



Rijkswaterstaat

Deltares

Spanjaards Duin and Dynamic Coastal Management: an overview

L. van der Valk¹, S.D. IJff¹, M.R. van Eerden², F. van der Meulen³,
en M.A. Eleveld¹

21 september 2021

¹Deltares, ²Rijkswaterstaat WVL,

³Frank van der Meulen Consultancy,



enabling delta life

Contents

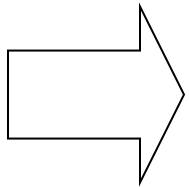
- Dynamic Coastal Management (DCM)
- Future of the coast
- Challenges for dynamic dune management
- BwN: lessons learnt from Spanjaards Duin



Zandvoort 20 Jan 2018
Photo Marieke Eleveld

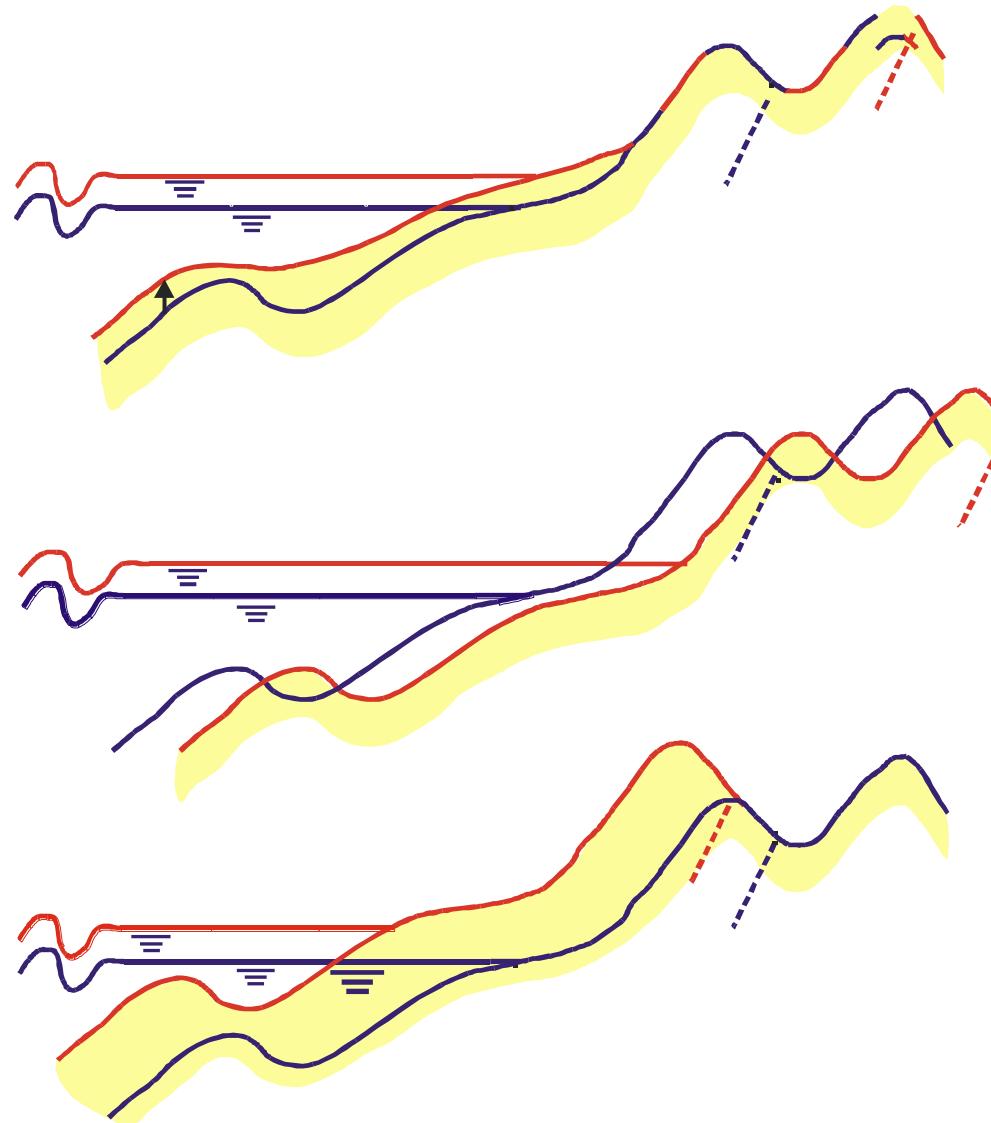
Resilience against effects of climate change 1990

1st Coastal Policy Document



Basal Coast Line

Deltas



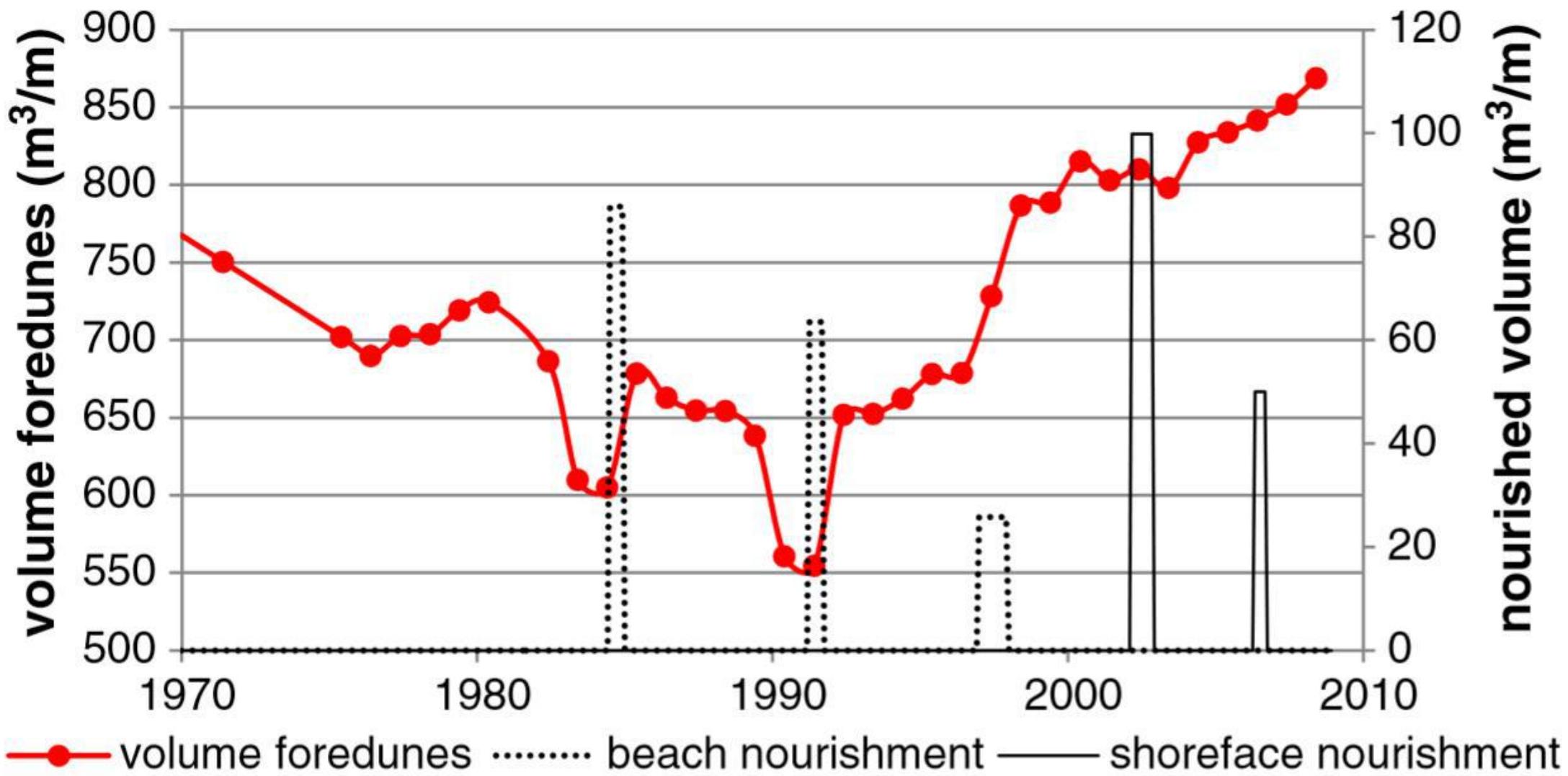
What is DCM?

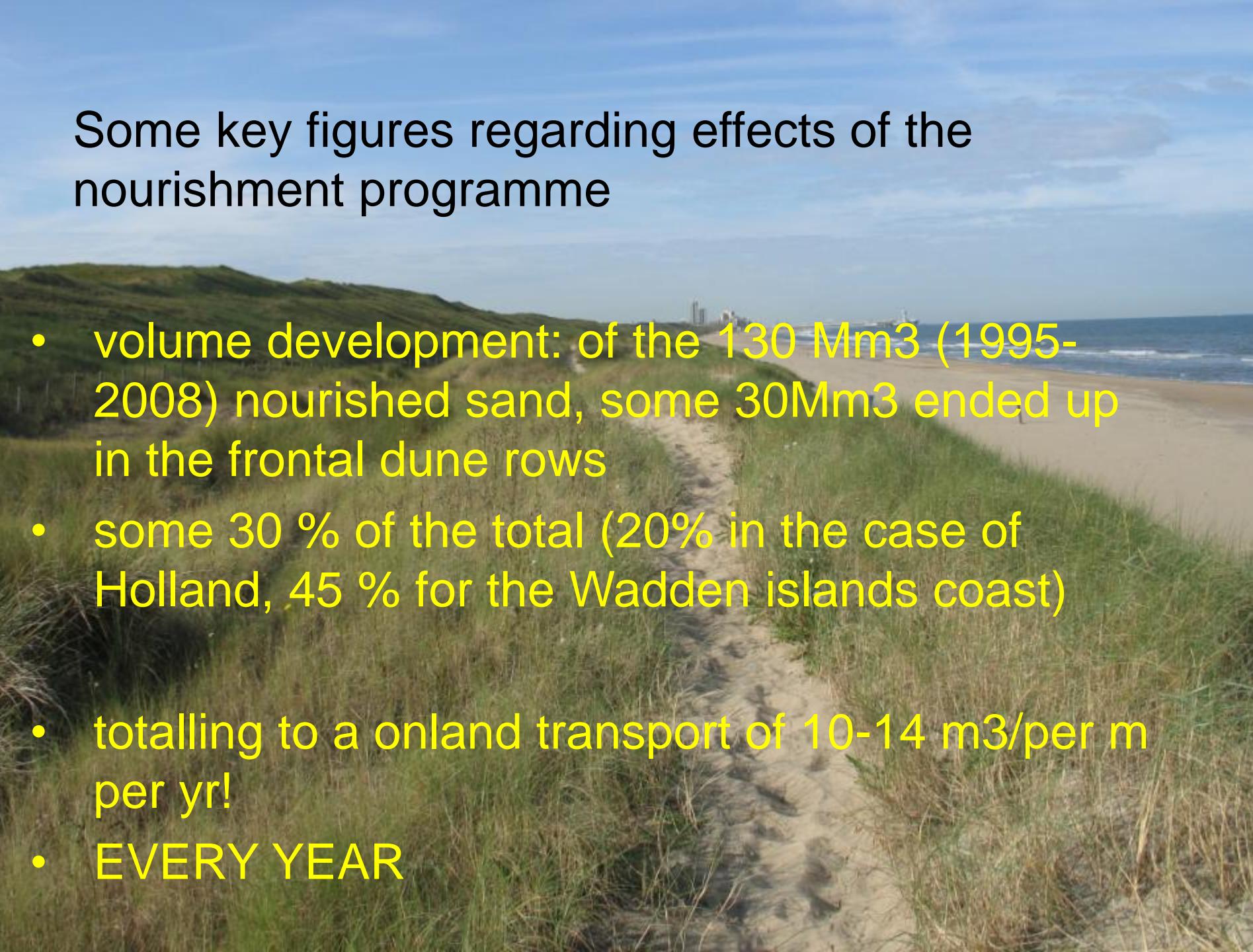


Dynamic Coastal Management (= dynamisch kustbeheer):

- **Maintain a certain volume sediment in the coastal envelope**
- **Occasionally replace lost sediment by nourishment (monitoring!)**
- **Let nature (waves, winds) do the work (BwN)**
- **Facilitated by modern dredging practice**

More sand in the foredune since the start of nourishments (and more dynamic dune management)

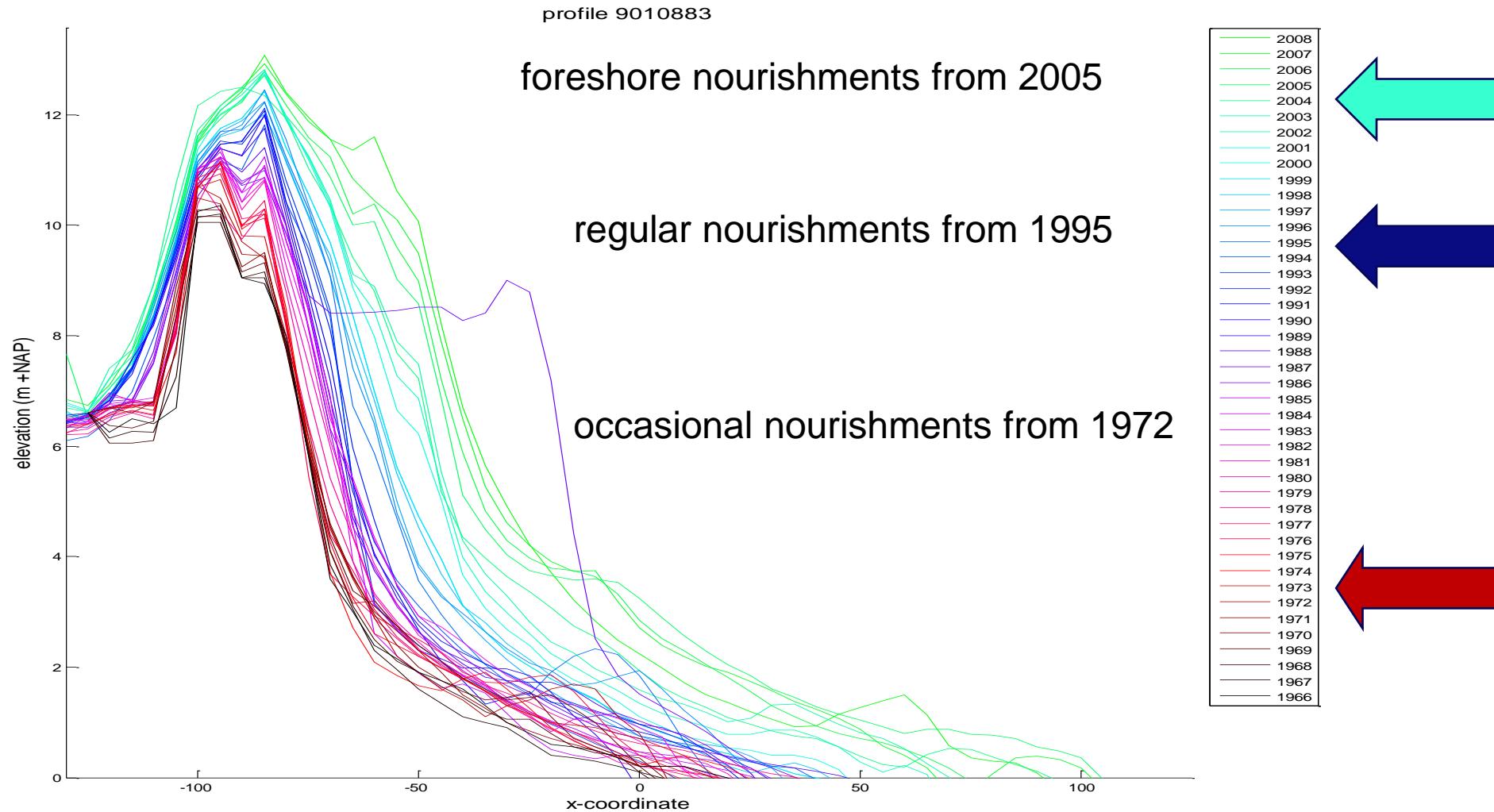




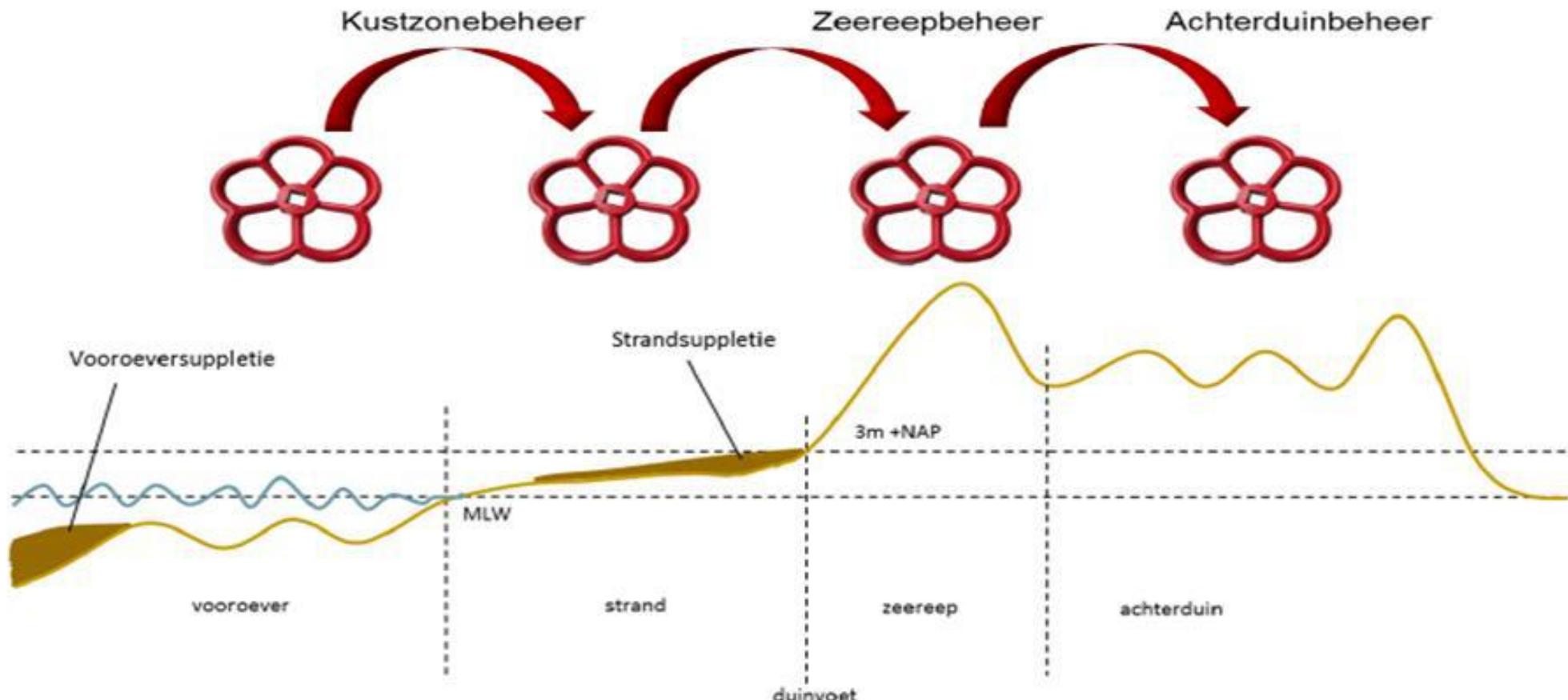
Some key figures regarding effects of the nourishment programme

- volume development: of the 130 Mm³ (1995-2008) nourished sand, some 30Mm³ ended up in the frontal dune rows
- some 30 % of the total (20% in the case of Holland, 45 % for the Wadden islands coast)
- totalling to a onland transport of 10-14 m³/per m per yr!
- **EVERY YEAR**

Different nourishment types at the Delfland frontal dune and their effects

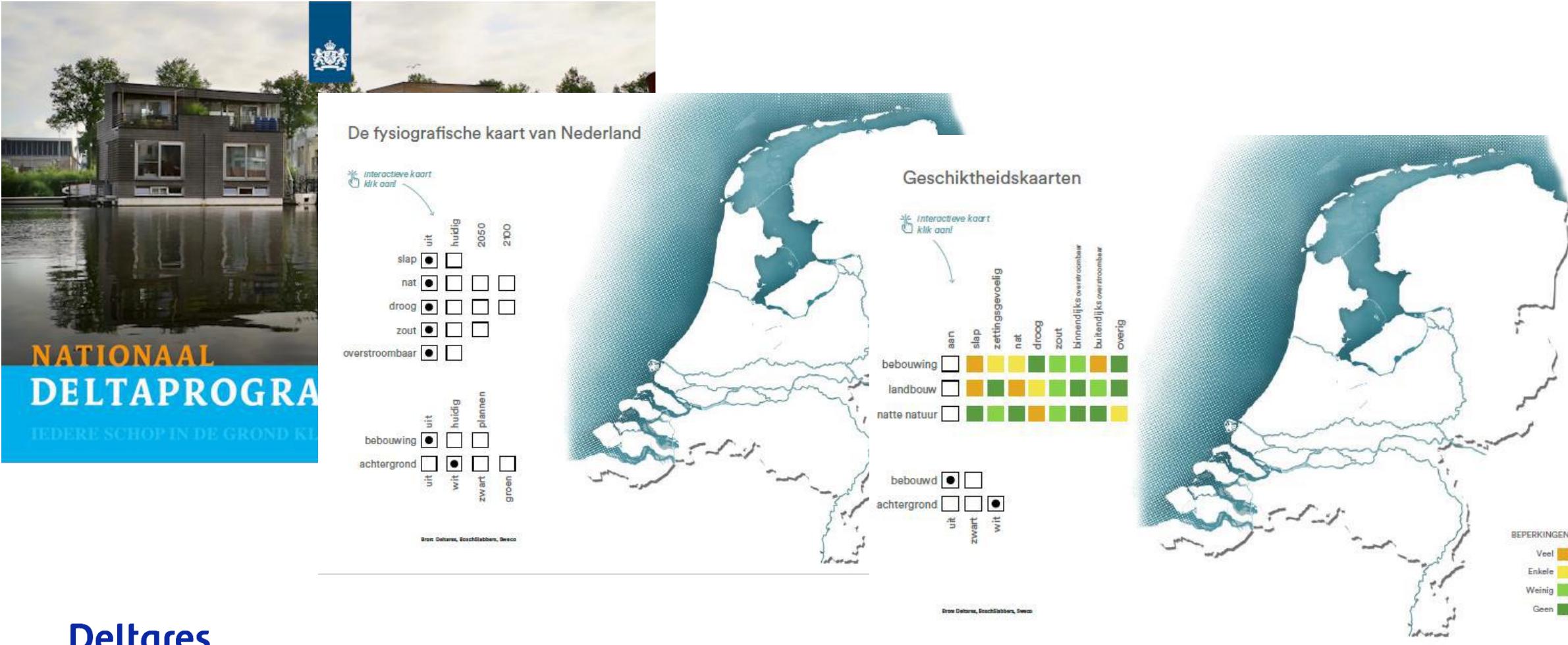
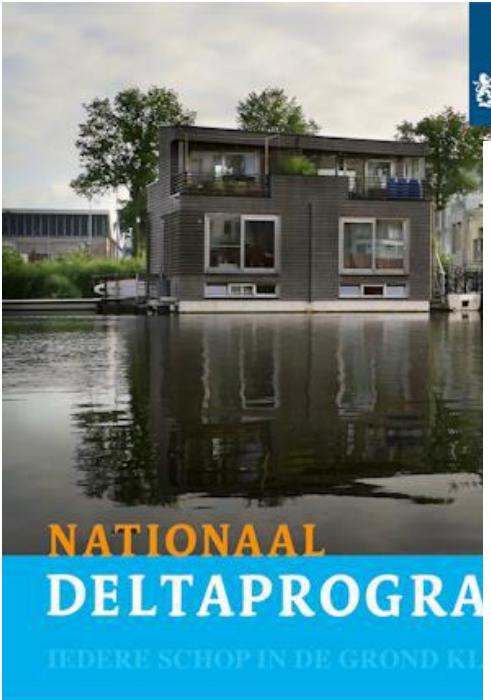


Challenges in Coastal Dune Management: Coastline and dune management



The future Deltaprogramma 2021

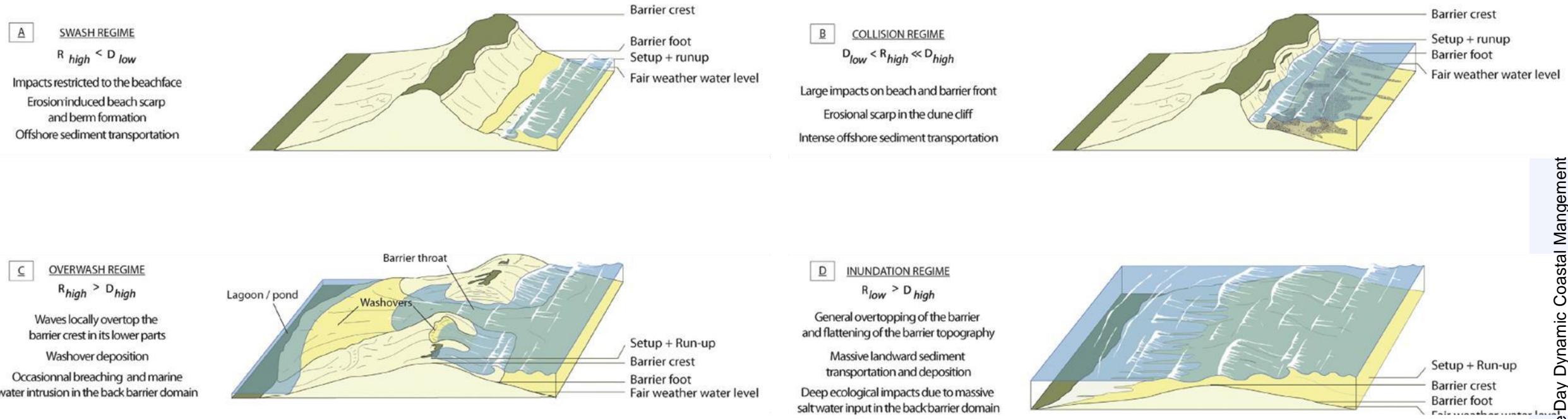
<https://www.deltares.nl/app/uploads/2021/07/Op-Waterbasis.pdf>



<https://www.youtube.com/watch?v=iSUi9v83kZo>

The image shows a YouTube video player interface. The URL in the address bar is <https://www.youtube.com/watch?v=iSUi9v83kZo>. The video content is a presentation titled "ENDURE viewer" developed by Deltares. The background of the video frame shows a coastal landscape with dunes and a beach. The title "ENDURE viewer" is displayed in large blue letters at the top, followed by "Tool developed by Deltares". Below the title, the names "Michelle Schouten HHNK, The Netherlands" and the date "May 2021" are visible. A black banner at the bottom of the video frame contains the text "Hello everyone. Welcome to the presentation of the ENDURE viewer." The video player includes standard controls like play, volume, and progress bar, along with logos for various partners: Flanders Hydraulics Research, Flanders State of the Art, Ghent University, Val d'Authie, Cerema, and Norfolk County Council.

ENDURE <http://www.vliz.be/projects/endure-viewer/>

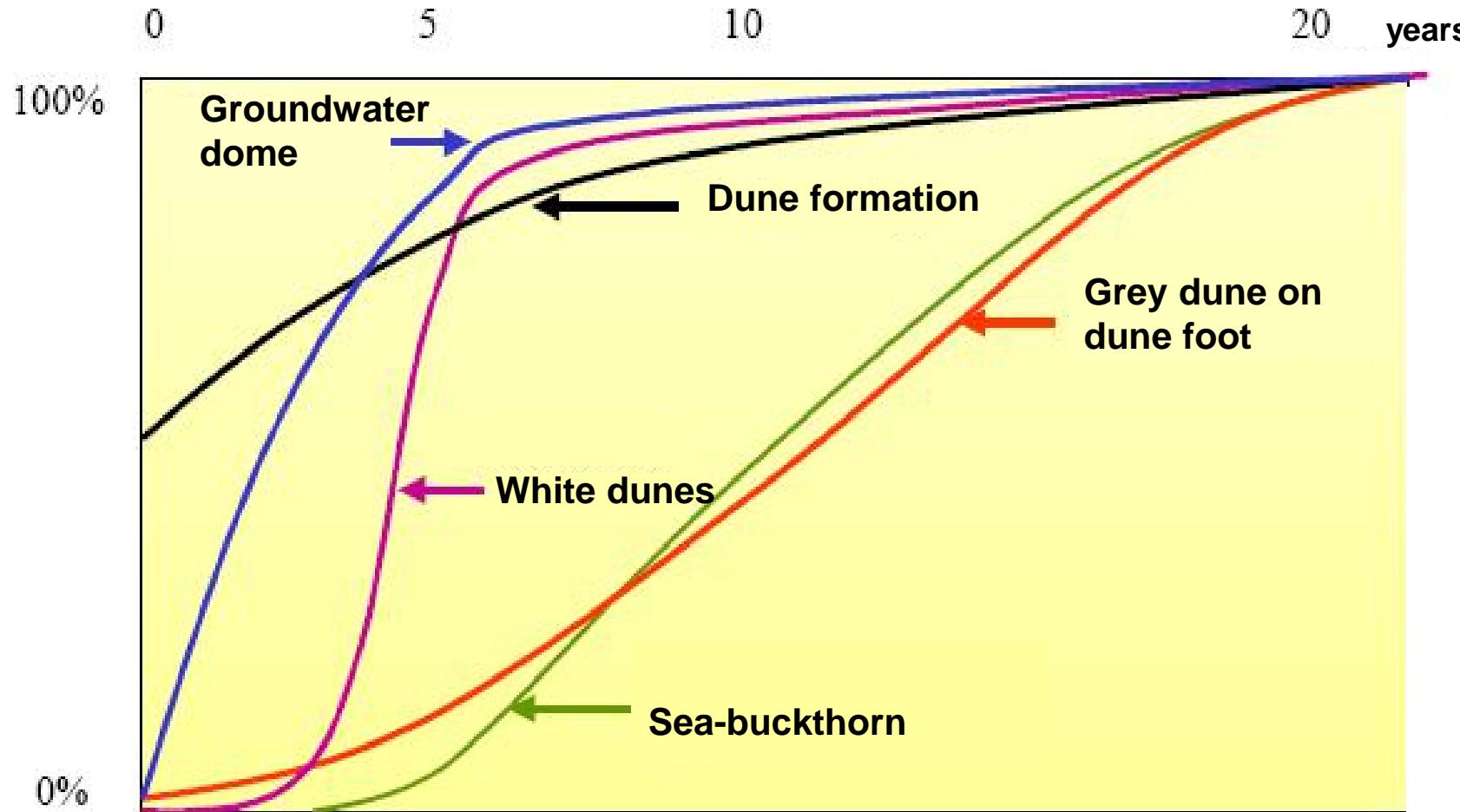


Goslin & Clemmensen, 2017. Quaternary Science Reviews.

Comparison newly coastal extension projects along NL coast

	Schouwen	Spanjaards Duin	Zandmotor	Kennemerstrand	Hondsbossche Duinen	PH zanddijk
Year/ Volume (mM3)	from 1995/ 0,5 /4 years	2009/ 6,6	2011/ 21,5	from 1968 ?	2014/ 42	2018
target	coastal defense and nature development	N2000	Coastal defense, nature, recreation	By accident, now N2000	Coastal defense	Coastal defense
method	periodical nourishment	nourishment	nourishment	natural accumulation	nourishment	nourishment
major agens	wind	wind	waves and wind	waves and wind	wind	?wind
nature quality	high	growing	slow progress	high	slow progress	Slow progress

Spanjaards Duin: estimated development time beforehand



Compensation objectives: N2000 qualifying nature



6.1 ha Moist dune valley



1 population Fen orchid (*Liparis loeselii*)



9.8 ha Dry grey dune

Learning-by-doing = adaptive management



Experiments



Speeding up vegetation development



Application in various other projects,
looking for X fertalisation

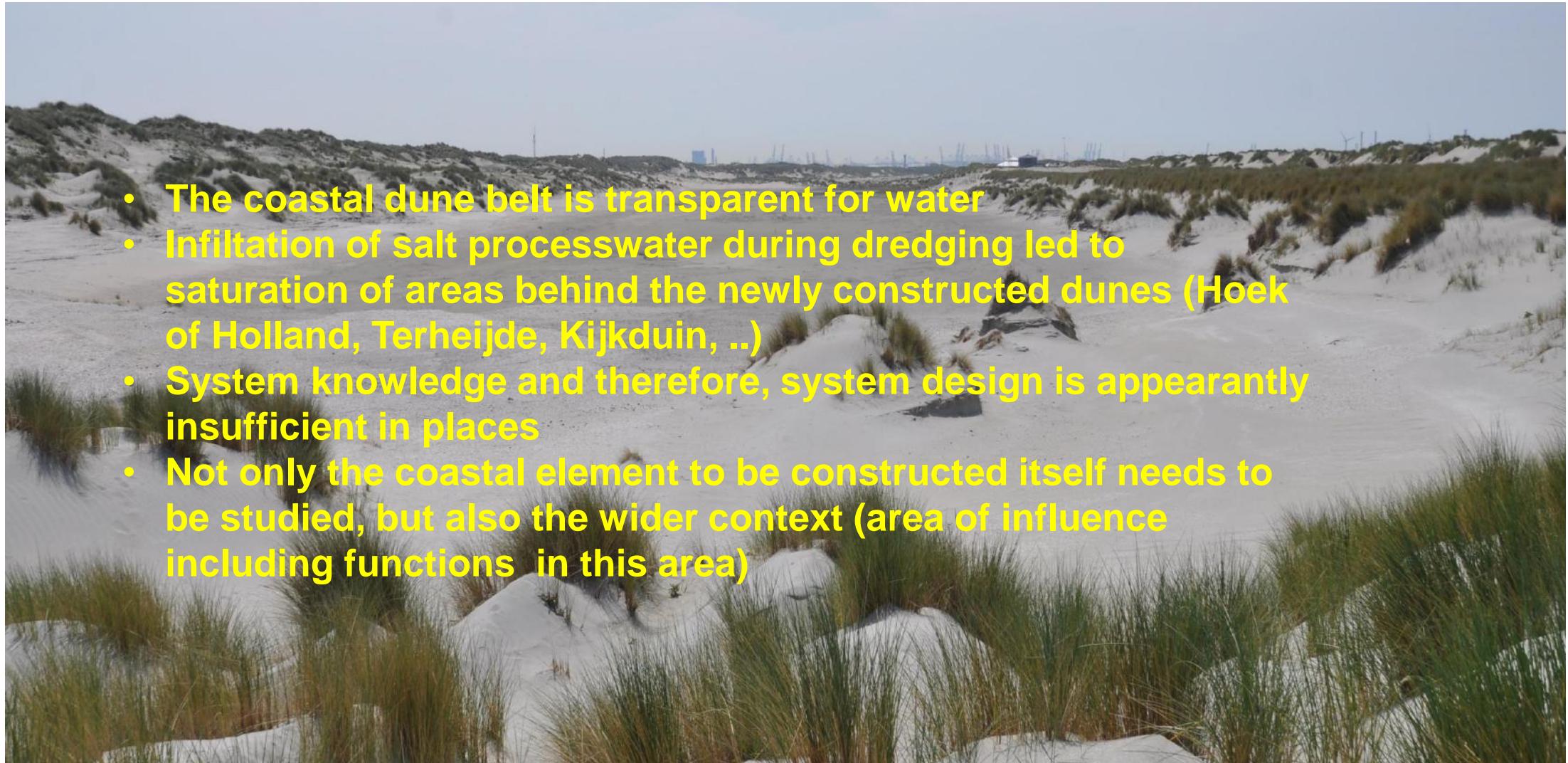
What have we learnt from Spanjaards Duin and other coastal extension projects?



- Areal geohydrology
- (Start of-) vegetation growth
- Single- and multipurpose areal use

Knowlegde base: Kustversterking
Delfland 2009, Zandmotor 2011,
Hondsbossche Duinen 2014, PH
Zanddijk 2018

Geohydrology of man-made dunes



- The coastal dune belt is transparent for water
- Infiltration of salt processwater during dredging led to saturation of areas behind the newly constructed dunes (Hoek of Holland, Terheijde, Kijkduin, ..)
- System knowledge and therefore, system design is apparently insufficient in places
- Not only the coastal element to be constructed itself needs to be studied, but also the wider context (area of influence including functions in this area)

(Start of-) vegetation growth on constructed dunes



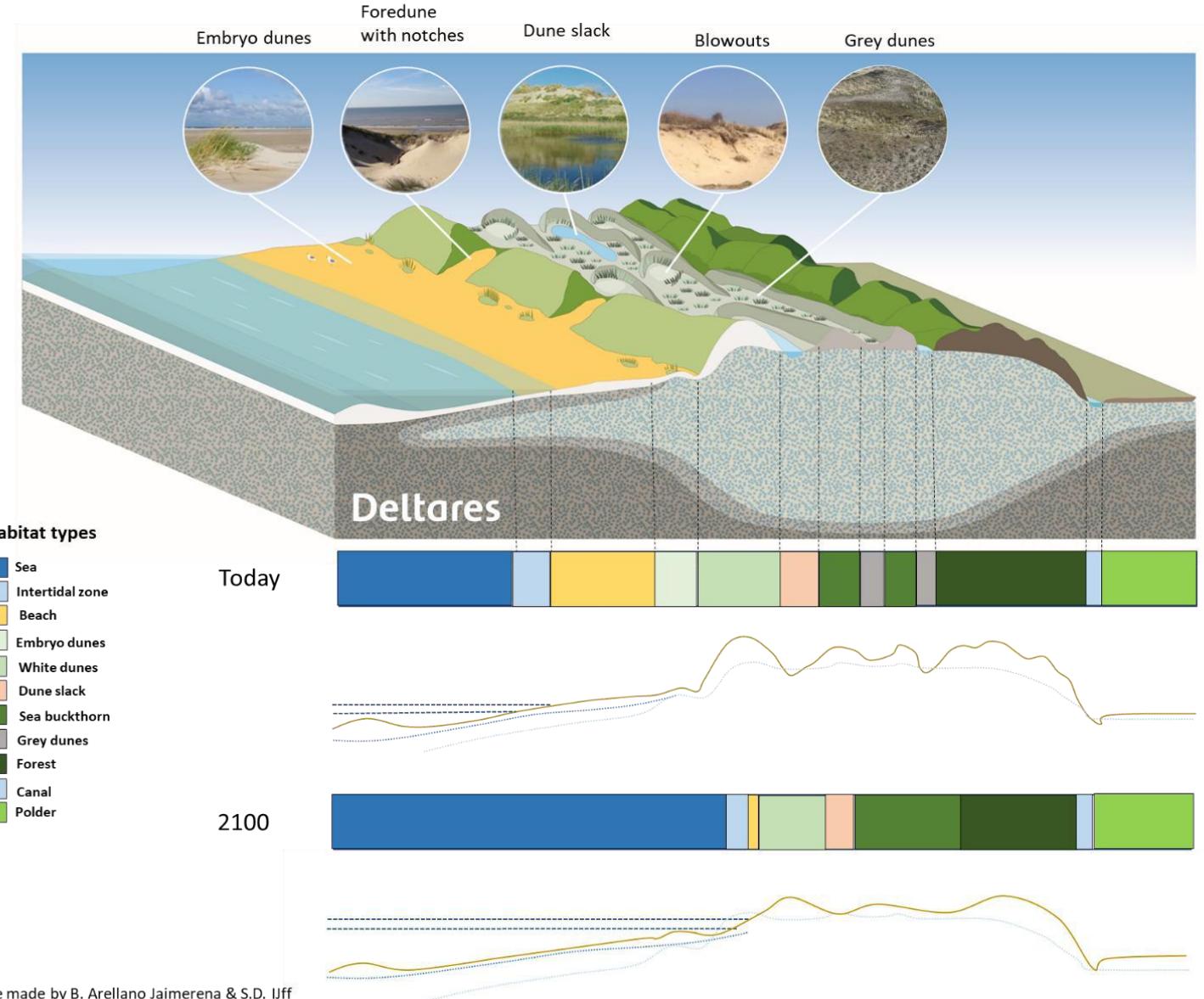
- Geohydrologically, the constructed dune topography must be 90% OK allowing for minor changes in bed level afterwards
- BwN approach may be useful if there is freedom of development
- In all other cases smaller or larger measures may have to be taken into account, also in the design. Incorporate lessons learned
- Take your time! Habitat-class natural vegetation needs it (decades)
- Planting Ammophila arenaria attracts Sea Buckthorn (both species function as green concrete!)

We need more concepts and tools to be prepared for the future (not only the hardware ☺)

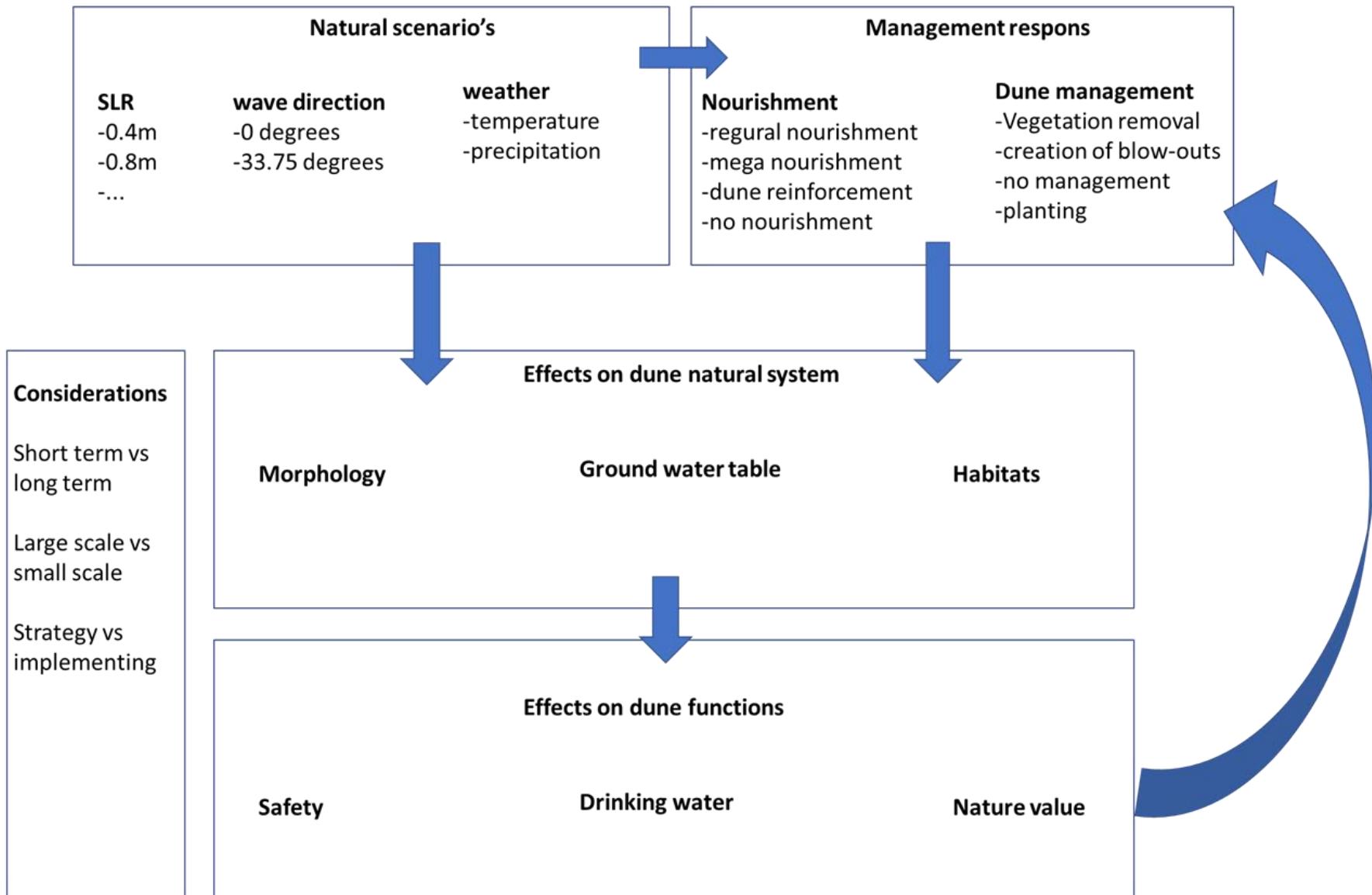


The combination of SLR, climate change and management affect **morphology, ground water, and ecosystems** of dunes.

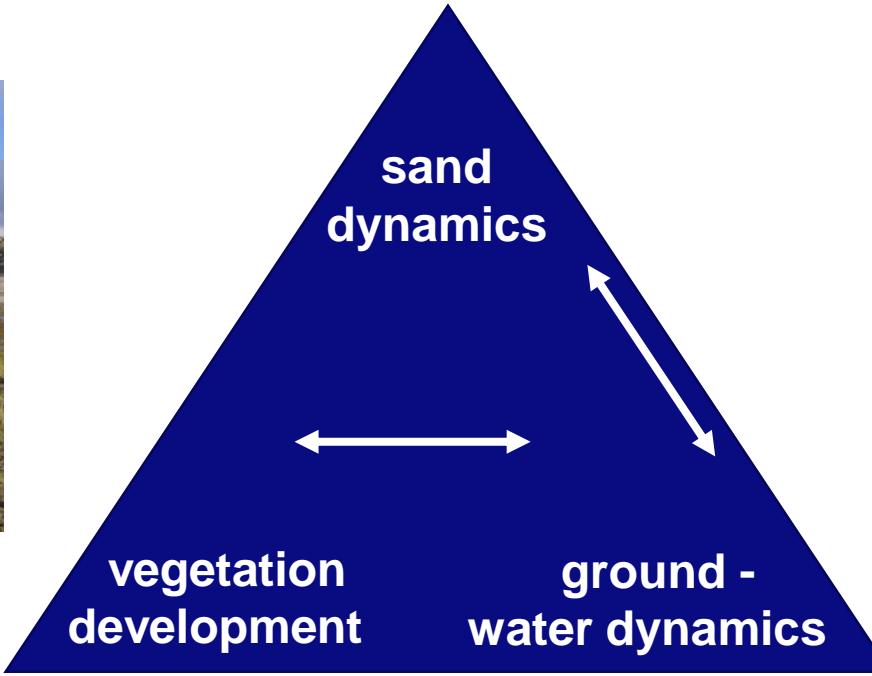
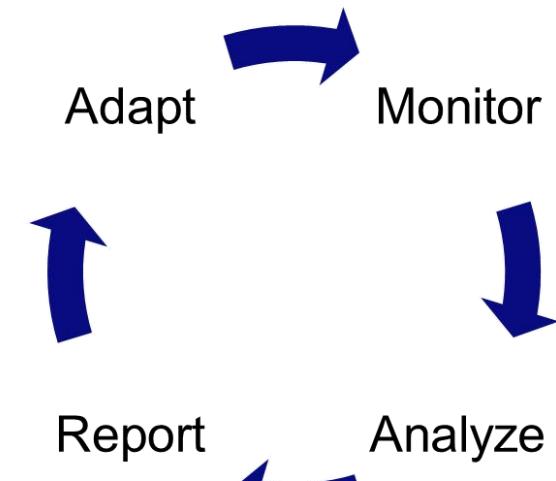
Hypothetic effect of SLR on dune landscape, with dynamic dune management



Conceptual model



By the way: we cannot do DCM without a nation-wide solid monitoring programme (scale factor!)



Management of Spanjaards Duin: dynamic if possible and adaptive where needed

- <https://mepduinen.openearth.nl/> >
Data Info Extra
- <https://waterinfo-extra.rws.nl/download-data/>
- <https://rwsprojectarchief.openearth.nl/downloads/Spanjaardsduin/repos/>

Spanjaards Duin 2009-2021:
natuurcompensatie Delflandse kust
in het kader van het gebruik van
Maasvlakte 2



A multifunctional coast, but safety prevails

