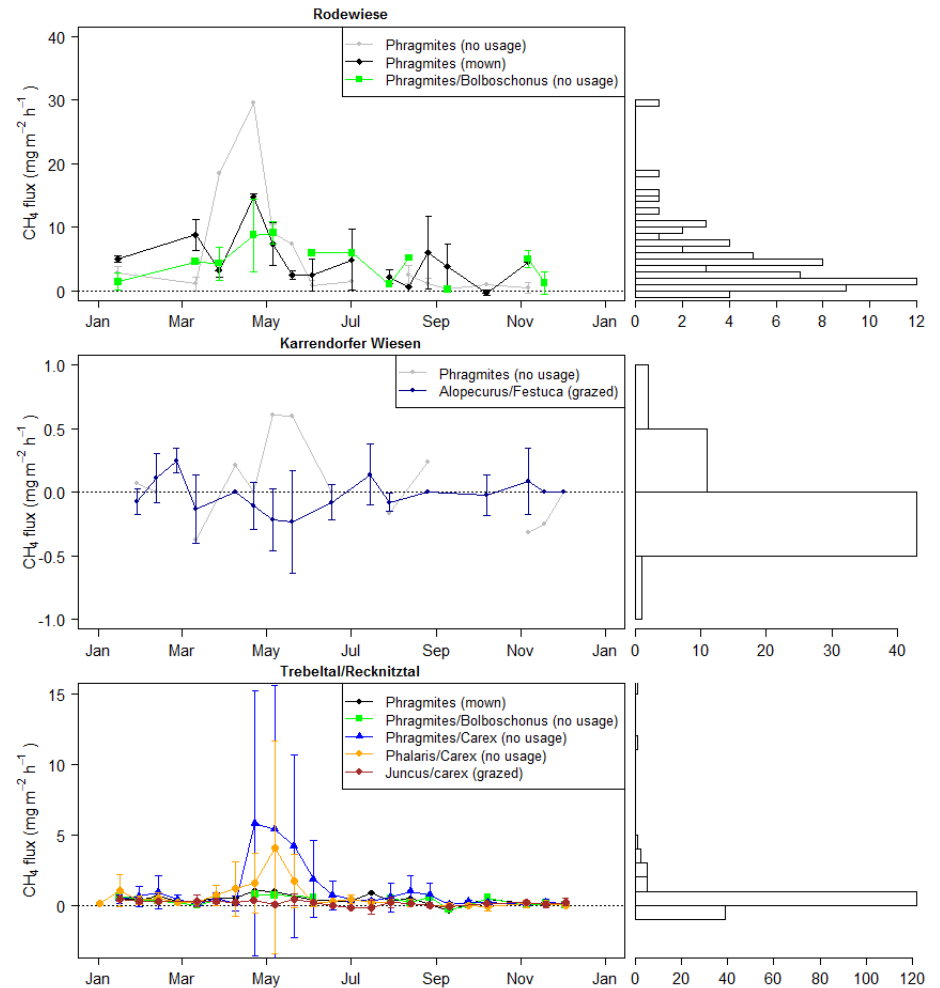
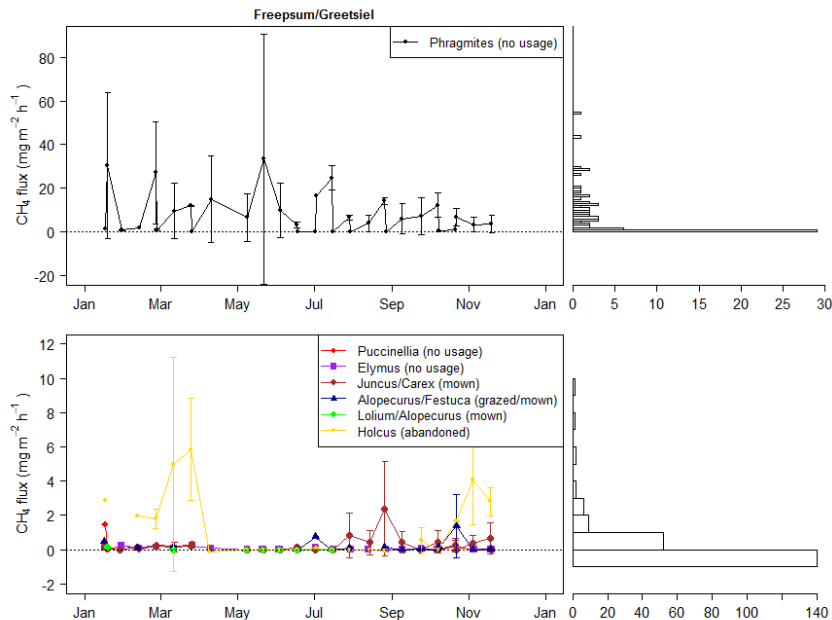
- Seven vegetation/land use types at three (four) sites
- Single measurements at spot-level
- Bi-weekly measurement of CH<sub>4</sub>, CO<sub>2</sub> and N<sub>2</sub>O fluxes
  - non-steady state closed chamber measurements, five concentration measurements at 6 or 8 minute intervals
  - Fluxes calculated by linear slope of concentration change over time with flux package (Jurasinski et al. 2012)
- Additional environmental variables (bi-weekly)
  - ground water level, electrical conductivity in ground water, ground water temperature
  - soil moisture content, soil temperature (2, 5 and 10 cm depth)
  - air temperature
- Soil properties (once in March 2012)
  - C<sub>org</sub>, C:N, C<sub>hws</sub>, P, K, ...

# Comparison of two different annual emission estimation techniques

- (I) Average per ecosystem: Integrating means of all spots on ecosystem level
- (II) Single spot estimate: Estimating annual emission on a single spot level and integrating afterwards



# Course of methane emissions 01/2012 – 12/2012 and histograms

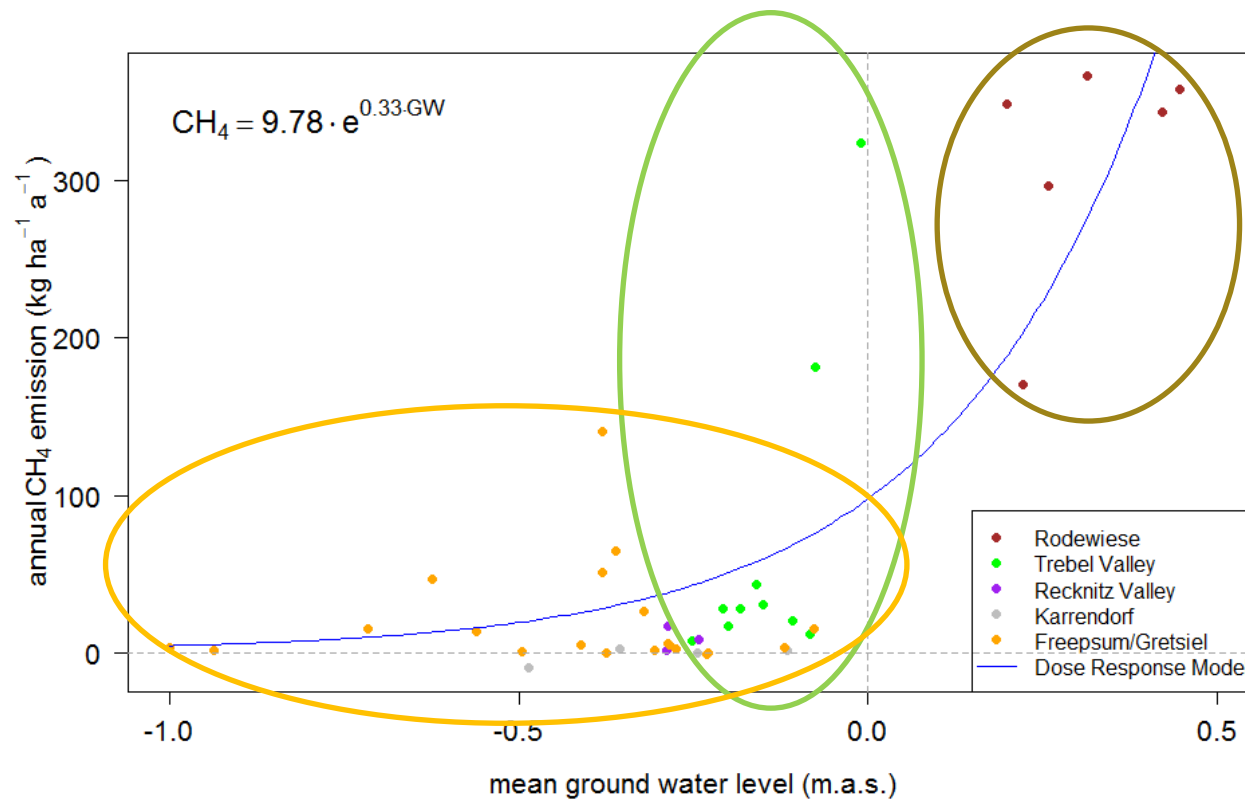


# Comparing annual estimates based on different techniques

Vegetation/land use type	Site	Single spot estimate (I) [kg ha <sup>-1</sup> a <sup>-1</sup> CH <sub>4</sub> ]	Average per ecosystem (II) [kg ha <sup>-1</sup> a <sup>-1</sup> CH <sub>4</sub> ]
Phragmites (no land use)	Hütelmoor	354.61 ± 65.03	260.68 ± 118.08
Phragmites (no land use)	Karrendorf	1.13 ± 1.28	1.13 ± 1.28
Phragmites (mown)	Hütelmoor	317.20 ± 37.89	328.73 ± 37.04
Phragmites (mown)	Trebel Valley	30.44 ± 1.73	30.44 ± 1.73
Phragmites/Bolboschonus (no land use)	Hütelmoor	306.29 ± 32.23	354.27 ± 15.45
Phragmites/Bolboschonus (no land use)	Trebel Valley	27.96 ± 1.93	27.96 ± 1.93
Phragmites/Carex (no land use)	Trebel Valley	82.89 ± 3.48	96.10 ± 152.07
Juncus/Carex (grazed)	Recknitz Valley	11.88 ± 0.87	9.32 ± 7.02
Phalaris/Carex (no land use)	Trebel Valley	43.25 ± 3.25	63.33 ± 82.61
Alopecurus/Festuca (grazed)	Karrendorf	-1.93 ± 0.90	-2.04 ± 6.44
Holcus Lanatus (abandoned)	Greetsiel/Freepsum	1.11 ± 40.93	100.29 ± 54.75
Lolium perenne (mown)	Greetsiel/Freepsum	1.01 ± 0.66	0.71 ± 1.00
Phragmites (no land use)	Greetsiel/Freepsum	516.96 ± 377.08	981.46 ± 1040.39
Puccinella maritima (no land use)	Greetsiel/Freepsum	17.19 ± 3.62	6.86 ± 7.93
Elymus athericus	Greetsiel/Freepsum	8.50 ± 1.07	2.94 ± 2.21
Juncus effusus	Greetsiel/Freepsum	12.49 ± 4.39	9.32 ± 7.02



# Mean annual ground water level vs. annual CH<sub>4</sub> emission



# Low intra-site variability, high inter-site variability

		Rodewiese			Trebeltal				Recknitztal	Karrendorf	
		Phr1	Phr2	Phr/Bol	Phr2	Phr/Bol	Phr/Car	Pha/Car	Jun/Car	Phr1	Alo/Fes
Rodewiese	Phr1	x	ns	ns	***	***	***	***	***	***	***
	Phr2		x	ns	***	***	***	***	***	***	***
	Phr/Bol			x	***	***	***	***	***	***	***
Trebeltal	Phr2				x	ns	ns	**	***	***	***
	Phr/Bol					x	ns	ns	***	***	***
	Phr/Car						x	**	***	***	***
	Pha/Car							x	ns	**	***
Recknitztal	Jun/Car								x	*	***
Karrendorf	Phr1									x	ns
	Alo/Fes										x

# Summary and conclusion

- High spatial heterogeneity in methane emission of northern German peatlands
- Mean annual ground water level describes the annual CH<sub>4</sub> budget
- Considerable differences in annual emission estimates when based on different estimation approaches
- Ground water level is more suitable for estimating annual CH<sub>4</sub> emissions than vegetation type
- Estimation technique is crucial for annual CH<sub>4</sub> budgets

# Questions and challenges in modelling and upscaling



Thank you for your attention