



## Evaluating landscape impacts of climate mitigation using land-use simulation

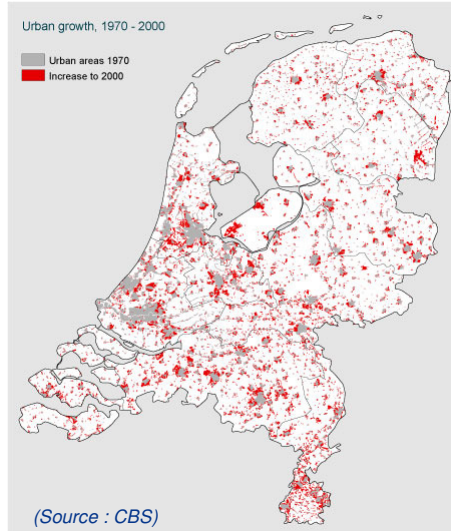
Alfred Wagtendonk

### Outline

- The decline of open space
- Evaluating landscape quality
- Methodology
- Results spatial indicator landscape cluttering
- Discussion & Conclusions

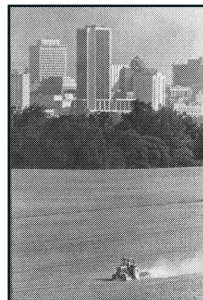
## The decline of open space

- Urban sprawl throughout Europe (EEA, 2006)
- Decline of open spaces in quantity and quality
- Open space preservation policy's

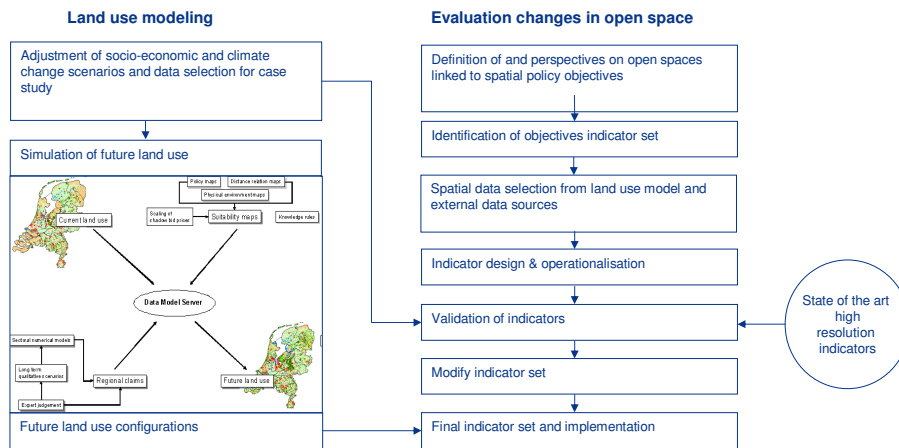


## Evaluating landscape quality

- Evaluating spatial policy alternatives with spatial indicators
- Ex-post: detailed studies
- Ex-ante: terra incognita
- The challenge ahead



## Methodology - general



## Methodology – indicator landscape cluttering

- “A cluttered landscape is a landscape that contains an increased level of variety combined with a lack of coherence, making a disorderly impression and with several to many visual intrusive elements, both green and artificial”.  
(adapted from Veeneklaas et al., 2006)



Aalsmeer, Noord-Holland, source: <http://www.verkniptlandschap.nl>

## Methodology – indicator landscape cluttering



Source: Roos-Klein Lankhorst et al., 2004



A15, Betuwe, Gelderland, source: <http://www.verkniptlandschap.nl>

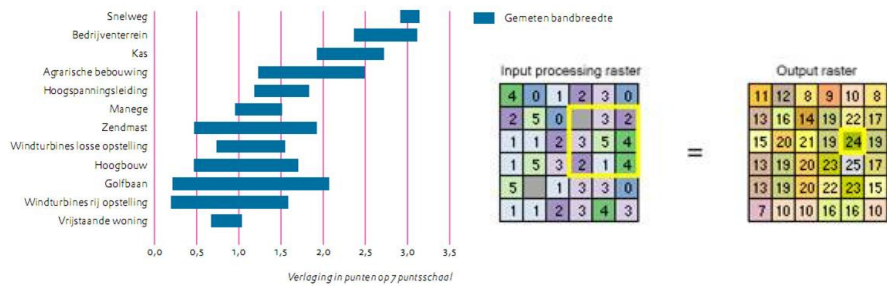
## Methodology – indicator landscape cluttering

- Landscape clutter can be explained from only two factors (Veeneklaas et al., 2006):
  - Almost three quarters of the variance in the clutter scores can be explained from the number of intrusive elements (weighted for the visual impact of the elements) and the degree of land use diversity in the area.
- Open landscapes are more vulnerable to clutter than enclosed ones.

## Methodology – indicator landscape cluttering

### ■ Component 1: Visual intrusion

- Visible intrusive elements weighted for their visual impact, are simulated with an inverse distance-weighted moving average. Maximum distance 1500 meter.



Impact of different types of disturbing elements on landscape appreciation (Source: Van der Wulp, 2009)

## Methodology – indicator landscape cluttering

### ■ Component 1: Visual intrusion

Impact		Impact	
<b>Highways</b>	<b>5</b>	<b>Recreation</b>	<b>3</b>
<b>Commercial</b>	<b>4.5</b>	<b>Residential – high density</b>	<b>2.5</b>
<b>Greenhouses</b>	<b>3.5</b>	<b>Residential (low density and rural)</b>	<b>1.5</b>
<b>Intensive live-stock farming</b>	<b>3</b>	<b>Bio fuel crops</b>	<b>?</b>

## Methodology – indicator landscape cluttering

- Component 2: degree of land use diversity
  - Operationalized with Simpson's diversity index: probability that any 2 randomly selected cells would be different land use types
  - Selected land use types:
 

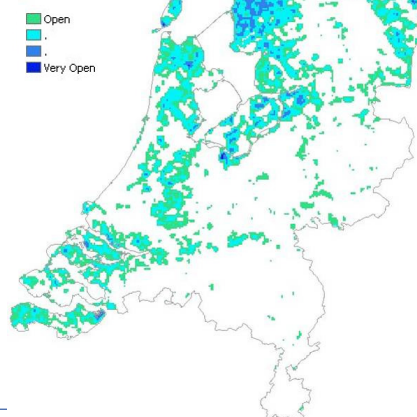
- residential	- intensive livestock farming (e.g. stables)
- arable land	- recreation
- grassland	- commercial
- biofuel crops	- infrastructure
- greenhouses	- other land use (rest class)
  - Calculation in Fragstat with neighborhood radius of 500 meter ) (moving windows option)

## Methodology – indicator landscape cluttering

- Component 3: Large open areas are more vulnerable for cluttering than smaller ones

Operationalization:

- Use of existing indicator for openness<sup>1</sup>, 4 classes (range 0 - 1)
- <sup>1</sup> based on Roos-Klein Lankhorst et al (2004)

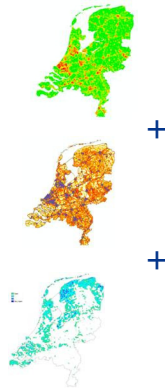




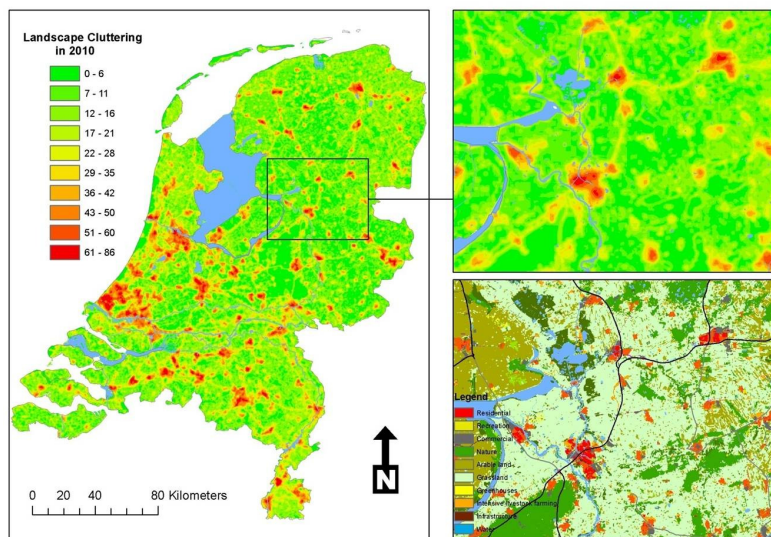
## Methodology – indicator landscape cluttering

### ■ Weighted combination of components

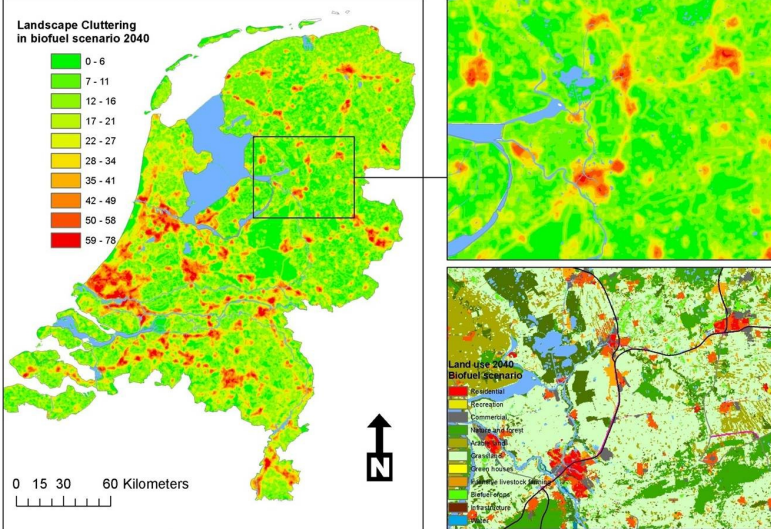
- 70% component 1
  - (visual impact intrusive elements)
- 20% component 2
  - (diversity land use)
- 10% component 3
  - (degree of openness)



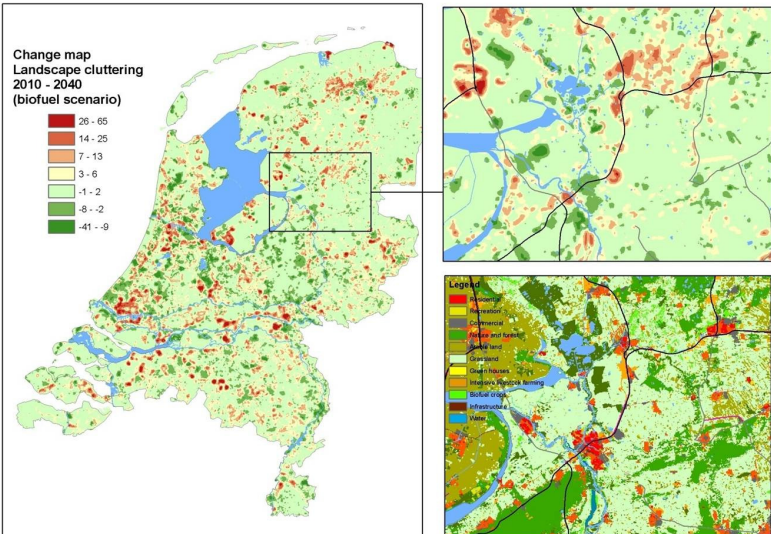
## (preliminary) Results spatial indicator landscape cluttering



**(preliminary) Results spatial indicator landscape cluttering**



(preliminary) **Results spatial indicator landscape cluttering**





## Discussion & Conclusions

- Indicator needs to be validated on the basis of existing indicator for present data
- Indicator was not specifically developed for Biofuel crops, but they do change the land use variety and with that the amount of landscape clutter
- Biofuel crops can also reduce clutter by sheltering intrusive elements and preventing more intrusive agricultural activities
- Alternative indicator could e.g. be the amount of land use change in highly valued cultural-historical landscapes



## Discussion & Conclusions

- We lack empirical data concerning likes / dislikes of biofuel crops. It could be all a matter of taste..

