Ecological Optimisation of Dynamic Coastal Defence

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(NCP + LDD)

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Dynamic Coastal Defence

- Coastal defence policy since 1990: *dynamic preservation*

- Main objective : preserving *basal coastline*
- Primary means : sand nourishments

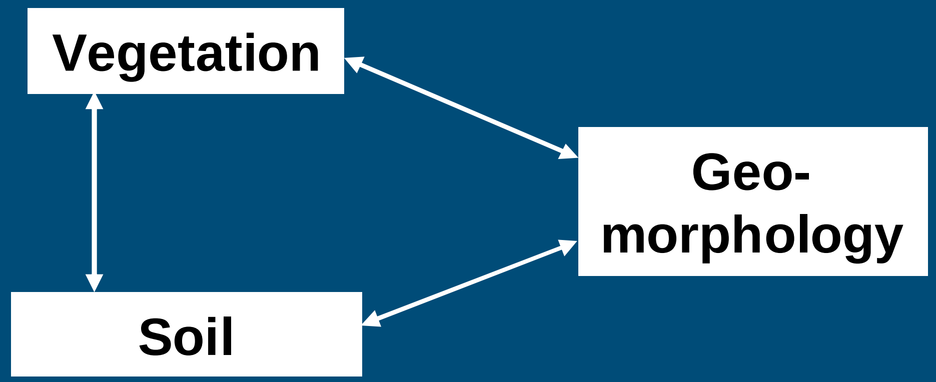
- Working together with natural dynamics

Research question

- Does dynamic coastal defence lead to an increase in the ecological value of the landscape and to a wider, safer, dune area?
  - Gradients in salinity, pH, nutrient availability and groundwater depth.
  - Influence of blowing sand and periodic inundations.

Research outline

- Development of spatially explicit simulation model
  - Aeolian sand transport + dune formation
  - Growth and development of pioneer vegetation
  - Soil development and vegetation succession
  - Modular set-up:

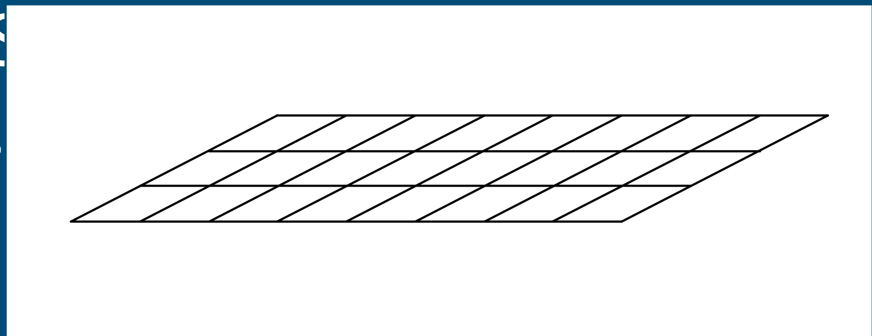


WEPS (Wind Erosion Prediction System)

- (Wind speed -- aerodynamic roughness) = friction velocity
- Grain size + moisture content + flat biomass cover + surface roughness → threshold friction velocity
- Friction velocity > threshold friction velocity = sand transport

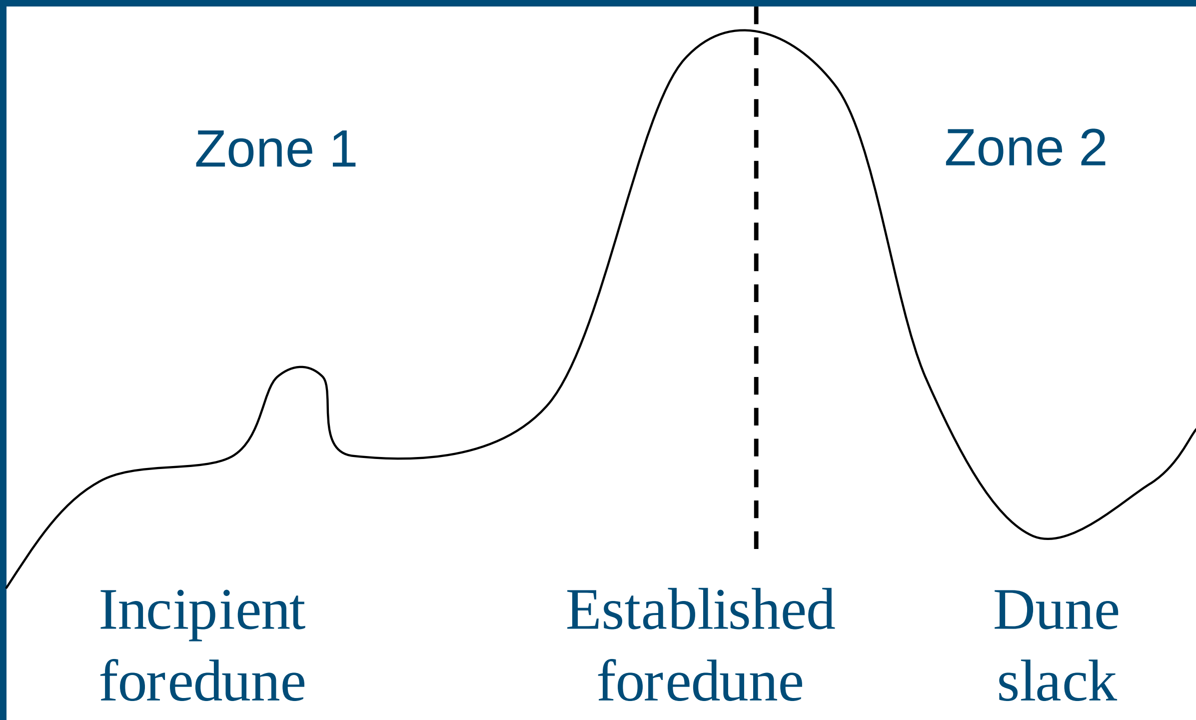
DECAL (Nield and Baas, 2008)

- Dune formation simulated using DECAL-approach
- Cellular automaton model
  - Interactions between cells governed by transition rules
  - Large versatility: different kinds of transition rules possible
- ‘Fed’ by WEPS
- Vegetation gr



NUCOM2 (Berendse 1988)

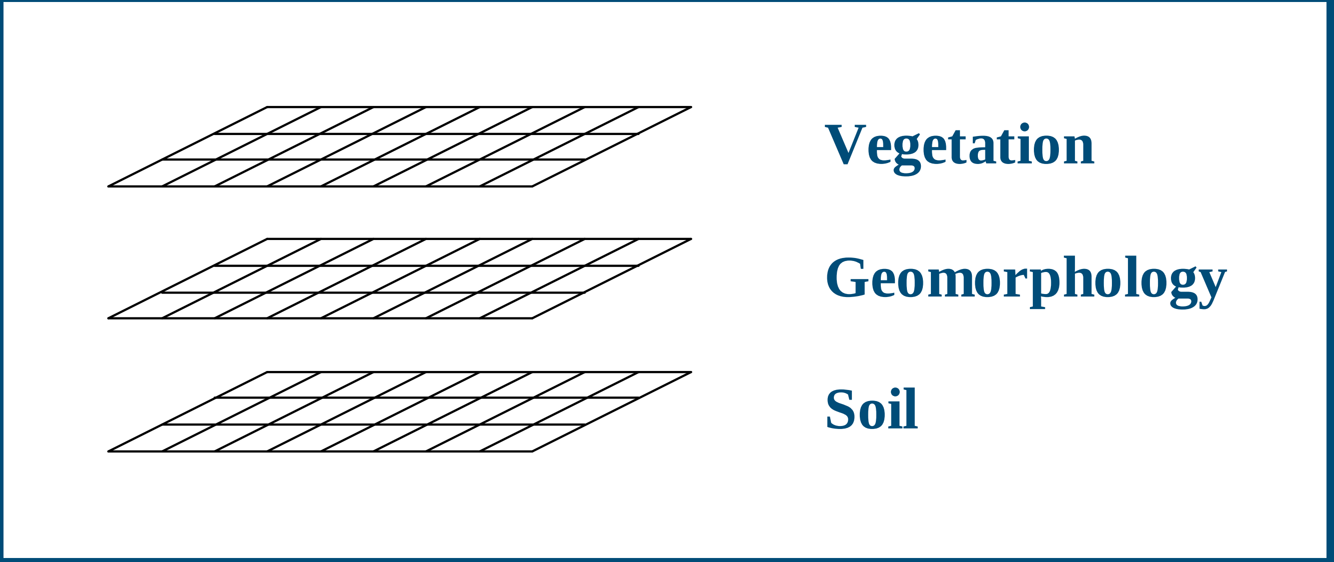
- Plant growth + competition driven by nutrient uptake
- Division of model area in 2 zones



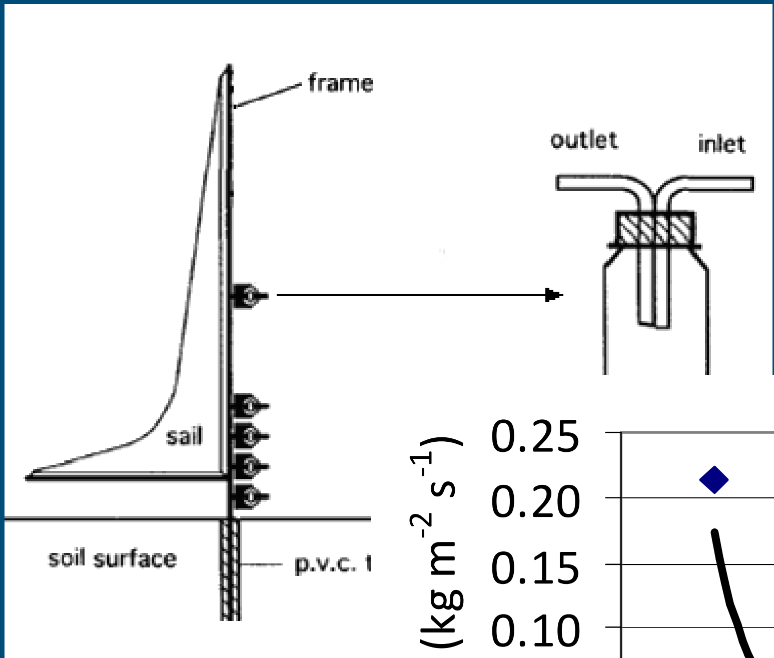
NUCOM2 (Berendse 1988)

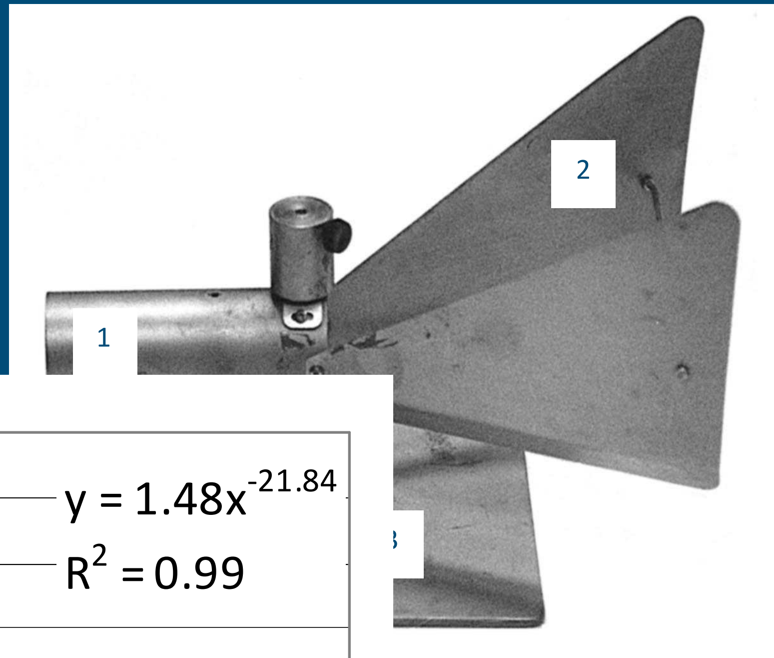
- Zone 1:
  - Growth limited by nitrogen availability
  - Mortality dependent on salinity, burial by sand, abrasive forces of sand
- Zone 2:
  - Growth determined by:
    - accumulation of organic matter (nutrient availability and pH)
    - distance to groundwater level

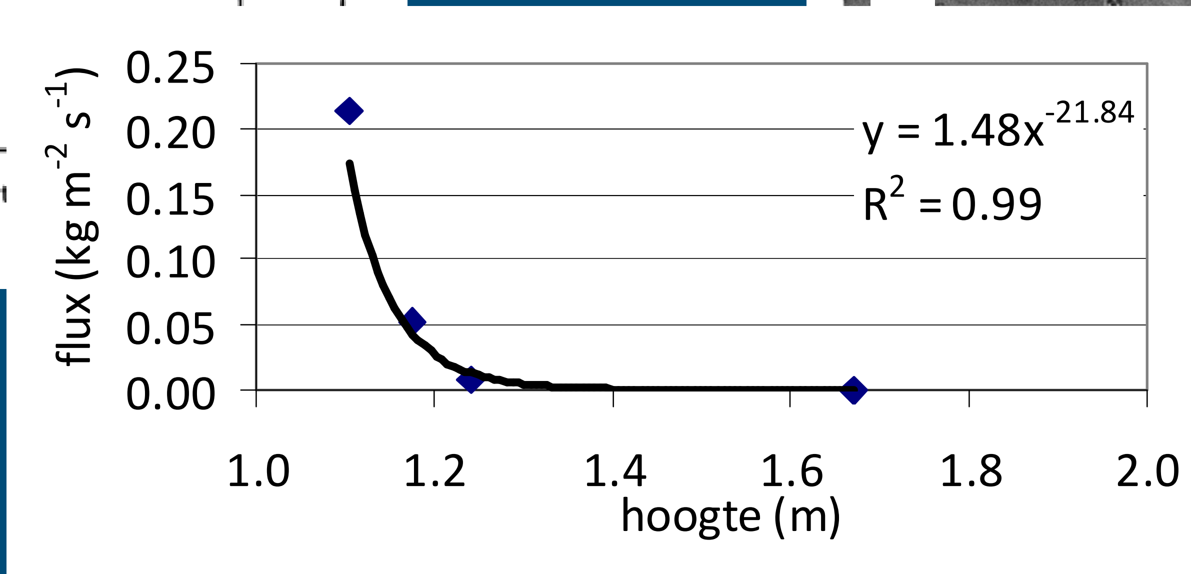
- Integration of the three modules:
  - Simulation grid-based
  - Ouput *i* = Input *i+1*



Pilot field study – sand transport







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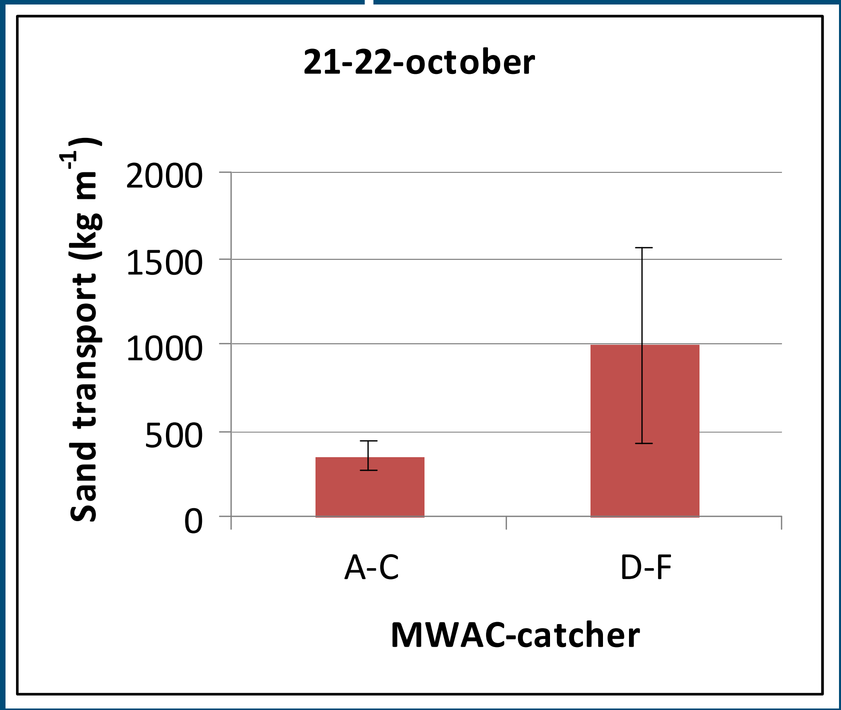
Pilot field study – study area

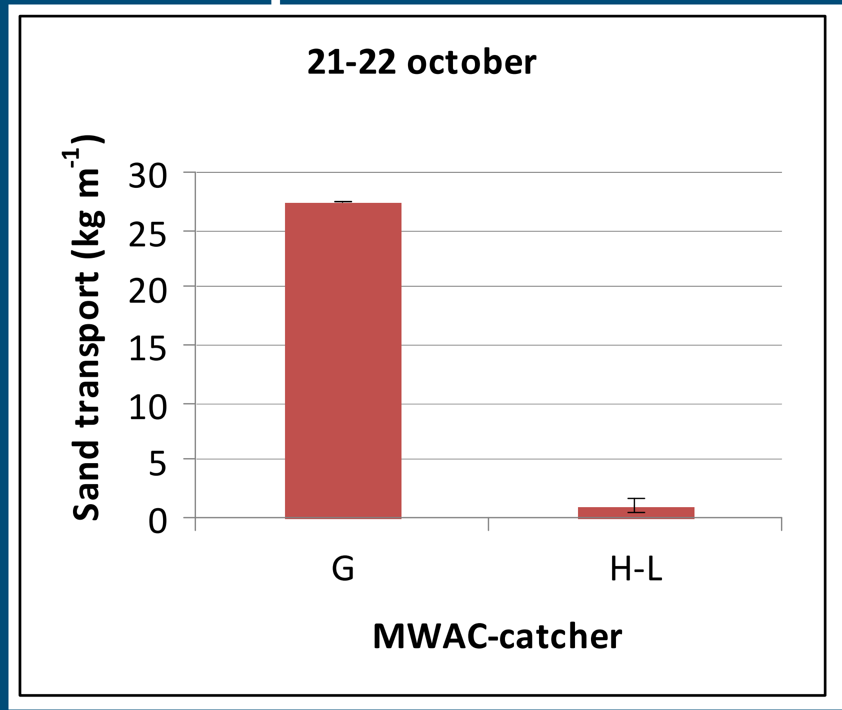
1. **Transport zone**
2. **Deposition zone**

Some preliminary results

Transport zone



Deposition zone



F C

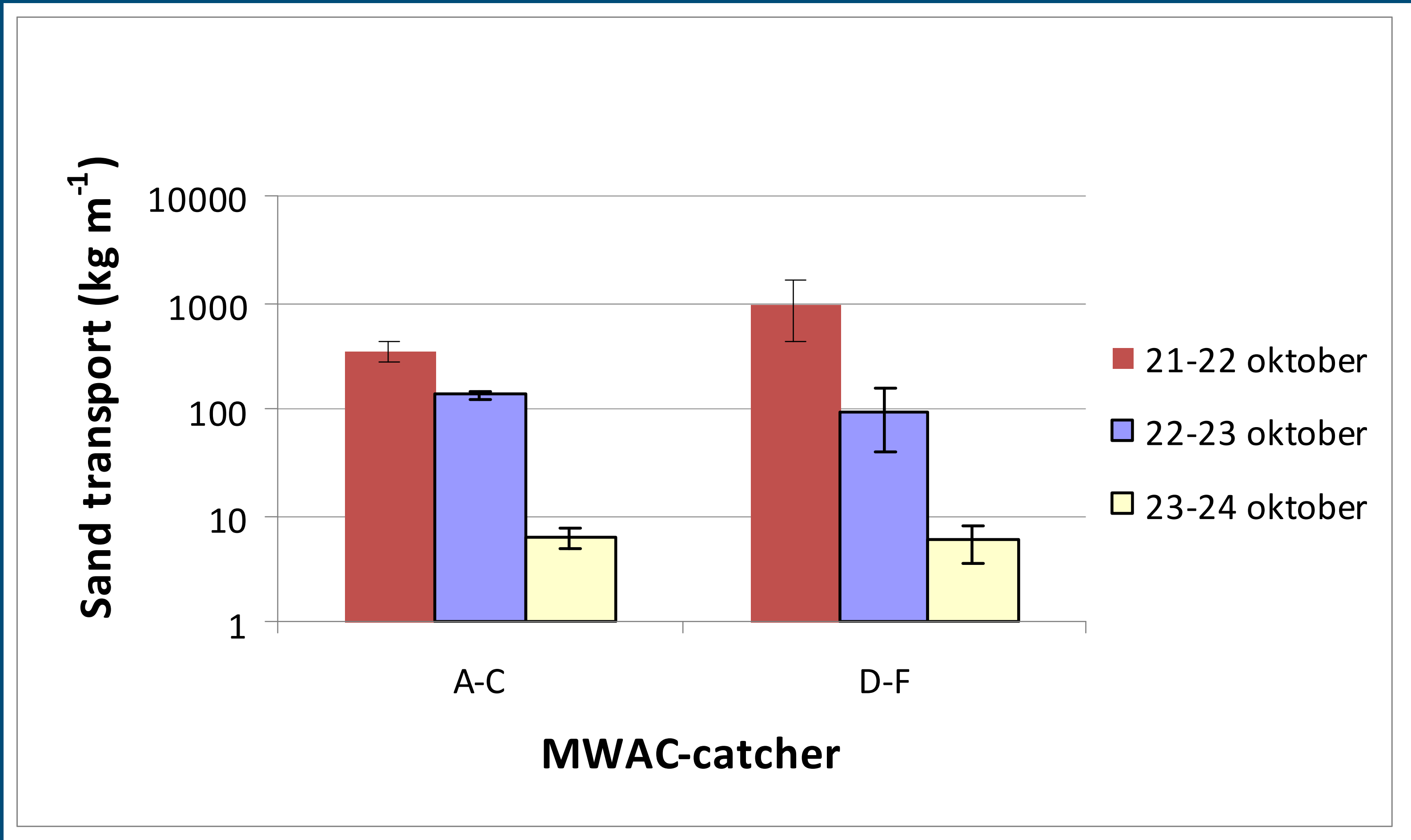
E B

D A

G I K

H J L

Some preliminary results



Some preliminary conclusions

- No ... tran... ture!
- Wir... s and inte...
- Me... under a ra...
- Pos... pend on ...