Use of remote sensing techniques to optimize vegetation parameters for wave damping modelling

Colloquium Geo-Information Science

Elbert de Hon

9th of April, 2019

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Content

- Introduction
- Problem definition
- Main – and sub research questions
- Data & Methods
- Results
- Discussion
- Conclusion & Recommendations

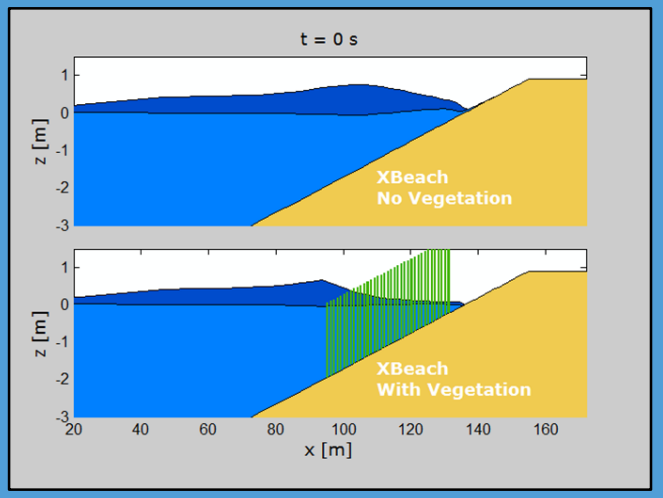
Introduction

- Netherlands, vulnerable for floodings
- Water management
- Building with nature
- GIS & watermanagement?

Introduction II

- Netherlands, vulnerable for floodings
- Watermanagement
- Building with nature
- Modelling of waves & design flood protection measures
- GIS & watermanagement?

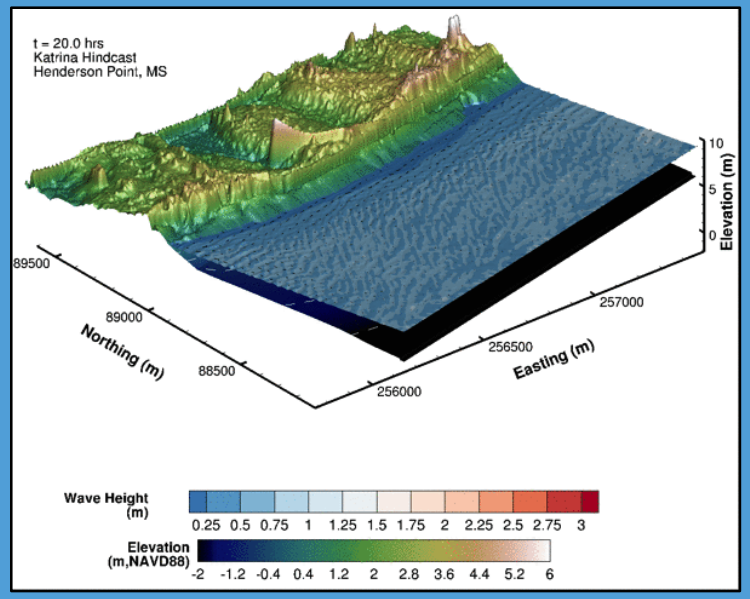
Modelling wave damping



Wave damping by vegetation – Building with nature

Problem definition

- Wave damping & optimisation vegetation parameters
- Remote sensing & vegetation parameters



XBeach

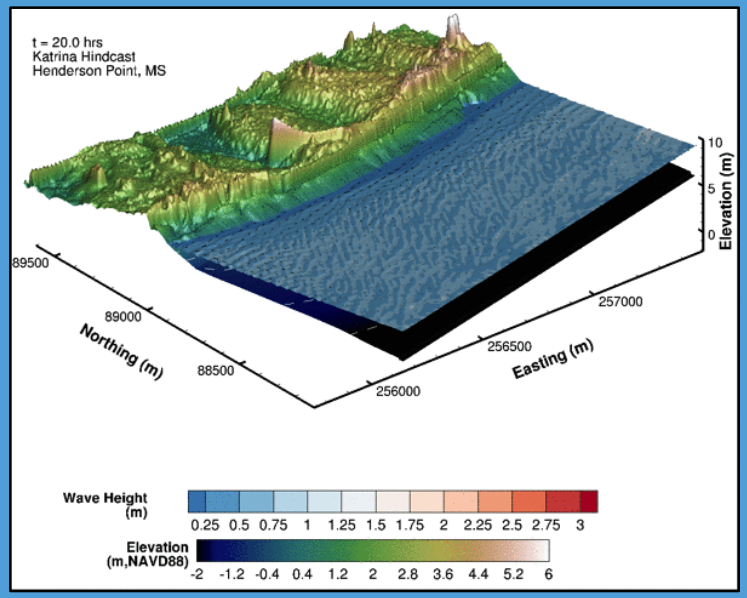
Main research question & sub research questions

Which vegetation traits are relevant for wave damping modelling and can potentially be characterized by remote sensing techniques?

Sub research questions

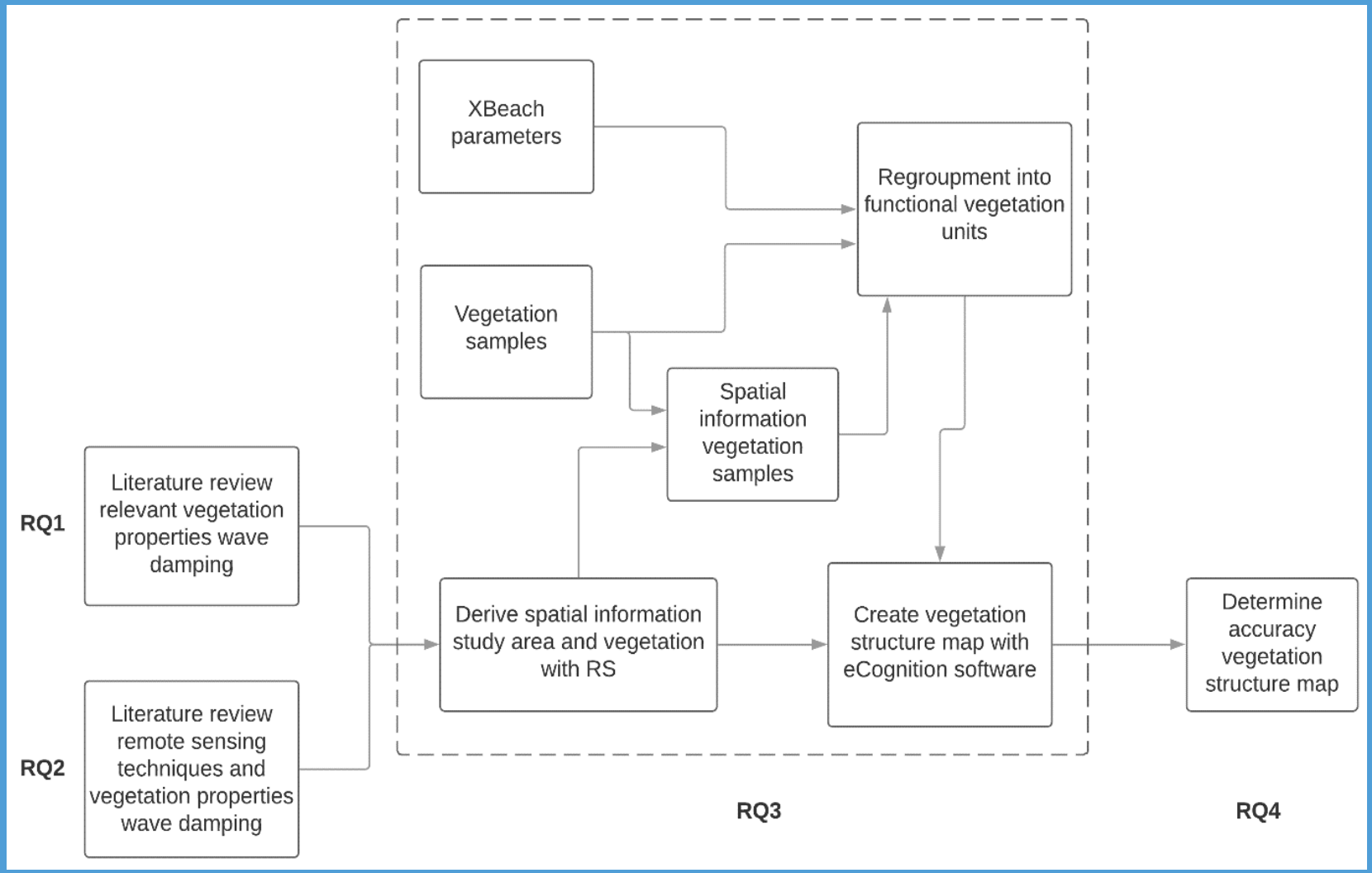
- Relevant vegetation parameters wave damping
- Vegetation parameters and remote sensing
- Regroupment plant associations of vegetation to functional XBeach units
- Validation classification
- Upscaling developed method

XBeach model



Vegetation parameter	Unit	Code
Vegetation height	meter	a
Stem diameter	meter	b
Stem density	stems per m^2	N
Drag coefficient	-	C_d

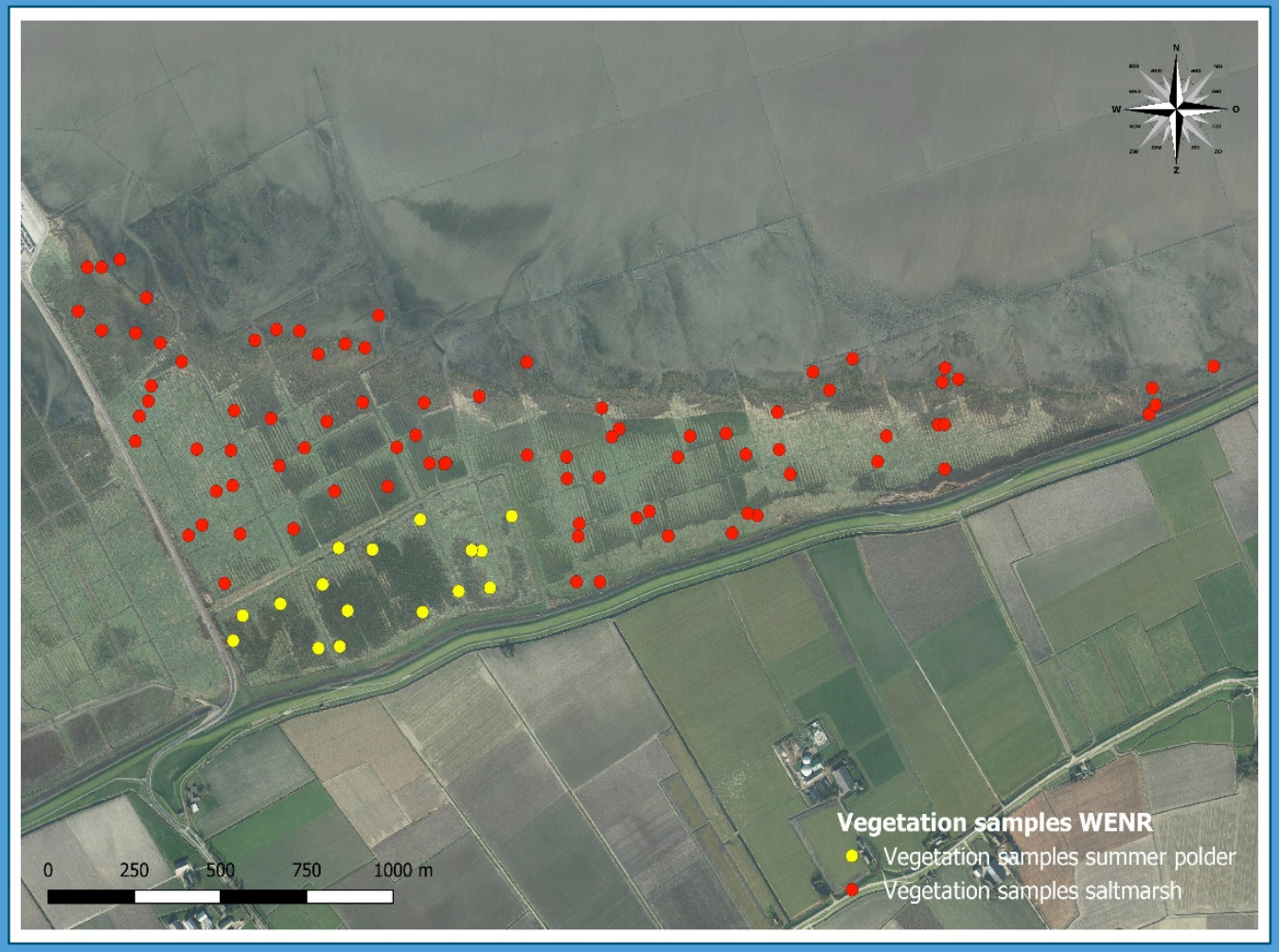
Methods: workflow



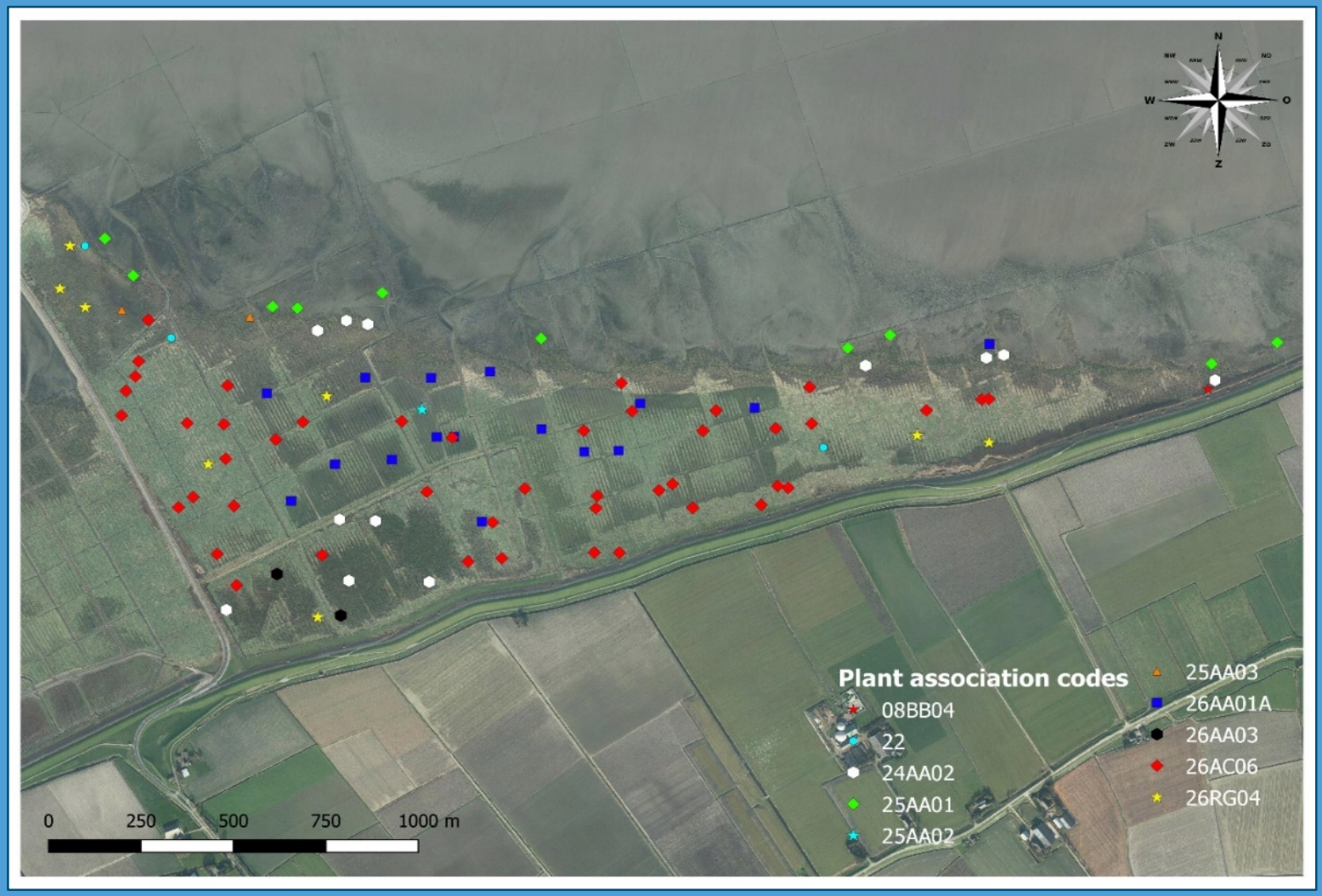
Study area

- Saltmarsh Holwerd
- Vegetation samples Wageningen Environmental Research (WENR)

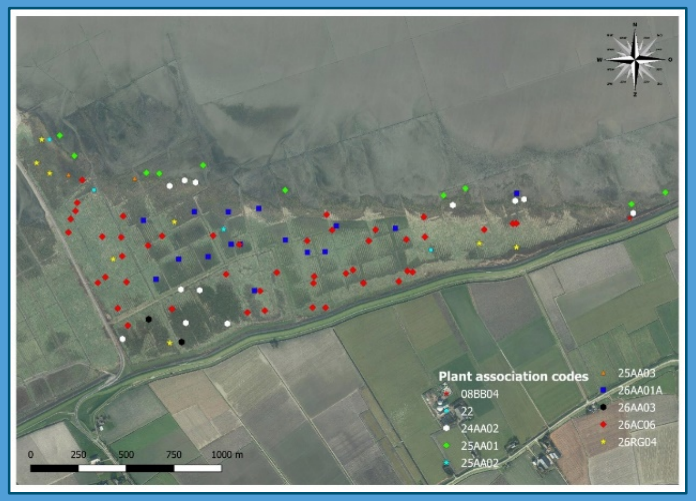
Study area: Vegetation samples WENR

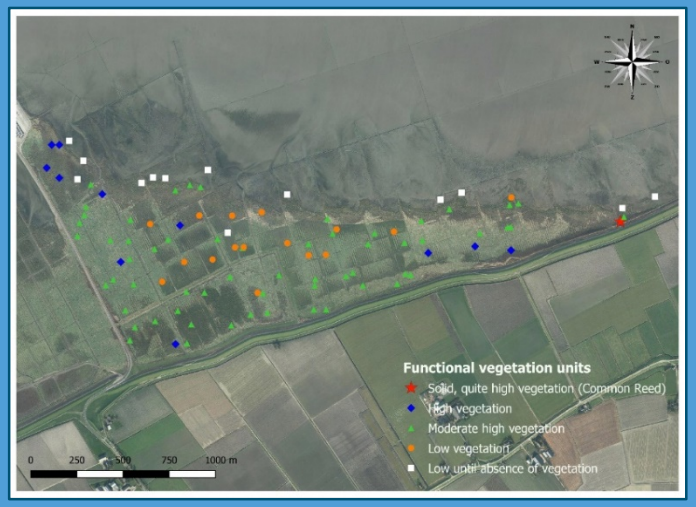


Study area: Plant associations vegetation samples



Vegetation structure & remote sensing techniques?





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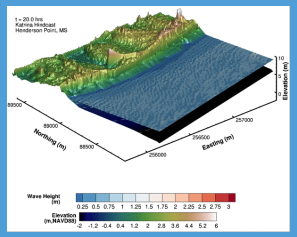

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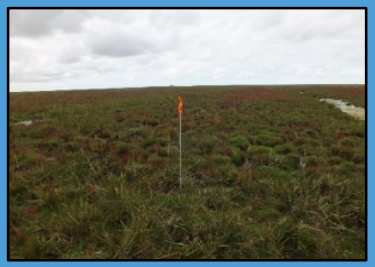
Vegetation structure classes

Class code	Height	Information
A	Quite high vegetation (Common Reed)	Solid plants, remains during winter
B	High vegetation	High Sea Aster (high rigid stems) and floodmark vegetation. This vegetation consists of perennial plants.
C	Moderate high vegetation	Plant assemblages with remaining vegetation during winter.
D	Low vegetation	Low grassy, perennial vegetation, turfs
E	Low to absence of vegetation	Open vegetation, annual plants. During autumn these plants die. Dead remnants remain. It is possible to find water standing at these locations.

Quite high vegetation

High vegetation

Moderate high vegetation



Low vegetation

Low to absence of vegetation

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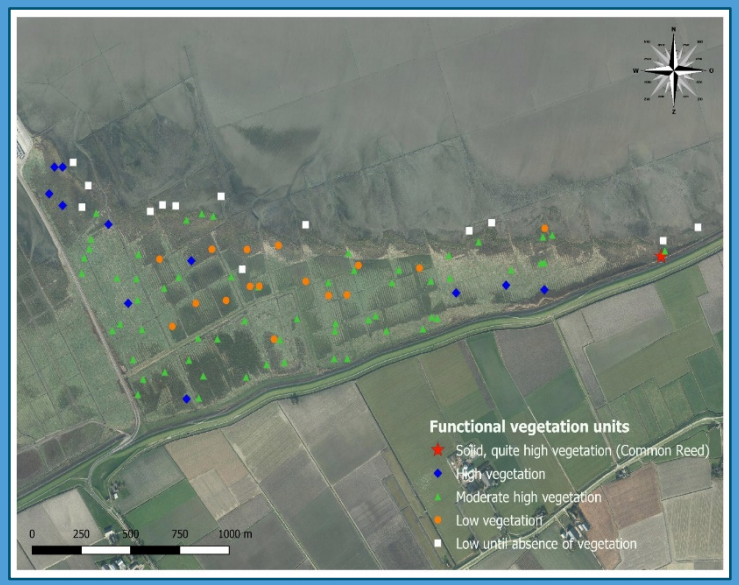
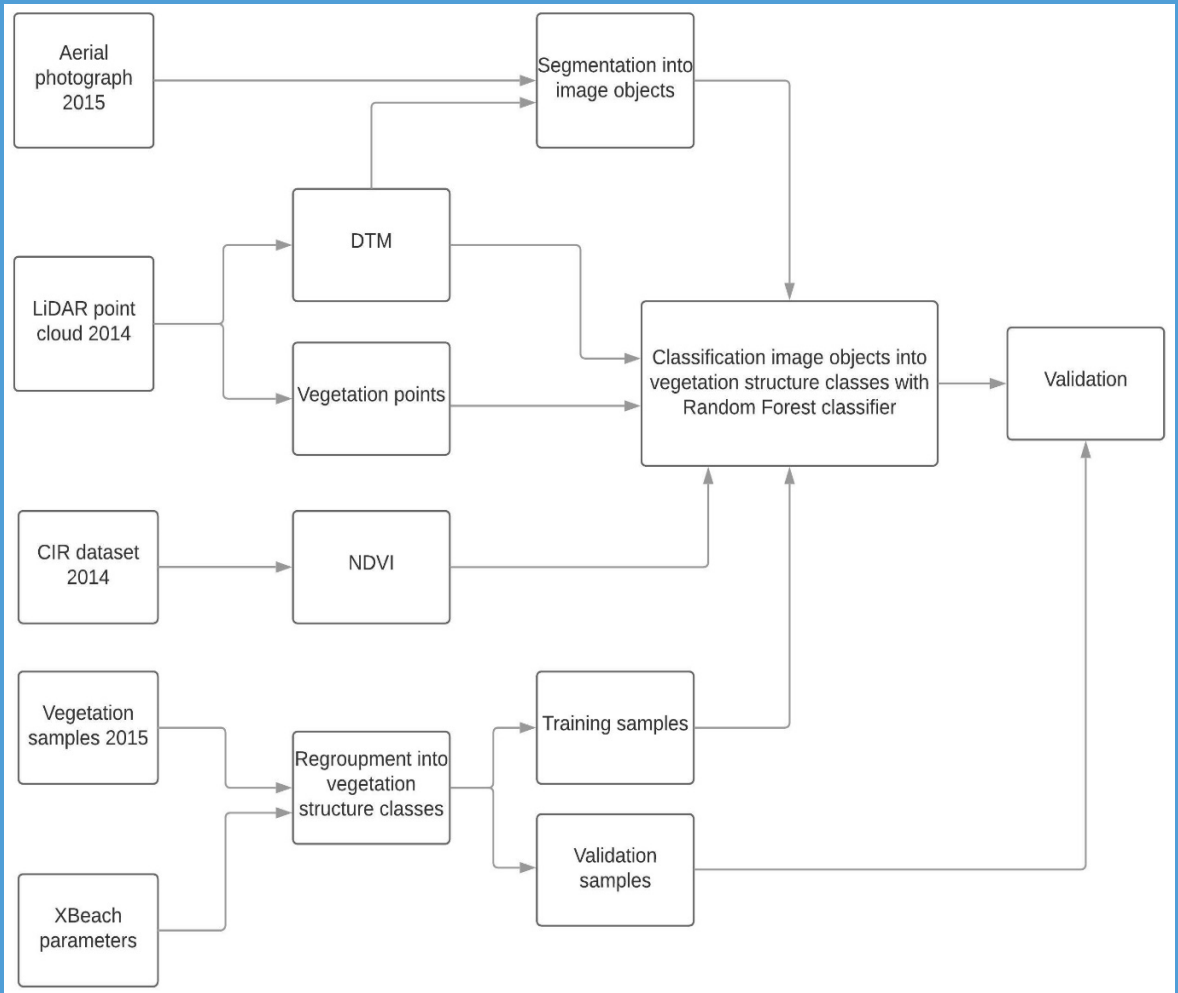
To a surface covering vegetation map



Analysis & Results



Data

Remote sensing data

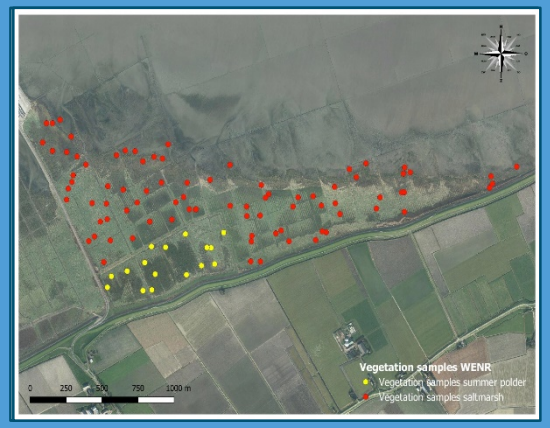
- LiDAR AHN3
- Aerial imagery
- Colour Infrared imagery

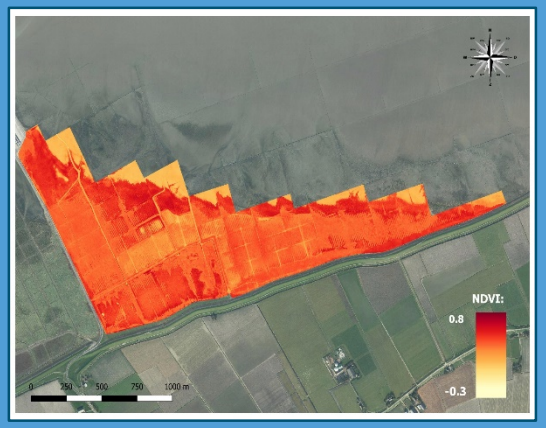
Reference data vegetation

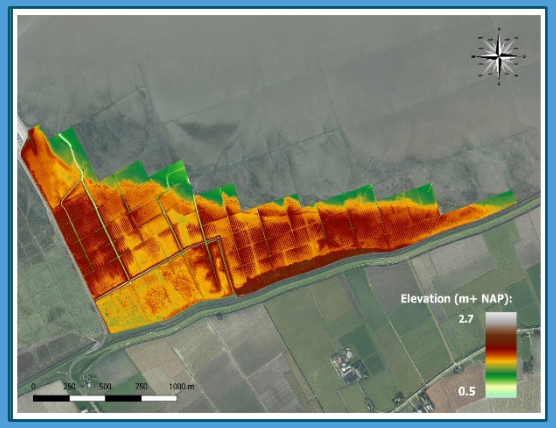
- Vegetation samples

Dataset:	Resolution	Source	Year acquistion
Aerial imagery	25 cm	Geodesk Wageningen University	2015 (Winter)
Colour Infra Red	25 cm	Rijkswaterstaat	2014, July
LiDAR point cloud	14 points/m^2	PDOK	2014, March
Vegetation samples	-	Wageningen Environmental Research	2015 (Summer)

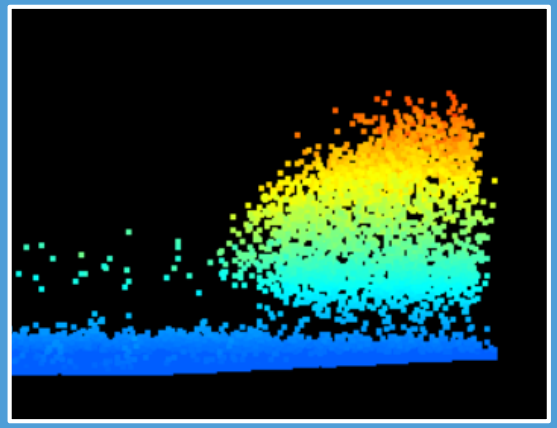
Data II


Vegetation samples WENR
Vegetation samples summer polder
Vegetation samples saltmarsh
0 250 500 750 1000 m

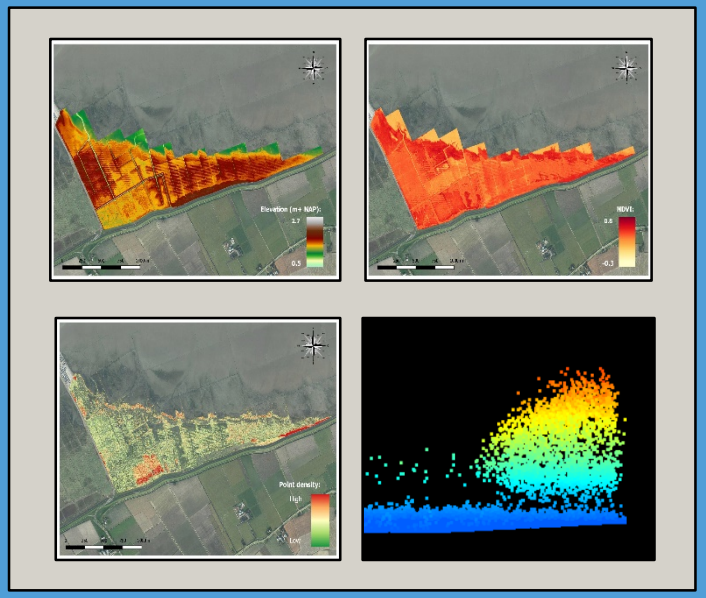

NDVI:
0.8
-0.3
0 250 500 750 1000 m

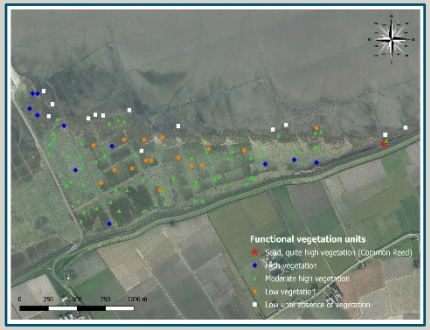

Elevation (m+ NAP):
2.7
0.5
0 250 500 750 1000 m


Point density:
High
Low
0 250 500 750 1000 m



Development vegetation structure map





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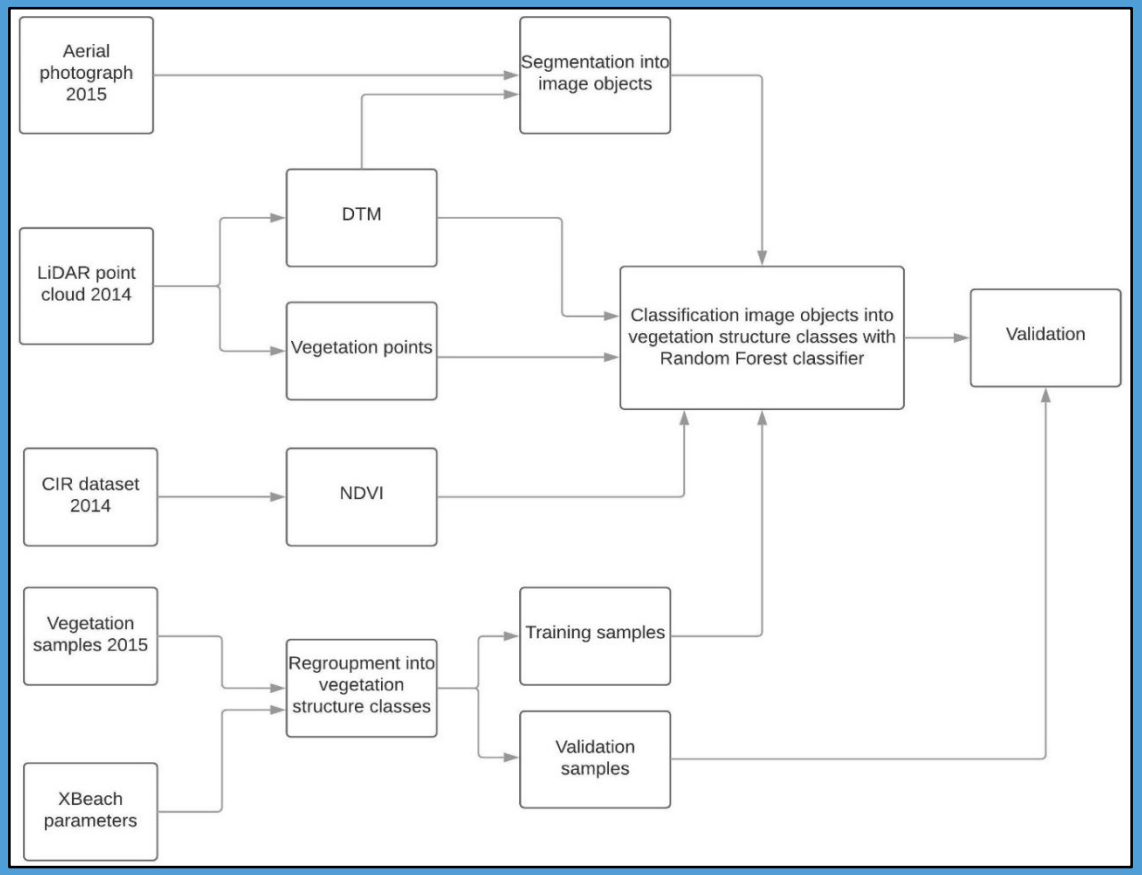
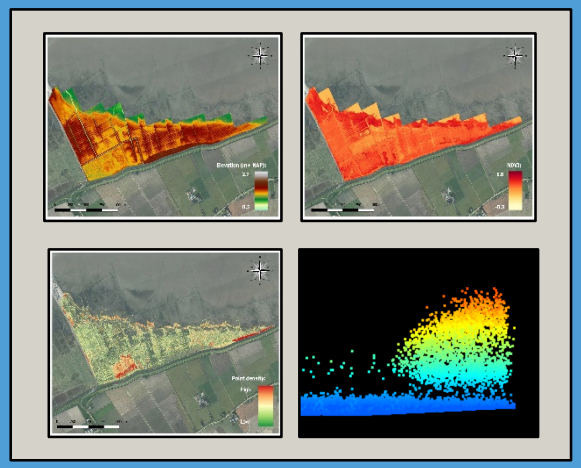
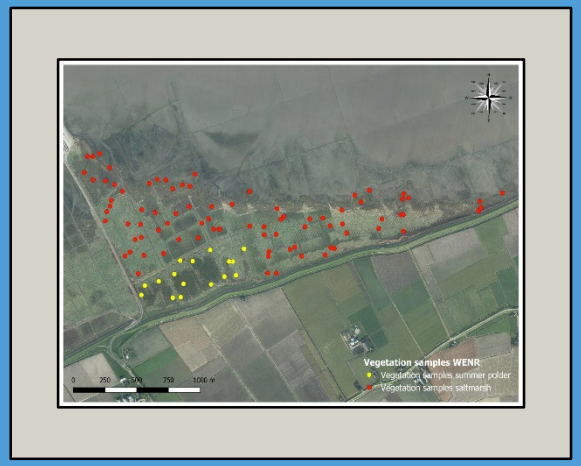
Classification eCognition

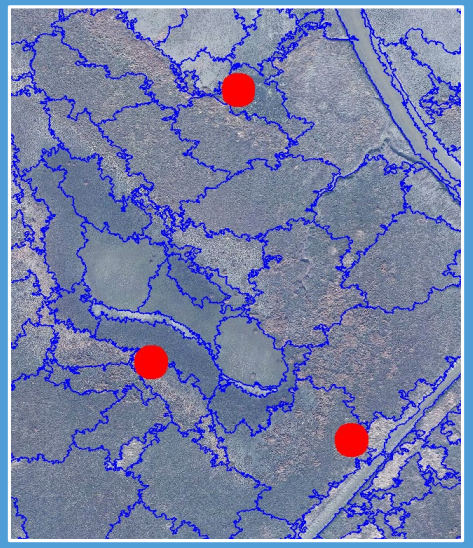
- Object-based image analysis
- Machine learning: Random Forest classifier

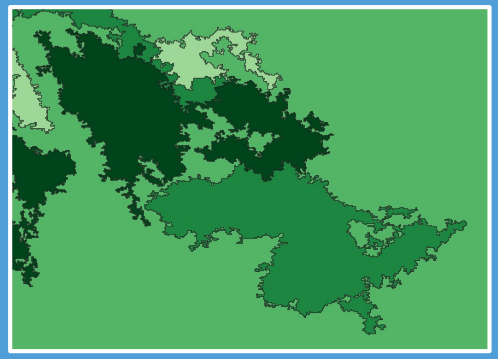


Workflow eCognition



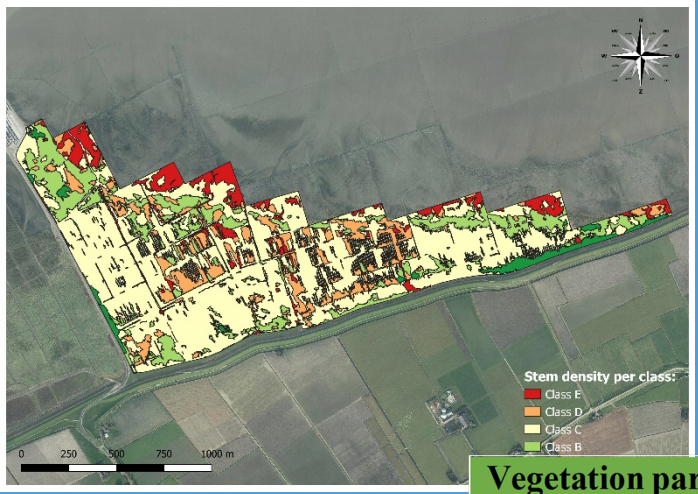






Validation vegetation classification

XBeach parameter maps



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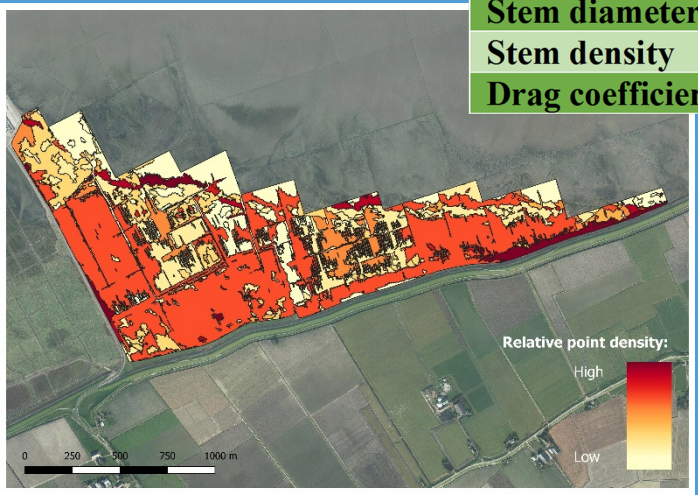
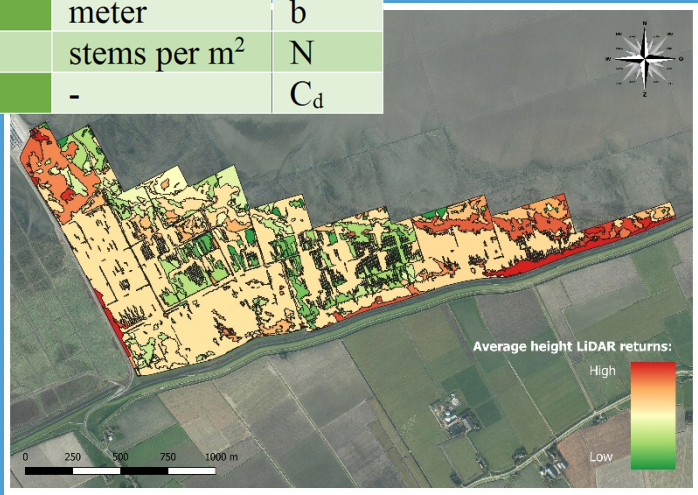
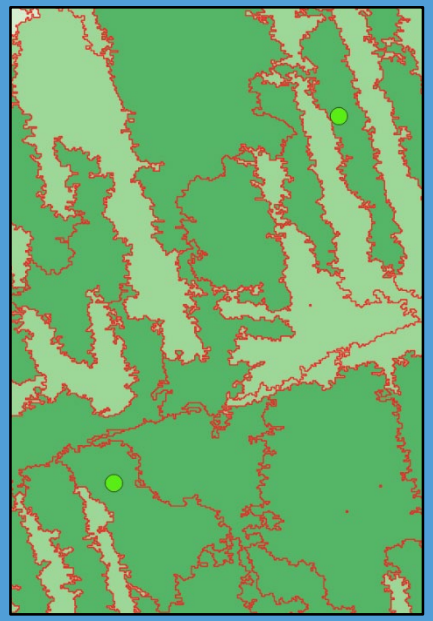
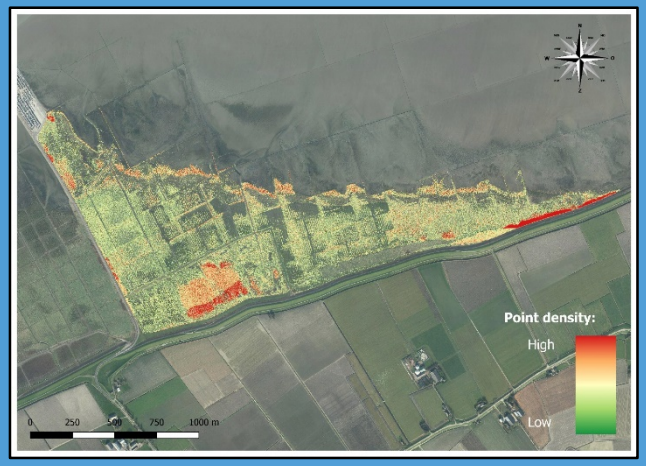




Discussion

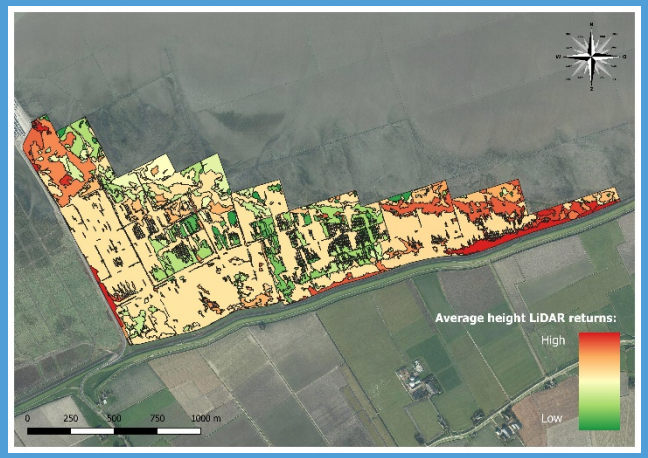
- Density LiDAR point cloud
- Potential for upscaling
- Classification method

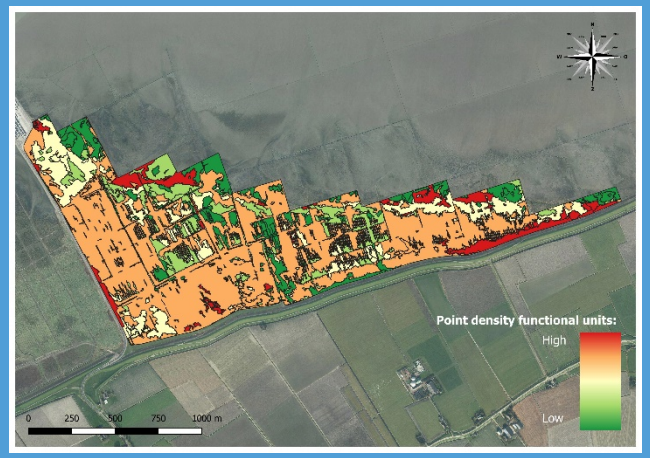




Conclusions

- XBeach parameter maps
- Spatial distribution vegetation characteristics
- LiDAR: height & relative density
- Literature + expert knowledge: stem density & stem diameter





Thanks for your attention