

Alien and invasive woody species in the dunes of the Wadden Sea island of Vlieland

A remote sensing mapping approach

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Dunes of Vlieland

Vlieland is one of the West Frisian barrier islands, situated in the North of the Netherlands. The Natura 2000 area 'Duinen Vlieland' protects most of the island. Especially the 'grey dunes', characterized by sandy slopes of lichens and open species rich vegetation, are a key habitat type. The management objectives are focused on increasing the quality and area of the 'grey dunes'.



H. rhamnoides and *R. rugosa*



P. serotina sprouting

Invasive woody species

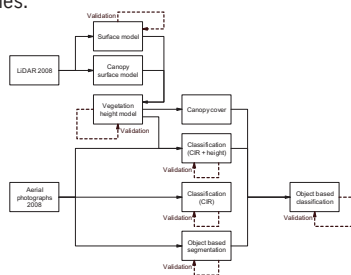
The open nature of the habitat was maintained by extensive grazing by native herbivores, rabbits and domestic livestock. A lack of appropriate grazing levels increased the growth of native and non-native scrub and the atmospheric deposition of nitrogen compounds is also speeding up the shrub encroachment.

Remote sensing

Remote sensing methods can be used for a relatively cheap monitoring of shrub distribution useful for management and monitoring. Different successive mapping campaigns delivers time series to observe the invasive character of the shrub species.

Input data

- Aerial photographs of 2008
- LiDAR (height) data of 2008
- Validation dataset 2010



Test site Vlieland

- Analyses: North-West of Vlieland
- Detail in red: location of the classified maps shown here

Three different classification methods

Maximum Likelihood (ML)



Image 1 Field	Hippophae rhamnoides	Pinus nigra	Prunus serotina	Rosa rugosa	Salix repens	Sambucus nigra
Hippophae rhamnoides	32	15	29	4	31	1
Pinus nigra	6	24	6	1	2	1
Prunus serotina	9	14	26	6	6	2
Rosa rugosa	0	0	3	54	1	15
Salix repens	2	1	4	10	22	3
Sambucus nigra	0	0	0	0	0	85

ML + vegetation height



Image 1 Field	Hippophae rhamnoides	Pinus nigra	Prunus serotina	Rosa rugosa	Salix repens	Sambucus nigra
Hippophae rhamnoides	46	7	41	6	33	2
Pinus nigra	3	26	2	1	0	2
Prunus serotina	17	6	42	11	16	9
Rosa rugosa	0	0	1	60	2	9
Salix repens	2	0	4	14	30	1
Sambucus nigra	0	0	0	4	0	78

Shrub species

- *Rosa rugosa*
- *Hippophae rhamnoides*
- *Sambucus nigra*
- *Salix repens*
- *Prunus serotina*
- *Pinus nigra*

Object based



Discussion

- Although the LiDAR data was not ideal for vegetation height extraction (obtained during the winter), the extra height information increased the ML classification success with at least 10%.
- Especially the classification result for the taller shrub increased.
- The use of LiDAR data obtained during summer could increase the mapping success. Not only the obtained vegetation height would be more accurate, but also structural analyses like skewness or standard deviation of the measured height could be used for the classification.

Conclusion

- The extra vegetation height increased the classification success.
- The object based classification delivers a shrub map comparable to human visual analysis with a guaranteed reproducibility useful for management and evaluation of alien and invasive woody species.