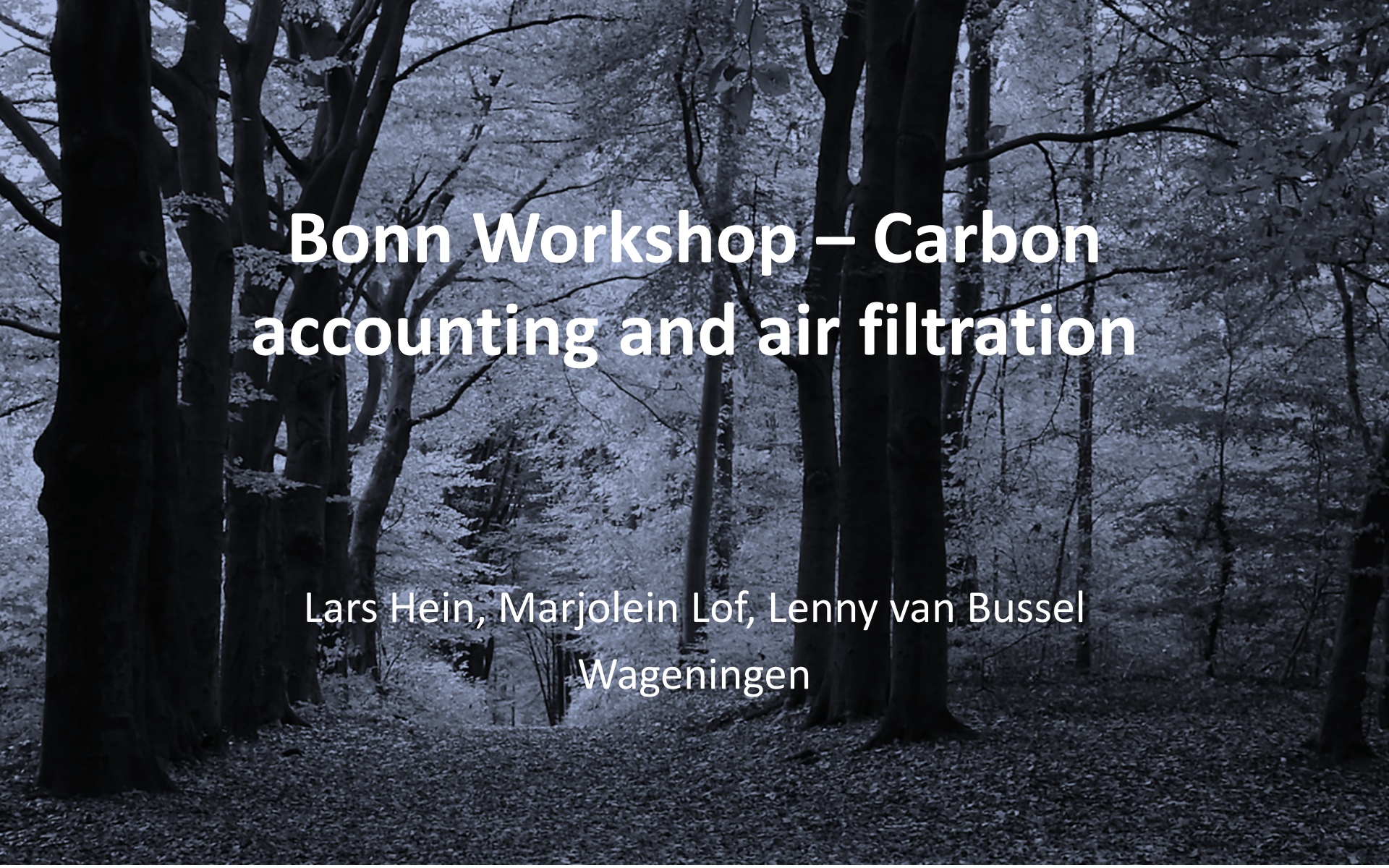

Bonn Workshop – Carbon accounting and air filtration

Lars Hein, Marjolein Lof, Lenny van Bussel
Wageningen

Natural capital accounting in the Netherlands

- ongoing work –

- 3 year project, financed by Ministry of Economic Affairs and Ministry of Infrastructure and the Environment
- National pilot for the Netherlands
- Testing the SEEA EEA
  - Extent account
  - Condition account
  - Physical ecosystemservices supply and use accounts
  - Monetary ecosystem services supply and use accounts
  - Preliminary testing of asset and capacity accounts

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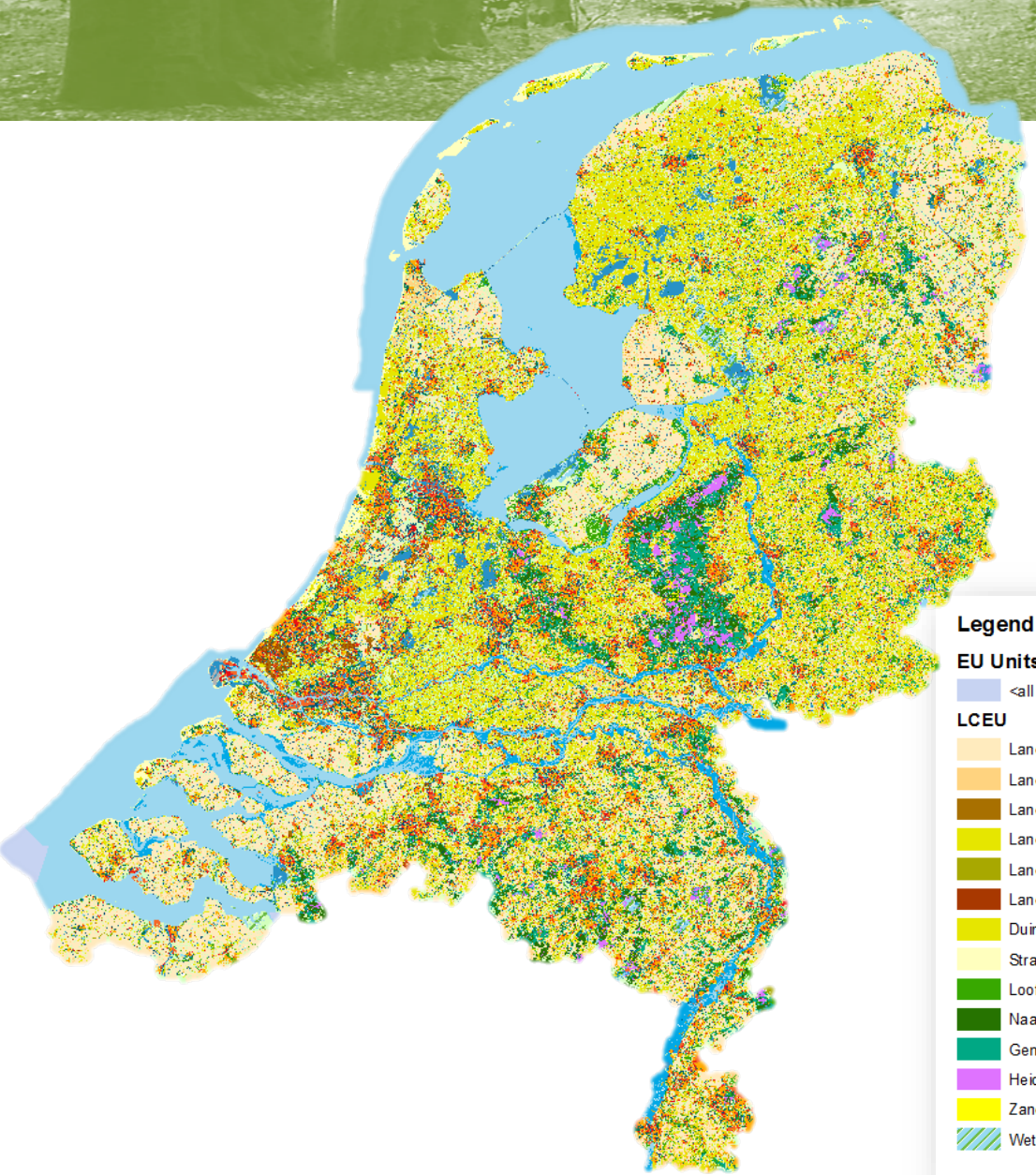
Methodology

Ecosystem type map of the Netherlands

Based on 5 basemaps from CBS and cadastre



Legend

EU Units

- <all other values>

LCEU

- Landbouw: eenjarige gewassen
- Landbouw: meerjarige gewassen
- Landbouw: kassen
- Landbouw: grasland voor veeteelt
- Landbouw: faunarand
- Landbouw: bebouwd
- Duinen met vaste begroeing
- Strand, droogvallend zand en actieve duinen
- Loofbos
- Naaldbos
- Gemengd bos
- Heide
- Zand
- Wetlands
- Grasland, geen weiland
- Openbaar groen
- Overig onverhard terrein
- Uiterwaarden
- Kwelders
- Woongebied
- Kantoren en bedrijven; industrie
- Kantoren en bedrijven; services
- Kantoren en bedrijven; overheid
- Wegen, parkeerterrein, overig verhard terrein
- kantoren en bedrijven; bosbouw
- Kantoren en bedrijven; visserij
- Kantoren en bedrijven; niet-commerciële dienstverlening
- Zee
- Meren, plassen, overig binnenwater
- Rivieren
- Onbekend

Ecosystem services (NLs)

Provisioning services

- Crop production
- Fodder production
- Timber production
- Other biomass
- Water supply

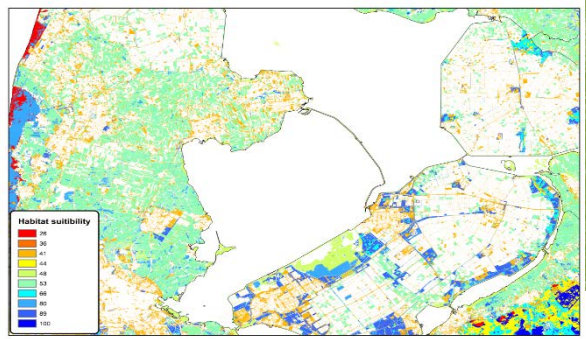
Regulating services

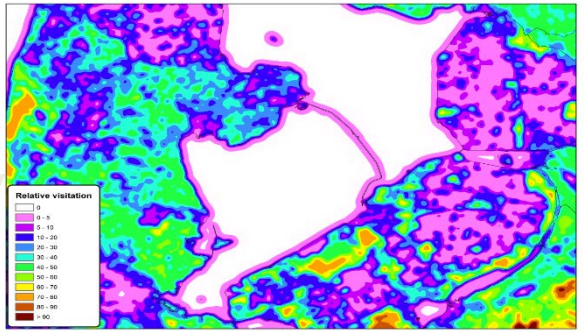
- Carbon sequestration
- Erosion control
- Air filtration
- Water infiltration
- Pollination
- Pest control

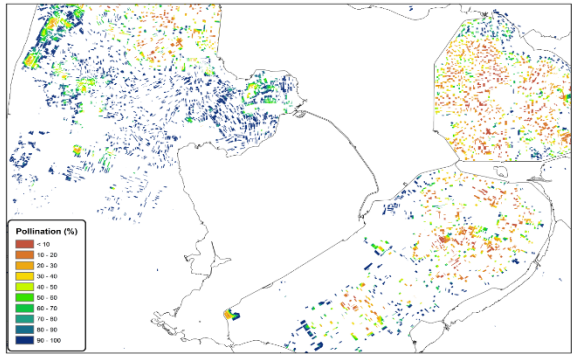
Cultural services

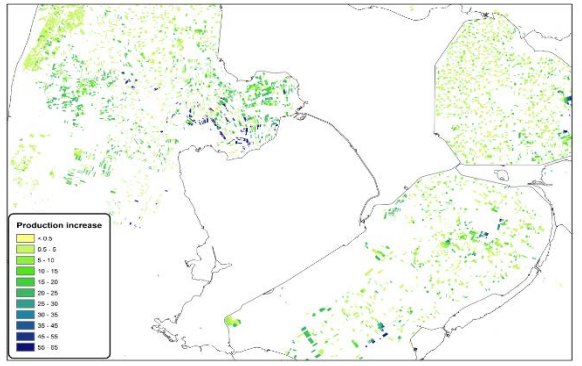
- Nature recreation (hiking)
- Nature tourism

Multiple datasets and models per service

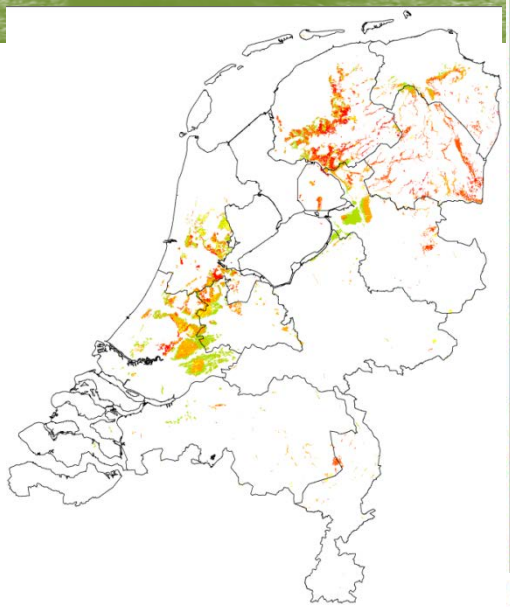


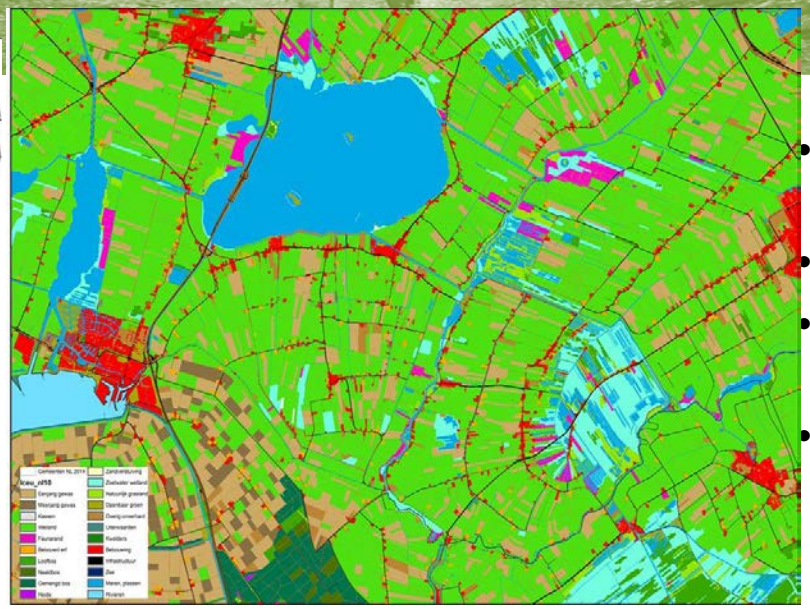


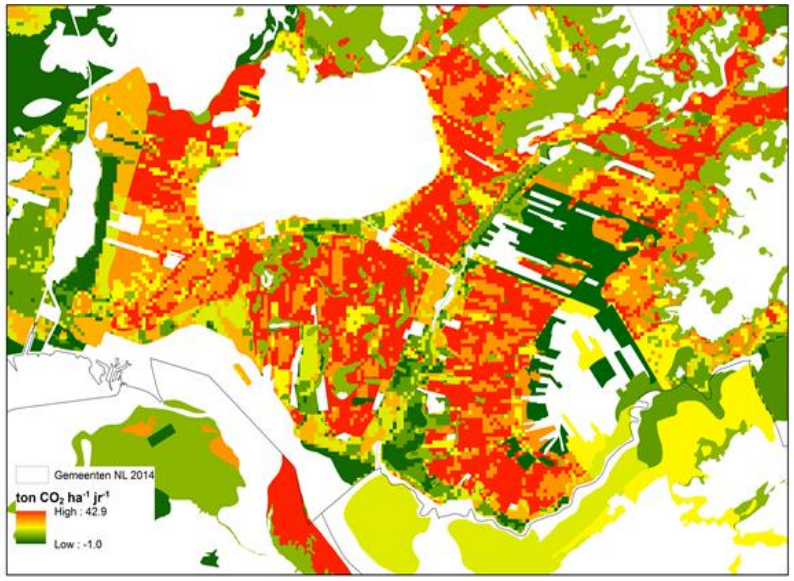




From accounts to policy support







Carbon emission by peat

t C ha^{-1} yr^{-1}

- 0 - 0.25
- 0.25 - 2.5
- 2.5 - 5
- 5 - 7.5
- 7.5 - 10
- 10 - 12.5

- CO_2 emission peat ~4% of national emissions
- Depend upon drainage
- Different management leads to major emission reductions
- Accounts can facilitate local actions

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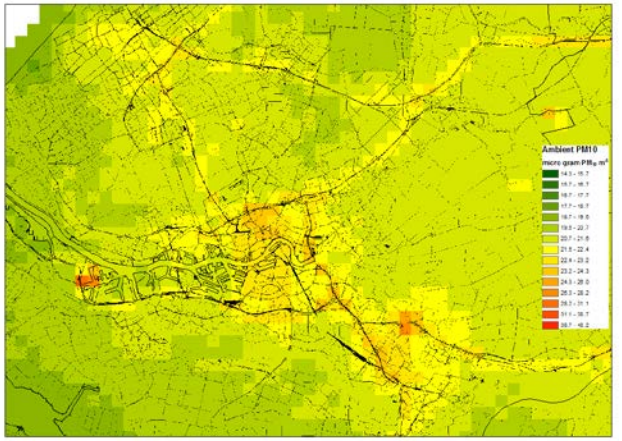
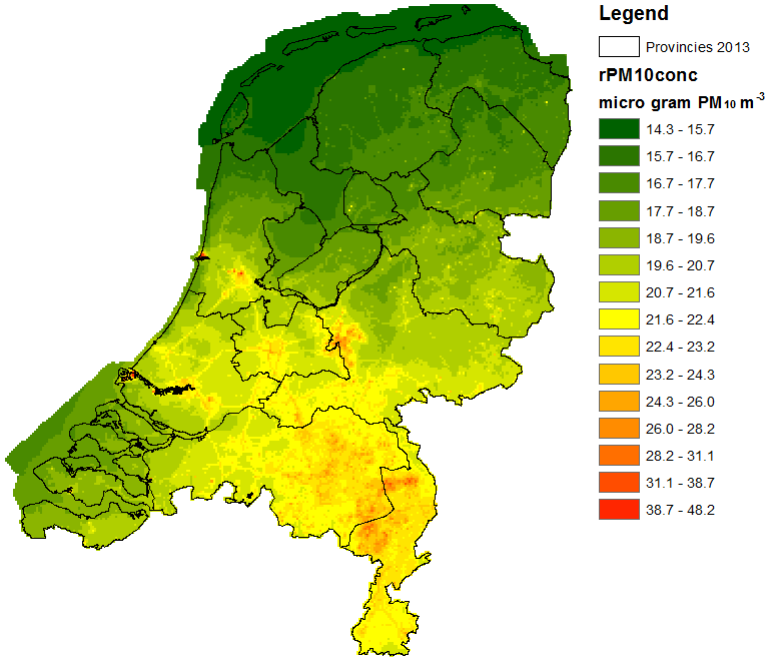
Air filtration in the NLs - material

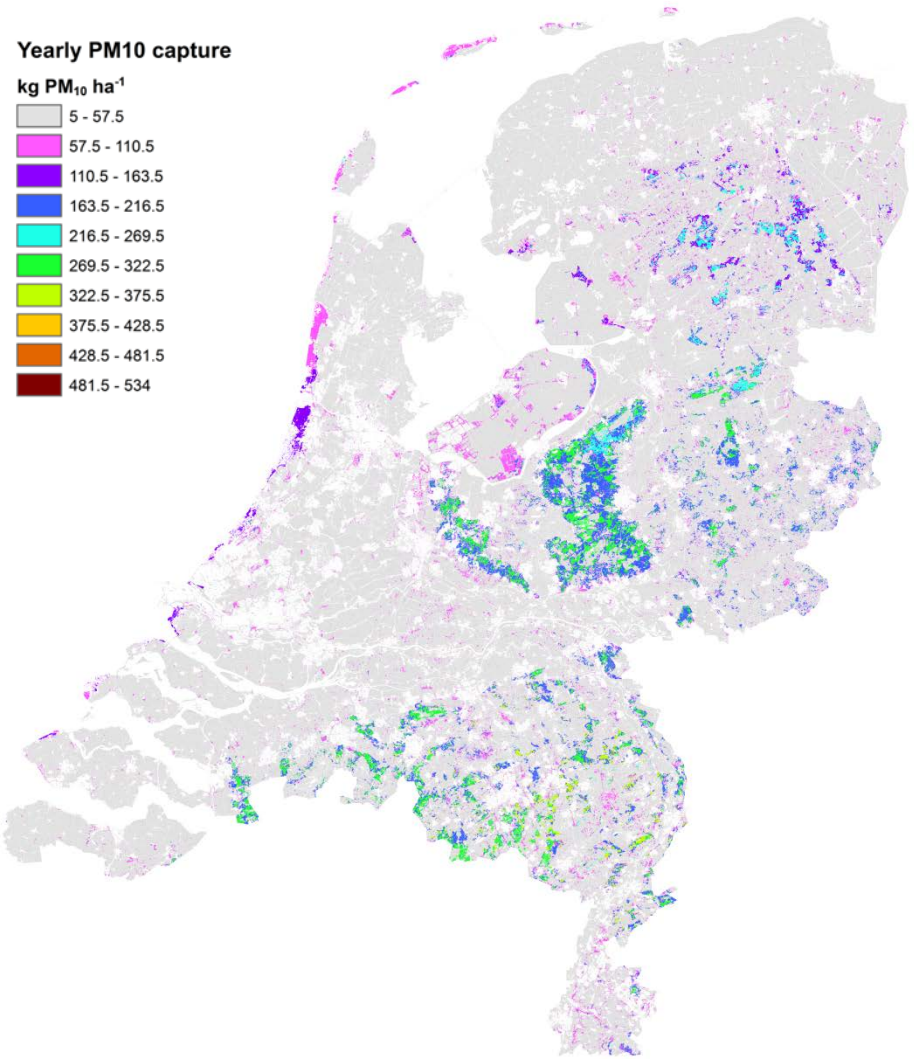
- Data
  - Ambient PM_{10} concentration
  - Ecosystem type map



- Model parameters:
  - LUT deposition velocity (ET)
  - LUT surface area (ET)
  - Length growth season (ET)
  - Rainy days



PM_{10} capture



- Input: ambient PM_{10} concentration
- Largest contribution by coniferous trees
- Mean capture: 27 kg PM_{10} yr^{-1} ha^{-1}
- Total capture: 72,500 tonne PM_{10} yr^{-1}

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Valuation of air filtration

- Building upon work by Remme et al. – avoided damage cost approach
  - requires modelling reduction in exposure due to air filtration – question: which distance applies?

Health impact categories	Physical impact per person per µg PM_{10} ($1/(\mu g/m^3)$)	Treatment costs per case for 2010 (€)
Work loss days	$1.39 * 10^{-2}$	362
New case chronic bronchitis	$1.86 * 10^{-5}$	22748[a]
Respiratory hospital admission	$7.03 * 10^{-6}$	2453
Cardiac hospital admission	$4.34 * 10^{-6}$	2453
Medication/bronchilator use child	$4.03 * 10^{-4}$	1.23
Medication/bronchilator use adult	$3.27 * 10^{-3}$	1.23
Lower respiratory symptoms adult	$3.24 * 10^{-2}$	47
Lower respiratory symptoms child	$2.08 * 10^{-2}$	47
Total avoided costs per person per avoided PM_{10} concentration increase		

[a] Adapted from RIVM (2012).

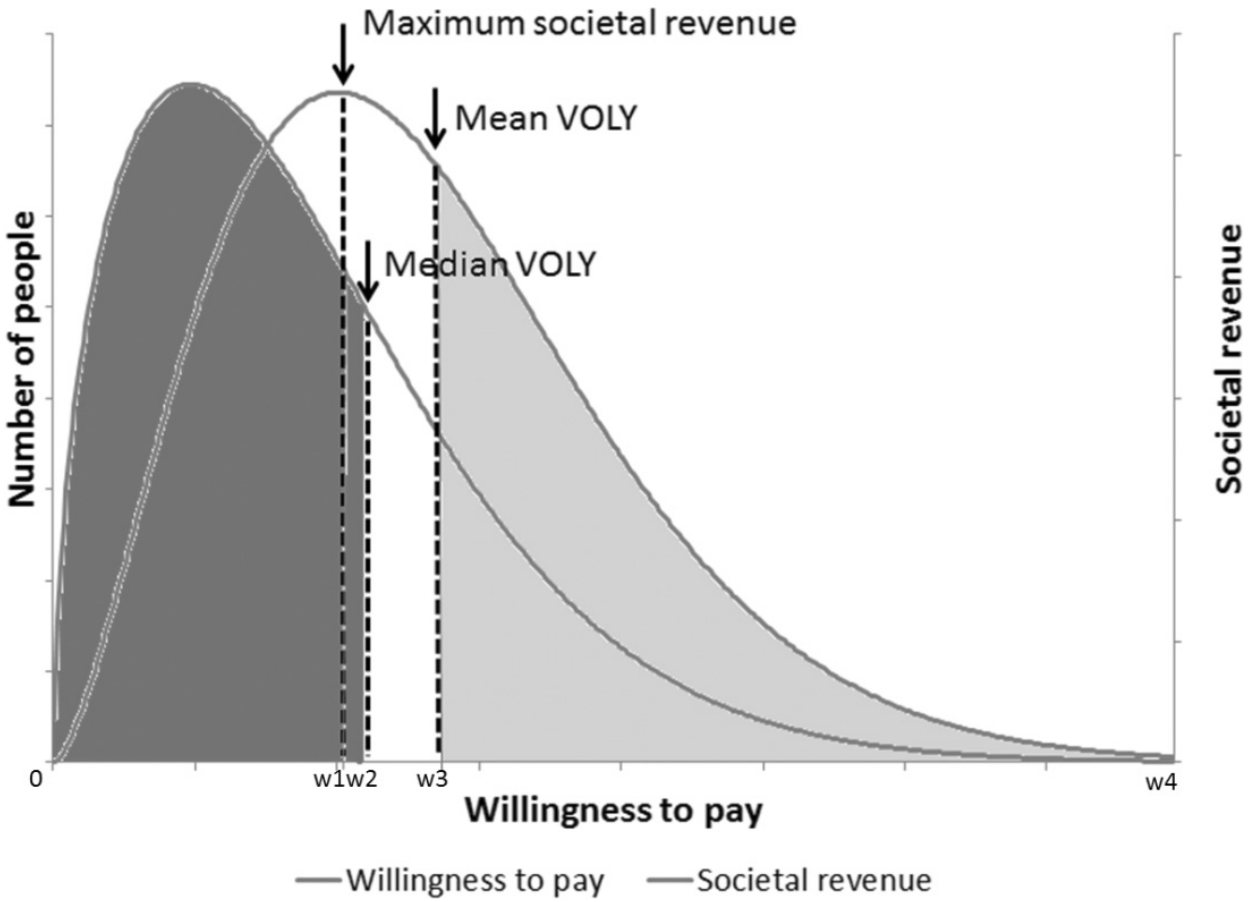
Valuing air filtration

- Large difference in valuing air filtration with exchange value approach and welfare-based approach
- Limburg province: exchange values: €2 million/year, i.e. approximately €900/ton PM10 avoided.
- When compared to air quality regulation studies reviewed in Gómez-Baggethun and Barton (2013), our results (in €/ton PM10 avoided) are between a factor2 to 20 lower.
- If all welfare-related health damage categories are included, the air quality regulation value would be about €4900/ton PM10 avoided and the provincial value of this service would be nearly €11 million.

Valuation approaches

- Strict interpretation of exchange value
- Simulated exchange value
- Welfare based

Akin to SEV



- WTP for increased life expectancy as it can be related to air filtration based on Hein et al., 2016

Discussion questions

- Any further insights in the spatial relation between PM deposition and reduced exposure?
  - Note: NO2 seen as being more rapidly diluted
- Does the valuation approach appear sound?
  - Based on avoided damage costs related to medical costs, loss of working days
  - Note that this approach would not change GDP
- And/or is the SEV approach applicable?
  - Note that this approach would change GDP if the value of ES would be added to other goods and services