



WAGENINGEN
UNIVERSITY & RESEARCH

Big Data sources & cultural ecosystem services

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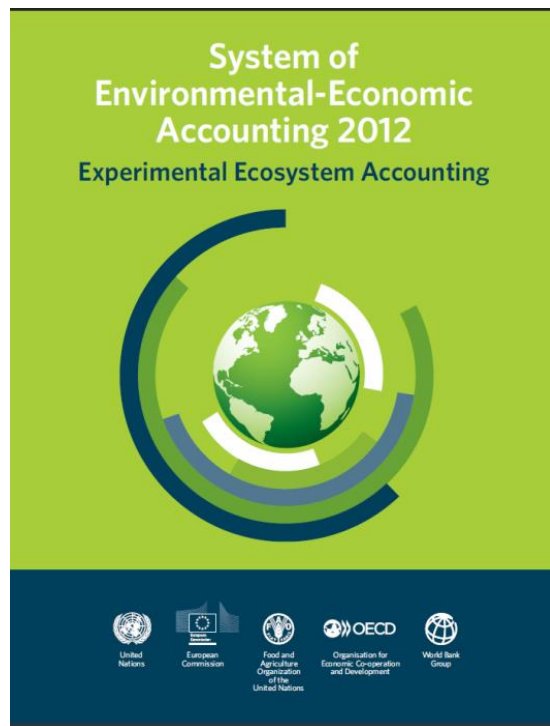
SEEA-EEA Forum of Experts 2019

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 - Nature recreation (biophysical)
 - Nature tourism (biophysical / monetary)
 - Supply and use tables
 - (Education)
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 - Aesthetic services (biophysical)
 - Spiritual – some ideas



Cultural services – what does the manual say?



Ecosystem services:

“the contributions of ecosystems to benefits used in economic and other human activity”

Cultural services:

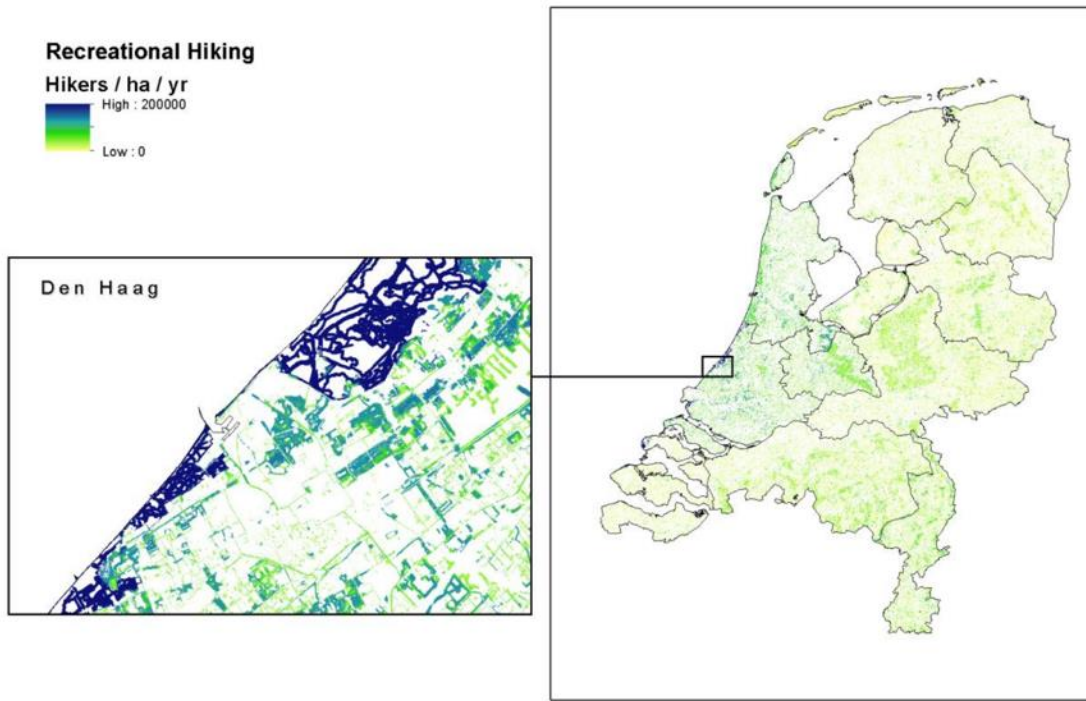
*“the physical settings, locations or situations that give rise to **intellectual and symbolic benefits** obtained by people from ecosystems through recreation, knowledge development, relaxation and spiritual reflection”*



Nature recreation - hikers/ha/yr

Method:

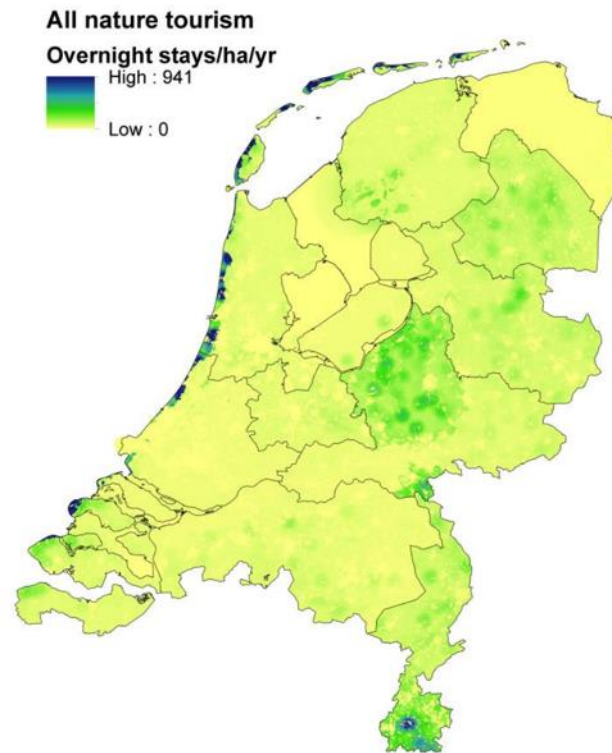
- **ES:** attractive surroundings
- **Measure:** number of hikers passing through individual ha of ecosystems
- **Allocation model:** total number of hikes per ecosystem distributed between area within 50m of roads (<4m) and beaches
- **Data:** national hiking statistics, ecosystem type map



Nature tourism - overnight stays/ha/yr

Method:

- **ES:** attractive surroundings
- **Measure:** overnight stays
- **Allocation model:** overnight stays distributed based on weighted radiuses around accommodations
- **Data:** provincial domestic tourism statistics, bed and marina densities



Nature tourism - €/ha

Method:

- **ES:** nature tourism
- **Measure:** resource rent method - the residual of the total revenue of an economic activity, after all costs for capital and labour have been subtracted.
- **Allocation model:** resource rent spatially allocated to nature areas within 15km of accommodations
- **Data:** tourism statistics incl. revenues and costs, nature tourism activities, nature areas







Looking forward – refining the concept



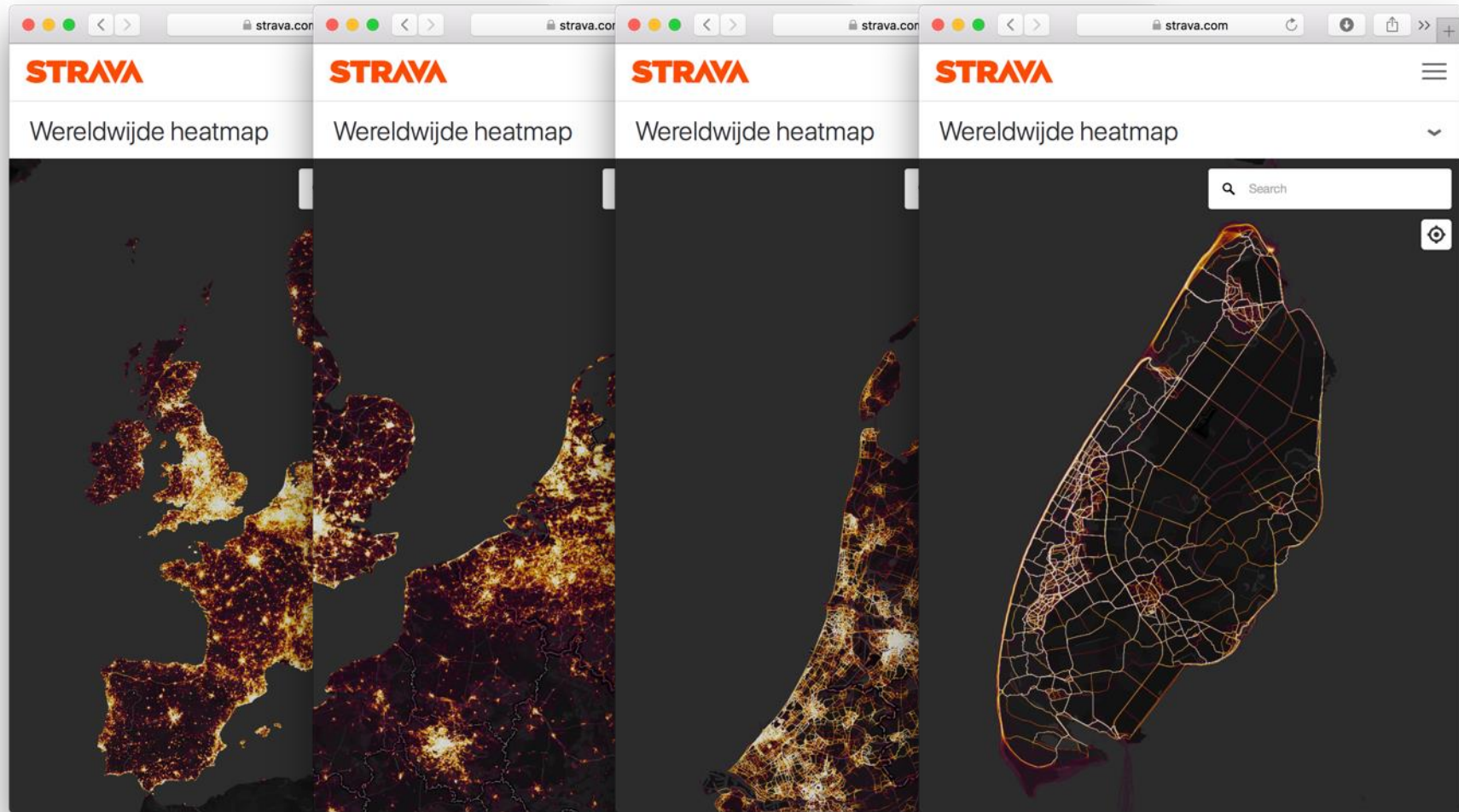
- As part of revision process, cultural services is being reconsidered
- We propose cultural services should be defined as “*information-flows generated by ecosystems that contribute to cultural experiences*”
- Online data sources, mobile phone data provide rich sources of *self-reported information*

A typology for cultural services

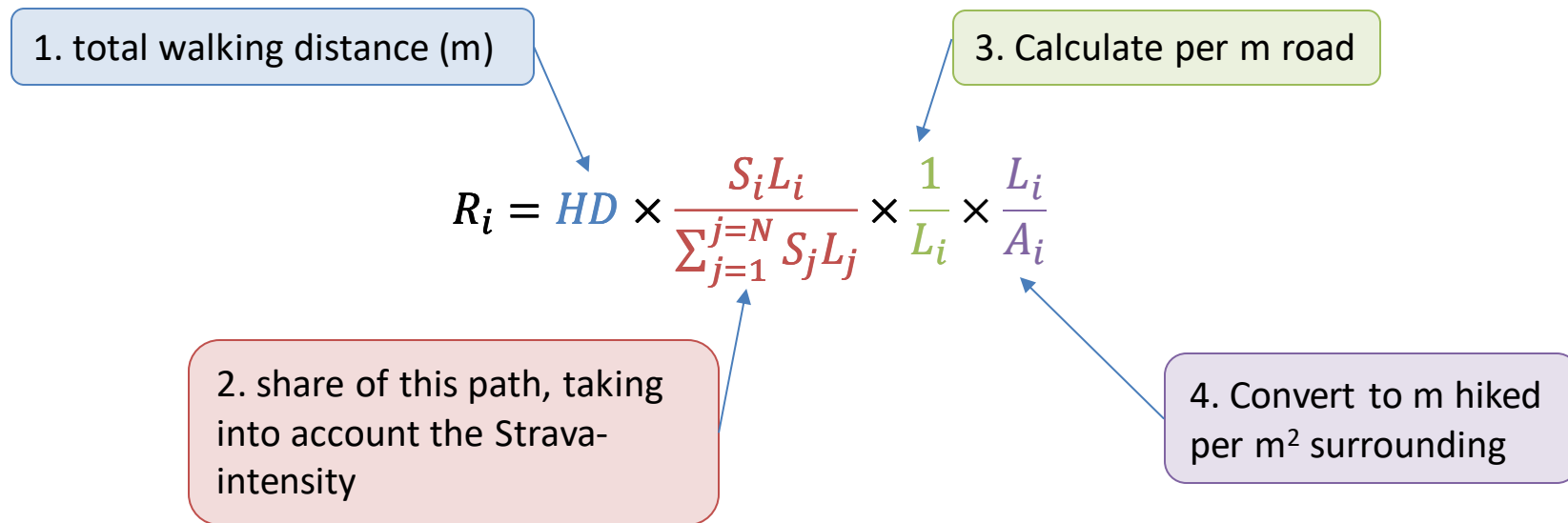
| Type of service | Information flow | Sources | Benefit |
|-------------------------|---|--|---|
| Activity | Providing an attractive environment for recreation | STRAVA flickr  | Recreational activity |
| Aesthetic | Generating a sensory configuration of beauty | flickr  | Scenic view |
| Amenity | Contributing to the desirability of a place or building | | Pleasant living environment |
| Artistic | Role in the realisation of art | flickr | Artistic expression |
| Habitat | Conferring a sense of ecological importance | iNaturalist.org eBird | Species record |
| Heritage | Generating a sense of historic attachment | flickr | Sense of place |
| Knowledge | Contributing to the development of knowledge | flickr  GBIF | Scientific knowledge, educated students |
| Religious and spiritual | Conferring a sense of spiritual importance |  flickr | Spiritual experience |

Tourism





From Strava 'heat' to outdoor recreation



R_i = Outdoor recreation (m/m²)

H = Total hikes

D = Distance per hike (m)

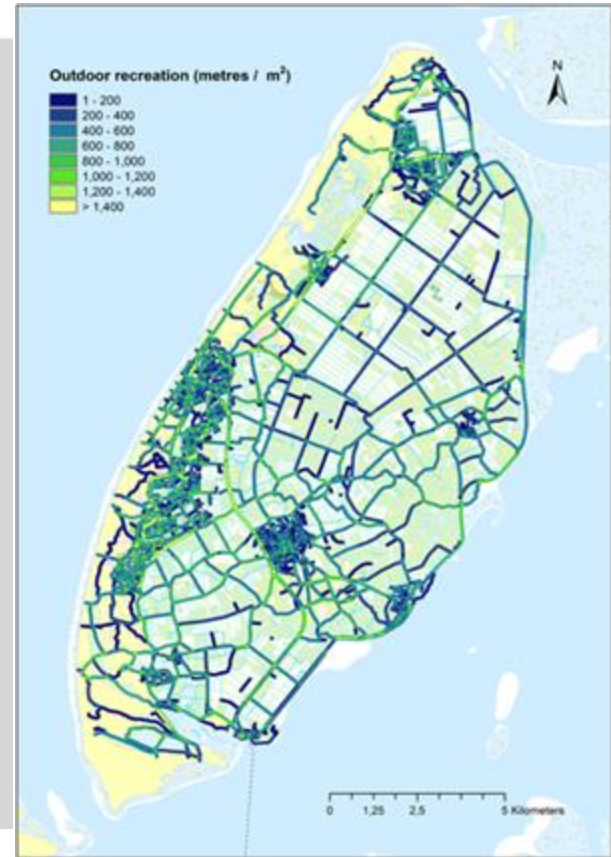
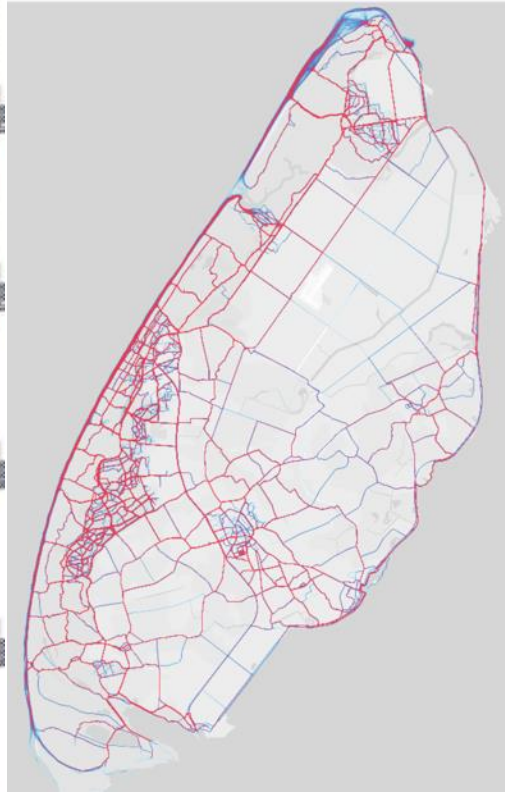
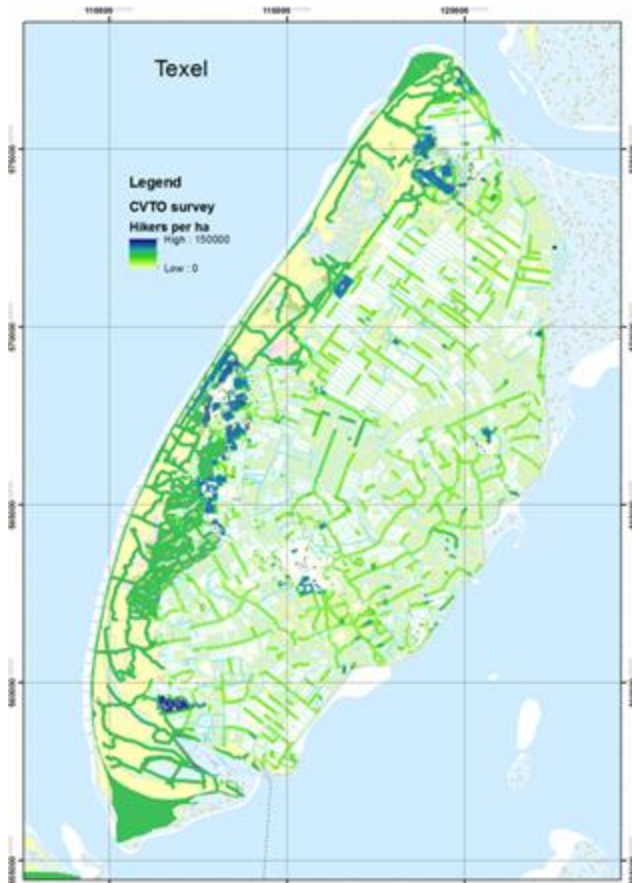
S = Strava-intensity

L = road length (m)

A_i = surrounding area (m²)



Results



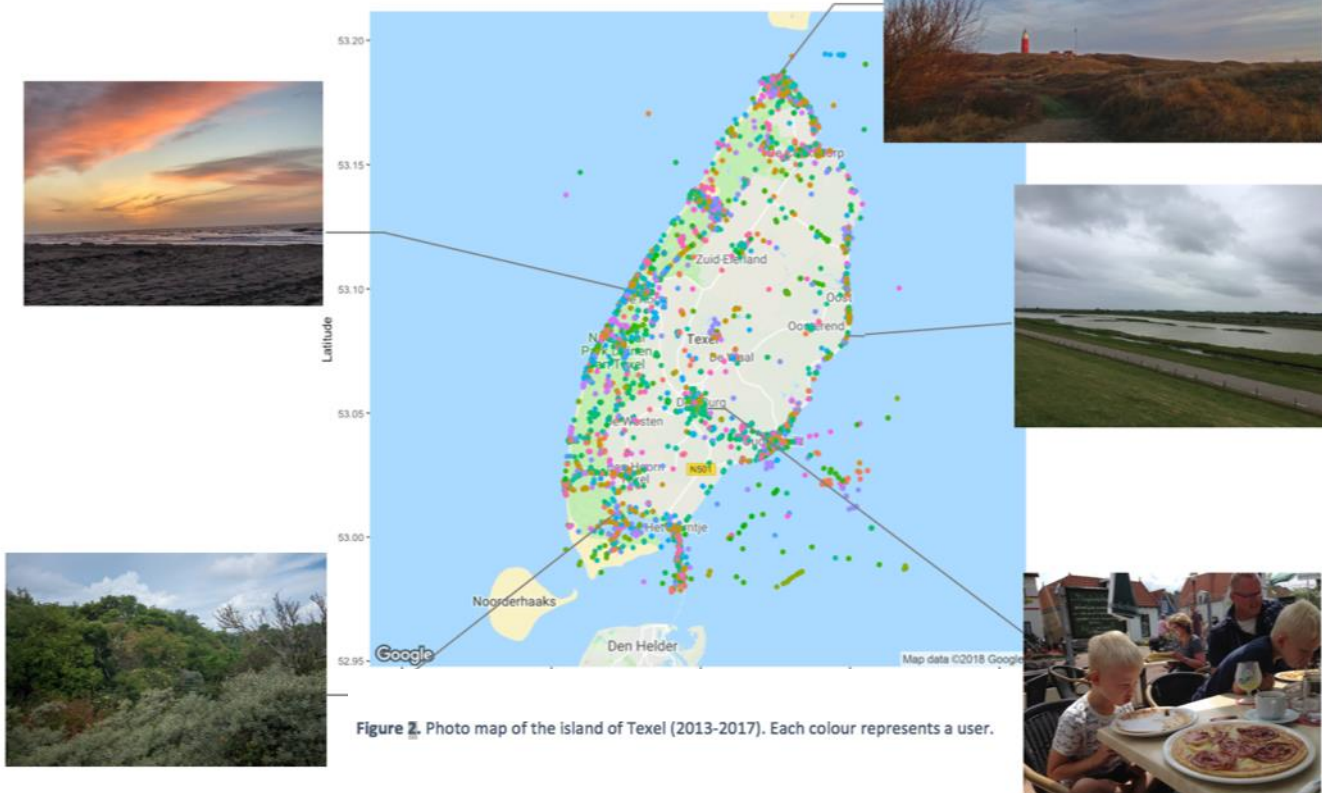
Conclusions (Strava)

- Information content of Strava heatmap data limited...
 - Biased user base
 - Many transformations involved
 - Ordinal rather than truly quantitative
- ...but still very usefull
 - Spatial patterns
 - Relative values
 - weeding out of unused paths



Aesthetic services

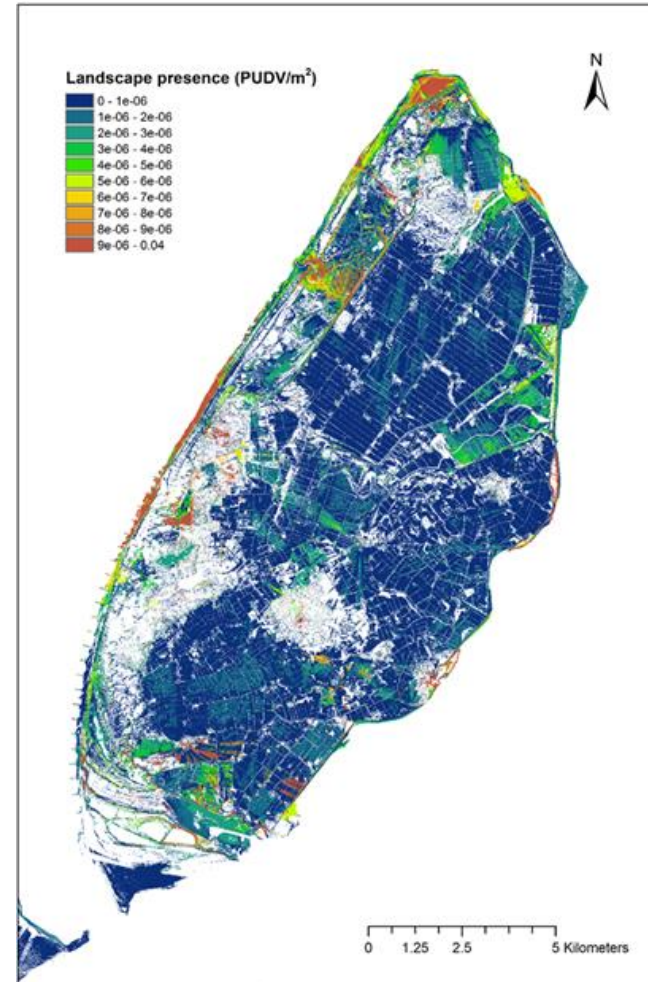
flickr



Aesthetic services

Method:

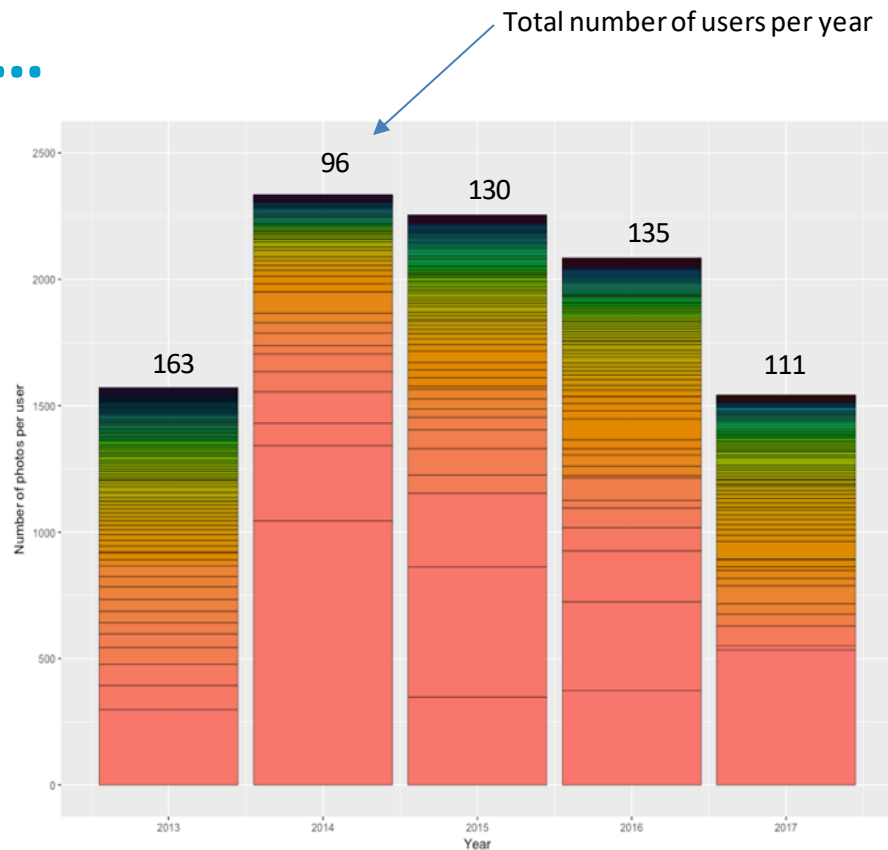
- **ES:** landscape presence
- **Measure:** Photo-User-Day-Viewshed (PUDV)/ m^2
- **Allocation model:** the presence (contribution) of the landscape to a user's photos per day, exponential function to reflect decline with distance
- **Data:** Flickr images, digital surface model (DSM)



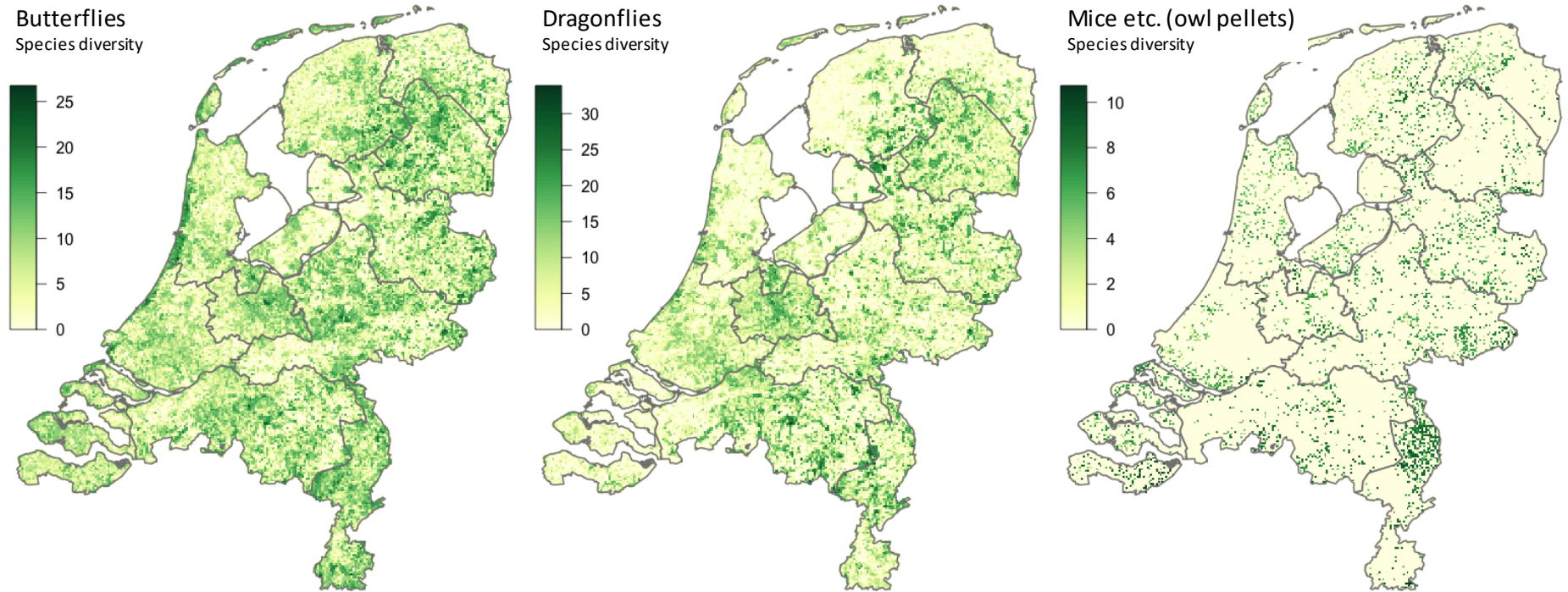
Some issues however...

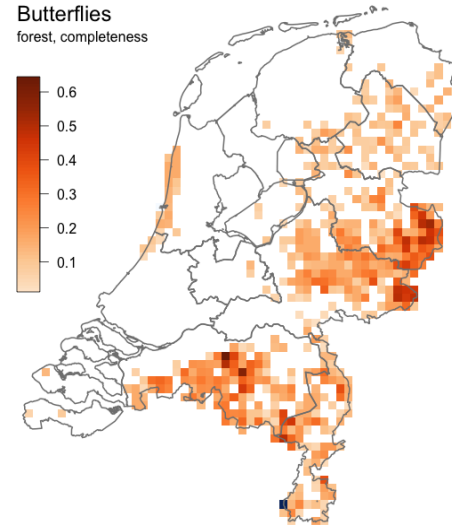
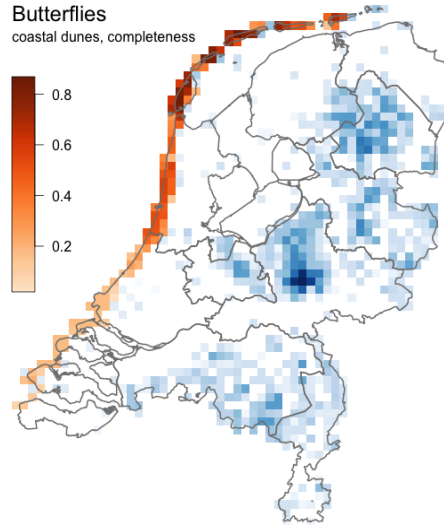
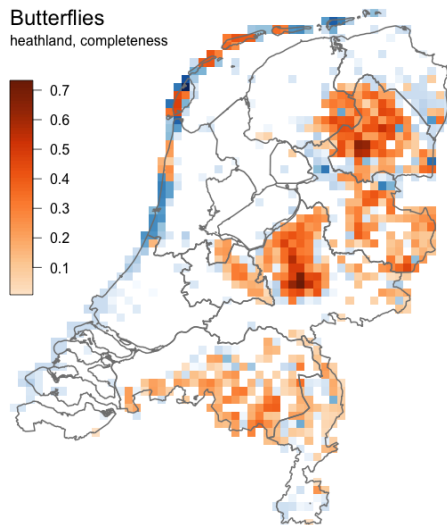
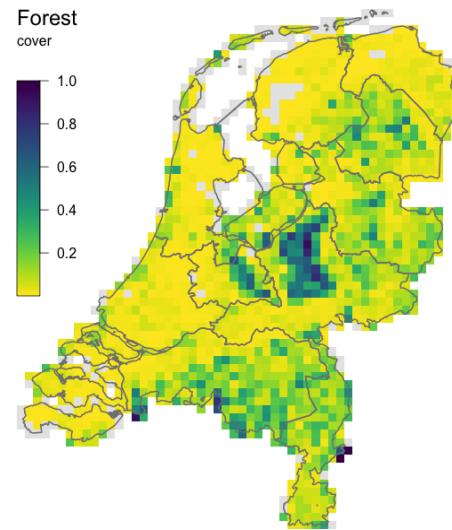
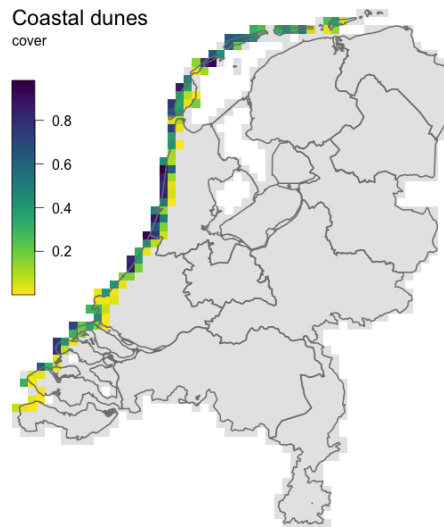
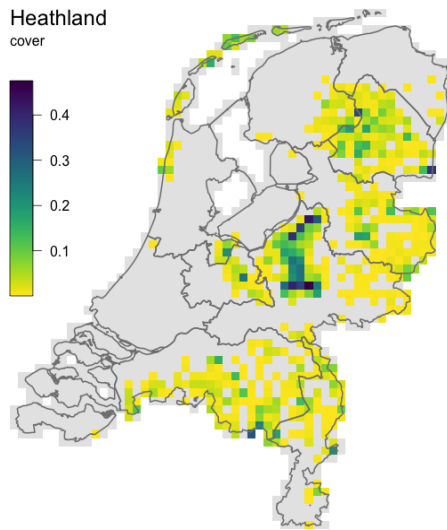
– Representativeness

- Highly active users
- Bias towards demographic groups



Biodiversity: occupancy modelling

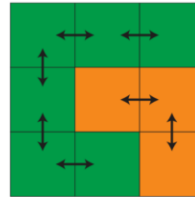




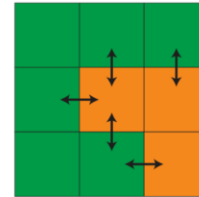
Landscape spatial structure



a)



b)



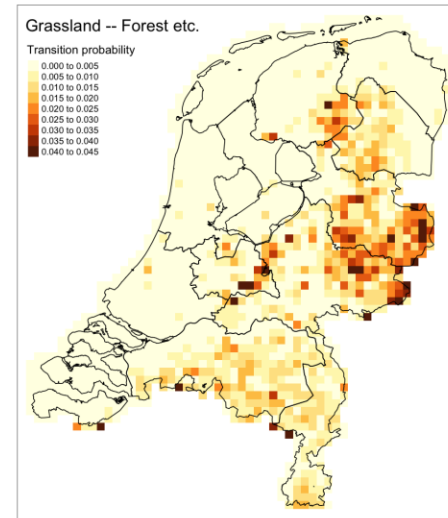
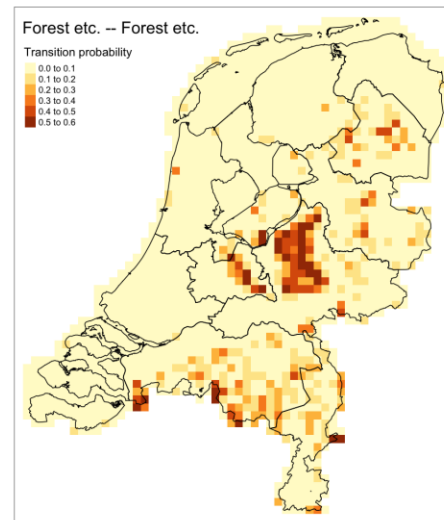
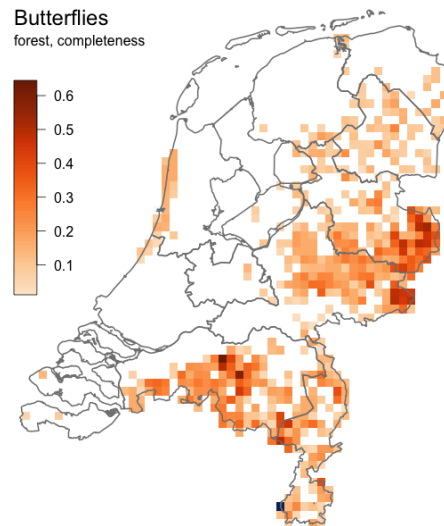
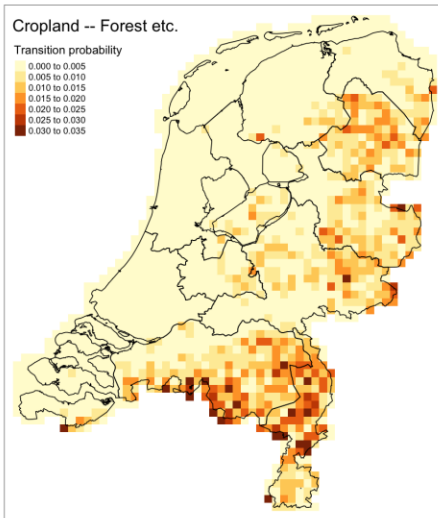
c)

Land cover classes



| | A | B |
|---|-------|------|
| A | 10/24 | 5/24 |
| B | 5/24 | 4/24 |

d)



Work in progress

- Outdoor recreation from mobile phone data
- “Habitat services” from submitted species observations

