# Salt marsh response to 32 years of relative increase in sea level

*Minor thesis final presentation*

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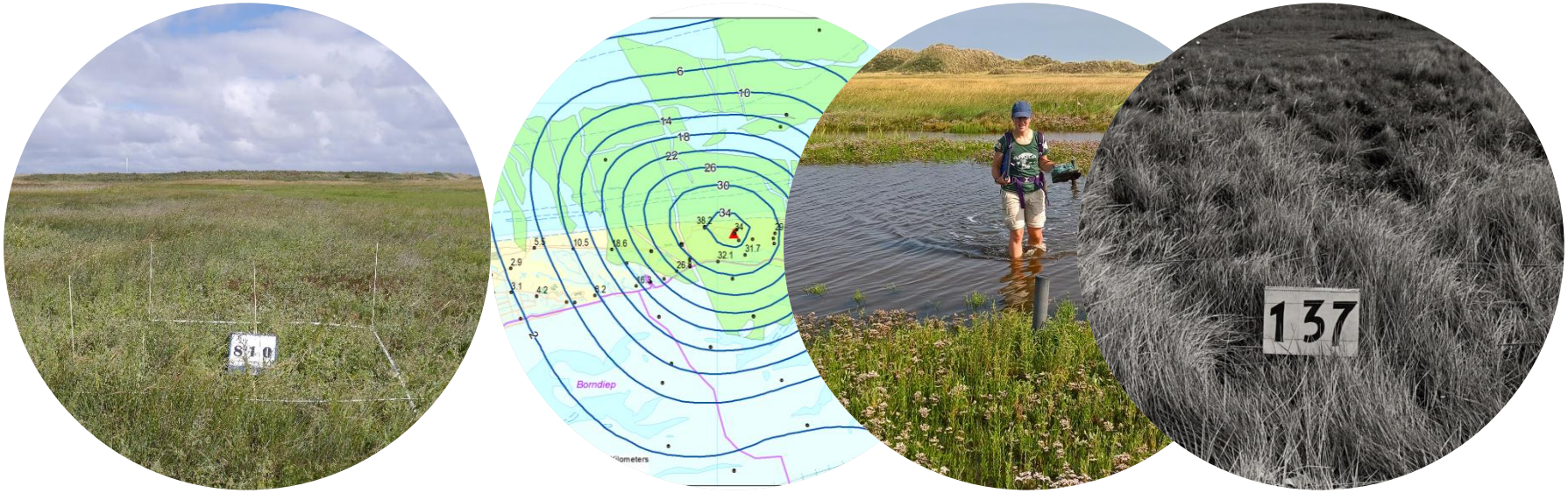


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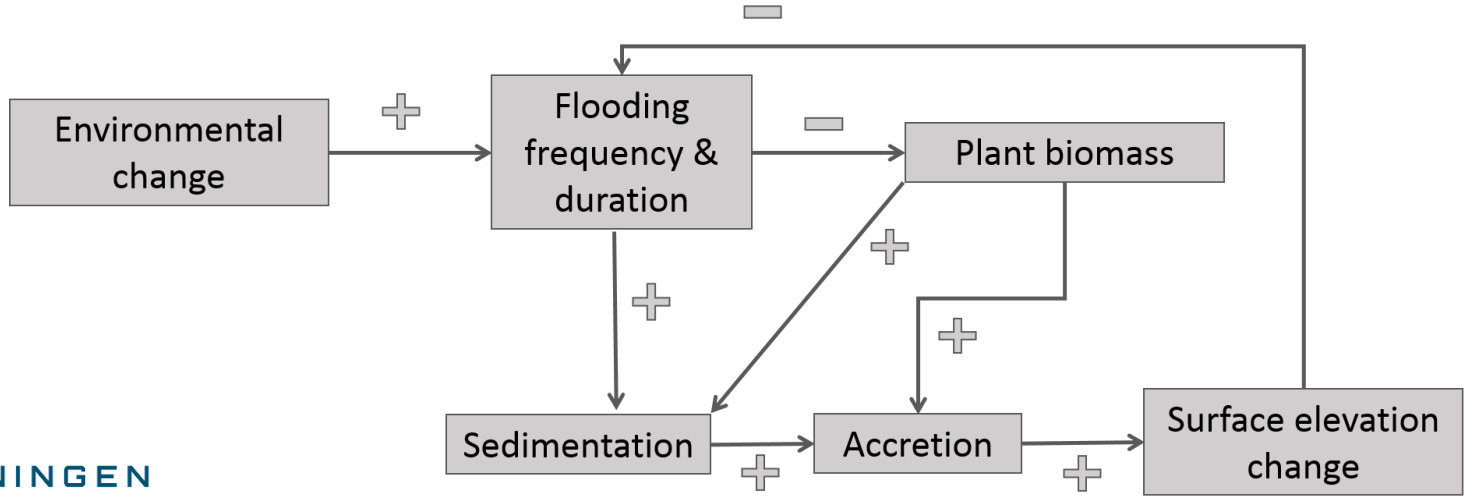
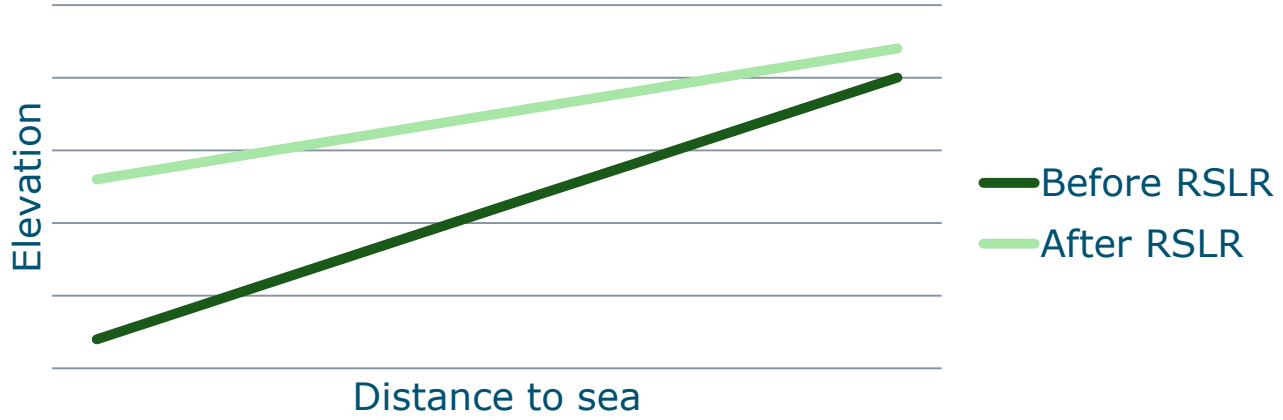
# Background

- Climate-change → sea level rise (SLR)
- Threat to salt marshes
- Empirical research rare
- Effects of **relative** sea level rise on salt marsh sedimentation & vegetation → adaptive capacity?



# Hypotheses

- Lower sedimentation rates further away from the sea
- More succession / less regression close to the sea or creeks, because of higher sedimentation rates
    - Low initial biodiversity negatively affects succession

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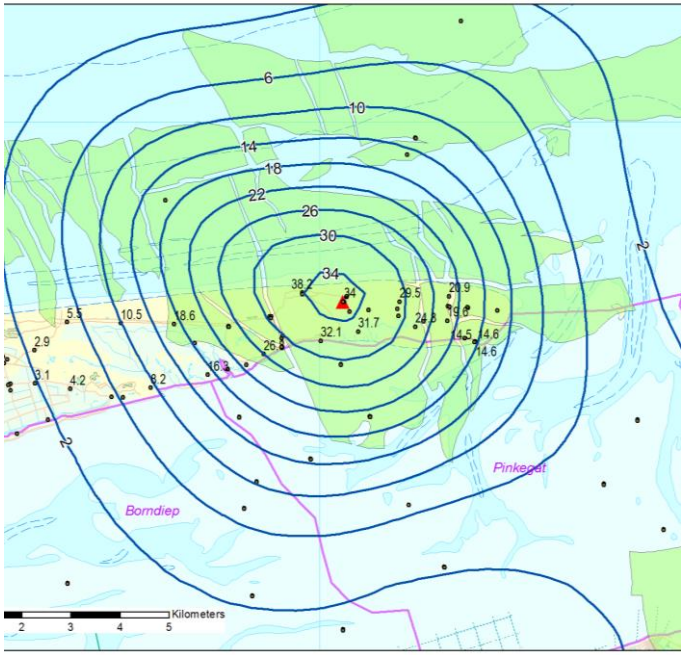
# Materials & methods – *Study area*




Soil subsidence on Ameland due to natural gas extraction (+/- 7 mm/year)


2 salt marshes

4 transects, 84 plots

Assessed in 1986 & 2018

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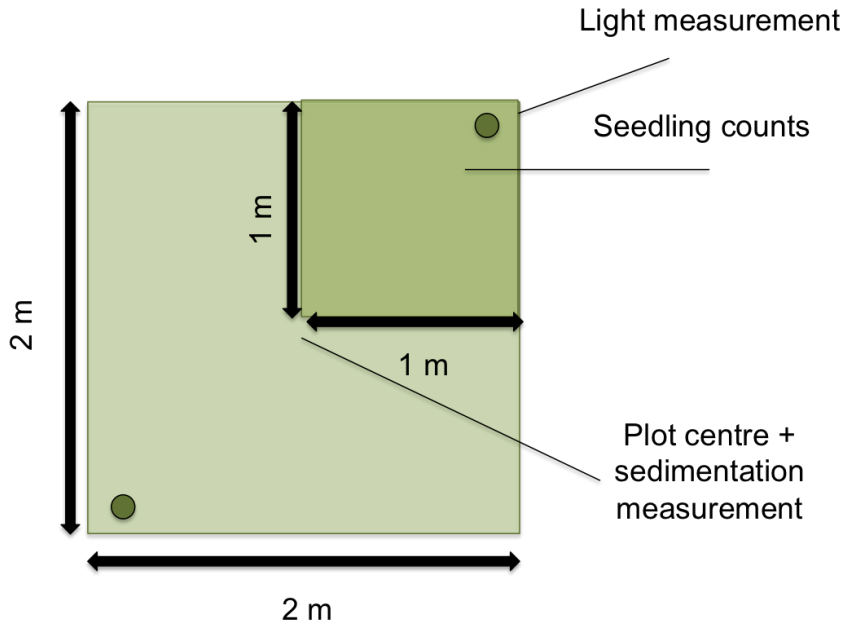
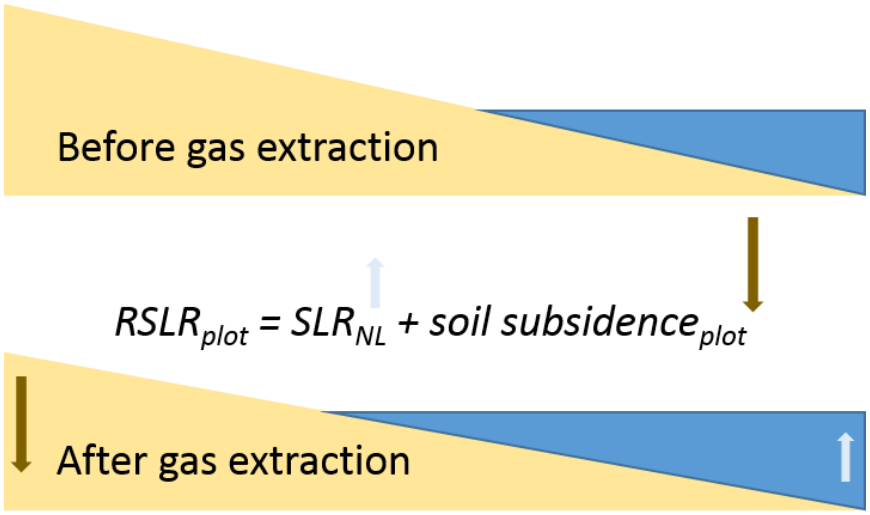
# Materials & methods - *Measurements*

| Low | Middle | High |
|---|---|---|
| *Puccinellia maritima* | *Glaux maritima* | *Juncus gerardii* |
| *Suaeda maritima* | *Artemisia maritima* | *Elytrigia atherica* |
| *Salicornia europaea* | *Plantago maritima* | *Agrostis stolonifera* |
| *Atriplex portulacoides* | *Limonium vulgare* | *Armeria maritima* |
| *Spartina anglica* | *Aster tripolium* | |



# Materials & methods - *Calculations*

- $Sedimentation_{plot} = (z_{2018} - z_{1986}) + |soil\ subsidence_{plot}|$
- $RSLR_{plot} = SLR_{NL} + |soil\ subsidence_{plot}|$
- $Lag_{sedimentation} = Sedimentation_{plot} - RSLR_{plot}$

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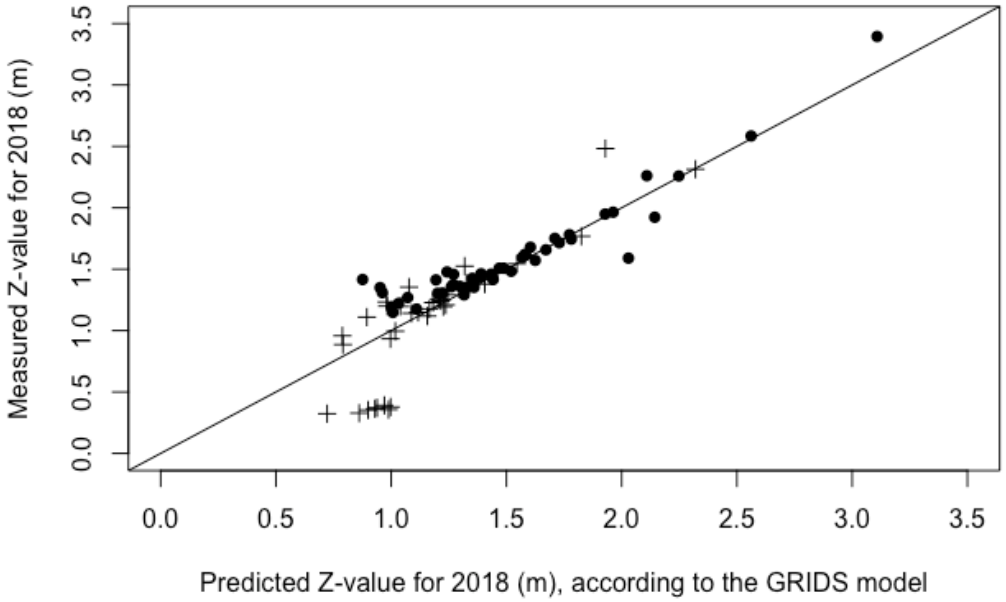
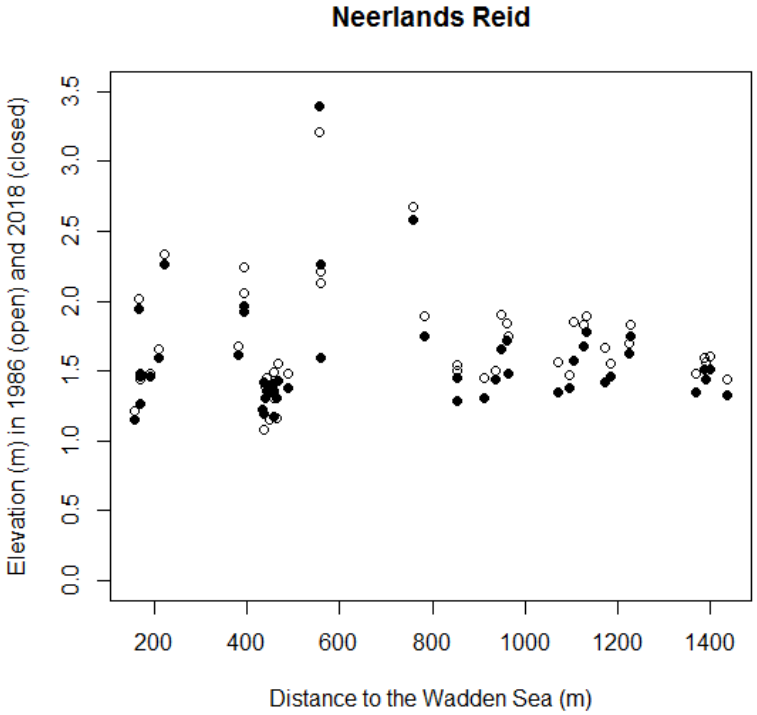
# Materials & methods – *Data analysis*

- Plots excluded
- Shapiro-Wilk normality tests & QQ plots
- Wilcoxon's signed rank tests
- Pearson correlation (r) & Spearman rank correlation (ρ)
- Linear Mixed Models
    - AIC

# Results – *Sedimentation partly compensates for relative SLR*

- Sedimentation decreased with distance to the Wadden Sea

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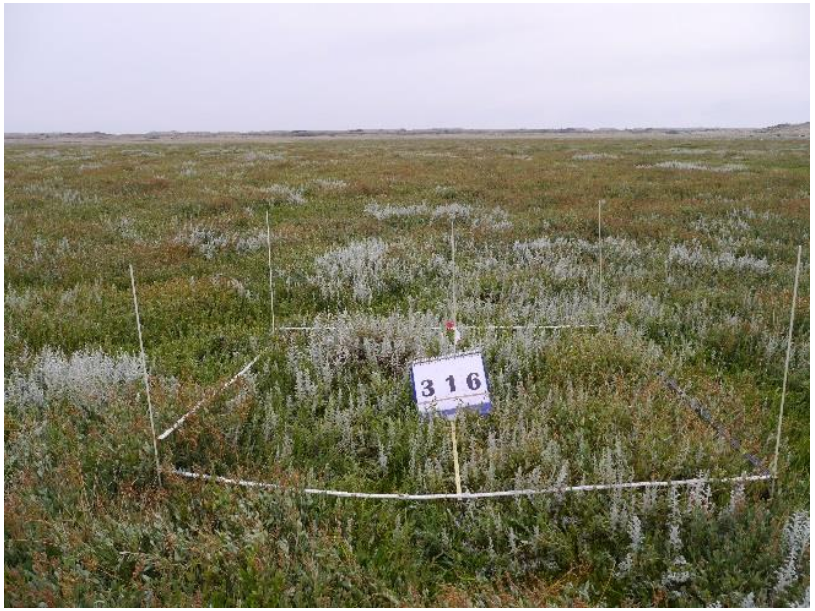
# Results – *Vegetation succession continued*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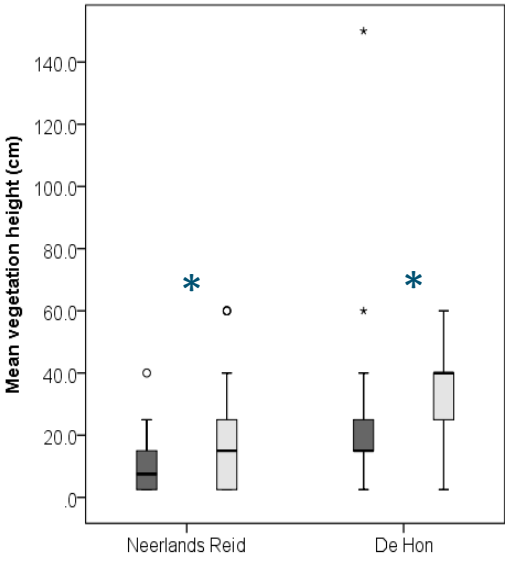
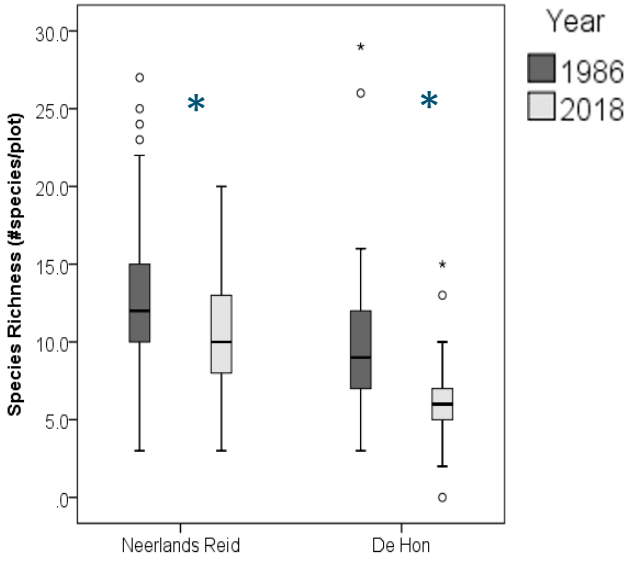
# Results – *Vegetation succession continued*

- Increased vegetation height
- 1986: 102 species vs. 2018: 61
- 45/49 lost species already lost in 2016
- Shannon-Weaver biodiversity index: no sign. change

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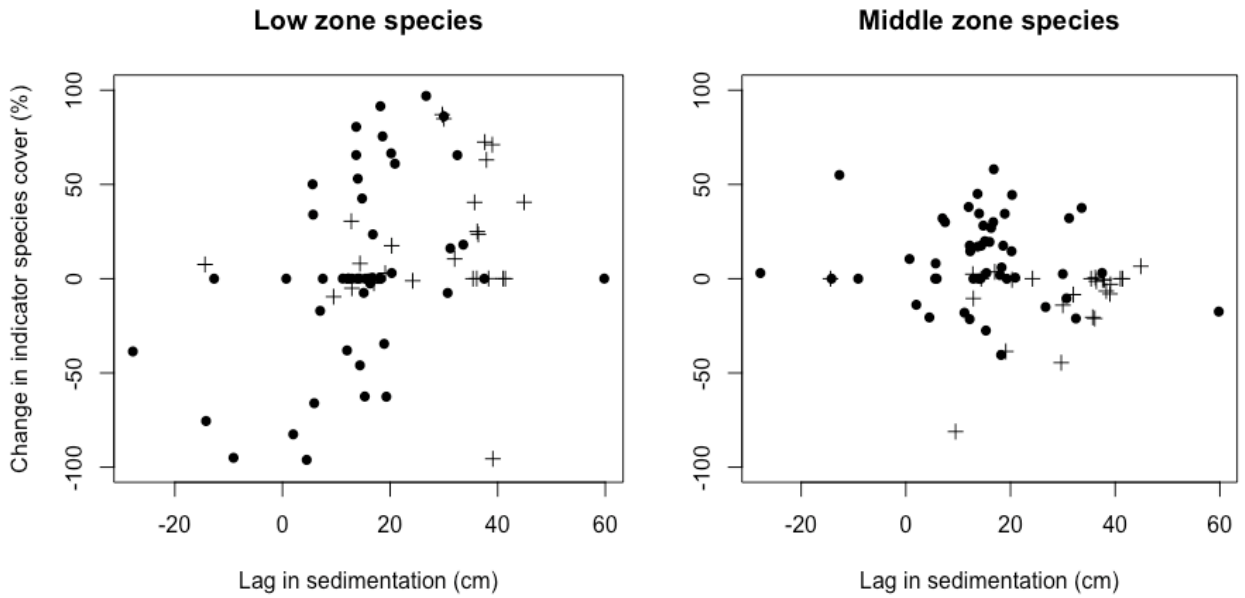
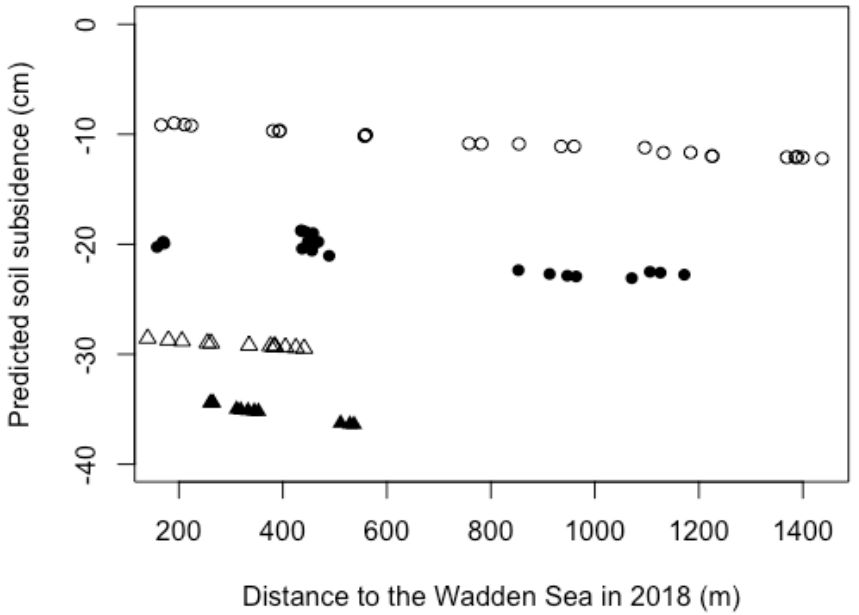
# Results – *Indicator species*

- Presence: striking changes for species, not overall
- Indicator species cover of low & middle zone changed related to a lag or advance in sedimentation



# Discussion - *Sedimentation*

- Hypothesis: Lower sedimentation rates further away from the sea
- But also higher soil subsidence rates!

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# Discussion - *Vegetation*

- Loss of species: therophytes (drought!) but also dune species & species of dry soils
- Increased vegetation height: succession & lower grazing pressure
- Rain, marsh effect & seedling counts
- Hypothesis: Low initial biodiversity negatively affects succession
    - Effect of *Elytrigia atherica?*

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# Discussion – *Indicator species*

- Presence of *Atriplex portulacoides* ↑
- Hypothesis: More succession / less regression close to the sea or creeks, because of higher sedimentation rates
- Elschot et al.: 10-15 cm lag in sedimentation before regression
    - Here: approx. 20 cm for low zone species

# Conclusion

With a *relative* sea level rise comparable to predicted future rates of SLR, the salt marshes on Ameland do not seem to be at risk of drowning.


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# Thank you for your attention!