

GIS in the Cloud and on the Net

Lecture at the GIS course

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Outline

1. Intro: GIS and www
2. Web-services (access to online geodata)
3. WebGIS approaches as basis for research

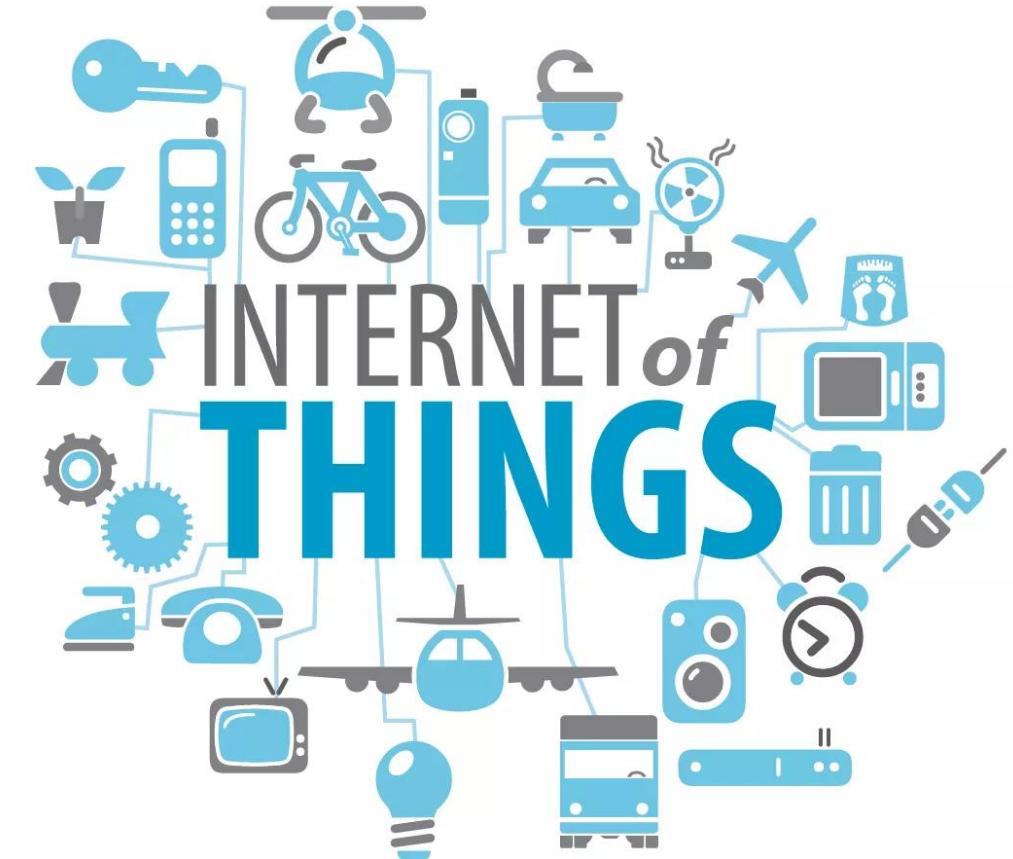
- Exercise: Test of a PPGIS

WebGIS approaches in action:

- Case 1: Landscape value mapping across Europe
- Case 2: 'Blue' outdoor recreation mapping across Denmark
- Case 3: Recreational use of cemeteries in Copenhagen and Helsinki
- Take home messages

1. Intro: IoT

- E-society...digital economies
- Internet relating to everything
- E.g. smart cities relying on 'Big data', Internet of Everything
 - IoT: A network of connected sensors

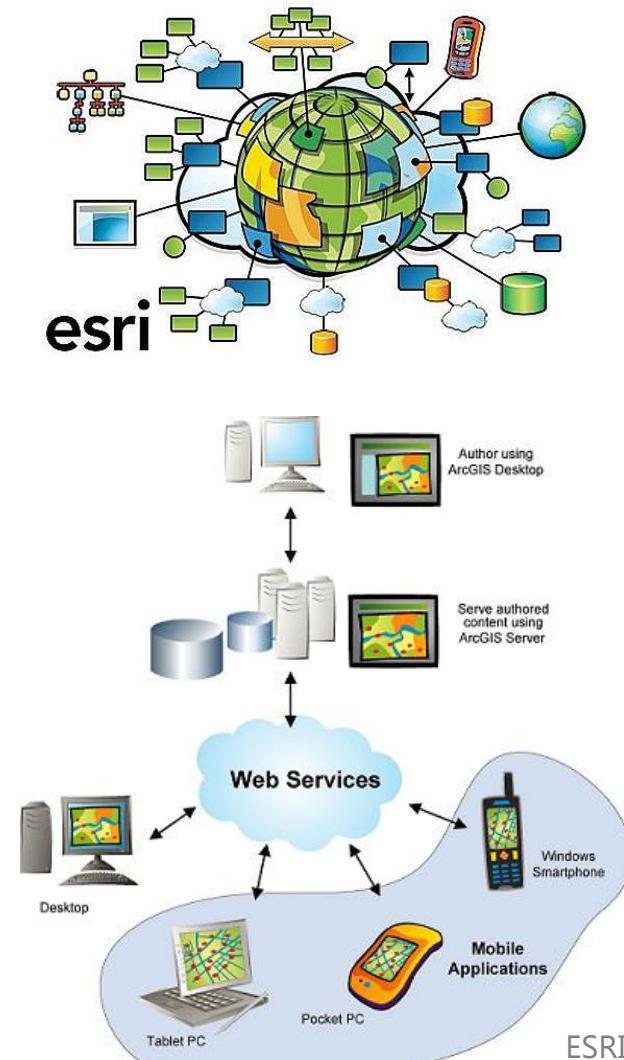


1. GIS, the internet and the web.

- GIS is increasingly becoming a part of the IoT
 - Increasing focus and use of all form of spatial data ('every where')
 - Multiple examples of **webGIS** solutions (Internet GIS, GeoWebs, web mapping, web maps, cloud-based GIS solutions)
 - Open data and data sharing agenda

Your desktop GIS:

- Relies on **web-services** (online data)
- Gives you possibilities to publish your maps online (**ArcGIS online**)



The Internet of Things

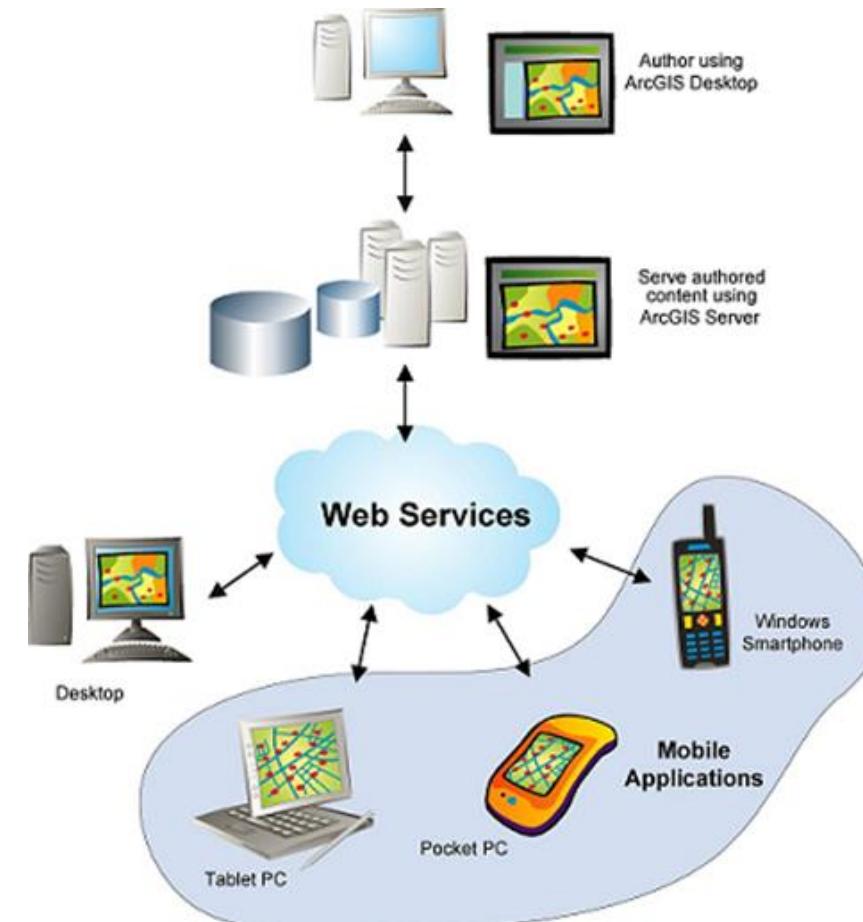


2. Web-services

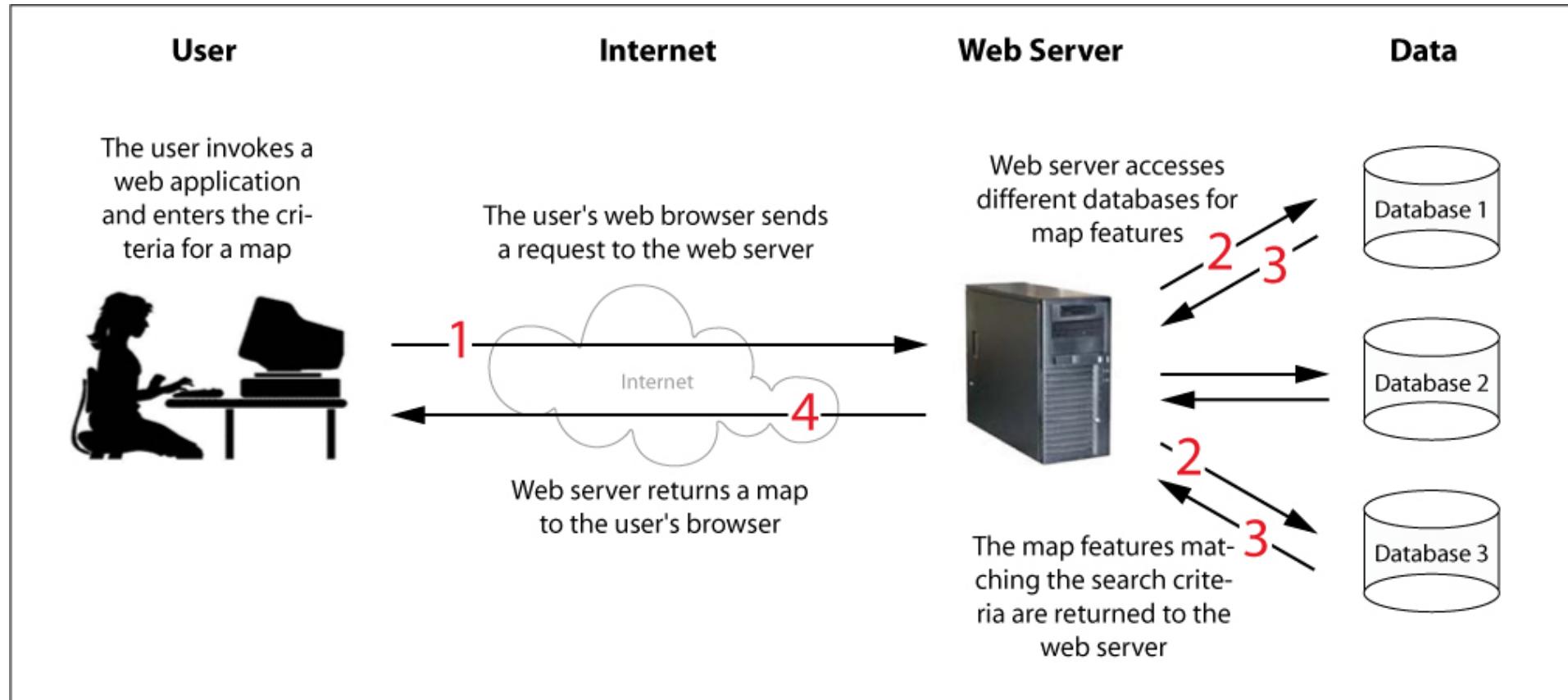
Web Services:

Enables the access to map/data
with no data storage
(maps/data is in the cloud)

Enables publishing/sharing of
data



2. Web services (how it works)



2. Examples of web-services

Terminology of abbreviations

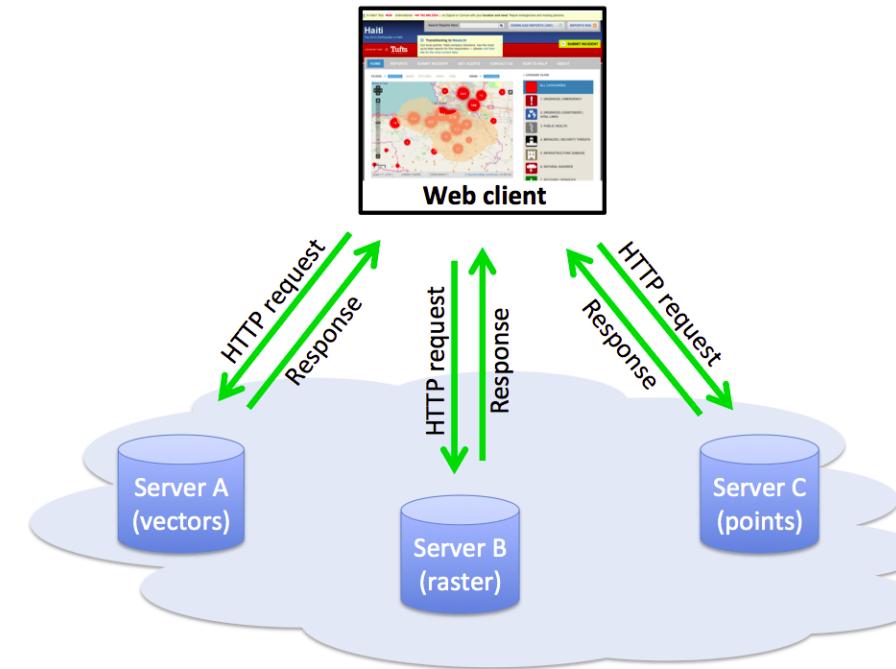
- WMS
- WFS
- CSW

And less popular services

- WMTS, TMS, WCS, WPS

2. WMS – Web Map Service

The web service delivers a raster image (map) usually in PNG, JPEG or GIF



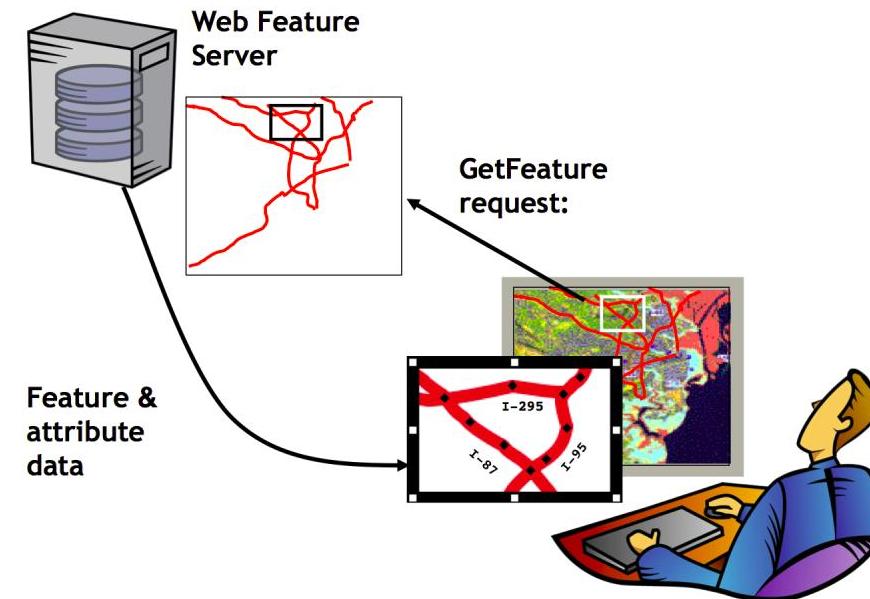
Service of georeferenced images

Credit: H. Draux

2. WFS – Web Feature Service

The web-service delivers vector data (points, lines, polygons)

Web Feature Service (WFS) returns data.



Service of georeferenced vectors

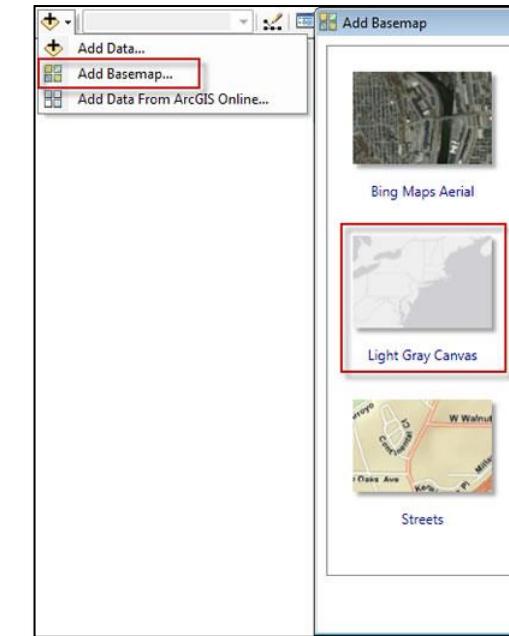
Credit: H. Draux

2. CSW – Catalog Service for the Web

Information service. Describes services/data via metadata (data on data)

Less used:

- WMTS – Web Map Tile Service (raster images in tiles)
- TMS – Tile Map Service (raster images in tiles)
- WCS – Web Coverage Service (elevation data in raster)
- WPS – Web Processing Service (enables calculations)



2. Examples of web services (DK)

- <https://dataforsyningen.dk/data> (all types of topo maps, national data, ortophotos)

Lots of up-to-date planning data, e.g.:

- [Adgang til webservices | Planinfo.dk](#) (planning docs)
- [Danmarks Miljøportal IT Systemer \(miljoeportal.dk\)](#) (nature and environment protection)
- <https://data.kk.dk/> (open data Copenhagen)



2. Examples of web services (DK)

Overview of GIS services from the Danish Environmental Protection Agency on nature and environment (<https://mst.dk/service/miljoegis/>)

- 47 webGIS
- 26 WMS/WFS
- 9 links to direct downloads
- 1 PPGIS (public registration of invasive species)

Profilbeskrivelse	Link	WMS, WMTS og WFS - kopier hyperlink og sæt ind i dit desktopGIS	Læs mere om
MiljøGIS for basisanalyse for vandområdeplaner 2021-2027	Vandrammedirektiv 2021-2027	Hent temae ved download eller WMS/WFS	Basisanalysen 2021-2027
Tilskud til skov- og naturprojekter. Ansøgningsrunden starter 2. maj 2018	Ansøgning om skovtilskud for private		Tilskud til skov- og naturprojekter
Naturmæssigt særlig værdifuld skov	Særligt værdifuld skov	WMS / WFS - Højreklik, kopier hyperlink og sæt ind i dit desktopGIS	Kortlægning af særligt værdifuld skov

Examples of web services (EU)

- Internationale data: EEA/DiscoMap, Copernicus, euro stat (<https://discomap.eea.europa.eu/Index/>)
- Some really impressive high resolution (works also for more local analysis)

The screenshot shows the DiscoMap website interface. At the top, there's a banner with the European Environment Agency logo and the text "Discover Map Services". Below the banner is a search bar with the placeholder "I'm looking for a map service about...". There are two buttons: "SEARCH DATA SETS IN SDI" and "BROWSE OUR WEBMAP COLLECTION". On the right side of the header, there are links for "System Status", "Contact us", and "LOG IN", along with social media icons for Facebook and Twitter.

The main content area is divided into several sections based on service categories:

- LAND:** Agriculture (15), Background (4), Elevation [land] (2), FISE (10), Forest (7), Fragmentation (5), Imperviousness (9), Land (71), land_recycling (1), LandTake (1), LCFs (47), LPD (2), Urban (4), Urban_GI (5), Urban_Sprawl (12), UrbanAtlas [land] (3).
- CLIMATE:** ClimateAdapt (17), ClimateChange (5), Drought (12), Forest_Fires (2), Heatstress (2), Heatwave (4), Phenology_PEP725 (21), UAMV (55), UAMV2020 (9), Urban_Vulnerability (45), UrbanAdapt (12).
- BIO:** Article_12 (1), Article17 (2), BioRegions (3), Ecosystem (10), Internal (14), Life (2), MAES (4), ProtectedSites (31), SEIS (3).
- COPERNICUS:** Corine (18), Elevation [copernicus] (5), EUHydro (5), GioLand [copernicus] (9), GioLandPublic (46), RiparianZones (3), SoilSealing (2), UrbanAtlas [copernicus] (10).
- AIR:** Air (4), Airbase (13), AirQuality (4), EPRT (1).
- WATER:** BathingWater (9), Ecrrins (2), UWWT (8), Water (28), WaterExploitationIndex (3), WISE_SoE (17), WISE_WFD (12).
- MARATLAS:** Maratlas (161).
- IMAGE:** GioLand [image] (9), Image (2), Natura2000 (2).
- NOISE:** Noise (35), noiseStoryMap (12).
- MARINE:** Marine (34), MarineLitterWatch (4).
- SOER:** SOER (7).

Advantages of GIS web services?

- *Individual reflections → share to plenum!*

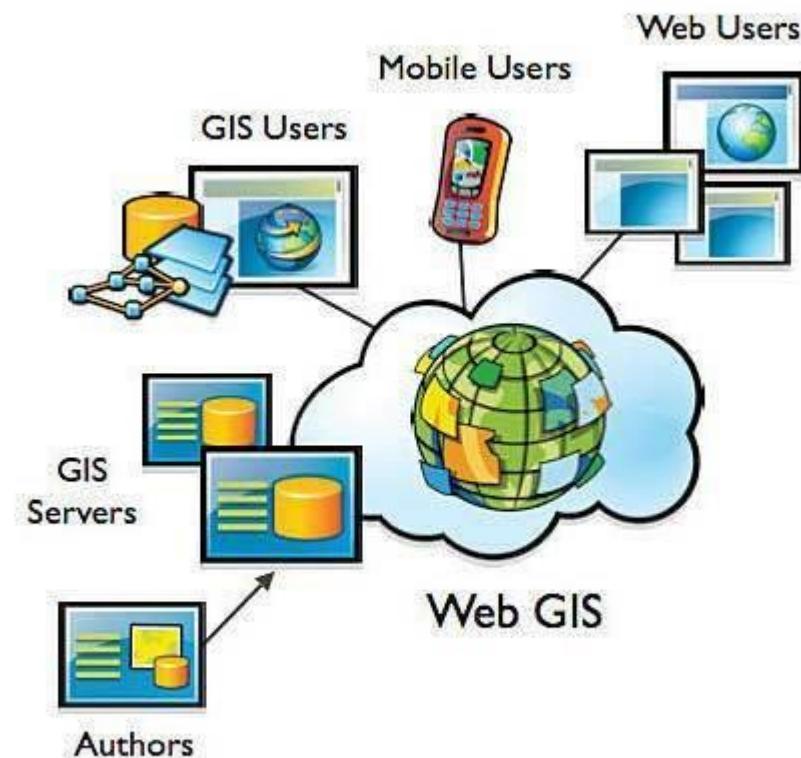
Advantages of GIS web services?

- Easy access to updated data
- Data only stored one place
- Sharing beyond traditional organizational boundaries
- Integration within different GIS environments (crossing devices and software)
- ...

3. WebGIS

Many, many online GIS apps (online GIS interfaces)!

- Locations, way-finding (GoggleMaps/GoogleEarth etc)
- Sharing user generated data (images, preferences, open street maps, wikis, etc)
- Collections of geodata (e.g. city of Copenhagen, give a hint/'giv et praj' app, public participation GIS)
- Real-time geodata (emergencies, earthquakes, social media activity).



3. WebGIS examples

Examples include real-time GIS, such as:

- E.g. Corona virus outbreak
<https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6>
- E.g. tweet map: <https://www.heavy.ai/demos/tweetmap>
- E.g. Strava heatmap:
<https://www.strava.com/heatmap#16.00/12.54328/55.68486/hot/all>
- E.g. ...

Advantages of WebGIS

- Users don't need any GIS Software: cross-platform
- Minimal training in GIS for the user
- Authenticity and accuracy are guaranteed by the provider
- Changes made to the map and/or database repository are reflected everywhere
- Small amount of hardware serving multiple users and multiple purposes

Disadvantages of WebGIS

- Internet access...
- Data access...
- Controlled environment often with limited options for spatial analyses, queries and printing...

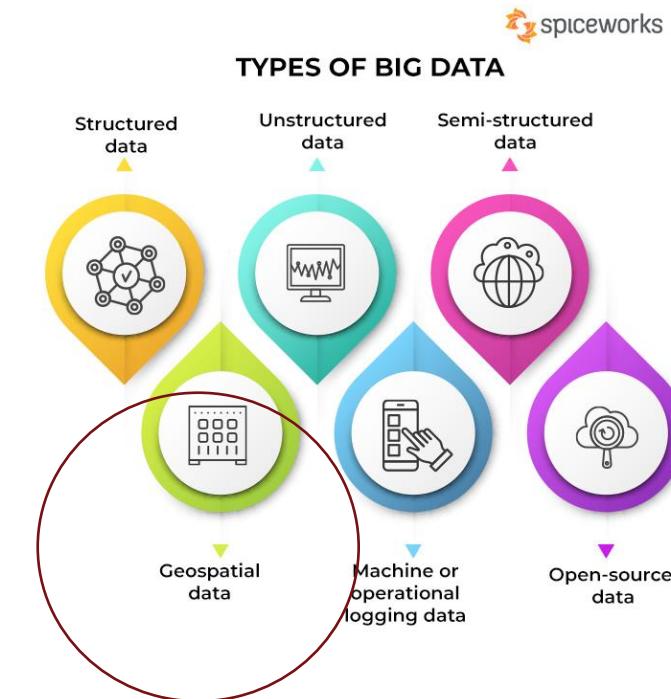
3. WebGIS approaches as basis for research

Terminology:

- Big data
- Crowdsourcing
- Citizen science
- Location Based Services
- Volunteered Geographic Information (VGI)
- Public Participatory GIS (PPGIS)

WebGIS approaches as basis for research

Big data



WebGIS approaches as basis for research

Crowdsourcing

Crowdsourcing is making use of:

- User generated data
- Online community
- Either 'passive' (e.g. tracking)
or 'active' (e.g. sharing) data



"Wisdom of the crowds"

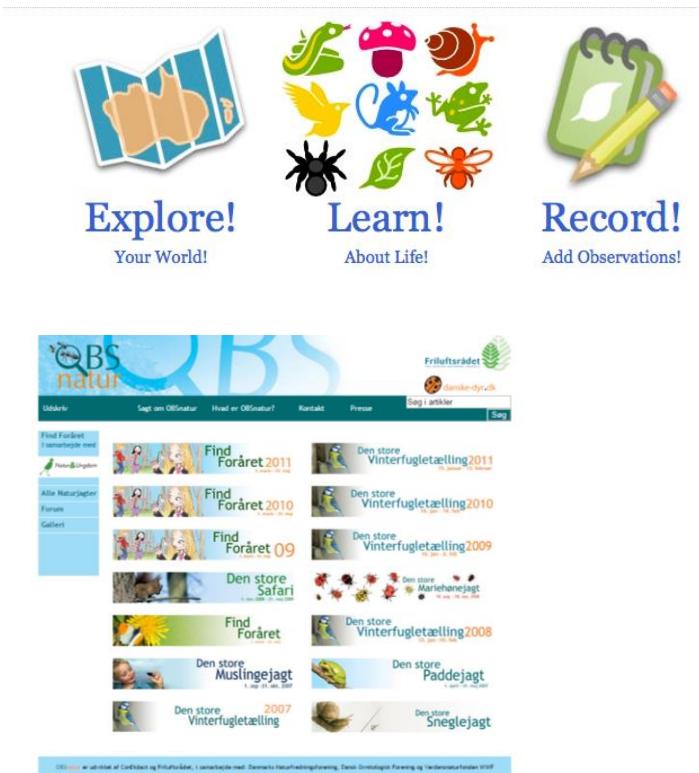
WebGIS approaches as basis for research

Citizens science

Do you know any citizens science projects?

WebGIS approaches as basis for research

Citizens science



Screenshot of the OBSnatur website, showing various citizen science projects:

- Find Foråret (2011, 2010, 09)
- Den store Vinterfugletaelling (2011, 2010, 2009)
- Den store Safari
- Find Foråret
- Den store Vinterfugletaelling (2008, 2007)
- Den store Muslingejagt
- Den store Paddejagt
- Den store Vinterfugletaelling (2007)
- Den store Sneglejagt

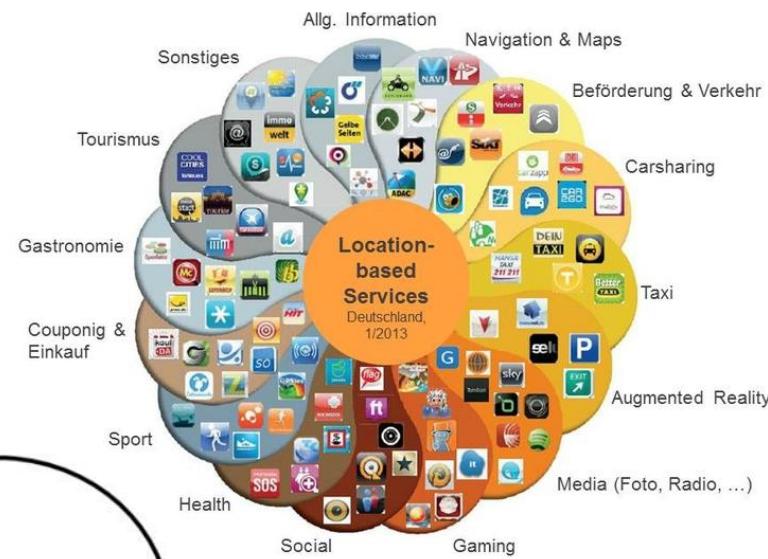
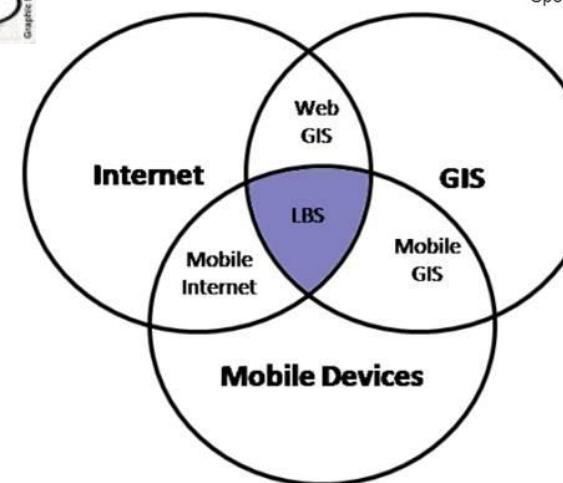


WebGIS approaches as basis for research

Location Based Services



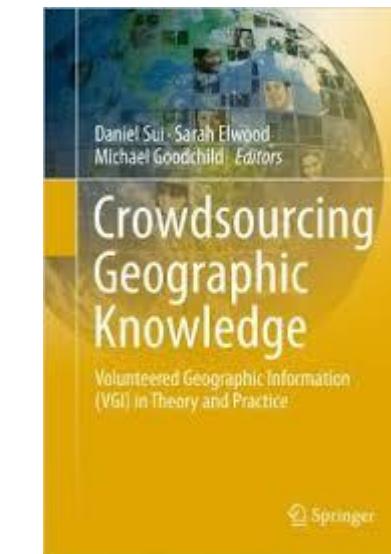
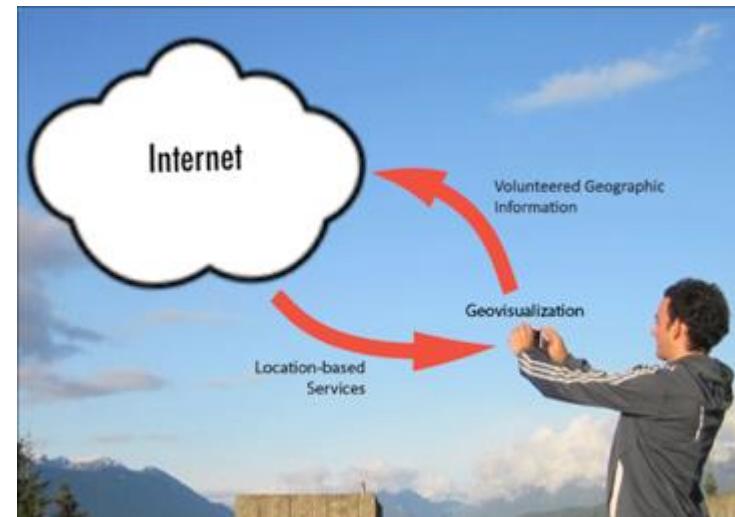
"The citizen as sensor"



WebGIS approaches as basis for research

Volunteered Geographic Information (VGI)

- A form of crowdsourcing geotagged information (data from location based services, GPS)
- User generated geographic content
- Open Street Map



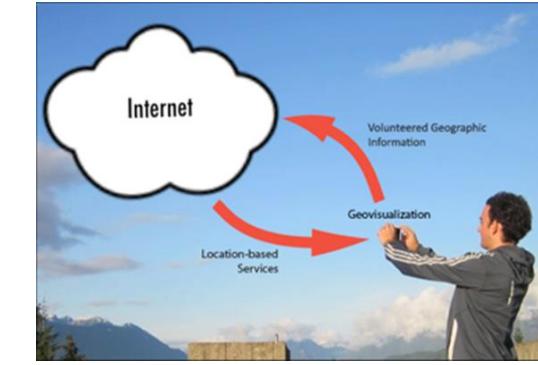
How to make use of social media data as Volunteered Geographic Information?

Smartphones are sensors of the environment (location based services, geotagging)

- They create, assemble, and disseminate geographic information
- They have: "*Unleashed the potential of a geographer within everybody*" (Sui et al 2013:9)
- 'Social sensing' (as opposite to remote sensing, Liu et al. 2015).
- Crowdsourcing, citizen science, big data

A huge capacity

- Instagram community alone upload > 60 mill images a day globally.
- Multiple e-communities (Twitter, wiki's, flickr, facebook, etc)

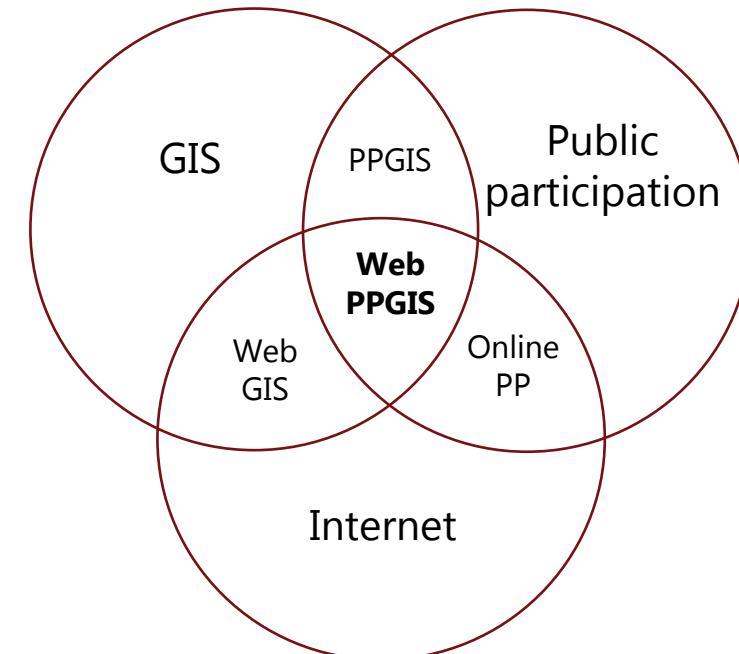


WebGIS approaches as basis for research

PPGIS (Public Participatory GIS)

WebGIS meets public participation

- Bottom-GIS
- Collaborative GIS
- Soft GIS
- Participatory mapping
- Geo questionnaires



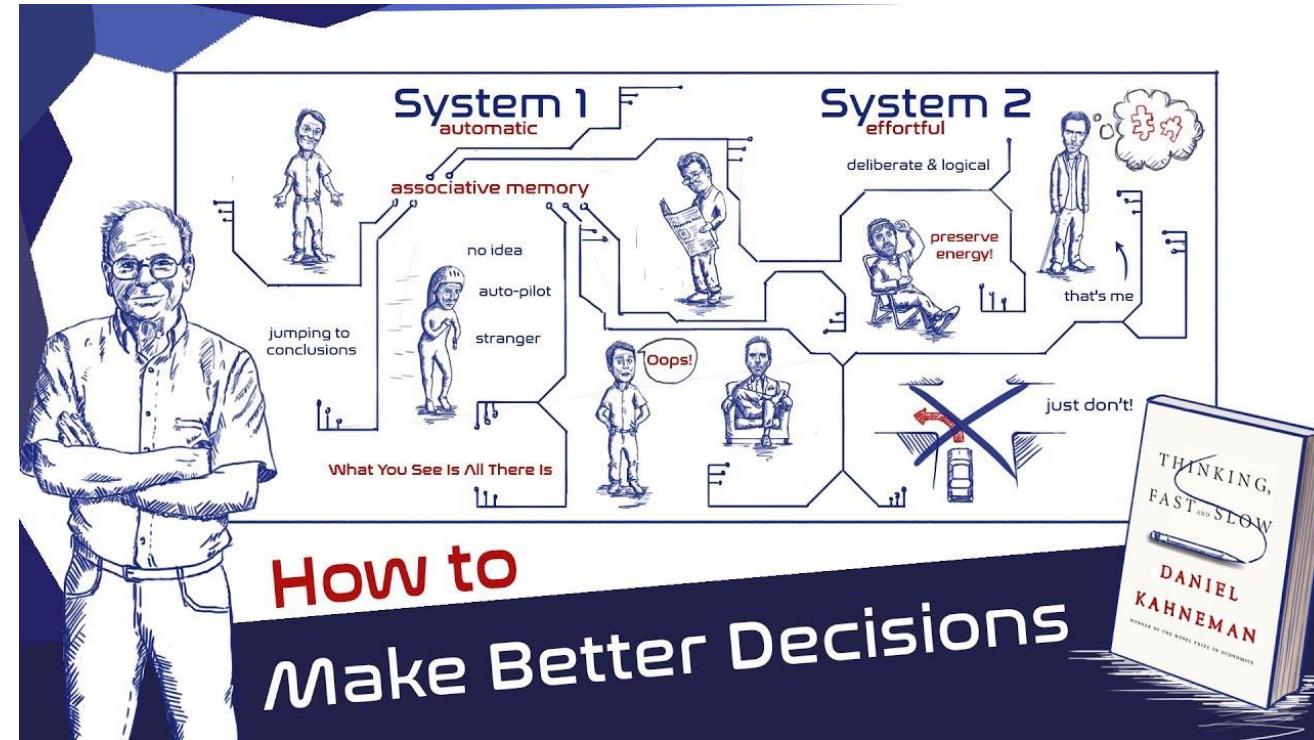
WebGIS approaches as basis for research

Likes and dislikes at Frederiksberg Campus (web PPGIS)

- <https://new.maptionnaire.com/q/8wtm2b4v22m3>

Type the link above into your browser and participate!

Types of data collections relates to different modes of thought



<https://www.youtube.com/watch?v=uvDtyJ5sg7U>

How does this relate to webGIS?

- According to H.J. Miller (2020):
 - In a smart city perspective we might risk relying too much on 'system 1' reasoning.
 - We have to also remember 'system 2' reasoning in decision-making

System 1 (IoT, big data, real time data, VGI data)	System 2 (public participation GIS)
Automatic (user generated content)	Deliberate (survey respondents recruited)
Machine based	Human based
Fast	Slow
Cheap	Costly
Correlation	Causality

Examples of research projects relying on webGIS and system 1 and/or system 2 reasoning

- Case 1: Landscape values in Europe
- Case 2: 'Blue' outdoor recreation in Denmark
- Case 3: Recreational use of cemeteries in Copenhagen and Helsinki

Comparing landscape value patterns between participatory mapping and social media content across Europe

Anton Stahl OLAFSSON^a, Ross S. PURVES^b, Flurina M. WARTMANN^c, Maria GARCIA-MARTIN^d, Nora FAGERHOLME^e, Mario TORRALBA^f, Christian ALBERT^g, Laura N. H. VERBRUGGE^{h,i}, Vuokko HEIKINHEIMO^{j,k}, Tobias PLIENINGER^{f,l}, Claudia BIELING^m, Roope KAARONEN^{i,n}, Maximilian HARTMANN^b, Christopher M. RAYMOND^{i,n,o}

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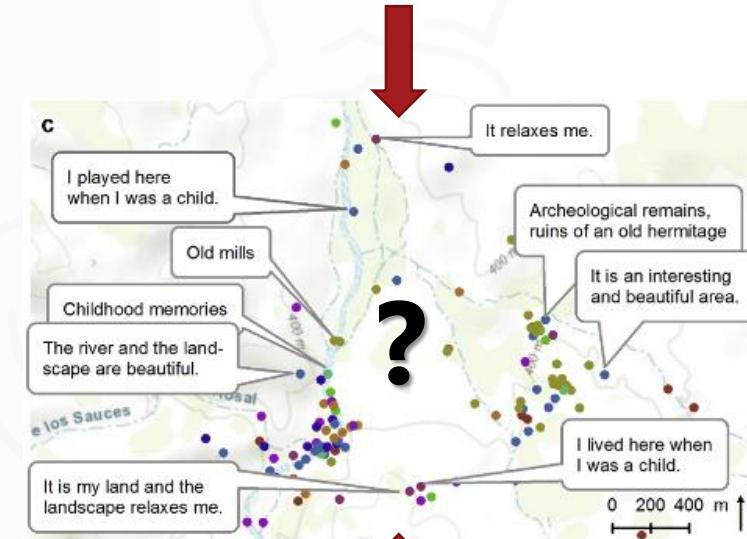
Anton Stahl Olafsson, asol@ign.ku.dk

KØBENHAVNS UNIVERSITET



PPGIS maptionnaire

Active contributed data



Fagerholm et al 2019

Passive contributed data



Rationale, idea

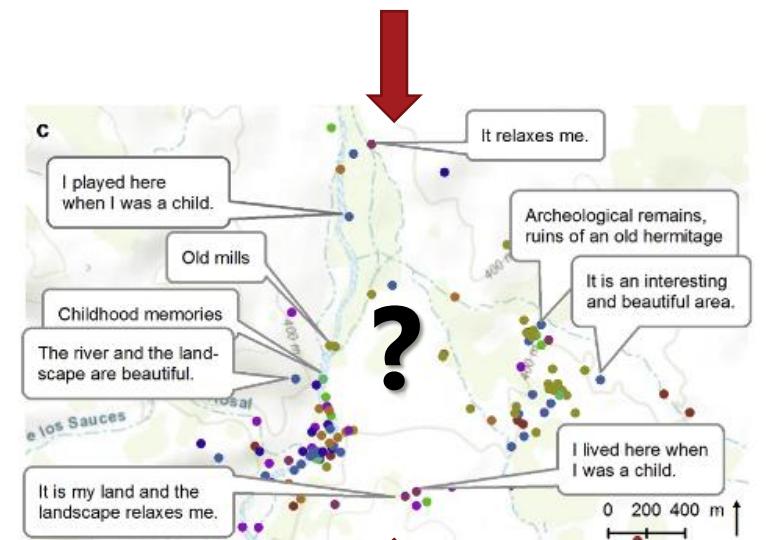
AIM:

- To bring PPGIS and social media analysis together in an exploration and discussion of their *similarities and differences* in eliciting *landscape values*.
- To expand the analyses from a single case area to cross-site analyses of *19 landscapes across Europe*.
- To support that researchers and planners can harness the qualities of both: need to place a *spotlight on strengths and shortcomings* of each method and *core opportunities for complementary use*.

System 2

PPGIS  maptionnaire

Active contributed data



Fagerholm et al 2019

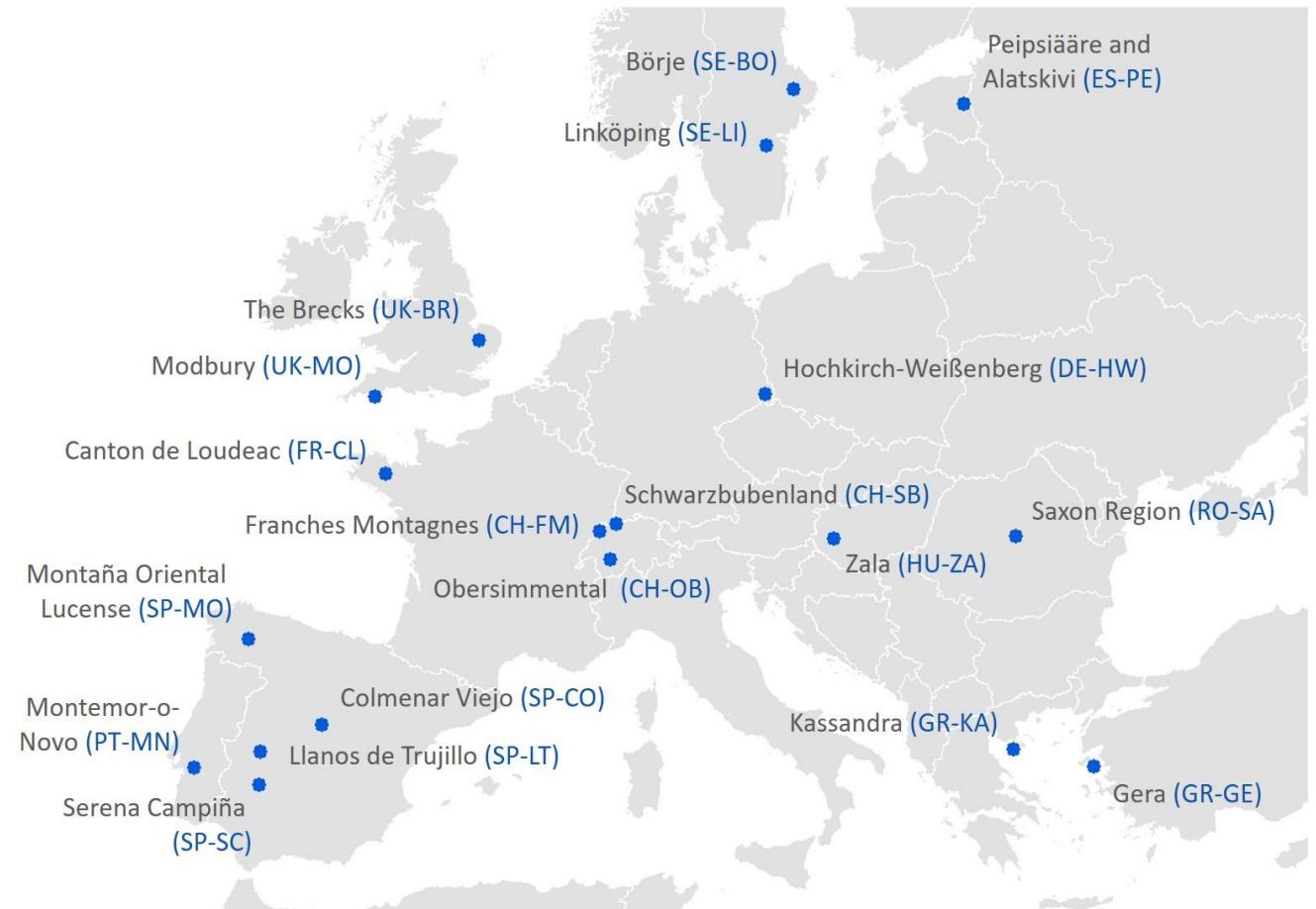
Passive contributed data



System 1

Method: cross-site analyses

- 19 sites across 11 countries in Europe
- Study sites from two European projects (ARGFORWARD and HERCULES)
- Focus on 'everyday' landscapes as perceived by locals (local administrative regions)



Method: data collection

PPGIS

- Recruitment of respondents at key public locations by stratified convenience sampling (gender/age)
- Facilitated PPGIS interviews with locals in local languages

Flickr

- Flickr content harvested from the same study areas
- Harvesting of image locations (x,y) and text (title and tags)
- *No analysis of image content, but focus on the users annotation of their images*
- Extraction of unique users, locations (x,y) by unique users, and unique shared tags (by at least two users for a given site)
- Text coding of a representative subsample of most popular tags for each site (95%, 10CI)
- Annotation guidelines developed and two annotators assigned to code Flickr tags for each site (high agreement between annotators, Kappa = 0.828, p<0.001)

Method: value typologies

PPGIS – 11 predefined values (top-down)

Perceived ecosystem services (ES). *Q: Do you find some particular place or area special in this landscape?*

Landscape value	Description in the survey
Farm products	I appreciate, produce or can buy farm products here.
Harvested products	I harvest fruits, berries, flowers, mushrooms, asparagus, fish, game etc.
Outdoor activities	I practice outdoor sports, walking, hiking, biking, dog walking etc.
Social interactions	I spend time together with other people.
Aesthetic values	I enjoy seeing this beautiful landscape or landmark.
Culture and heritage values	I appreciate the local culture, cultural heritage or history.
Inspirational values	I am inspired by feelings, new thoughts, religious or spiritual meanings etc.
Existence values	I appreciate this place just for its existence regardless of benefits for me or others.
Habitats and biodiversity	I appreciate the plants, animals, ecosystems etc.
Environmental capacities	I appreciate the environmental capacity to produce, preserve, clean, and renew air, soil, and/or water.
Special place	Other special place or area to me

Flickr – 6 coding categories (bottom-up)

- Similar ES categories not possible, use of Janet Stephenson's (2008:134) framework:

Landscape value	Tag examples
Biophysical landscape elements:	mountain, river, hill, flower, rocks, forest, ibex, marmot, glacier
Cultural landscape elements	village, street, car, cow, dog, child, hikers, cornfield, garden, people
Human activities	hiking, biking, walking, mountaineering, climbing
Ecological processes	summer, winter, raining, snowing, sunset, sunrise
Relationships	blue, green, quiet, tranquil, beautiful, beauty, nature, wilderness, tradition, joy, happy, home, panoramic
Place names	switzerland, makedonia, roumanie, plattensee, aegean

But how to compare?

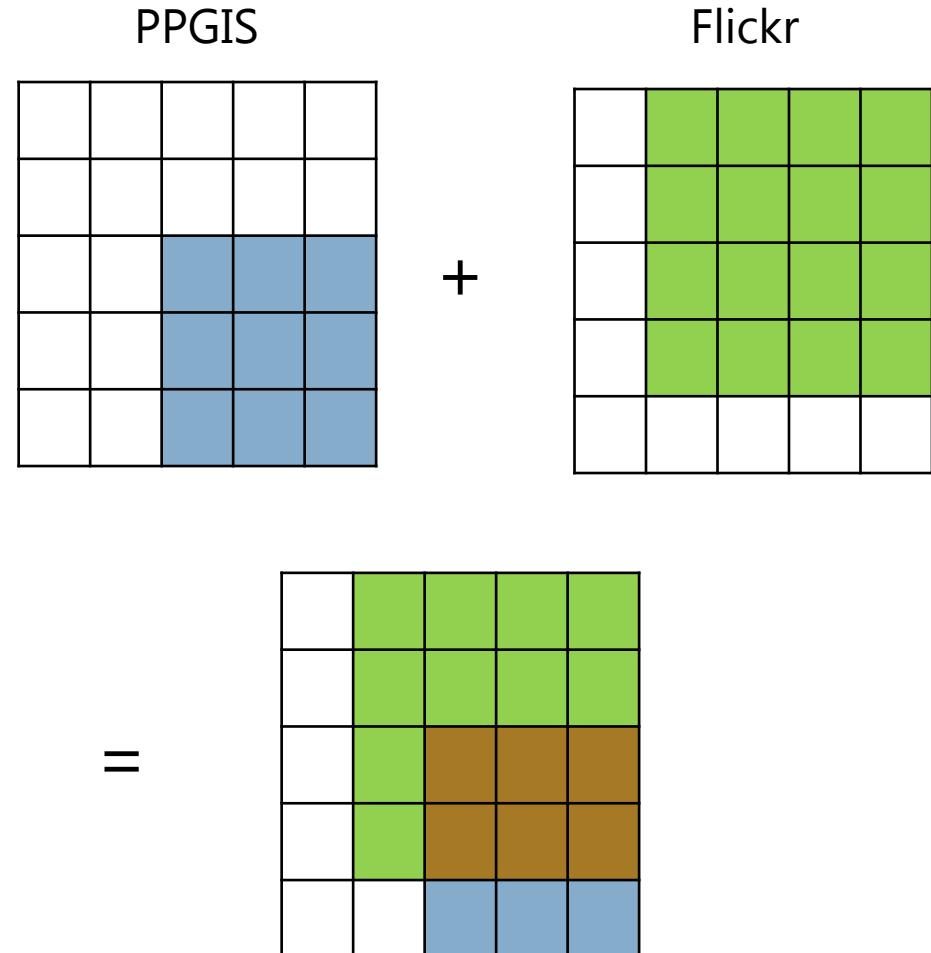
- How to spatially compare
(similarities and differences)
between two different GIS point
data sets across 19 case sites – any
ideas?

?

Method: spatial patterns

Overlay analyses of the two spatial dataset:

- Large variation in study size (37-1725 km²) → choice of 1 km² grid resolution
- Counts of unique PPGIS respondents and unique Flickr contributors in each grid
- Popular grids identified as the 5th quintile of counts (hotspots)
- Jaccard index calculation of grids (similarity between two sets as the intersection of two sets divided by their union)



Results: data volume

Summary:

	PPGIS	Flickr
Individuals	3027	5707
Locations (x,y)	32029	47600
Coefficient of variation (individuals)	0.38	1.66
Coefficient of variation (locations)	0.44	2.10

Similar volume

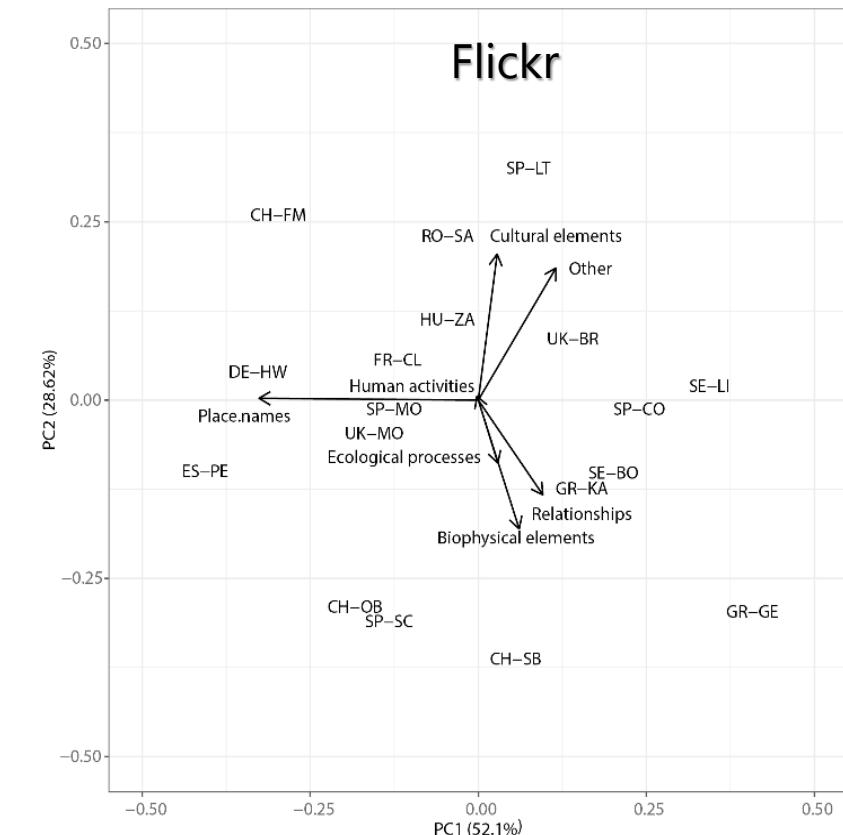
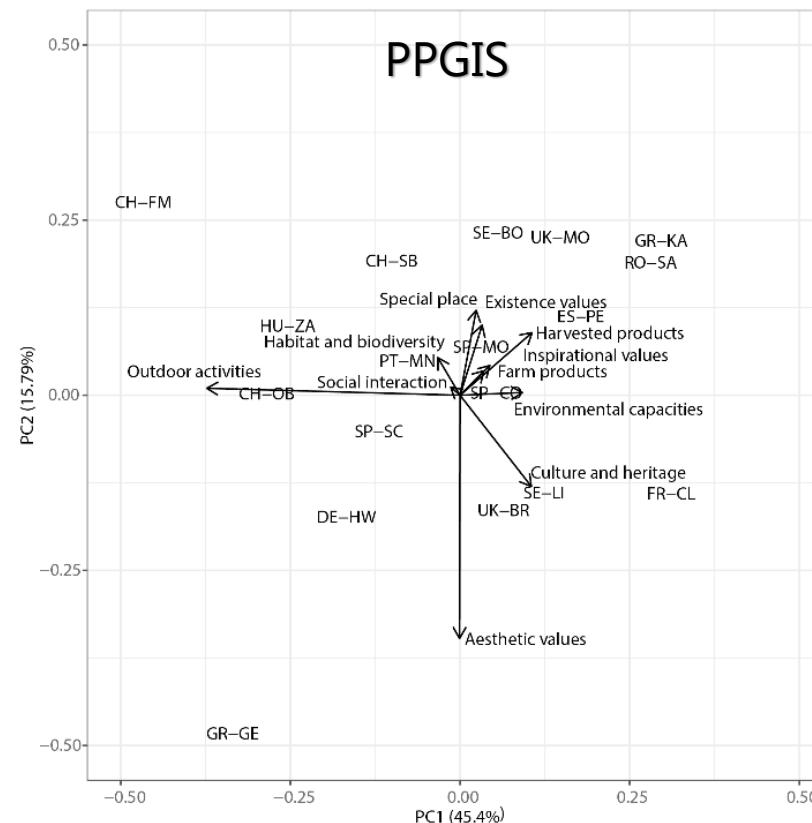
A lot more
variation in Flickr
data!

NB! Do not reflect
national cultural
differences

Results: landscape value comparison

- Hard to compare!
- No cross-site significant correlations between the different landscape values from the two methods

- PCA plots of value distributions:
- PPGIS dominated by outdoor activities and Flickr by place names

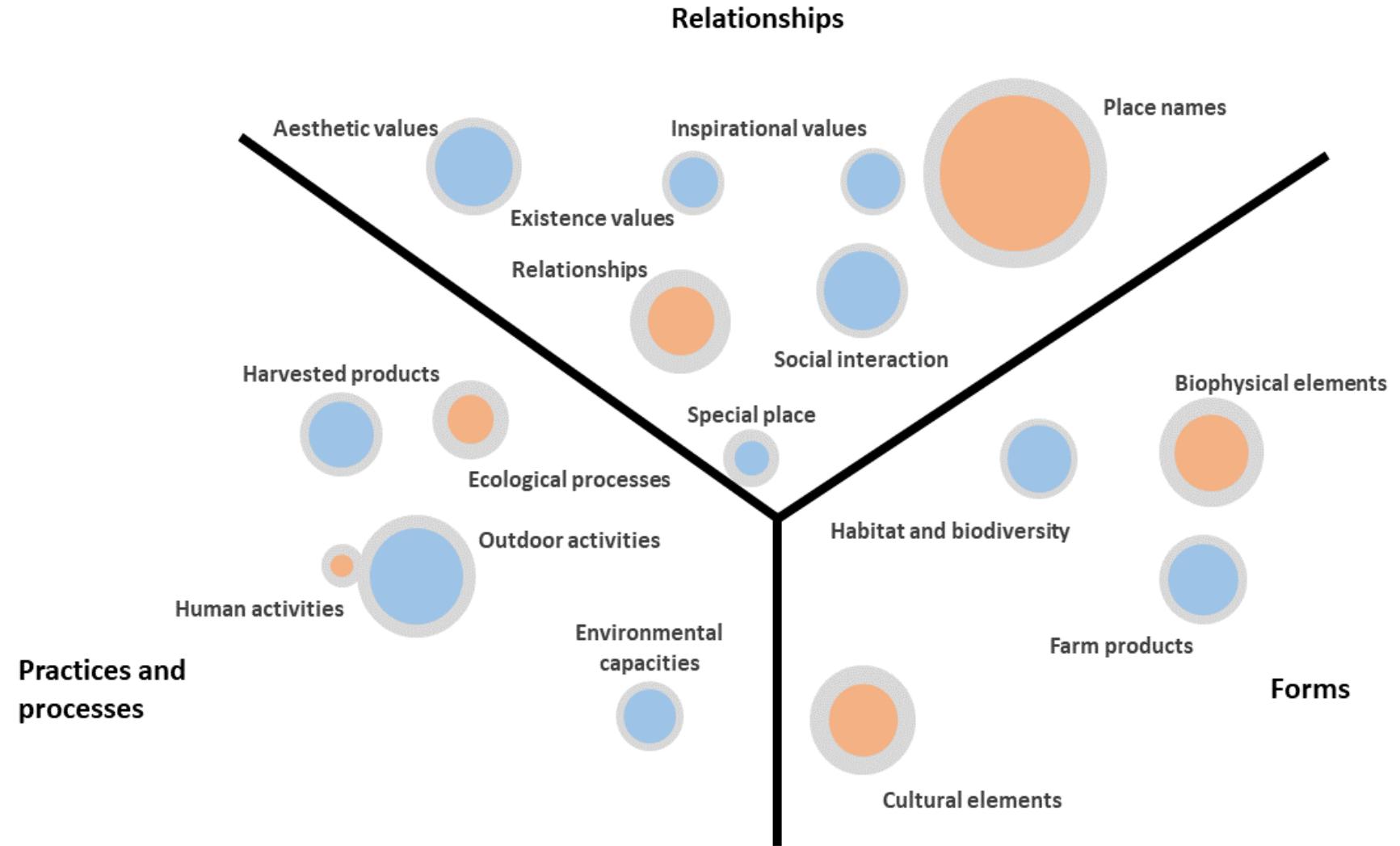


Results: landscape value comparison

- **Blue circles = PPGIS**
- **Orange circles = Flickr**
- **Circle size** indicates percentage of content
- **Grey borders** the coefficient of variation over the sites

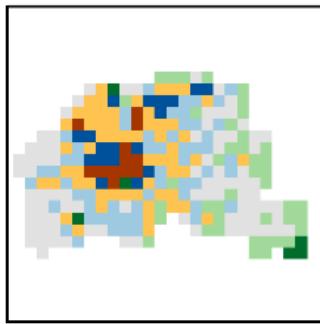
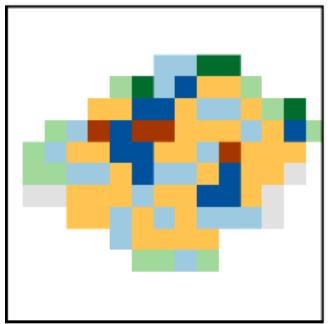
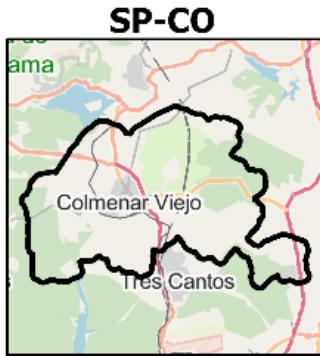
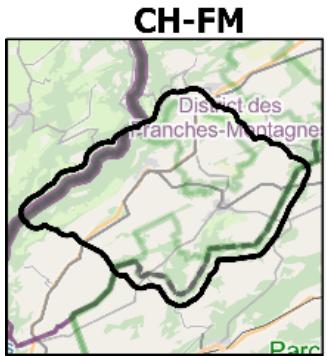
PPGIS: a wider spectrum of values across value dimensions

Flickr: mainly relationship values, more variation over sites

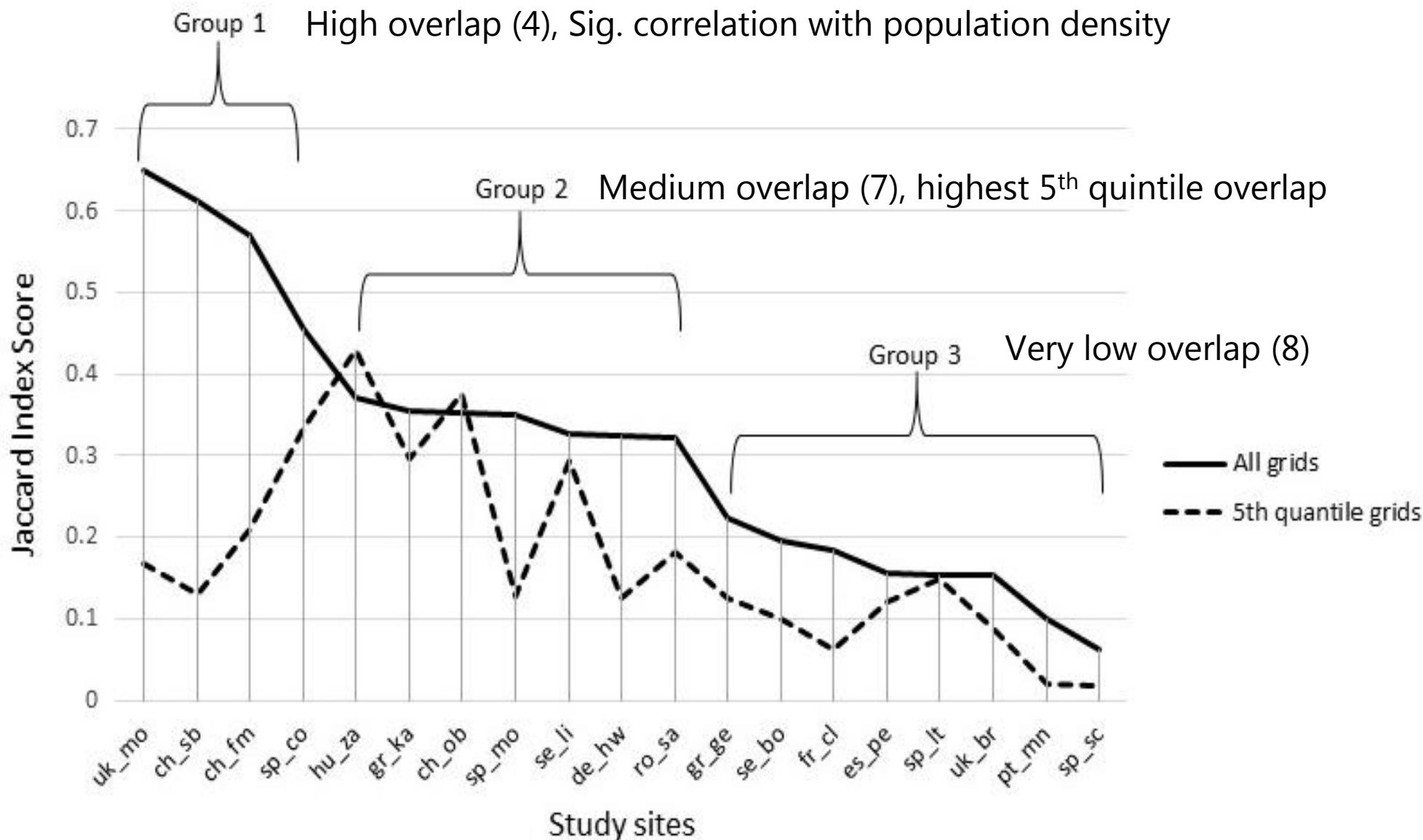


Results: spatial patterns

- *Are there spatial agreement between the two mapping results?*



Results: spatial patterns



Summary of complementary use

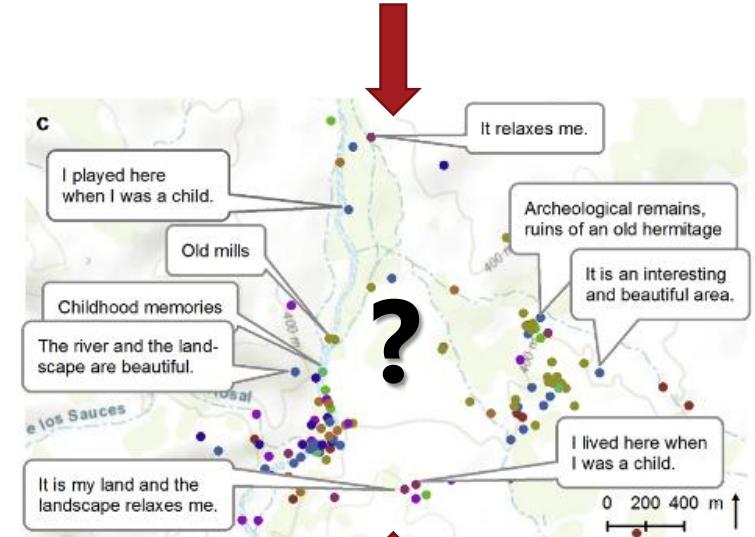
	Passive elicitation (Flickr)	Active elicitation (PPGIS)
Data collection?	Readily available (query by e.g. keyword or location)	Needs to be collected (project specific)
Sampling?	Opportunistic	Representative, stratified (other)
Whose value?	Visitors/locals/tourists	Residents/locals (targeted)
Value elicitation?	Inductive (bottom-up)	Deductive (top-down)
Value typology spectrum?	Small (<10 types)	Large (>10 types)
Spatial pattern reflects?	Visitation	Local knowledge, culture
Temporality?	Any time	On-off

Perspectives and conclusions

- PPGIS surveys cannot simply be replaced with social media data
- Not very comparable:
 - Different value ontologies and epistemologies
 - Only high overlap in few case areas (high pop density)
 - For most study sites the valued parts of the landscape are contrasting between the two methods
- However:
 - The two methods complement each other (plural valuation, engagement of diverse voices)
 - PPGIS elicits a wider spectrum of values
 - Flickr mainly elicits relationships to and with landscapes

PPGIS  maptionnaire

Active contributed data



Fagerholm et al 2019

Passive contributed data



Read more

- <https://doi.org/10.1016/j.landurbplan.2022.104511>

Landscape and Urban Planning 226 (2022) 104511

Contents lists available at ScienceDirect

Landscape and Urban Planning

journal homepage: www.elsevier.com/locate/landurbplan



Comparing landscape value patterns between participatory mapping and geolocated social media content across Europe

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HIGHLIGHTS

We compare the use of PPGIS and Flickr in landscape value assessments.
Landscape values and their spatial patterns are compared across sites.
We find more cross-site differences than similarities both in spatial patterns and value types.
PPGIS elicits a wider spectrum of values, while Flickr mainly elicits relationships to and with landscapes.
We recommend a complementary use in future landscape value studies.

1. Introduction

The geographic information universe is experiencing inflationary growth, fuelled by open georeferenced data, sensors, environmental imagery, and social media, allowing capture, monitoring and tracking of citizens' values, preferences and behavioural patterns (Helbing, Caron & Helbing, 2019; Miller, 2020). At the same time, landscape sustainability science is undergoing growth in participatory planning ideals with focus

on deliberative processes, co-creation and inclusion of diverse values for integrated landscape planning and management (Albert, 2019). Environmental policy and decision-makers are increasingly seeking out new approaches to integrate different value concepts and valuation methods, promoted under the concept of 'plural valuation' (Pascual, 2017; Zafra-Calvo, 2020). Plural valuation seeks to inform not only the efficient allocation of resources, but also support a range of environmental justice, equity and well-being goals.

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<https://doi.org/10.1016/j.landurbplan.2022.104511>
Received 25 June 2021; Received in revised form 30 June 2022; Accepted 4 July 2022
Available online 10 July 2022
0169-2046/© 2022 The Author(s). Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Case 2: Documenting and mapping coastal and marine recreation and tourism in Denmark



Case 2 agenda

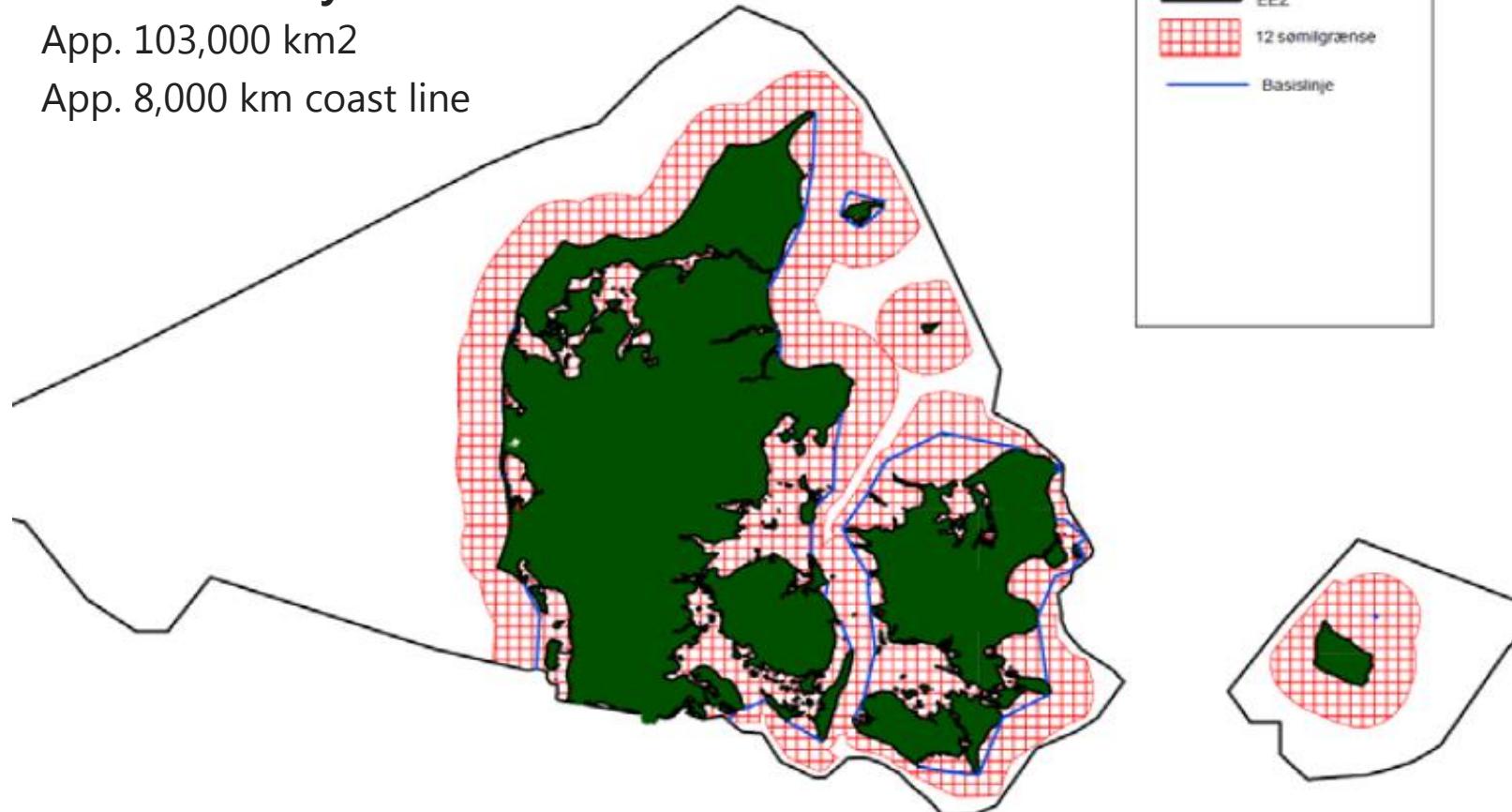
1. Intro: Why a need for documenting and mapping coastal and marine recreation?
2. Two PPGIS survey approaches
3. Mapping results
4. Quality assessment
5. Examples of planning use:
 - Maritime Spatial Planning (MSP)
 - National park planning
 - Ecosystem based management

Why mapping coastal and marine recreation?

Marine territory

App. 103,000 km²

App. 8,000 km coast line



In DK 40 years of research on 'green' outdoor recreation (eg forest recreation)

...we do not know much about 'blue' outdoor recreation

Why mapping coastal and marine recreation?

- Blue outdoor recreation is on the planning agenda!
- EU directive on *Maritime Spatial Planning* (MSP) → new maritime spatial plan in DK!
- MSP :
- Blue growth (energy, aquaculture, shipping, etc.)
- Ecosystem based approach
- Stakeholder consultation

→ **A call for spatial data on marine recreation
“the missing social landscape”** (e.g. Douvre & Ehler)



Why mapping coastal and marine recreation?

- Blue outdoor recreation is on the planning agenda!
- E.g. increased focus on marine protected areas globally

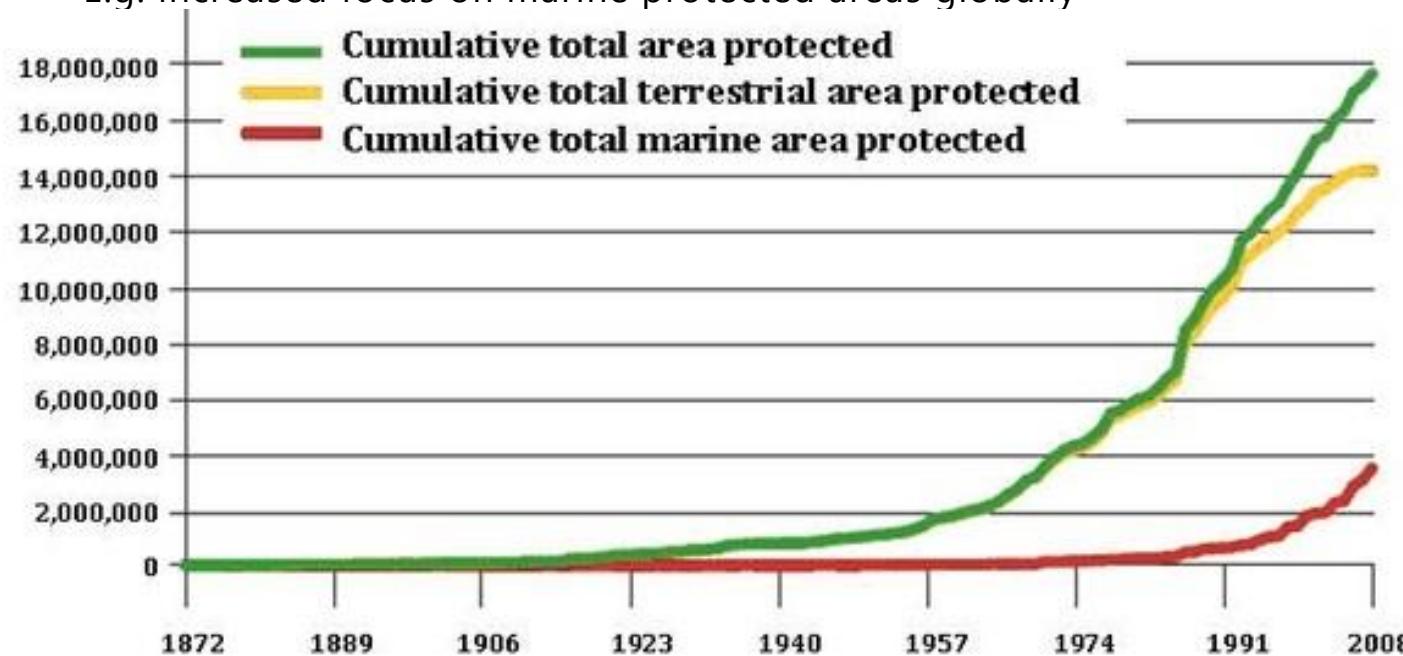
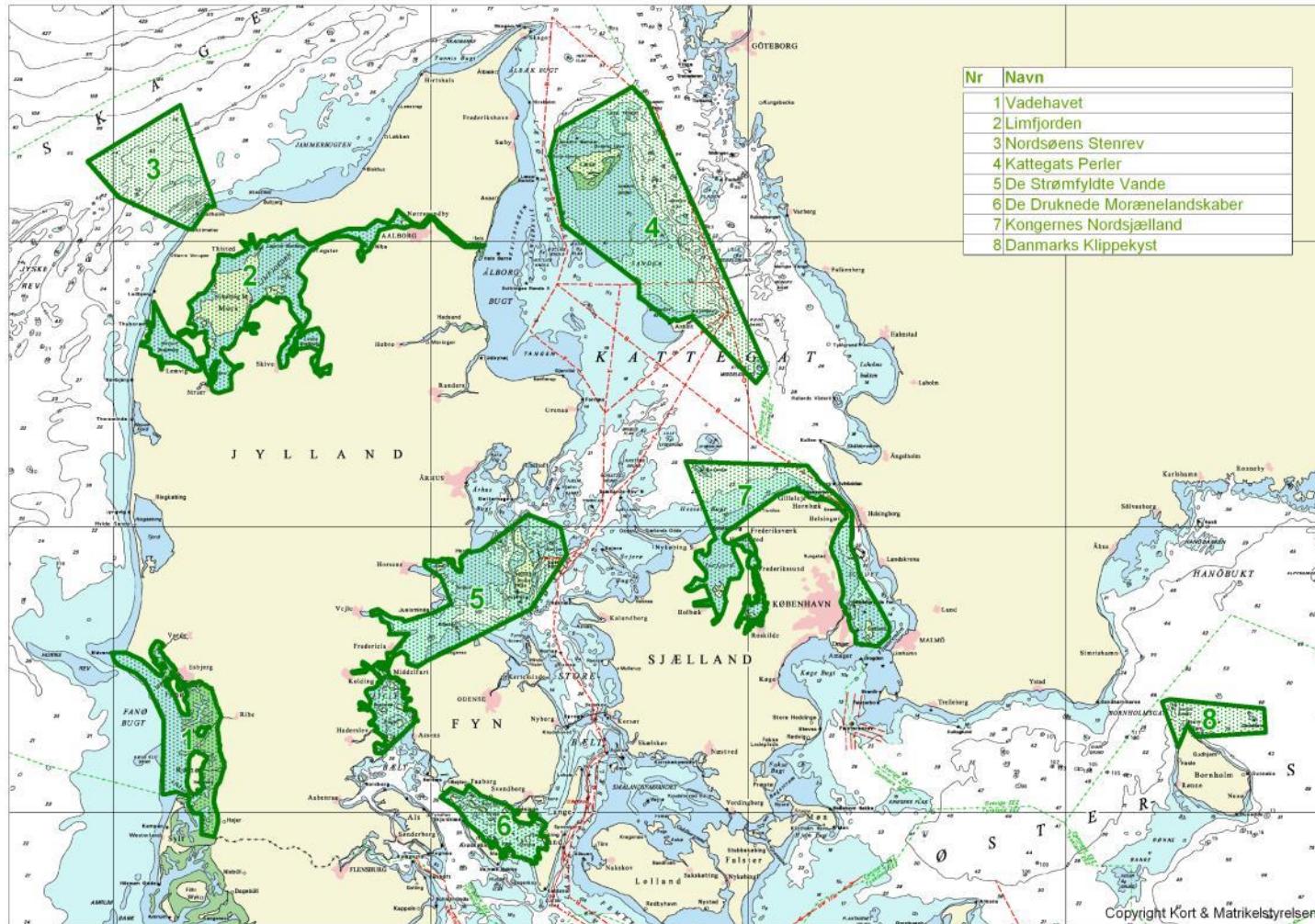


Figure 1. Growth in nationally designated protected areas from 1872 to 2008. Figure excludes protected areas with unknown year of establishment (UNEP-WCMC 2009).

Discussions about marine national parks in DK

- Source: Danish nature conservation society



Why mapping coastal and marine recreation?

- Recreation and tourism sector express a need for spatial documentation → e.g. designation of surf reefs

VM-surfere advarer kommune: I gambler med brandet Cold Hawaii

Vindmøller risikerer at forringe Nordeuropas bedste surfspot, advarer nogle af verdens bedste surfer.



Midt under VM-stævnet i stand-up-paddle protesterer surferne mod Thisted Kommunes planer om tre store vindmøller ud for Hanstholm Havn.

Marine recreation activities in DK

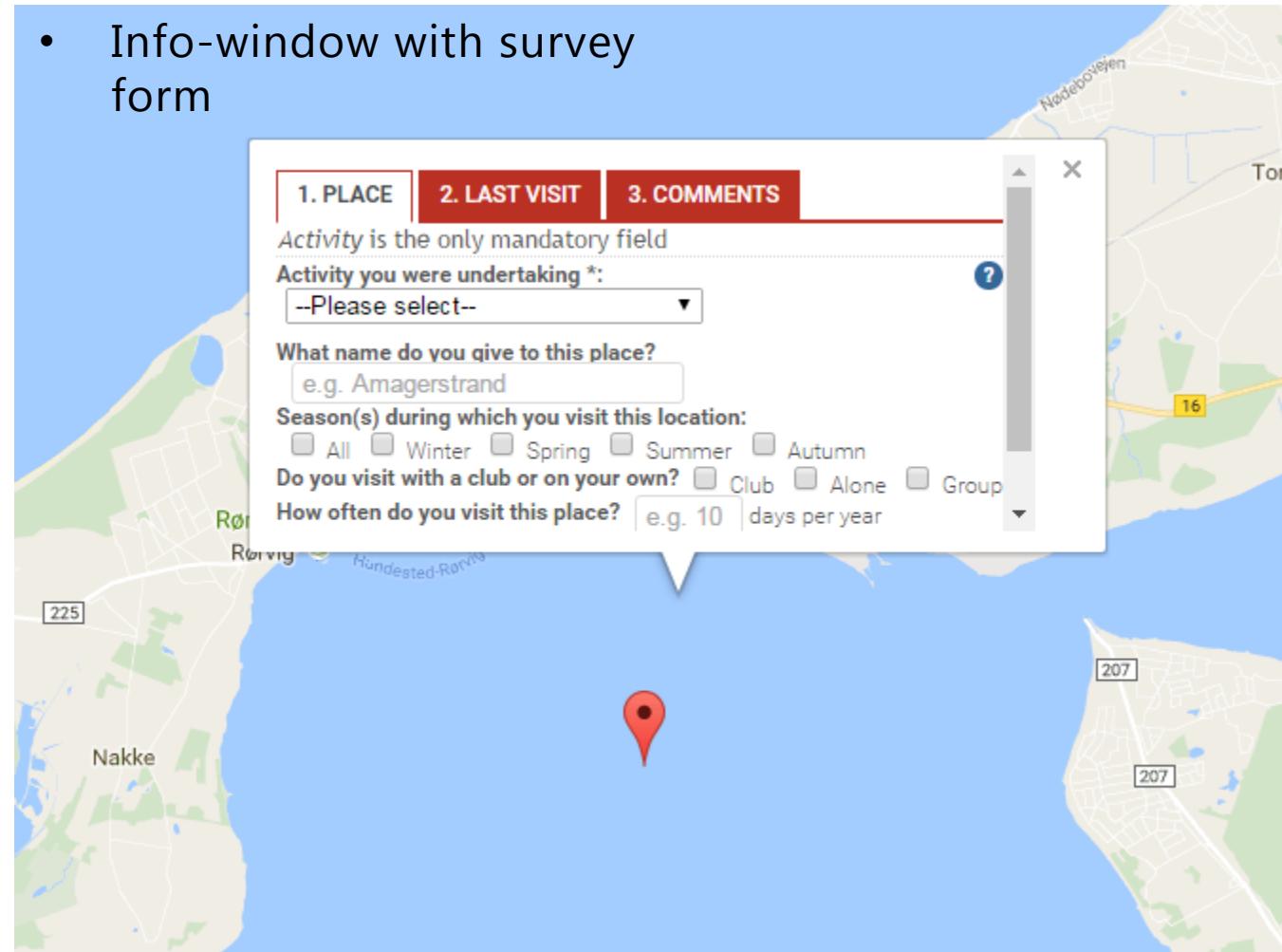
- All types of diving
- Bathing and swimming
- Sailing and Boating
- Surfing
- Jetski and wakeboard
- Kayak and rowing
- Recreational fishing
- Hunting
- Collection and beach combing
- Marine education
- Nature observation
- Air activities
- Ice activities
- Cultural
- Snorkling
- Scuba diving
- Wreck diving
- Aquatique nature watching
- Marine archeology
- Under water photography
- Under water hunting
- Free diving

Our list: 77 activities in 14 groups + outings



Mapping marine recreation activities: Two different public participatory GIS (PPGIS) approaches

- Info-window with survey form



Mapping marine recreation activities: Two different public participatory GIS (PPGIS) approaches

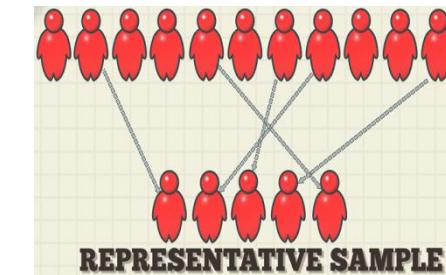
(1) **Crowdsourced** PPGIS mapping – sampling:

- Website and facebook (www.havfriluftsliv.dk)
- Contact to national blue sports federations, regional and local clubs, 650 Facebook groups related to marine activities.
- Featured story in members magazines
- After 1 year: 77 websites had promoted the survey



2) **Panel** PPGIS mapping – sampling:

- A representative panel survey (adult pop. 18-80 years old)
- In total 10.291 replies to a conventional survey linked to the online PPGIS platform.



Mapping result

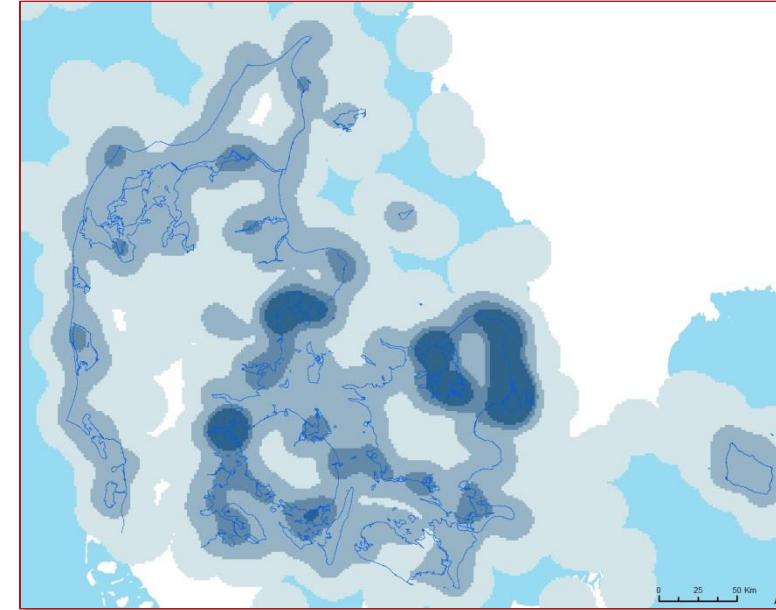
Crowd-sourced

Users: 2,453

Points: 7,344

Lines: 624

3.2 features per participant



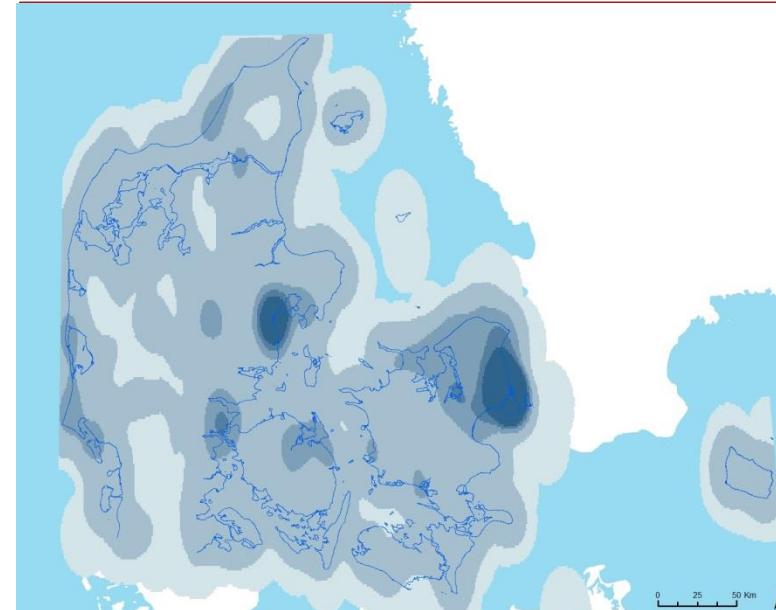
Panel

Users: 4,054

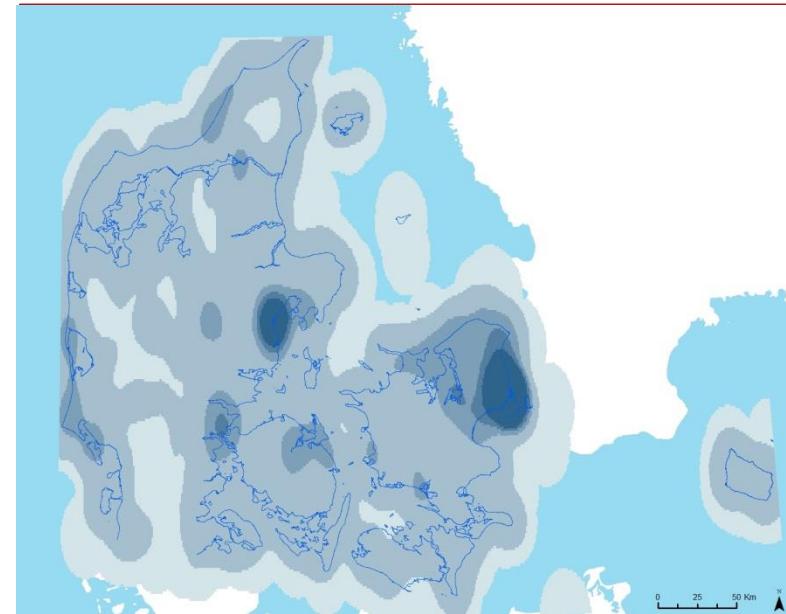
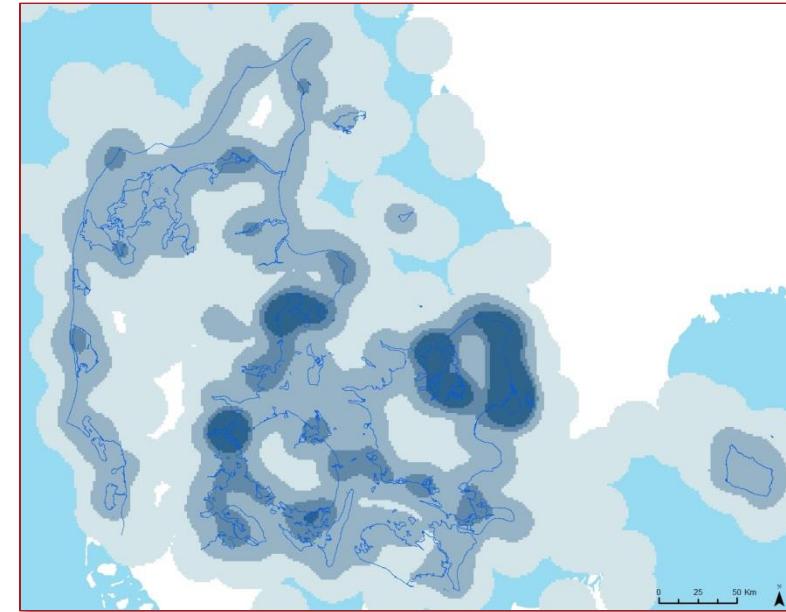
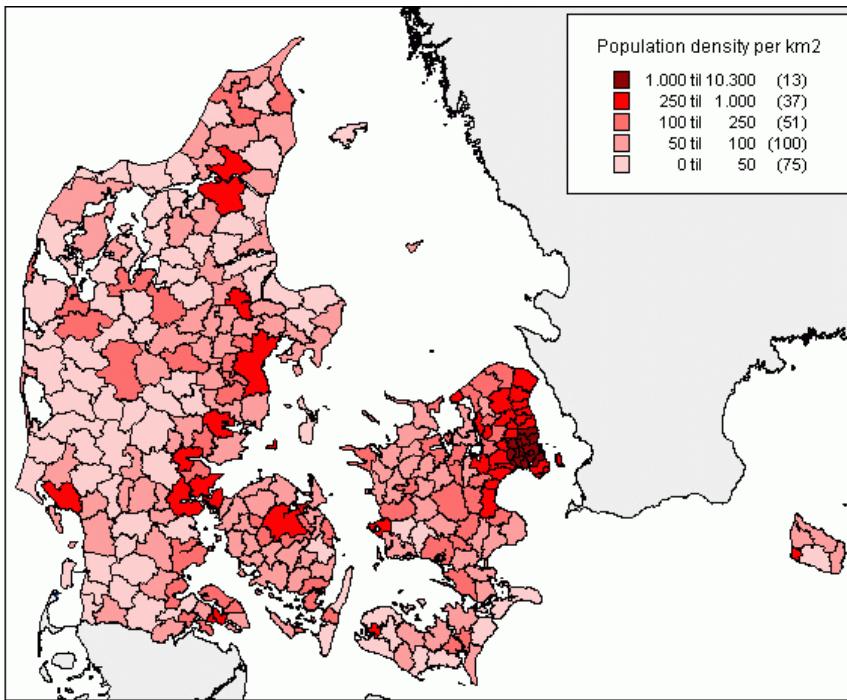
Points: 7,055

Lines: 1,634

2.1 features per participant

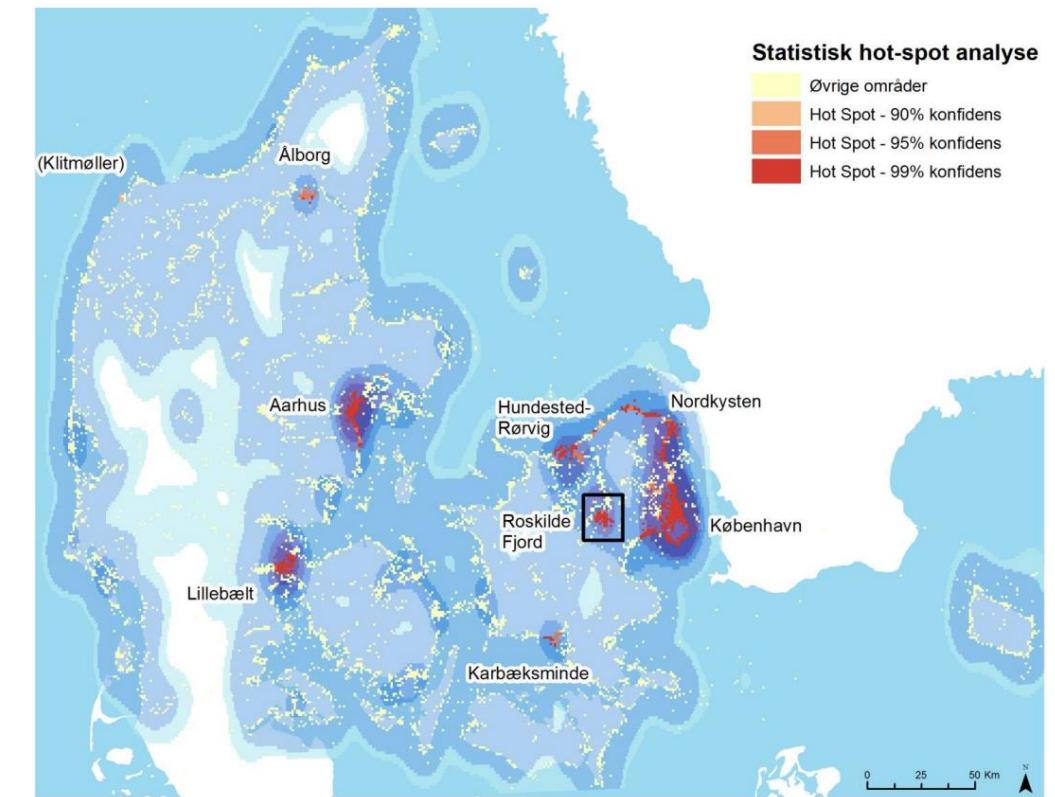


Mapping result



Spatial challenge: *What is a spatial hotspot – how to calculate?*

- IDEAS?
- The European case used 5th quantiles.
- Spatial statistics → Hot Spot Analysis (Getis-Ord Gi*)
 - Point data aggregated at 1x1km fishnet



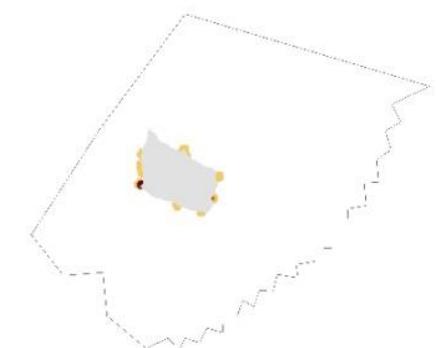
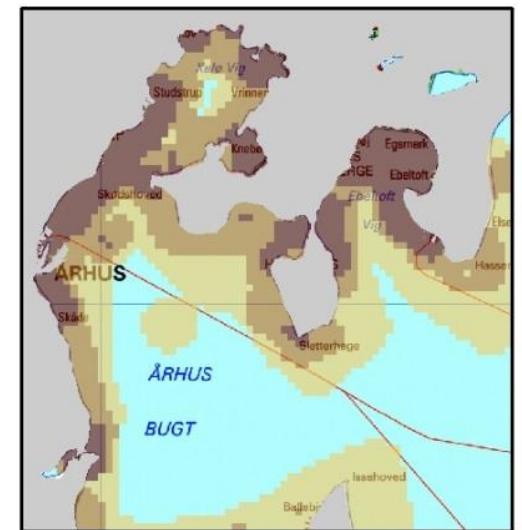
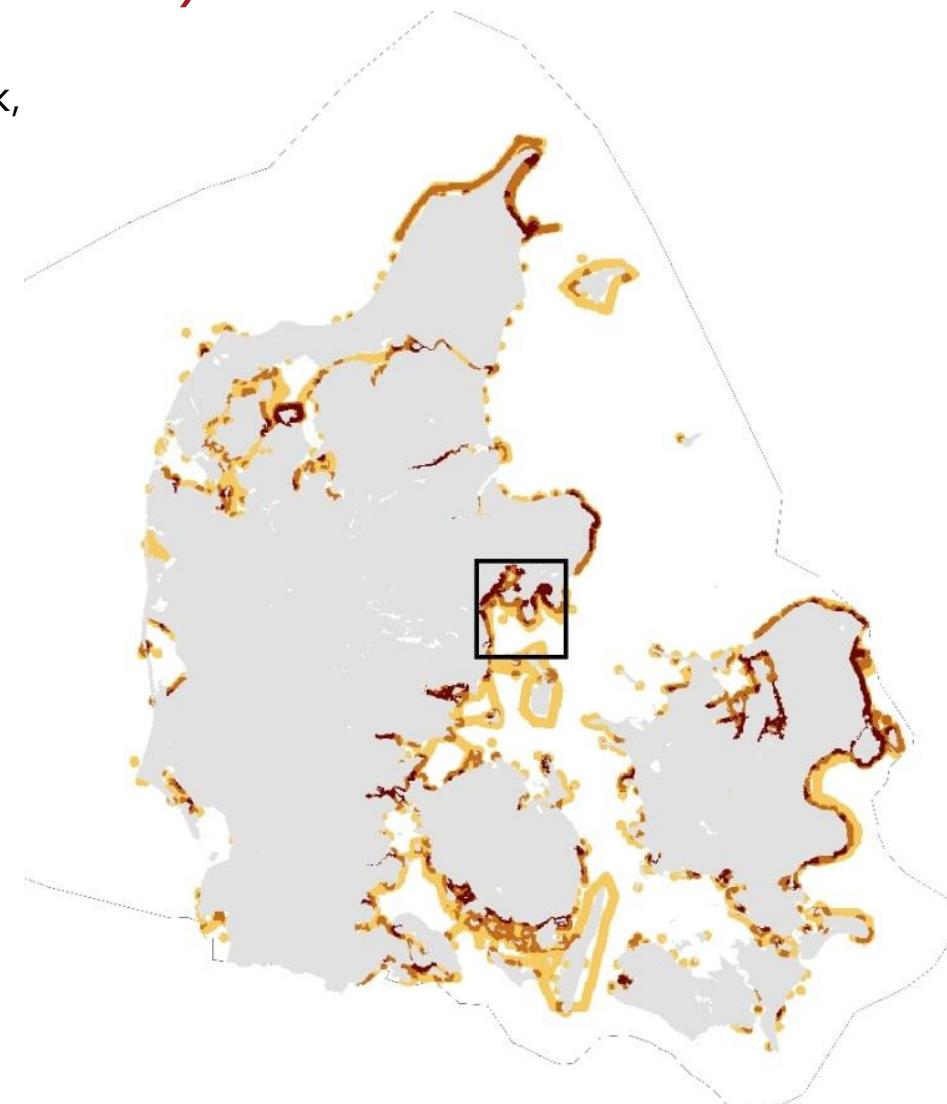
Example of activity specific data aggregated at 500m grids and divided in 3 levels (quantiles)

Non-motorised water craft activities (kayak, surfing, etc):

DATA INPUT:

- Crowdsourced data (kernel densities)
201 mapped routes
2076 mapped places
- Panel survey data (kernel densities)
53 mapped routes
156 mapped places

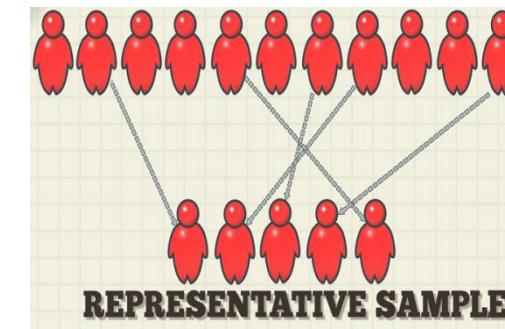
Reclassified outputs (3 levels, quantile distribution) summarised into a single data layer, and then reclassified into a final 3 level feature (low; medium; high).



Spatial data quality. Crowdsourced vs. a representative panel: *what is the data quality implications?*



?



Quality assessment framework

PRINCIP: Fitness-for-purpose! → The MSP process in DK

Dimension	Description	Spatial indicators	Attribute indicators
Credibility	Representativeness (age, gender, geography) of the sample	-	-
Compliance	How the respondents followed the guidelines	Number of 1-point lines. And features not in Denmark	Amount of attributes entered Bad attribute entry
Richness	How rich is the datasets	-	Number and frequency of activities
Accuracy	Spatial and theme	Line density Zoom used during data capture	Mislabelled
Granularity	Precision of the information	-	Amount of data entered
Completeness		Compare to external resources (kitesurfing)	-

Adapted VGI data quality framework from Ballatore & Zipf (2015)

Credibility

- The final mapping output from both samples reflects urban pop. distribution (most intensive use of waters close to cities)
- Representativeness of participants:

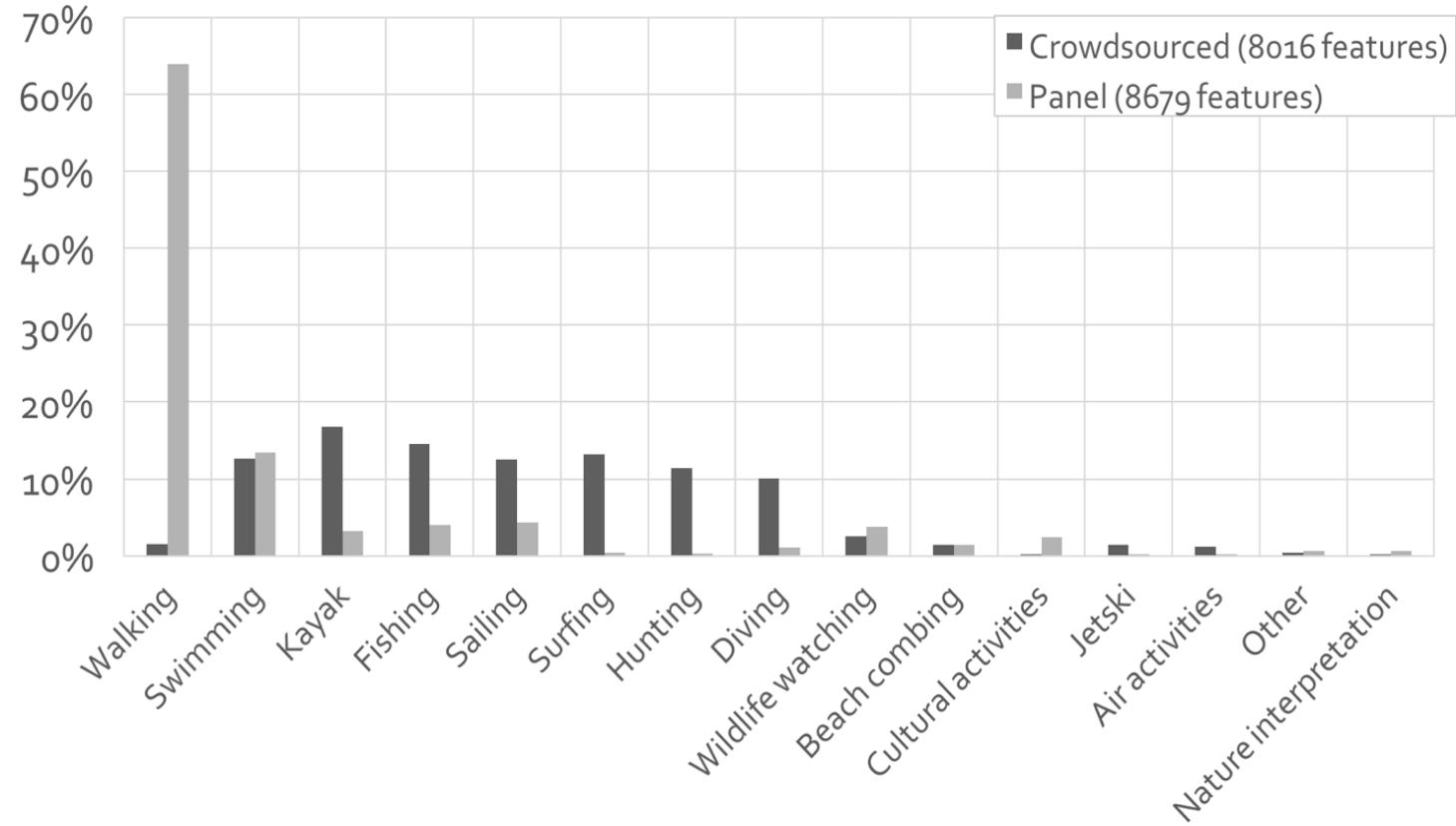
	Avg. age	Gender (% male)
Crowd-sourced	46.5 years	75%
Panel	42.2 years	42.6%

Credibility

- The final mapping output from both samples reflects urban pop. distribution (most intensive use of waters close to cities)
- Representativeness of participants:

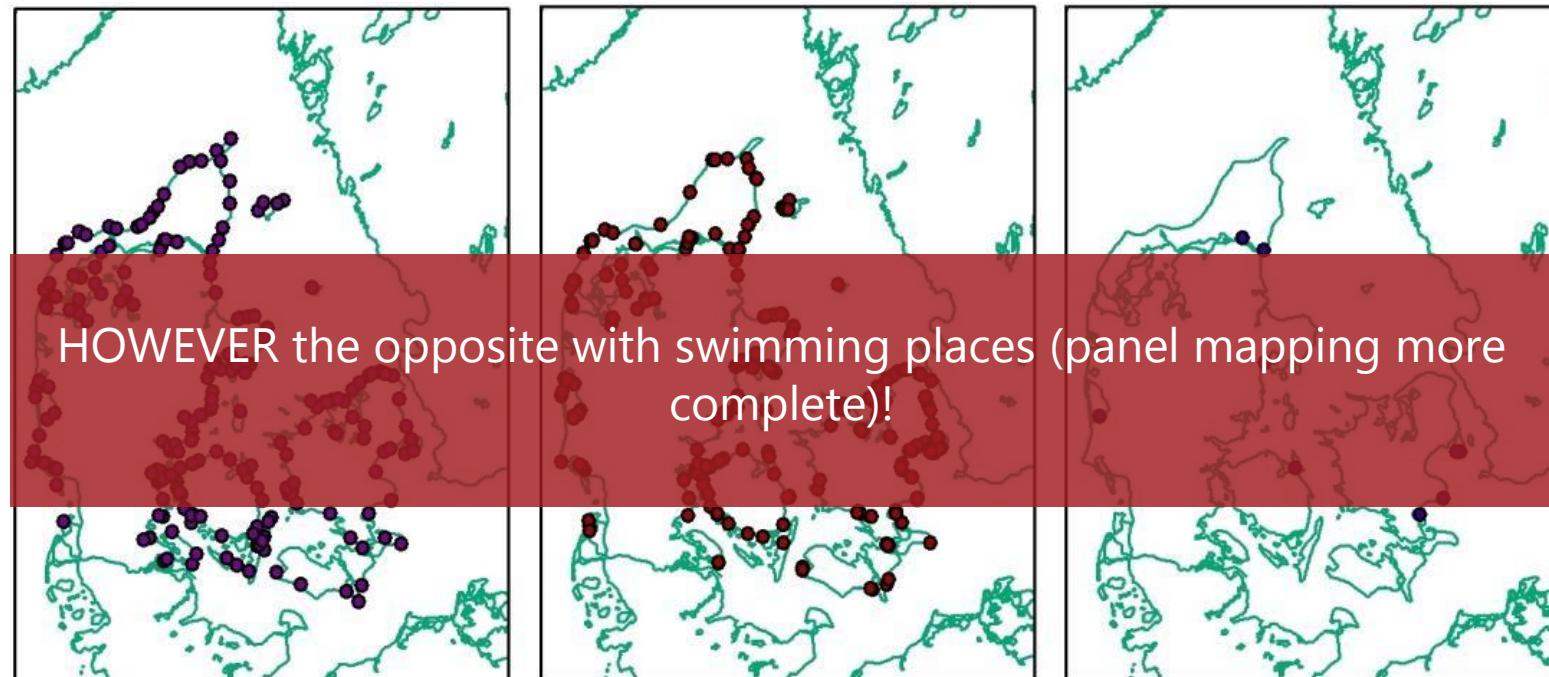
	Avg. age	Gender (% male)	<i>National numbers</i>
Crowd-sourced	46.5 years	75%	<i>50.4 years and 70% male members of marine sports clubs (Sports Confederation of DK)</i>
Panel	42.2 years	42.6%	<i>41.2 years and 49.7% male in the national population (Statistics Denmark 2016)</i>

Richness



Completeness

- Crowdsourced 612 kitesurfing places → 151 spots (106 in kitemekka, 45 'new' spots)



Kitesurfing spots
 $n=214$
(kitemekka.dk)

Kitesurfing places
 $n=612$
(crowdsourced)

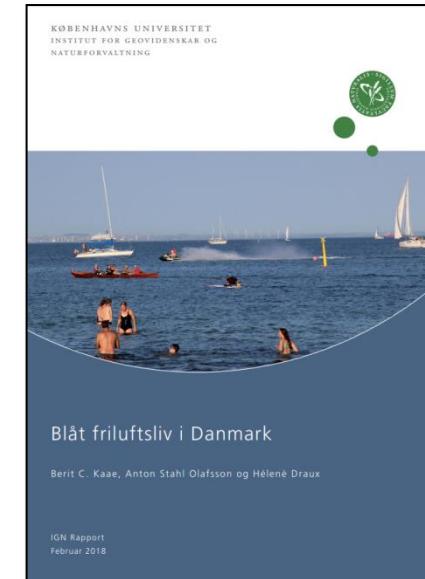
Kitesurfing places
 $n = 9$
(panel)

Sum-up of quality assessment

- Credibility: Both sampling methods were credible (based on different target groups)
- Compliance: The crowdsourced sample followed the guidelines **slightly** better
- Richness: Both sampling approaches were successful in collecting their targeted activities
- Accuracy: Spatial and attribute accuracy was (slightly) better in the crowdsourced approach (but not for zoom)
- Granularity: Similar (most data in easy to fill fields)
- Completeness: Crowdsourcing better for small specialised activities (e.g. kitesurfing) – while panel better for widespread/popular activities like beach visits, coastal walks and swimming.

Sum-up documenting and mapping

- ALL IN ALL the two approaches seems to supplement each other!
- The two fundamental different sampling approaches were successful in uncovering the diversity and spatiality of marine recreation:
 - New knowledge on small specialised activities (crowdsourced)
 - New knowledge on the importance of blue recreation for the general population (panel)
 - New knowledge on the least/most intensively used areas for coastal and marine recreation at a national level



How has it been used?

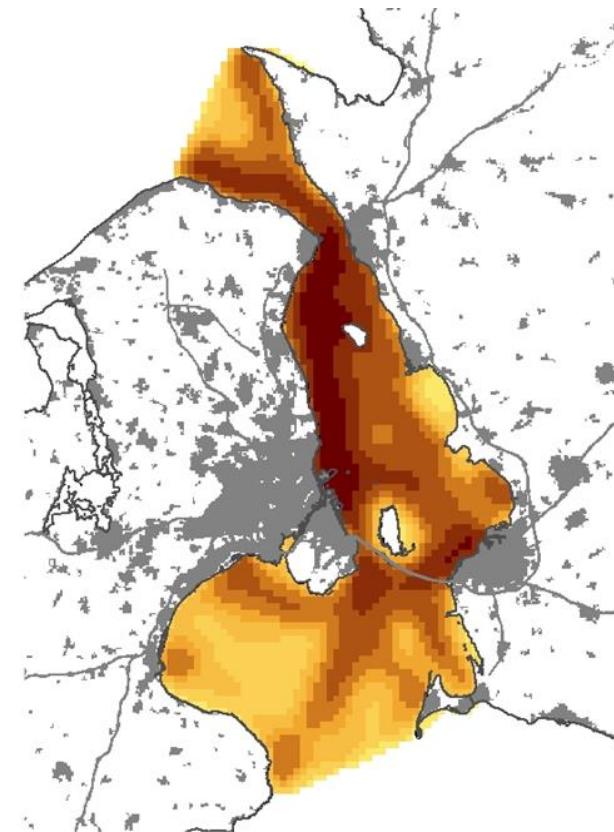
Use case 1: MSP (Maritime Spatial planning)

- Data fit for MSP?
 - Mapping of socio-cultural ecosystem services (ecosystem based setup in MSP)
 - Public Participation GIS (stakeholder consolidation in MSP)
 - Data fit for a regional level (a national MSP plan)
- All in all: The collected data seems to be fit for the MSP process in DK!



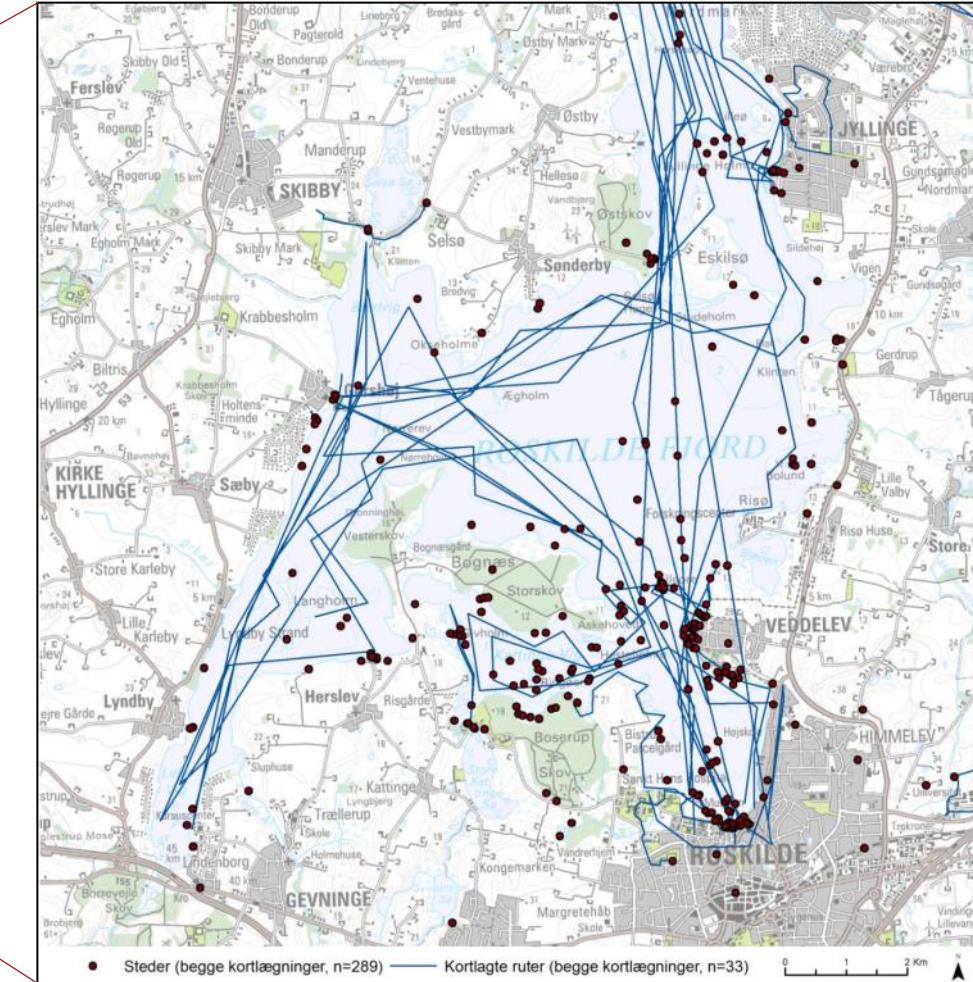
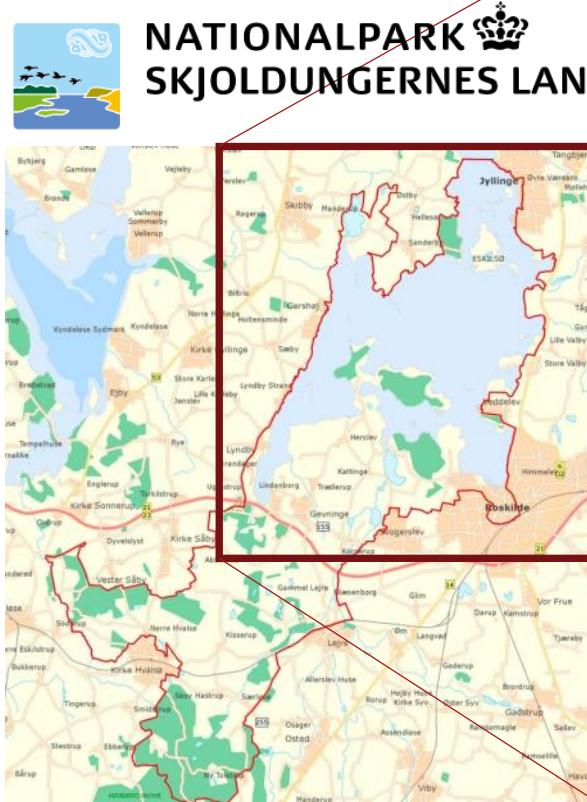
Use case 1: MSP (Maritime Spatial planning)

- Integration of mapping output in the official Marine Spatial Data Infrastructure
- Example of a recreation synthesis map from the collaborative pilot project Havplan Øresund:

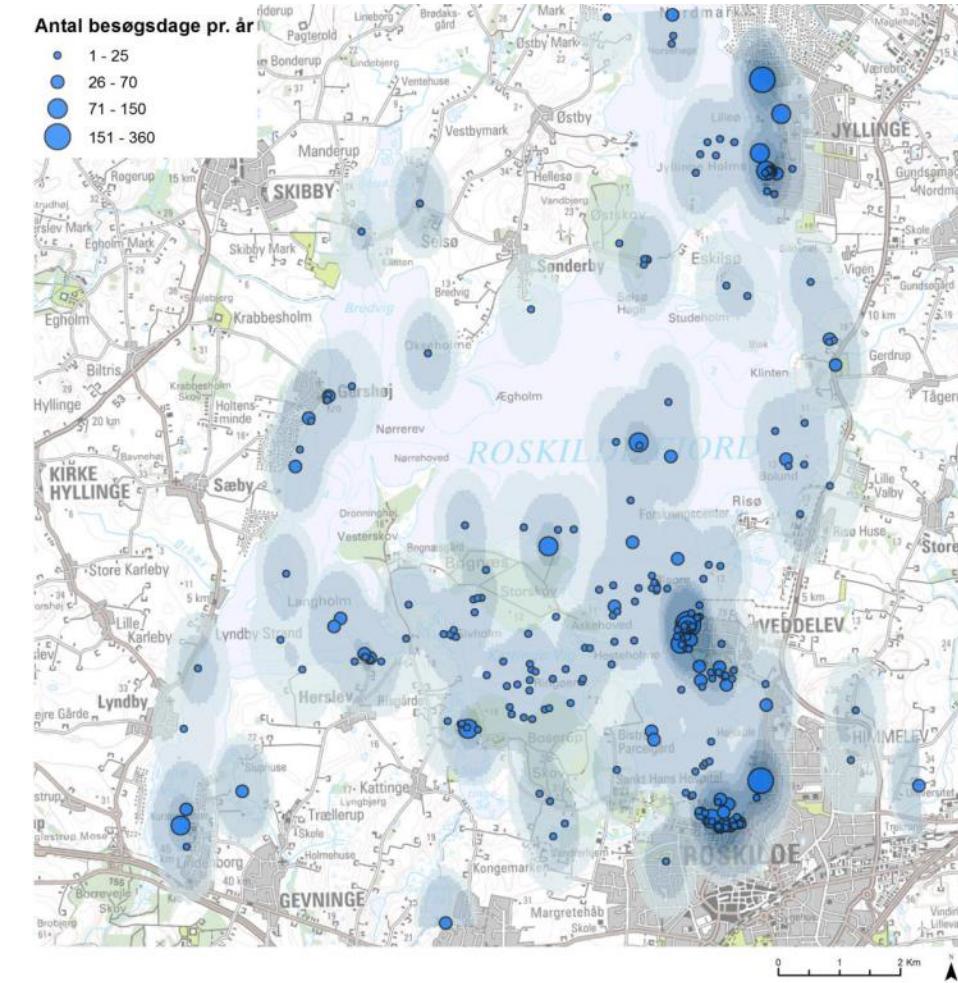
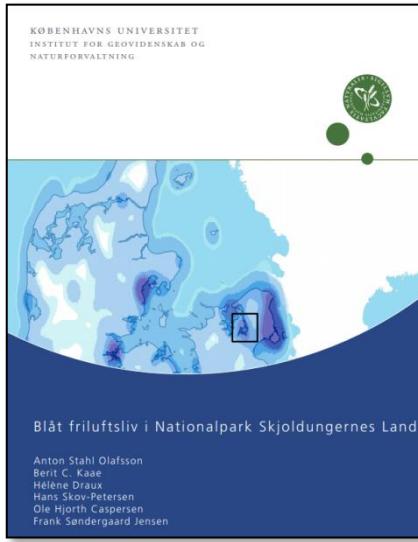


1 km grid model of recreational use based on crowdsourced data + panel data + AIS tracking data for leisure boating

Use case 2: National park planning



Use case 2: National park planning

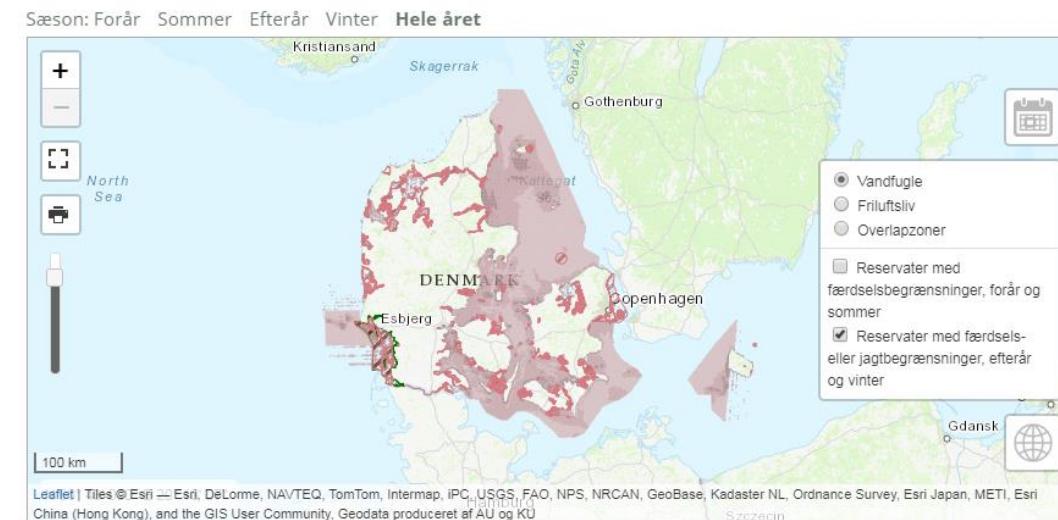


Use case 3: Ecosystem-based modelling and screening of potential recreational disturbances

- Cumulative Impact Assessment
- Screening of spatio-temporal overlaps between water-oriented recreation and waterbirds



KORTLÆGNING AF VANDFUGLE OG FRILUFTSLIV



<https://www.vandfuglefriluftsliv.dk/>

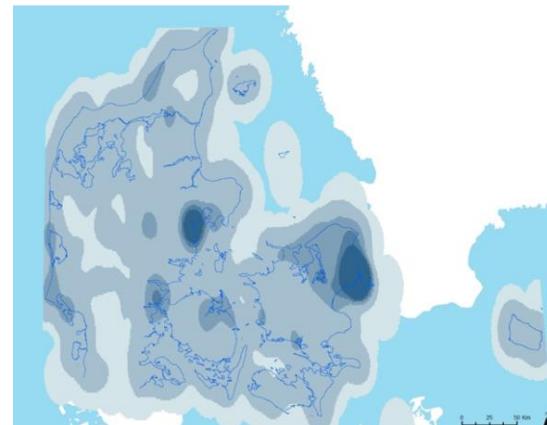
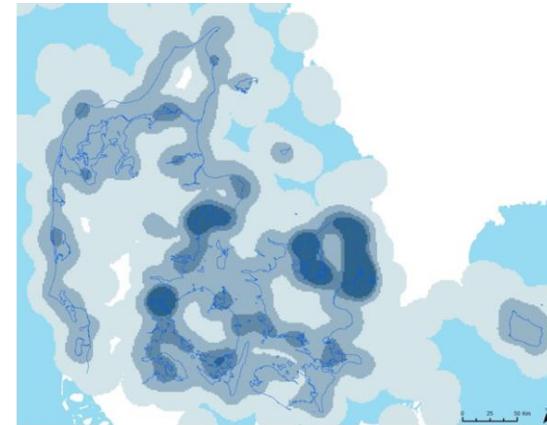
Case 2 conclusions

Mapping of blue outdoor recreation:

- Promising use of crowdsourced and representative PPGIS data
- New data and new knowledge on spatial distribution of coastal and marine recreation in DK
- A lot of interest locally and regionally as well as national and international

However, need for:

- Triangulation with proxy indicators (e.g. VGI data, facilities like parking places, jetties, boat ramps, harbours, clubs, tracking data, ect) → new ongoing projects!
- Input from international tourists is needed (a 3rd sample) .



Read more

Journal of Outdoor Recreation and Tourism

Contents lists available at [ScienceDirect](#)

Journal of Outdoor Recreation and Tourism homepage: www.elsevier.com/locate/jort

Research Article
Countrywide screening of spatiotemporal overlap between coastal and marine recreation and waterbirds in Denmark

Karsten Laursen^{a,*}, Berit C. Kaae^b, Jesper Bladt^a, Hans Skov-Petersen^a, Preben Clausen^a, Anton Stahl Olafsson^a, Hélène Draux^c, Thomas Bregnølle^c

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ARTICLE INFO

Keywords: Breeding birds, Ecological services, Marine planning, Migrating birds, Outdoor recreation, Pycnometrics

Abstract Coastal zones are important for recreational activities and waterbirds. However, recreational activities may have negative implications for birdlife, which calls for balancing of both types of use by integrated coastal and marine planning. This study screened the spatiotemporal overlap between coastal and marine recreation and waterbirds about the species' nesting protection and the outdoor recreation activities. This paper examines water-oriented outdoor recreation in Denmark in terms of activities, seasonality and geographical distribution, and presents a national screening of spatiotemporal overlap between coastal and marine recreational activities and waterbirds using a total of 10,220 locations and 6,499 geographical points. Overall, 77.6% of coastal areas participated in water-oriented outdoor recreation activities at least once within a year. The most frequent activities were to move along or stay on the coast/shore (65.9%), to bathe and swim (34.4%) and to observe nature and wildlife (20.3%). Overlap between recreational watersports and waterbirds was highest, indicating potential conflicts, ranged from 0.8% to 100% of the time spent on the water. These results reveal significant seasonal differences in both outdoor recreational activities and abundance of waterbirds during spring and summer on the water. The results also indicate that most recreational activities in areas with no low densities of waterbirds. Successful coastal and marine planning requires application of management tools that include educational and innovative initiatives that enhance the relationship between coastal and marine recreation and waterbirds. Management implications: The results support integrated planning and management of water-based recreation in conjunction with waterbirds by:

- Providing spatially explicit year-round data on recreational and waterbird use of coastal and marine areas.
- Obtaining the first ever national overview of potential areas of conflict and of possibilities for coexistence between coastal and marine recreation and waterbirds.
- Identifying specific local areas in need of management action and more detailed studies of effects and impacts of coastal and marine recreation on waterbirds.

1. Introduction

Outdoor recreation is an important cultural ecosystem service, which is the focus of increasing research interest (Rodrigues et al., 2017). Among the reasons for this is that outdoor recreation provides a wide range of important physical, social, psychological and spiritual benefits for participants, which increase human welfare and may contribute to a better and more healthy life (Kemper et al., 2013; Bell et al., 2017; Wood et al., 2017). Outdoor recreation also provides important experiences and environmental learning that may stimulate understanding of natural environments and generate public support for nature protection (Soga & Gaston, 2016; Zardie et al., 2009; Jensen & Cleemann, 2015). These elements are significant because the experiences of outdoor recreation depend on the qualities of the natural environment (Bell et al., 2017).

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<https://doi.org/10.1016/j.jort.2021.100399>
Received 23 November 2019; Received in revised form 12 November 2020; Accepted 25 May 2021
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Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s13280-023-01896-3>.

Published online: 28 August 2023
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www.kva.se/en

Springer

Ambio
<https://doi.org/10.1007/s13280-023-01896-3>

PERSPECTIVE

Are European Blue Economy ambitions in conflict with European environmental visions?

Jesper H. Andersen^a, Ziyad Al-Hamdan, Jacob Carstensen, Karen Edvång, Josefine Egekvist, Berit C. Kaae, Kathrine J. Hammer, Eva Therese Harvey, Jørgen O. Leth, Will McClintock, Clíaraín Murray, Anton S. Olafsson, Jeppe Olsen, Signe Sveegaard, Jakob Tougaard

Received: 1 March 2023 / Revised: 15 May 2023 / Accepted: 7 June 2023

Keywords Cumulative pressures - Ecosystem-based management - Good Environmental Status - Marine Strategy Framework Directive - Maritime Spatial Planning - Maritime Spatial Planning Directive

INTRODUCTION

Maritime Spatial Planning (MSP) is the European counterpart to Marine Spatial Planning—and is a process established by the European Union's (EU) Integrated Maritime Policy (Anon 2007), with its own legislation, i.e. the EU Maritime Spatial Planning Directive (MSPD), adopted 23 July 2014 (Anon 2014). MSP aims to reduce potential conflicts between sectors and activities competing for marine space. At the same time, MSP aims to protect the marine environment. Further, MSP intends to encourage investment by creating a level playing field between sectors and interests. MSP is defined by the UN Intergovernmental Oceanographic Commission (2021) as follows:

- MSP is a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that have usually been specified through a political process. Characteristics of marine spatial planning include ecosystem-based, area-based, integrated, adaptive, strategic and participatory.
- MSP is not an end in itself, but a practical way to create and establish a more rational use of marine space and to manage the interactions between its uses, to balance demands for development with the need to protect the environment, and to deliver social and economic outcomes in an open and planned way.

Case: 3 Cemeteries as recreational landscapes

- Why this study?
- Background and motivations



Similar spaces, different usage : A comparative study on how residents in the capitals of Finland and Denmark use cemeteries as recreational landscapes

Helena Nordh ^{a,*}, Anton Stahl Olafsson ^b, Anna Kajosaari ^c, Søren Præstholm ^b, Yu Liu ^b,
Saana Rossi ^c, Sandra Gentin ^b

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^c Department of Built Environment, Aalto University, Espoo, Finland

ARTICLE INFO

Handling Editor: Wendy Chen

Keywords:
Green space popularity
Nature experience
Physical activity
Social interactions
Spirituality
Supply and demand

ABSTRACT

Several studies from the Nordic countries show that cemeteries not only fulfil an important societal function as places for the disposal of bodily remains; they are also recreational landscapes that people visit to reflect, experience nature or perhaps go for a walk with the dog. In this comparative study, based on PPGIS data collected between 2018 and 2020 from residents in Copenhagen (Denmark) and Helsinki (Finland), we explored the extent to which residents use urban cemeteries as everyday recreational landscapes. We also assessed users' characteristics and the values they attached to the cemeteries. The results show that several of Copenhagen's cemeteries were actively used for recreation, while those in Helsinki were used much less frequently for this purpose. Of the total 7276 mapped visiting points in Copenhagen, 16.5% were located within cemeteries, compared with 1.9% of the 4290 mapped visiting points in Helsinki, hence conclusions from Helsinki should be drawn with caution. Physical activity and experiencing nature were the most common values attached to cemeteries in Copenhagen, whereas social interaction, spirituality and tranquillity were most common for Helsinki cemeteries. The results also revealed that younger Danes were particularly inclined to use cemeteries for social interactions, physical activity and spirituality and tranquillity. In the discussion, we elaborate on spatial differences between the cases, such as the availability of other green spaces, the size of cemeteries or people living in proximity to a cemetery, as well as on differences in policies and practices, including how Copenhagen stands out in actively promoting municipal cemeteries as recreational landscapes.

1. Introduction

In the last decade, the recreational use of cemeteries is an issue that has attracted increasing interest with respect to research, policy and practice in the Nordic countries (see for example Grabolov and Nordh, 2020). On a local level, there are examples of cemeteries that aim to attract neighbouring residents through different measures, including integrating park features such as a sensory garden, bike routes and lawns for sunbathing between graves of historical significance, as in Assistens cemetery in Copenhagen (Copenhagen Municipality, 2019a, 2019b), or the air movie event at Malmin cemetery in Helsinki (Helsinki Parish Union, 2019). However, the recreational use of cemeteries can be problematic as it may violate the peaceful atmosphere found in these unique green spaces. Every now and then, posts appear in social media

or newspapers from people upset about what they consider inappropriate behaviour at cemeteries. For example, in Copenhagen, during April or early May, hundreds of thousands of visitors come to Bispebjerg cemetery to experience and take photos of the alley of Japanese cherry blossom trees (Bachmann, 2018), something that causes tensions with mourners, many of whom desire a peaceful experience when visiting a grave. Likewise, in Helsinki, problems are caused by the high number of tourists that wish to visit the graves of particular celebrities (Östman, 2014). Similar examples can also be found in other Scandinavian countries, such as children sledding on the snow in the famous Skogskyrkogården, The Woodland Cemetery, in Stockholm Sweden (Scheutz, 2021), or youths sunbathing or playing badminton at a Norwegian cemetery (NTB, 2008). Whether the recreational uses of cemeteries are perceived as inappropriate and provocative depends on the type of

PPGIS mapping of people's outdoor spaces in Copenhagen during Covid19

- Lock-down situation
- Permission to use 5/10 local districts own online "residents panels"
- Email invitation send to residents panels (total N= 19700 out of 261700 residents)
- Collected from May to August 2020



The PPGIS survey

- Map: visited places (where you spend time outdoors)
- + associated experiential values

2/5 Hvor har du tilbragt tid udendørs?

Kortlæg så mange steder og ruter som muligt på kortet.

Klik på det grå felt og markøren vil hoppe til kortet.

Du kan flytte kortet eller markøren med din finger eller ved at trykke og holde den venstre knap på musen nede.

Du kan ændre baggrundskortet i højre hjørne af skærmen.

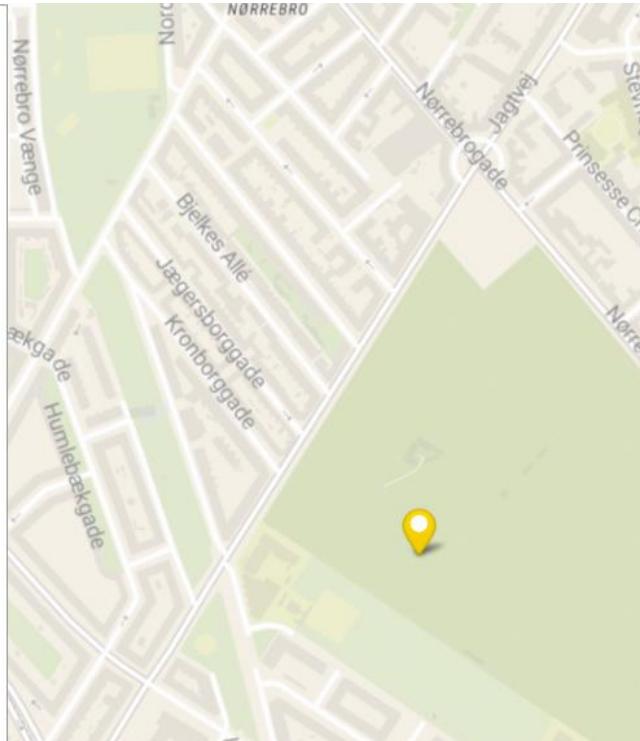
For at markere steder eller ruter så nøjagtigt som muligt skal du zoome ind på kortet ved hjælp af - tegnet til højre på skærmen med fingrene eller rulle med musehjulet.

Her bruger jeg tid udendørs

Kortlæg alle de steder hvor du normalt bruger tid udendørs samt steder som du særligt har brugt under coronavirus

Udendørs ruter

Du kan også tegne dine ruter, hvis det er svært at kortlægge et præcist sted. Ruten afsluttes med et dobbeltklik.



Here I spend time outdoors X

Here I spend time outdoors (MUST BE ANSWERED)

- In connection with coronavirus
- Usually in my everyday life
- Both under coronavirus and usually in my everyday life

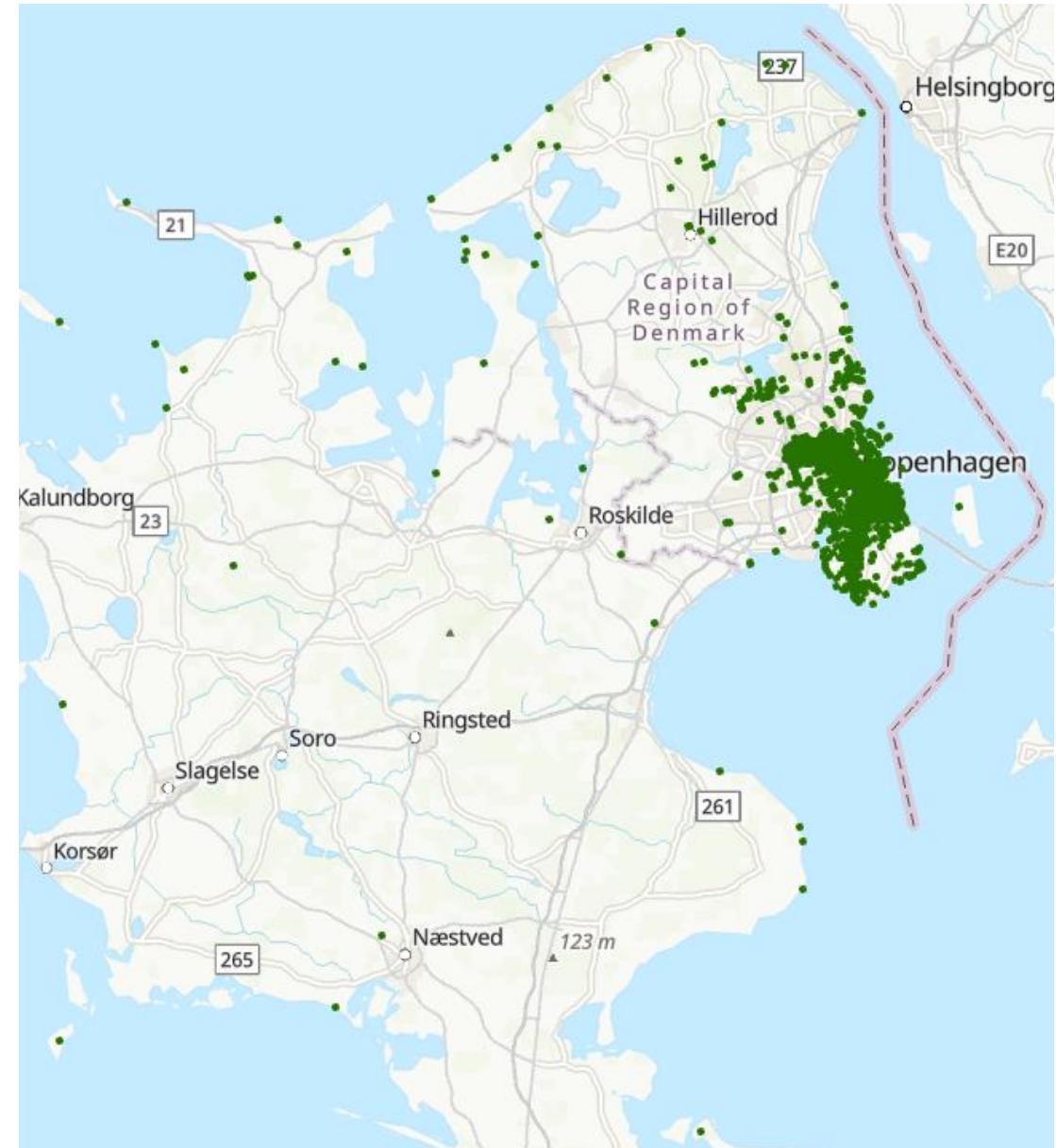
At this point, the following is important to me (you can choose several answer options):

- Eat brought food (food basket)
- Observe nature (eg plants or birds)
- Spending time with my family and other people
- Air dog (or other pet)
- Exercise / sports
- Shortcut (eg on the way to shopping, work, etc.)
- Proximity to water
- Play with children
- Lovely smells
- Culture and historical significance
- Be outdoors
- Enjoy the sounds and silence of nature
- Religious or spiritual experience
- Walk (walk)
- Opportunity to relax and 'recharge'
- Biodiversity (biological diversity)
- Emotions, ideas and experiences born of the place (eg inspiration or surprise)
- Beautiful place or view
- Proximity to nature and nature itself
- Other things

If otherwise, please elaborate:

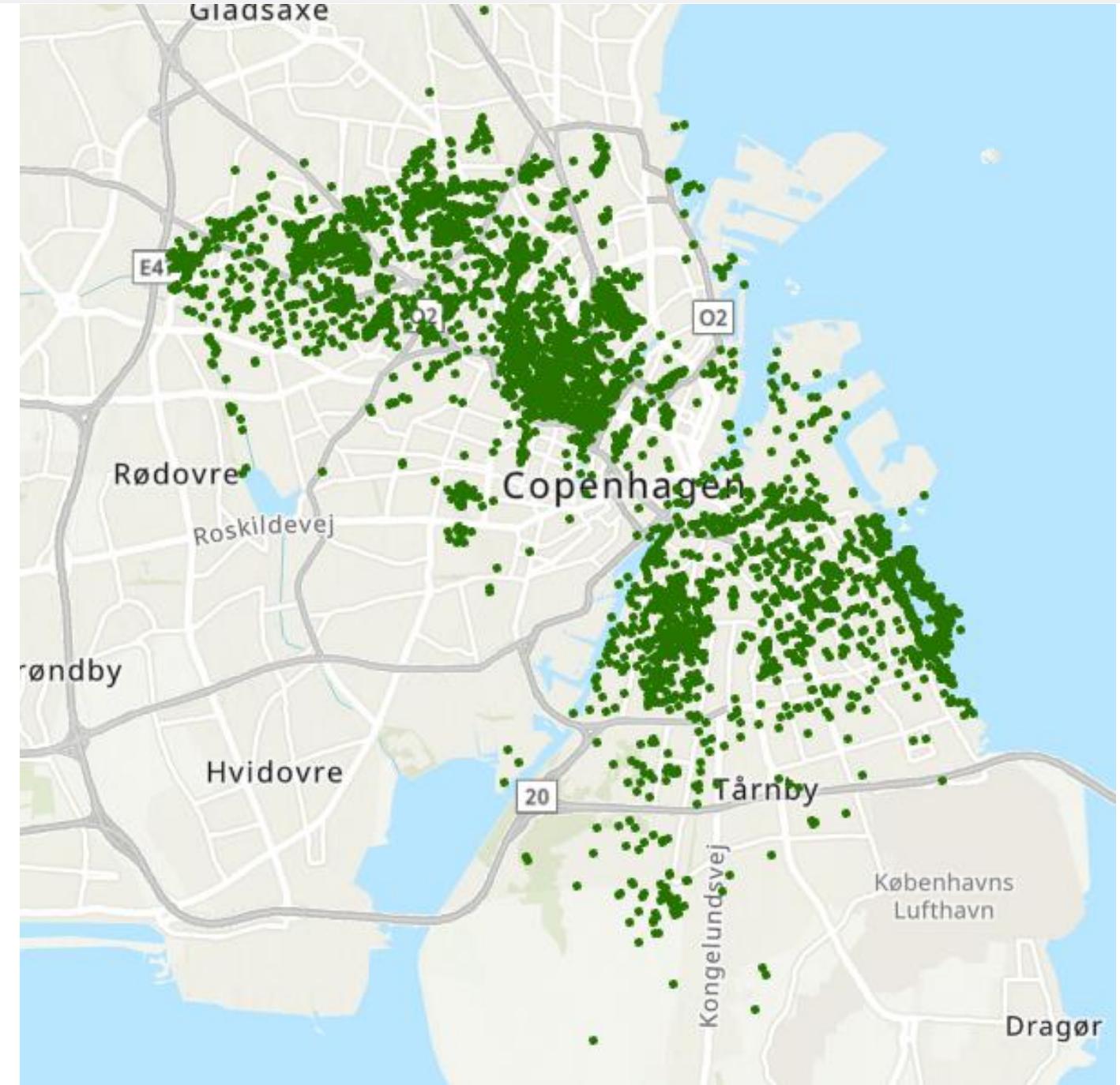
Result

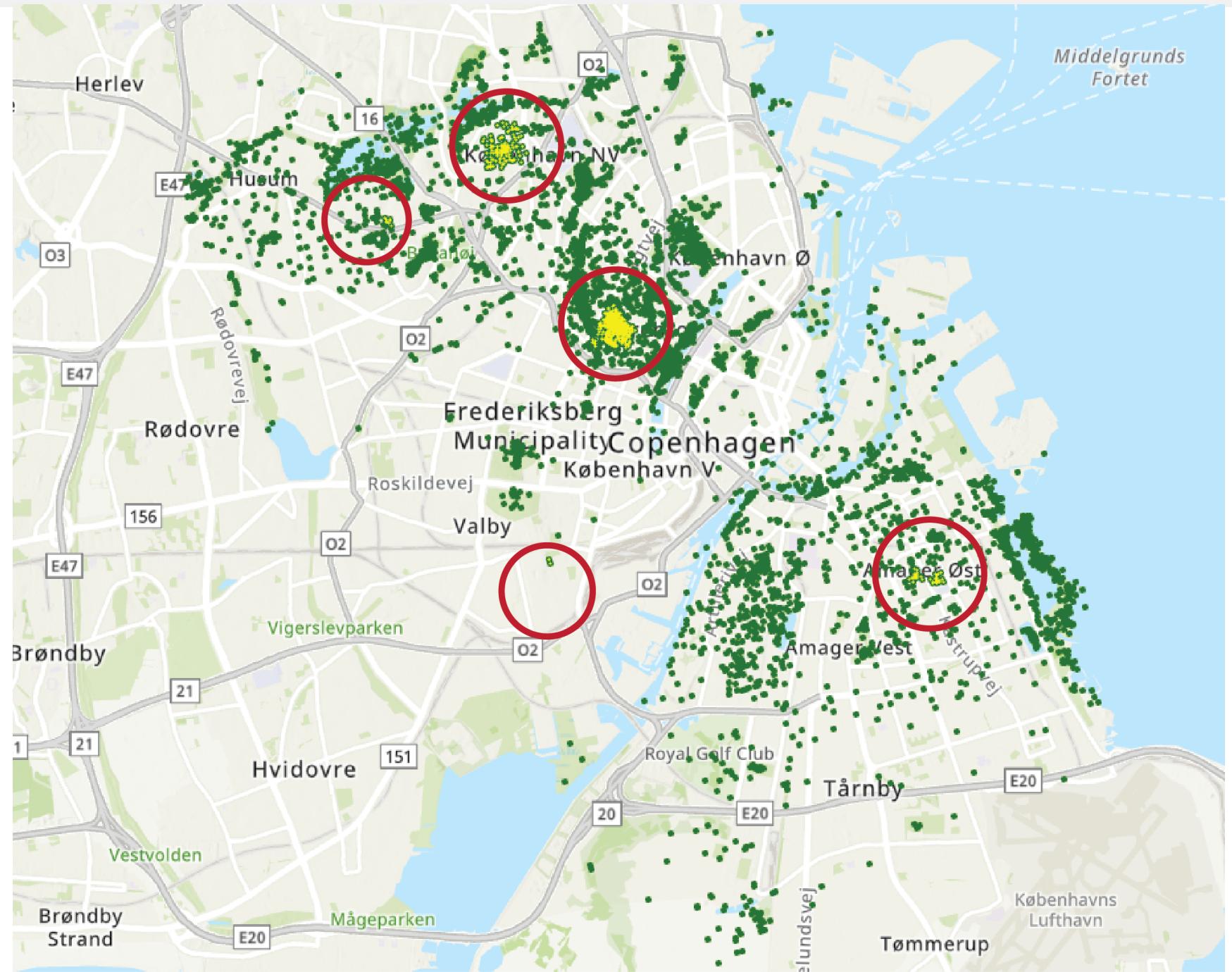
- 4947 respondents
- 8819 visited places with 39235 experiential values
- 1640 points with suggested improvement



Study area

- Calculate home-places distance
- Exclude the outliers (distance $> 3236.74\text{m}$)
- 7276 points selected





Action points!

- Contact to Helena Nordh, NMBU/SLU (leading recreational cemetery researcher in the Nordic)
- Helena part of another Nordforsk funded urban project (NORDGREEN) where PPGIS was collected from Helsinki (by Marketta Kyttä's group, Aalto Univ)

Research gaps (according to Helena):

- *We know something about recreational use of cemeteries in DK, Norway and Sweden, but limited about Finland.*
- *Most studies have been qualitative, limited knowledge on the quantitative importance of cemeteries as recreational places*

→ Let's do a comparative study between the two cities! ☺

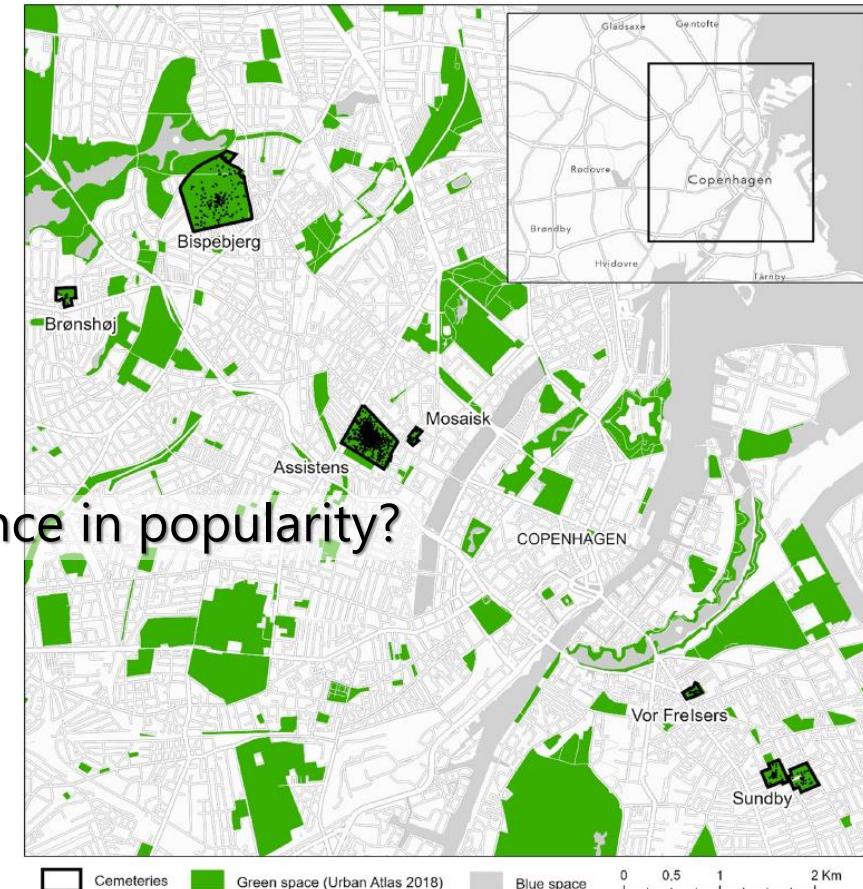


Comparative findings

4298 visiting places mapped → 1.9% in cemeteries



7276 visiting places mapped → 16.5% in cemeteries



Comparative findings

Why this difference in popularity?

- Size of cemeteries?
- Supply of additional greenspace opportunities?
- Difference in population density (local demand)?

City	Study site	Respondents with visiting points within cemetery		Area size Ha
		Respondents	Visiting points	
Copenhagen				
(rho = .886, p = .019*)	Assistens	860	899	20.4
	Bispebjerg	182	188	42.7
	Sundby	67	77	10.5
	Vor Frelsers	17	17	1.6
	Brønshøj	12	12	3.0
	Mosaisk	8	8	1.3
Helsinki				
(Not in Helsinki)	Hietaniemi	39	50	31.3
	Vanha kirkkopuisto	19	22	2.0
	Malmi	8	10	50.2

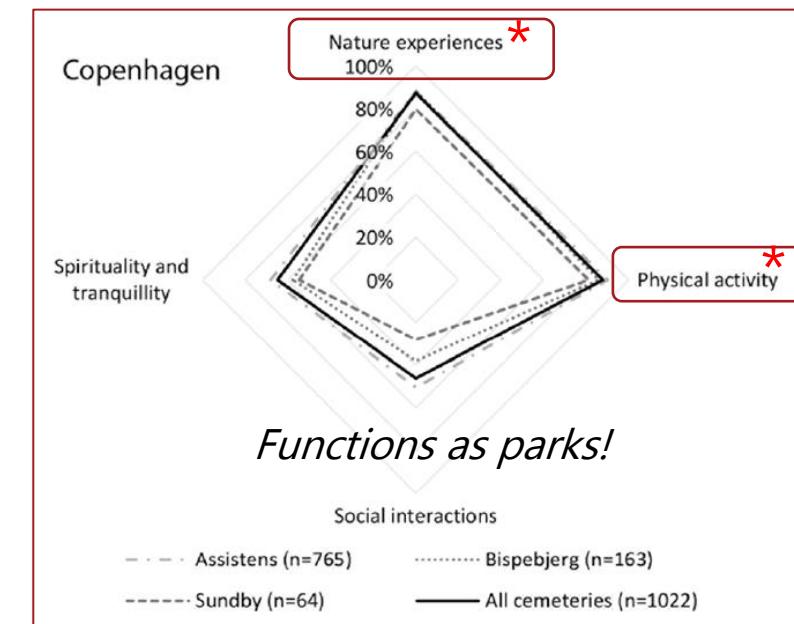
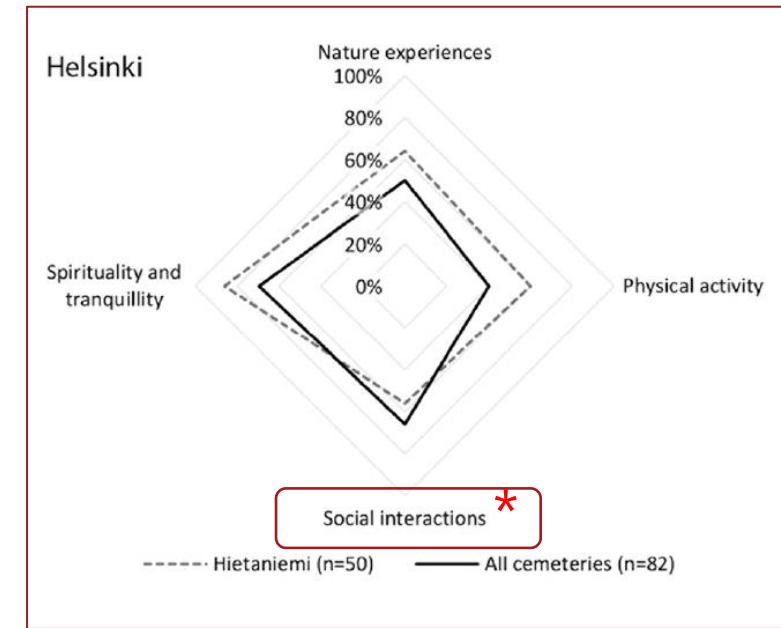
Comparative findings

- Associated experience qualities (place values)

Table 2

An overview of how original place values were grouped into for main groups.

Place values (main group). Places for:	Place values in Helsinki	Place values in Copenhagen
Social interactions	Enjoy urban life Spend time with family or friends Meet good people	Being with Family Friends Picnic Play with Children
Nature experiences	Enjoy nature	Biodiversity Close to nature Aesthetic view Nature sounds Observe nature Nice smells Closeness to Water
Physical activity	Leisure-time physical activity	Walk/stroll Exercise/Sport Dog Walking Relax recharge
Spirituality and tranquility	Escape stress Relax	Feelings/Inspiration/ Surprise Spiritual



What else might explain the difference?

- Culture?
- Design and programming?
- Public advertising and communication about recreational use of cemeteries (?)
- Accessibility barriers (walls, highways)?

Table 1
An overview of the selected cemeteries in the two case cities.

Name	Management	Active burial ground (yes/no)	Opening hours (winter / summer)	Size (ha)	Walled (yes/no)
Copenhagen					
Brønshøj	Municipality	Yes	07:00–22:00 (07:00–19:00 in winter)	3.0	Yes
Bispebjerg	Municipality	Yes	07:00–22:00 (07:00–19:00 in winter)	42.9	Yes
Assistens	Municipality	Partly (only ¼ of the cemetery)	07:00–22:00 (07:00–19:00 in winter)	20.4	Yes
Nørre Mosaisk	The Jewish Community in Denmark	No	08:00–20:00 (07:00–19:00 in winter)	1.3	Yes
Vor Frelsers	Church of Denmark	Yes	07:00–20:00 (08:00–16:00 during winter)	1.6	Yes
Sundby	Municipality	Partly (old part is being converted to park)	07:00–22:00 (07:00–19:00 in winter)	10.6	Yes
Helsinki					
Hietaniemi	Evangelical Lutheran Church of Helsinki	Yes	07:00–22:00	31.3	Yes
Malmi	Evangelical Lutheran Church of Helsinki	Yes	07:00–22:00	50.2	Yes
Vanha kirkkopuisto	Municipality	No	n/a	2.0	No

Conclusions

Big difference in the use and function of cemeteries as recreational landscapes between Helsinki and Copenhagen.

- Cemeteries in Copenhagen are a lot more popular than in Helsinki.
- The difference might relate to different spatial context (more alternative greenspace possibilities in Helsinki, higher population density in Copenhagen)
- Spiritual and tranquility at cemeteries important in both cities (traditional cemetery use)
- But, the cemeteries in Copenhagen functions a lot more like traditional parks with focus on nature experience and physical activity, while cemeteries in Helsinki is more important for social interaction.



Fig. 6. Routes in Malmi cemetery (photo: Saana Rossi).



Fig. 2. People relaxing on a lawn in Sundby cemetery (photo: Anton S. Olafsson).



Fig. 7. The new section of Hietaniemi cemetery (photo: Saana Rossi).



Fig. 3. Walking at Brynæsø cemetery (photo: Søren Praestholm).



Fig. 8. Gravestones, memorials and vegetation in Vanha kirkkopuisto park (photo: Saana Rossi).



Fig. 4. Opening up Bispebjerg cemetery to locals is in accordance with current strategy. Here the wall has been made permeable, a new entrance created, and a small pocket park atmosphere designed in order to draw people into the cemetery (photo: Søren Praestholm).

Perspectives

- Cremation in Copenhagen is high: >90% (85% in DK, 57% in Fin)
→ surplus of grave space!
- Copenhagen municipal strategies focus on converting cemeteries into 'cemetery parks' → inviting in new visitor groups (diversity) + open up the walls + climate adaptation functions (NBS) + biodiversity and more
- Zoning of cemeteries, but also challenges (conflicts between user groups)
- *What is the future in Helsinki?*



4. Conclusions – take home messages

- 'www' more and more integrated into desktop GIS…GIS more and more integrated into the 'www'.
- You can access a lot (!) of geodata through various WMS and WFS services
- Geocoded data are becoming 'big data' available for research, planning and management
- New opportunities are arising by crowd-sourced geodata (eg PPGIS surveys, social media VGI as the Flickr example) → reflecting system 1 and system 2 ways of collection geodata

4. Conclusions – perspectives and reflections

- Tech critique, eg analysis of power (surveillance capitalism)
- Privacy issues, GDPR → increasing need for anonymising spatial data (e.g. by aggregation)
- Web-services integrated part of open data, data sharing movement

