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in Health Promotion and Disease Prevention

Neighborhood Activity Hotspots for Multi-Ethnic Youth in Copenhagen, Denmark

Using GPS, Accelerometry and GIS: The WCMC study

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When Cities Move Children (WCMC)

Project aim

- How does urban renewal influence children‘s physical activity level and movement patterns?

Case

- Urban renewal of the Haraldsgade district in Copenhagen, DK, with e.g. new green areas and playgrounds for children

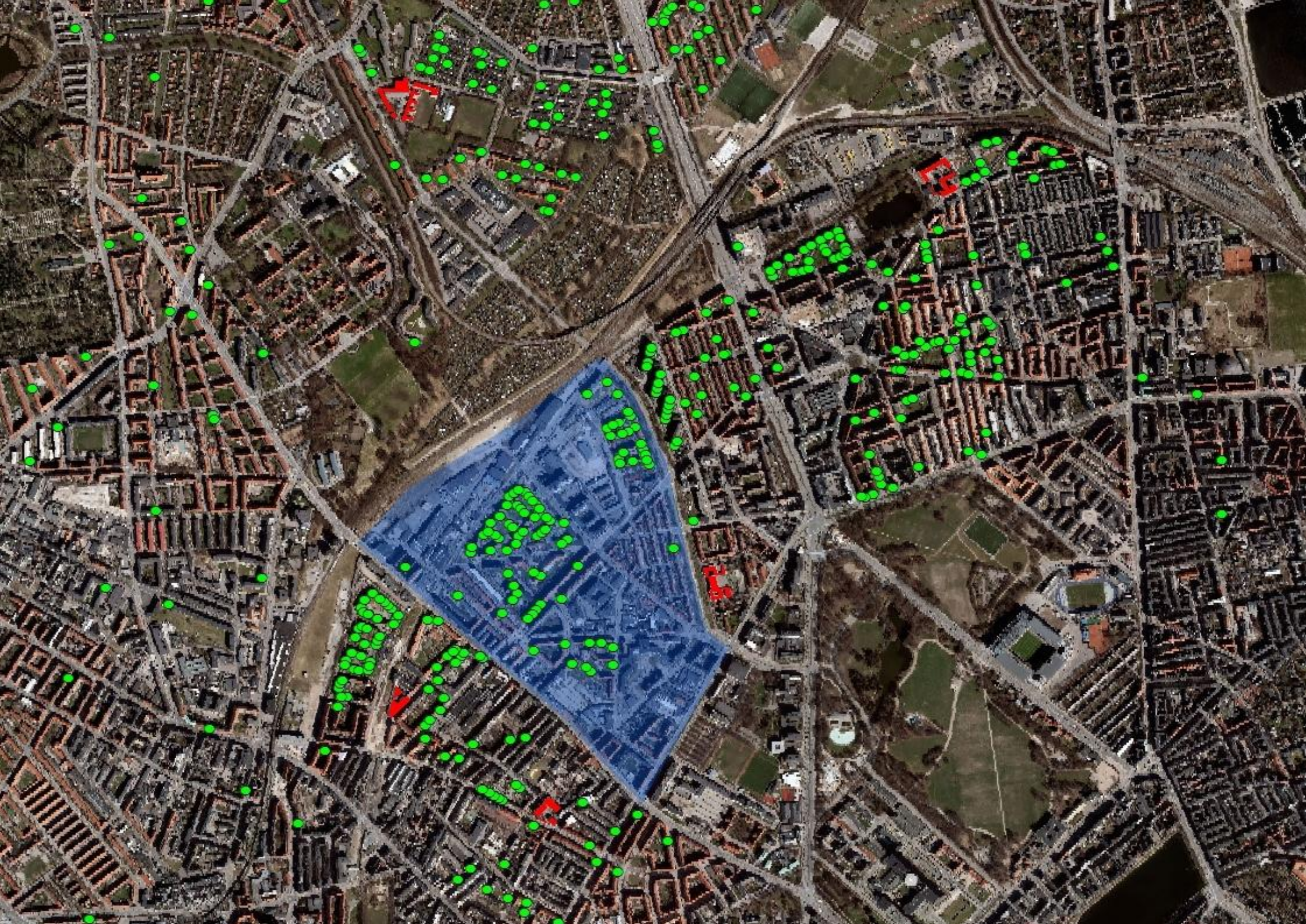
Design

- Natural experiment, before/after, baseline completed October 2011
- 623 participants from 4 public schools, 30 classes,10-16yrs old

Measurements

- Location, GPS (Qstarz Q1000X), 7 days, 15 sec epoch
- Activity, accelerometer (Actigraph GT3X), 7 days, 2 sec epoch
- Accelerometer and GPS were combined using PALMS* and exported to ArcGIS
- Questionnaire, electronic, during school hours
  - Sport participation & mode of transport to school
  - Presence of neighborhood characteristics
  - Social network & well-being
- Parental socio economic status and ethnicity, Statistics Denmark
- Weather data, Danish Metrological Institute
- Diaries and school time tables

* Physical Activity Location Measurement System, developed by UCSD, http://ucsd-palms-project.wikispaces.com



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Objectives current study

- Compile and explore baseline data
- Select and aggregate data
- Identify activity hotspots
  - Method development

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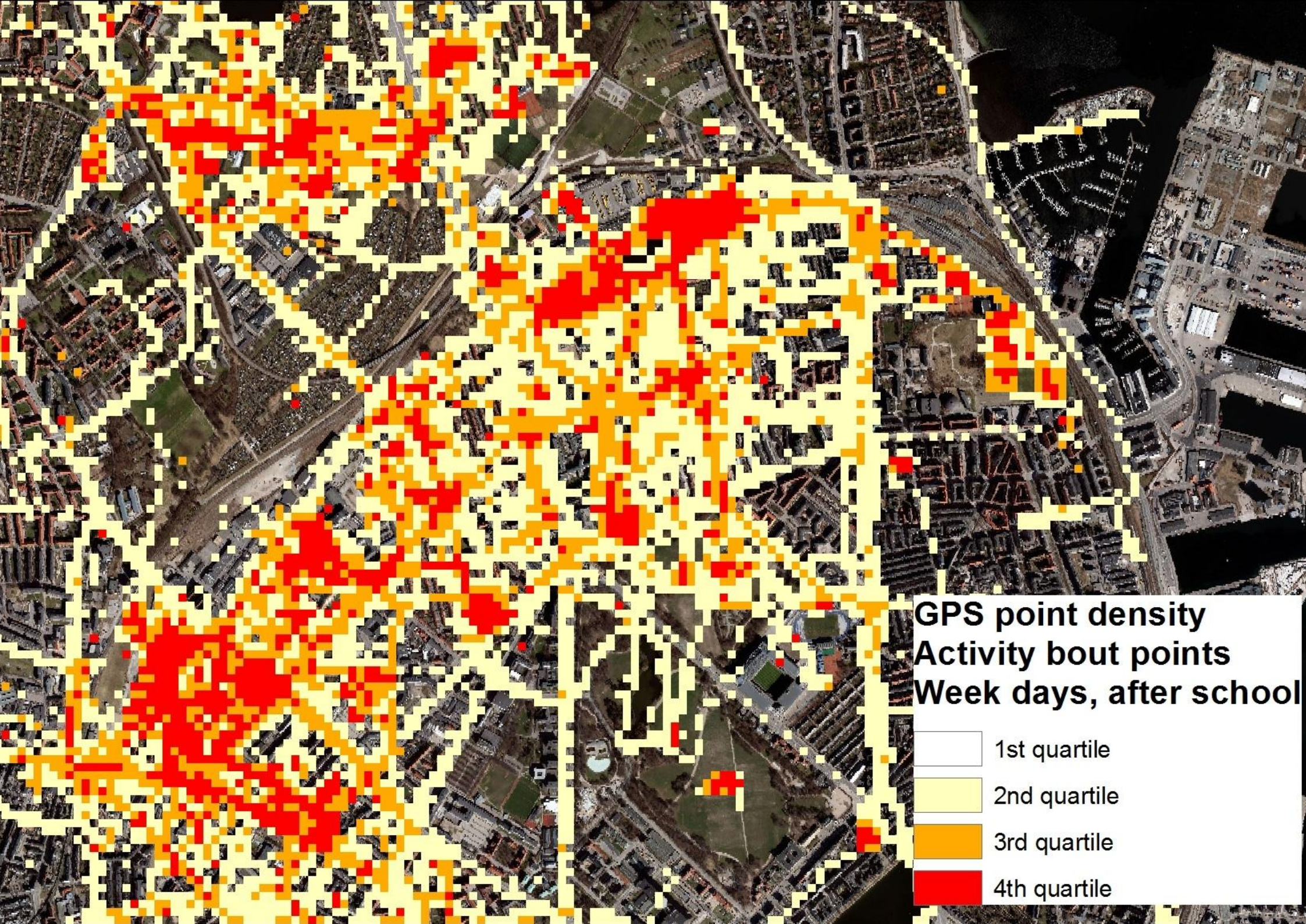
Baseline data: aggregation & selection

- 516 participants returned data (84%) ≈ 25,000,000 GPS points (9 GB raw data)
- 291 participants (47%) with valid accelerometer data
  - ≥ 3+1 valid days (≥ 8hrs data, 60min non-wear, 2 activity epochs allowed, 30sec epochs)
- Identification of activity bouts per person
  - Continuous period of at least 5 minutes of MVPA (Freedson age-adjusted cutoff points, MVPA ≥ 3 METS), but can include up to 2 minutes below threshold
- Use of ArcGIS and STATA to select:
  - Weekdays – weekend, morning – school – after school, boys – girls, grade level
- Calculate GPS point density (25*25 meter cells, 625m^2 / 6727.4 ft^2) in ArcGIS (in quartiles)


GPS point density
Activity bout points
Week days, after school
1st quartile
2nd quartile
3rd quartile
4th quartile

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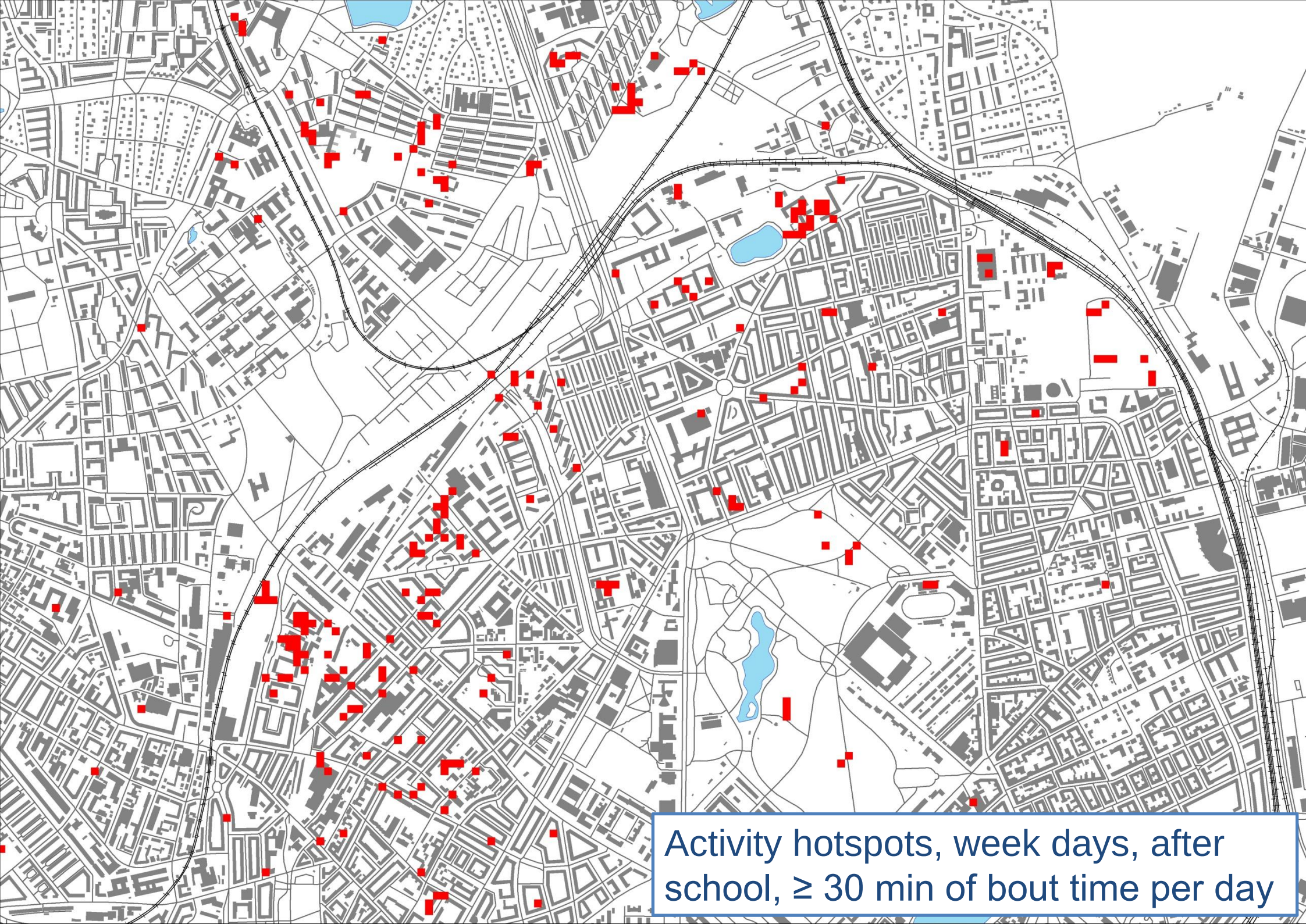
Identification of activity hotspots

1. Select after school time, and weekend days

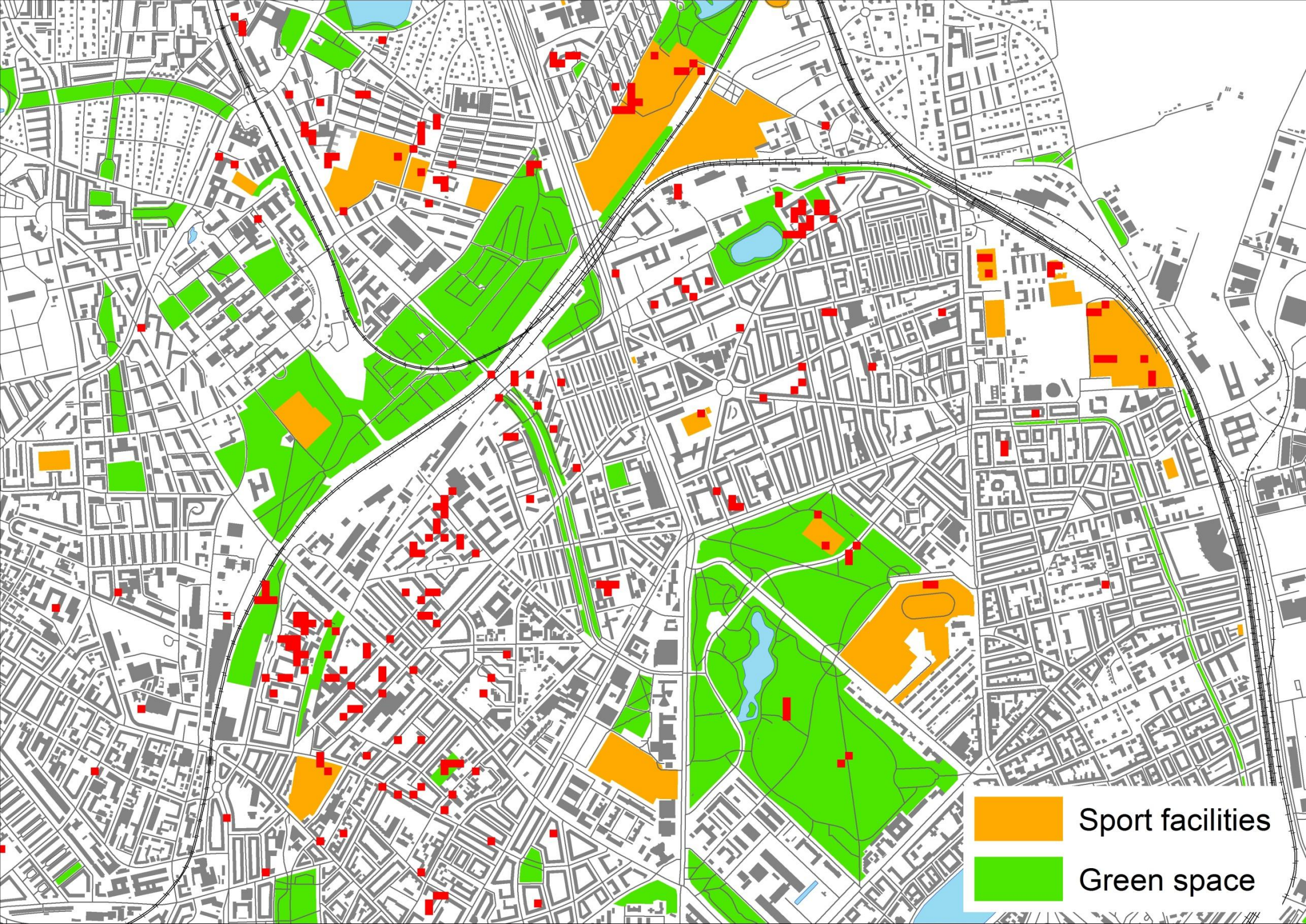
2. Per day, calculate number of GPS points per grid cell
   (25*25 meter cells, 625m^2 / 6727.4 ft^2)

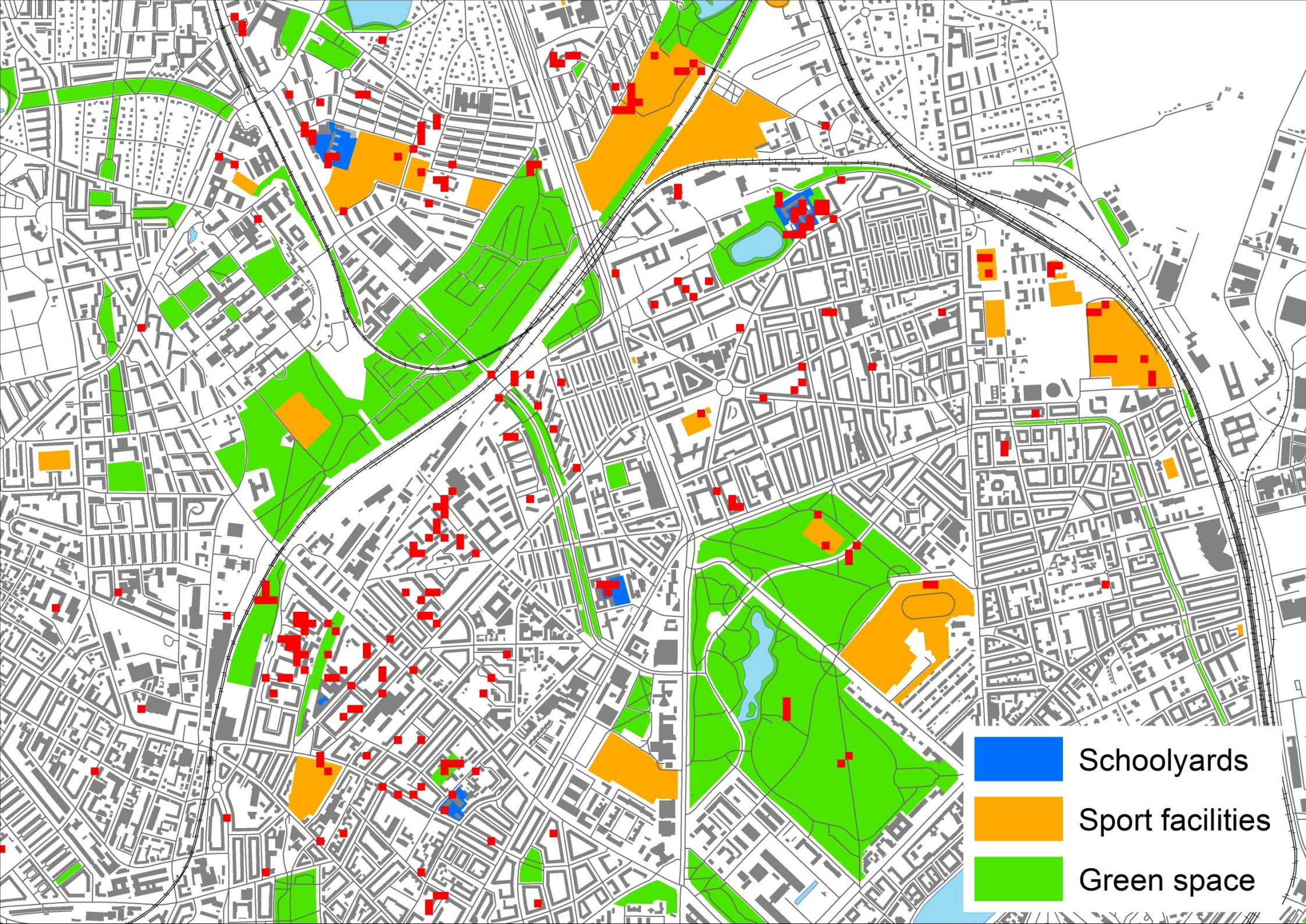
3. Activity hotspot: at least 30 minutes (=120 GPS points) of activity bout time per cell, on one day
   - Activity bout time can be generated by one or more participants

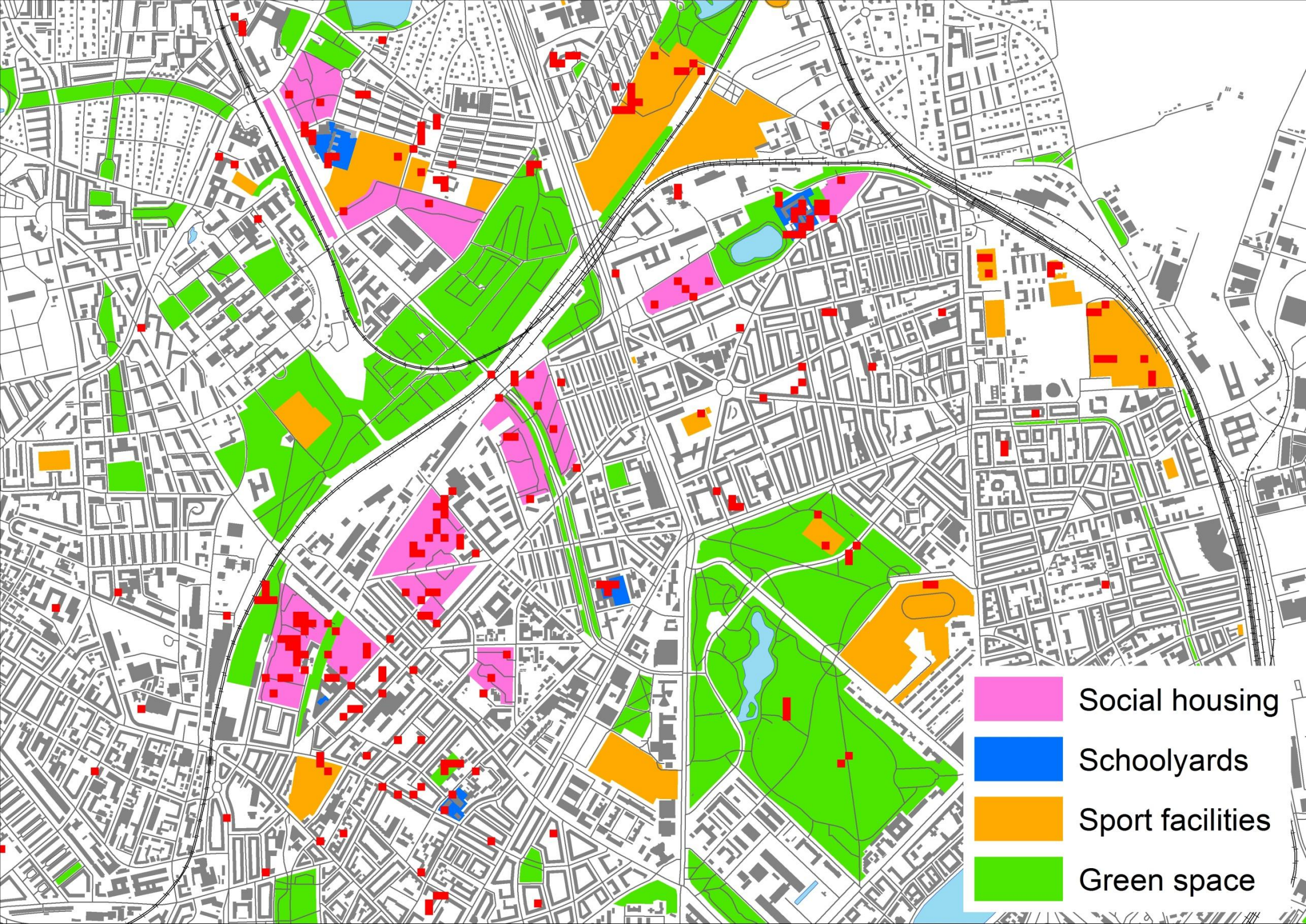

Activity hotspots, week days, after school, ≥ 30 min of bout time per day

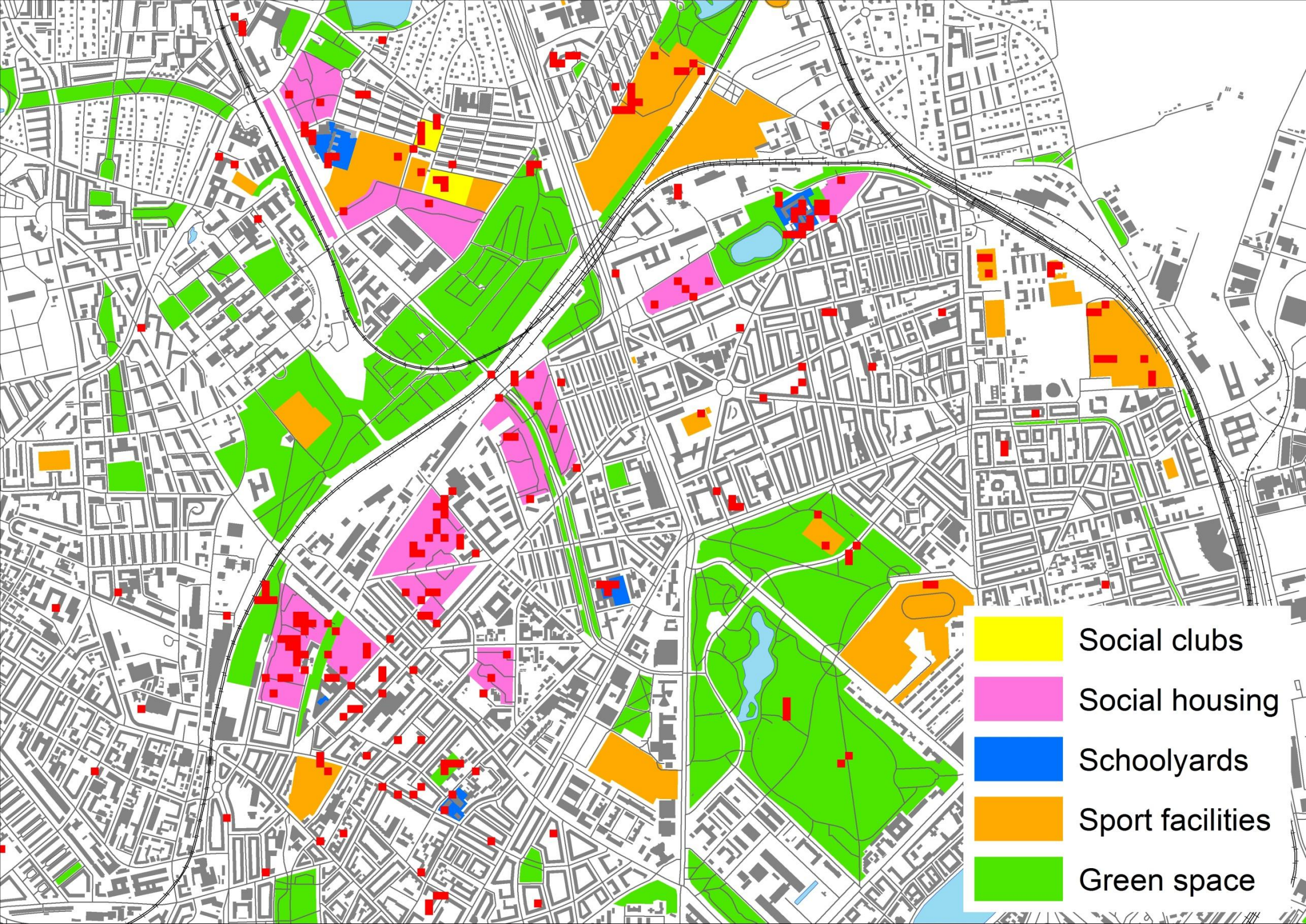

Activity hotspots, week days, after school, ≥ 30 min of bout time per day

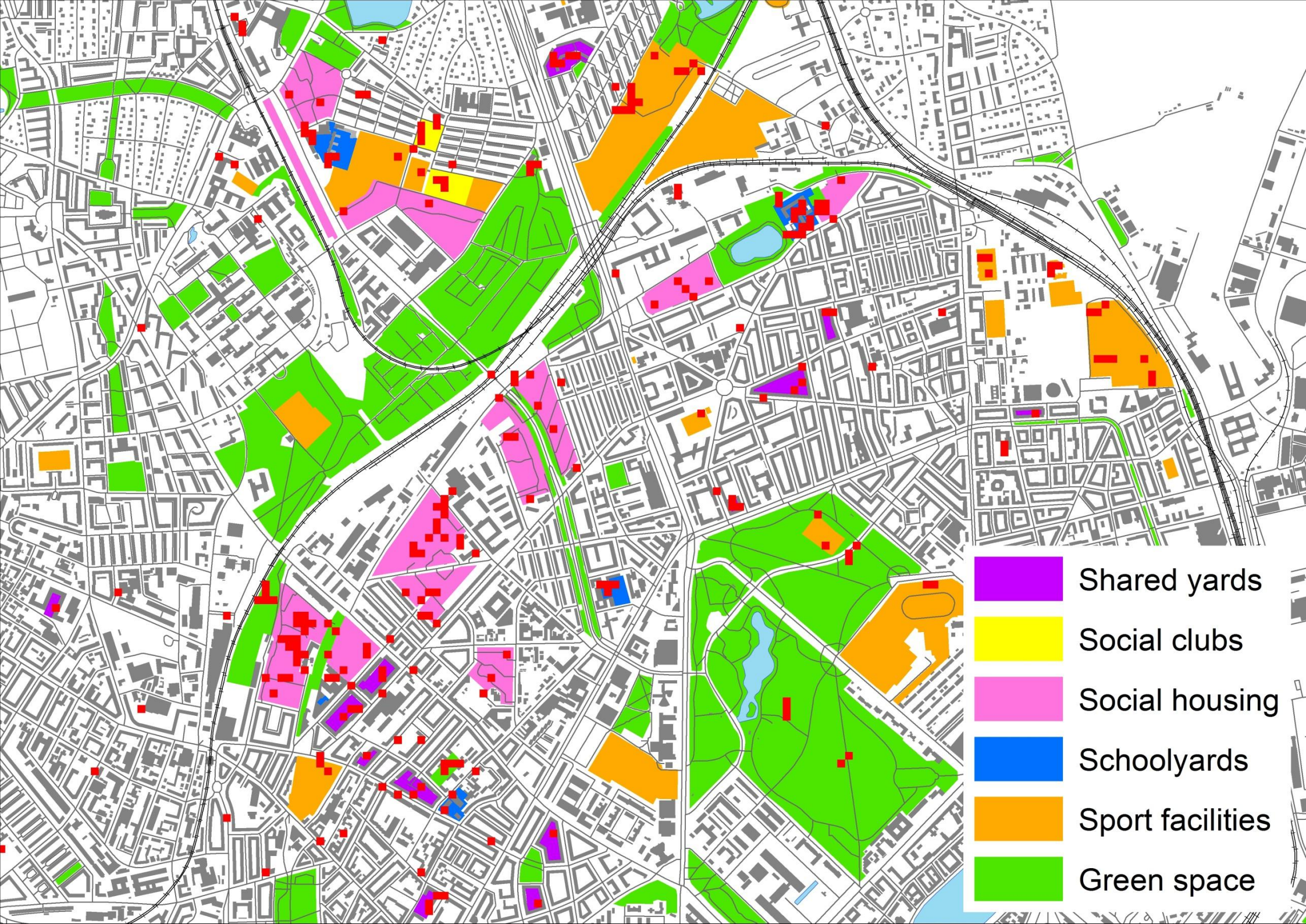

Green space


Sport facilities
Green space


Schoolyards
Sport facilities
Green space


Social housing
Schoolyards
Sport facilities
Green space


Social clubs
Social housing
Schoolyards
Sport facilities
Green space


Shared yards
Social clubs
Social housing
Schoolyards
Sport facilities
Green space

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Activity hotspots, week days, after school

Land use	count	percent
Social housing	67	25%
Sports facilities	43	16%
Green space	29	11%
Shared backyard	27	10%
Schoolyards	20	7%
Social club	8	3%
Currently uncategorized	*74*	*28%*
Total	268	100%


Activity hotspots, weekend days, ≥ 30 min of bout time per day

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Activity hotspots, weekend days

Land use	count	percent
Social housing	53	36%
Green space	15	10%
Sports facilities	13	9%
Shared backyard	12	8%
Schoolyards	4	3%
Social club	3	2%
Currently uncategorized	*46*	*32%*
Total	146	100%


Boys
Girls
Boys and girls

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Activity hotspots, week days, after school boys versus girls

	Boys		Girls	
Land use	count	percent	count	percent
Social housing	23	25%	22	24%
Sports facilities	15	16%	10	11%
Shared backyard	7	8%	15	17%
Green space	9	10%	7	8%
Schoolyards	7	8%	4	4%
Social club	4	4%	2	2%
Currently uncategorized	*26*	*29%*	*30*	*33%*
Total	91	100%	90	100%

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Conclusion

- For our study area, and study population, most activity hotspots are located in outdoor spaces in social housing areas
- Also schoolyards, sports facilities and shared backyards provide locations for many hotspots
- 6 land uses can ‘explain’ 67-72% of the hotspot locations. The remaining hotspot locations need to be further examined
- Differences between week days and weekend days: fewer hotspots on weekend, less at schoolyards
- Differences between boys and girls

Discussion & future steps

- Definition of hotspots can be discussed
  - Threshold of 30 minutes (120 GPS-points) per cell, per day
  - Activity bout threshold of 5 minutes
  - multiple persons versus one person

- Future steps: individual activity hotspots
  - Identify hotspots per person
  - Identify locations with hotspots for multiple persons

Thank you!

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