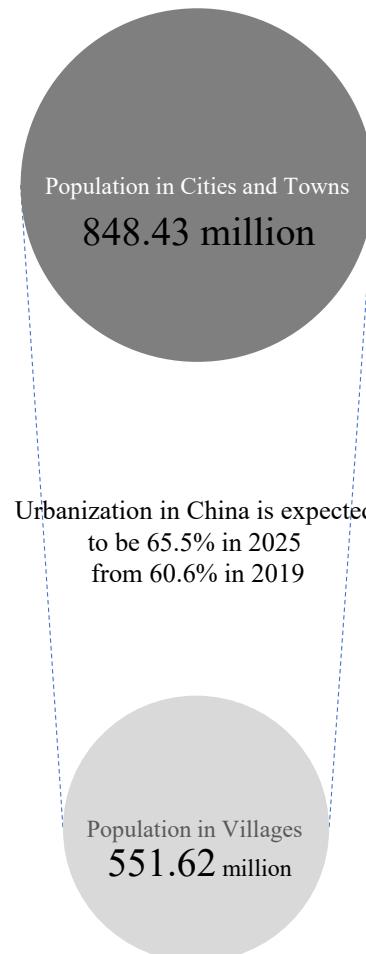


# **Re-perceive the Urban Environment**

---

YUANZHAO WANG

Understanding cities in China from public sentiment of social media and the built environment



**663 Cities**  
**41636 Towns and Villages**

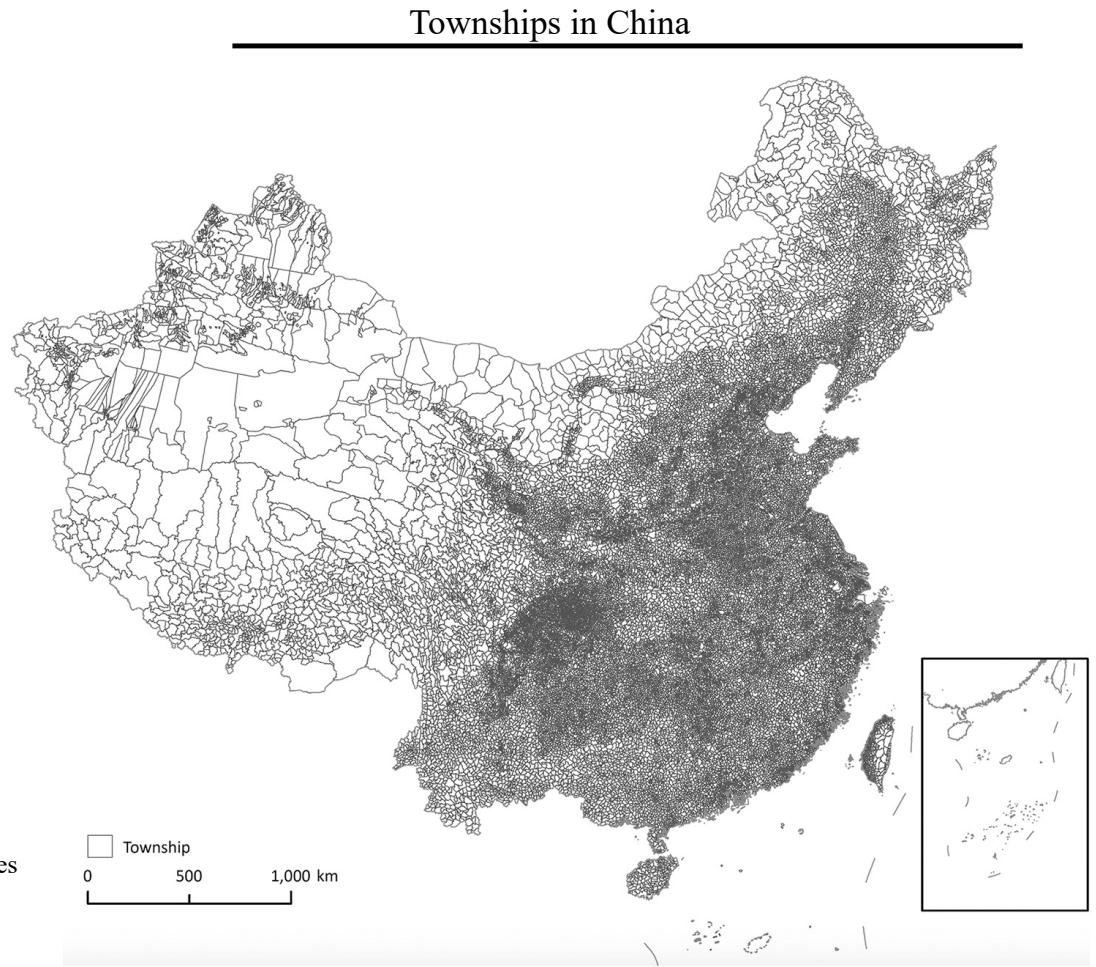


Figure from Ma, S. and Long, Y., 2020. Functional urban area delineations of cities on the Chinese mainland using massive Didi ride-hailing records. *Cities*, 97, p.102532.

# Context of Small Towns with Local Characteristic (特色小镇) Policy and New Urbanization (citzation and townization) in China

## Major urban issues and shifts in China

### 1. People-Oriented

Integrating **PODUCTION**, **LIFE**, and **ECOLOGY**, design a healthy, sustainable and people-centered city

### 2. Urban environment

Deterioration of resources and the environment; heavy traffic; urban heats...

### 3. Awareness of Ecology/Intensified Natural Disaster

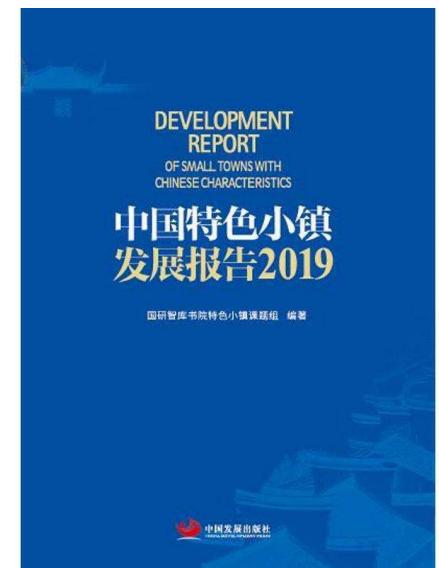
Intense precipitation, more frequent and powerful hurricane ...

### 4. Declining of Traditional Industries

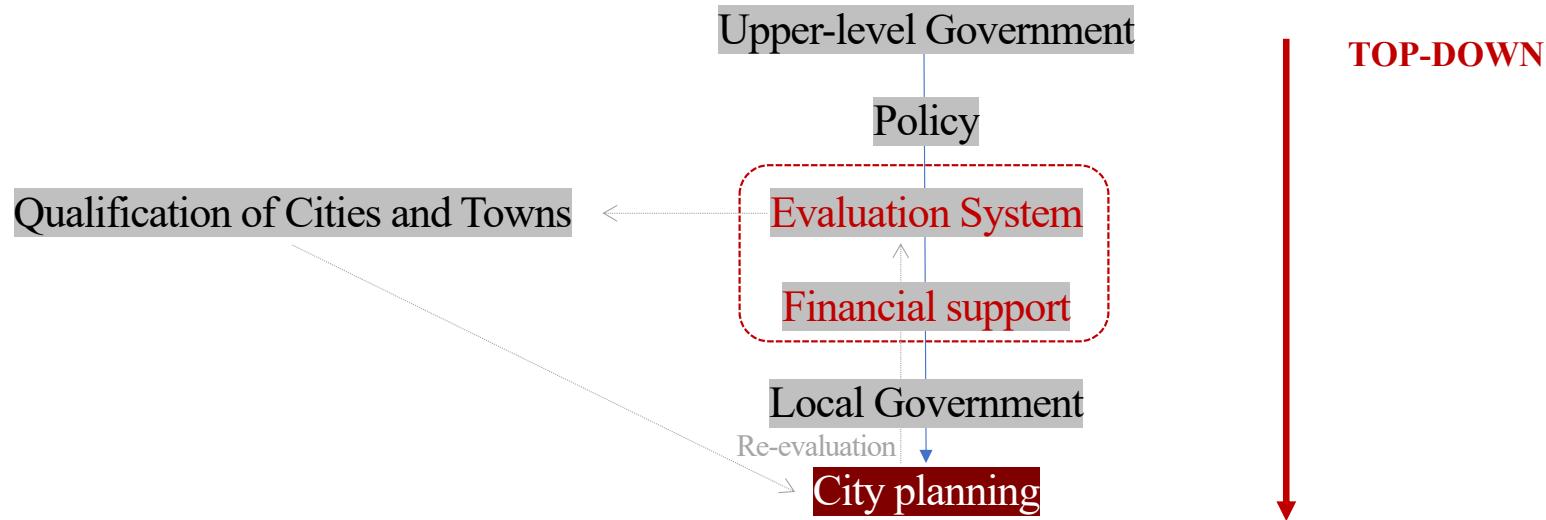
Energy, raw materials, and heavy chemical-based industries...

### 5. Upgraded of Rural Demands and Consumption

Large rural population, production demands...



How will these policies affect the spatial formation of cities and towns in China?



---

The preference of evaluation system & following financial support inevitably determine how local government issues the city planning with less opportunity for public engagement

yw6 可以在这提下特色小镇的重要性，提供了一个可以研究的evaluation system, which 别的城市规划方案不曾拥有的机会，虽然still unclear

yuanzhao wang, 2020/12/7

# First Assessment specification from Zhejiang Province

## Common Indicators

First class index	value	Second class index		Third class index	value
Function	200	Community		service	40
				smart construction	20
				population	10
		Tourism		scenic area	60
				small town	10
		Culture		development of culture	60
Form	100	Ecology		green planning	30
				beautify & sanitize	20
		Performance		figure of core area	30
				architectural style	10
				VI system	10
Mechanism	100	Government		town planning completion rate	15
				reform & innovation	20
		Enterprise		investment from non-government	20
				enterprise leading	10
		Market		investment pluralism	20
				marketization of public services	15

## Characteristic Indicators

First class index	value	Second class index		Third class index	value	
Industry	550	Specialization		Information economy industry town		Environmental protection industry town
				professional enterprise	60	professional enterprise
				leading technology	60	leading technology
				innovation	40	smart production and application
				proportion of characteristic industry	40	proportion of characteristic industry
				Tourism industry town		Financial industry town
				diversity of tourism	100	Financial management scale
				market development	50	proportion of characteristic industry
				tourism theme	35	
				tourism product	15	
				Healthcare industry town		Fashion industry town
				professional enterprise	60	innovation
				leading technology	50	professional enterprise
				innovation	50	industry influence
				proportion of characteristic industry	40	proportion of characteristic industry
				High-end manufacturing town		Historic industry town
				professional enterprise	60	industry influence
				leading technology	50	new technique and application
				innovation	50	Inheritance, promotion and development
				proportion of characteristic industry	40	
				Information economy industry town		Environmental protection industry town
				talented/skilled people	50	talented/skilled people
				research institution	50	research institution
				innovation	50	innovation
				Tourism industry town		Financial industry town
				talented/skilled people	50	talented/skilled people
				tourist facilities	50	financial institution
				high quality enterprise	50	
				Healthcare industry town		Fashion industry town
				talented/skilled people	50	talented/skilled people
				research institution	50	research institution
				innovation	50	innovation
				High-end manufacturing town		Historic industry town
				talented/skilled people	50	talented/skilled people
				research institution	50	well-known enterprise
				innovation	50	
				Information economy industry town		Environmental protection industry town
				input level	70	input level
				output effect	80	output effect
				radiation	50	radiation
				Tourism industry town		Financial industry town
				input level	70	input level
				output effect	70	output effect
				radiation	60	radiation
				Healthcare industry town		Fashion industry town
				input level	70	input level
				output effect	80	output effect
				radiation	50	radiation
				High-end manufacturing town		Historic industry town
				input level	70	input level
				output effect	80	output effect
				radiation	50	promotion

## Research Questions + Proposal

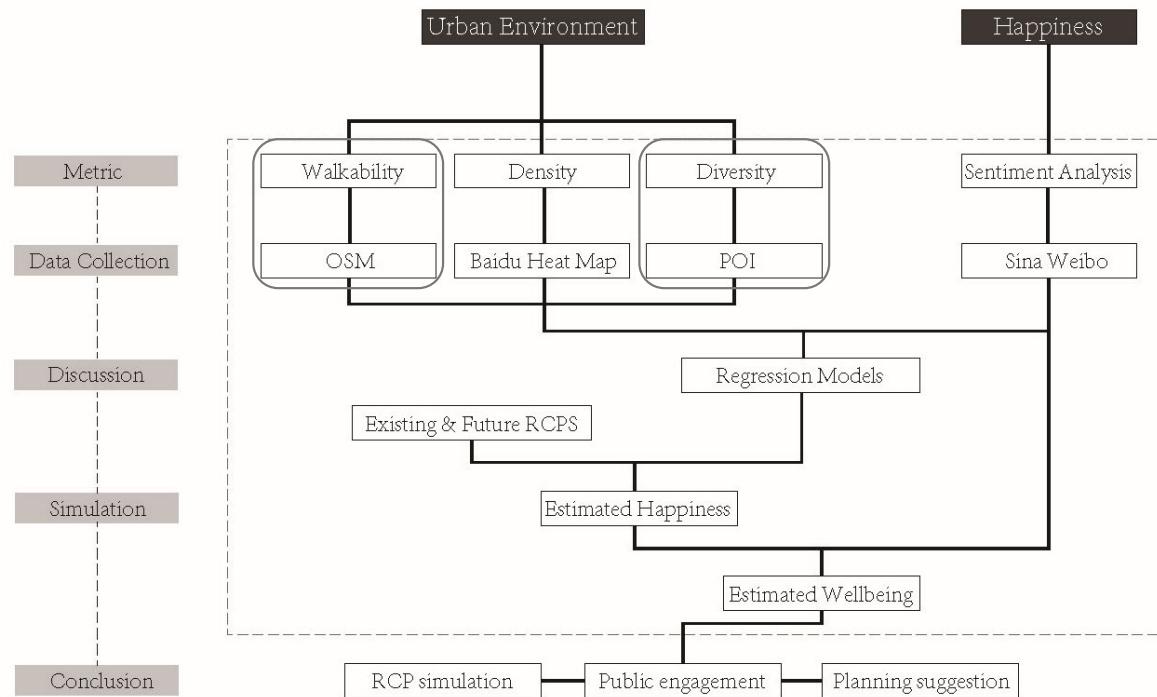
The Chinese government has progressively brought attention to public participation and views, which had previously been ignored. However, government approaches for fostering public engagement remain scarce. My research project proposes measuring **individual citizens' emotions** and **characteristics of the built environment**, the proximity of urban activities by walk and by characteristics of the pedestrian network, to explore the relationships between citizens' sentiments, urban form, and urban activities. By establishing a quantitative urban model, the happiness of urban residents can become an indicator and standard as a way of **bottom-up public participation**, guiding planners' decisions to design a healthy, sustainable and people-centered city.

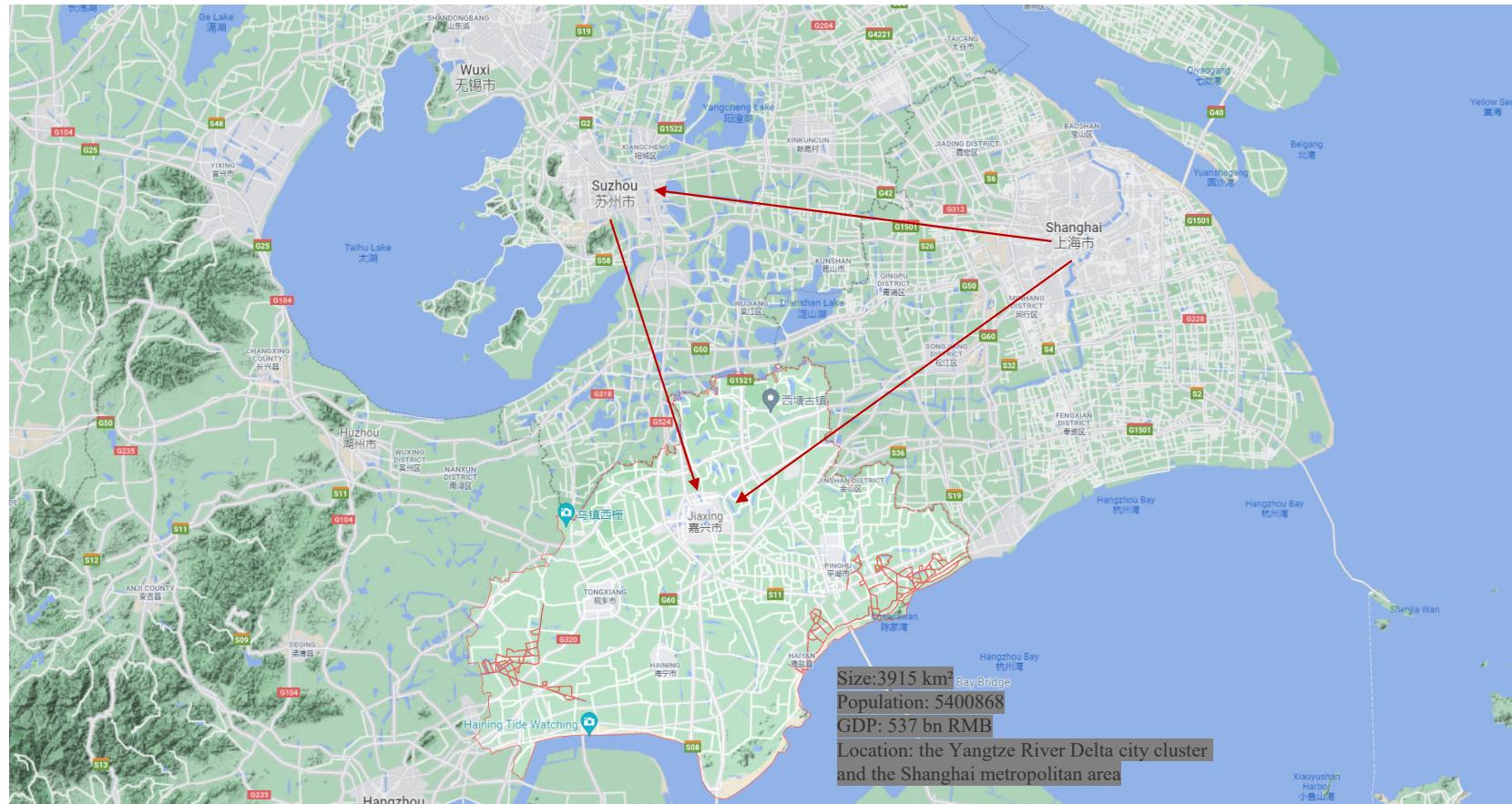
In this proposal, the following questions will be addressed:

- 1) Are the individual happiness correlated to the characteristics of the built environment such as the proximity?
- 2) How would proximity affect individual Spatio-temporal happiness? If so, what is the extent of these factors? Is there any model that can demonstrate how urban happiness is related to the various elements?
- 3) Is it possible to predict the Spatio-temporal happiness distribution in cities based on the Regulatory Planning Documents and different scenarios?

## Workflow

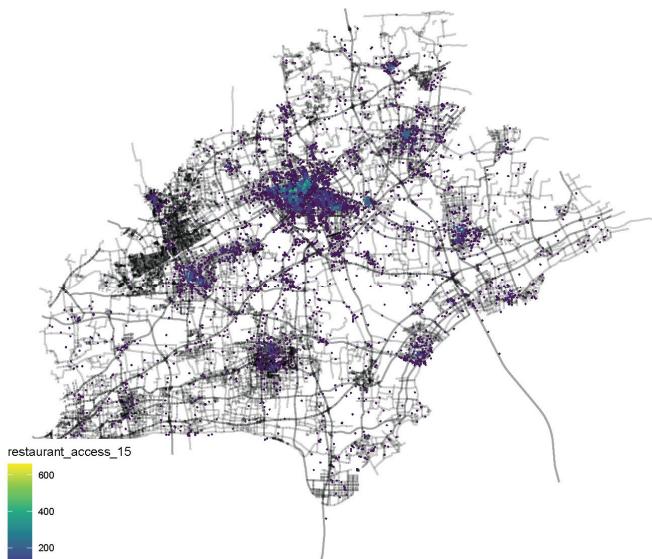
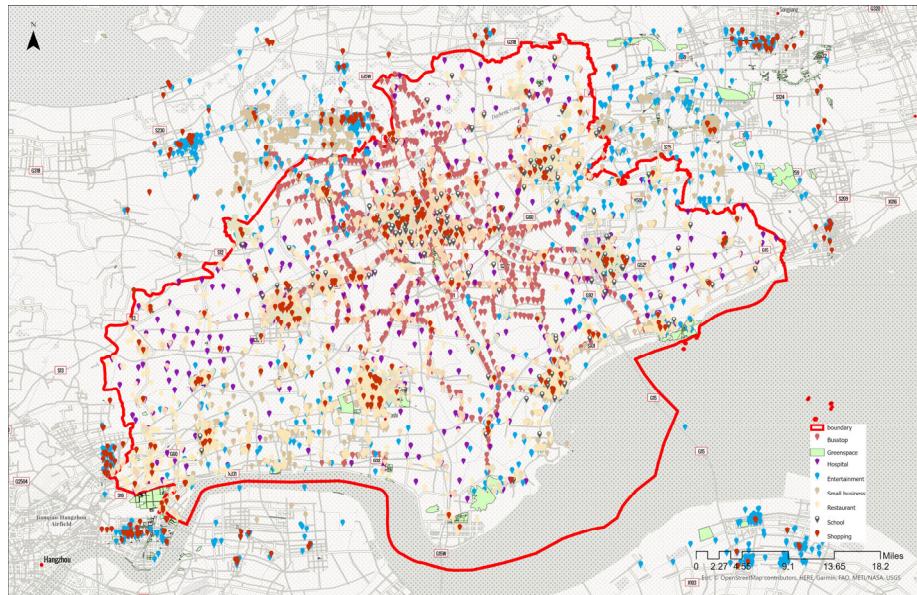
---





## Correlation between walkability and public sentiment

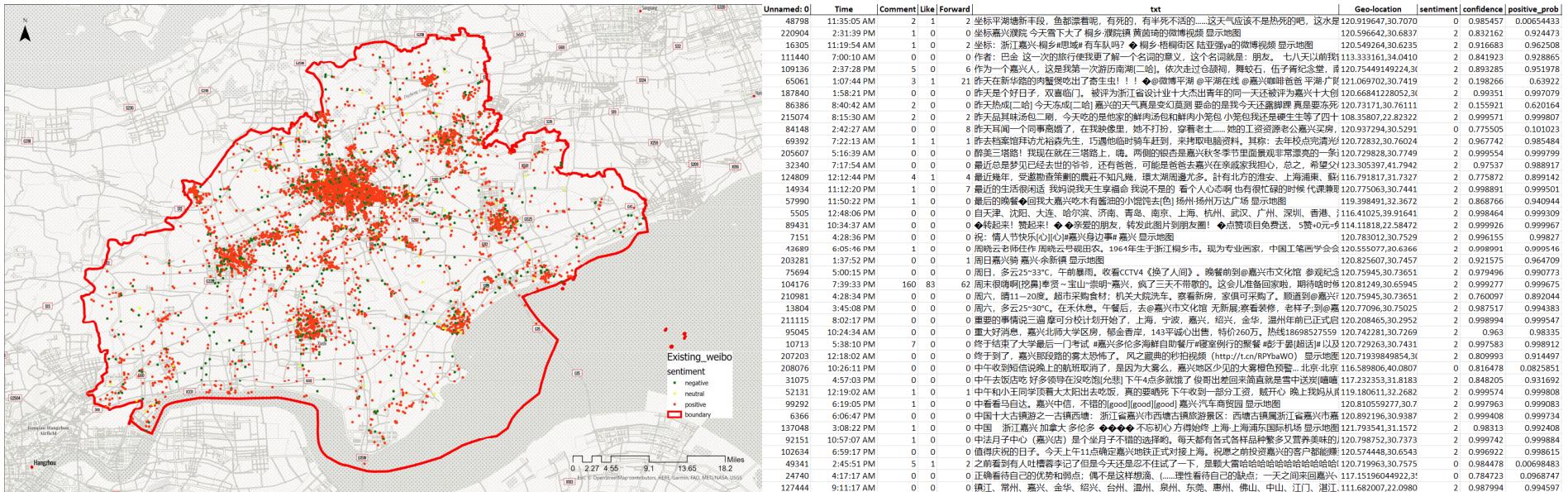
Density of facilities (bus stop, small business, hospital, restaurant, school, green space, shopping and entertainment)



Walkability to restaurant within 15 minutes

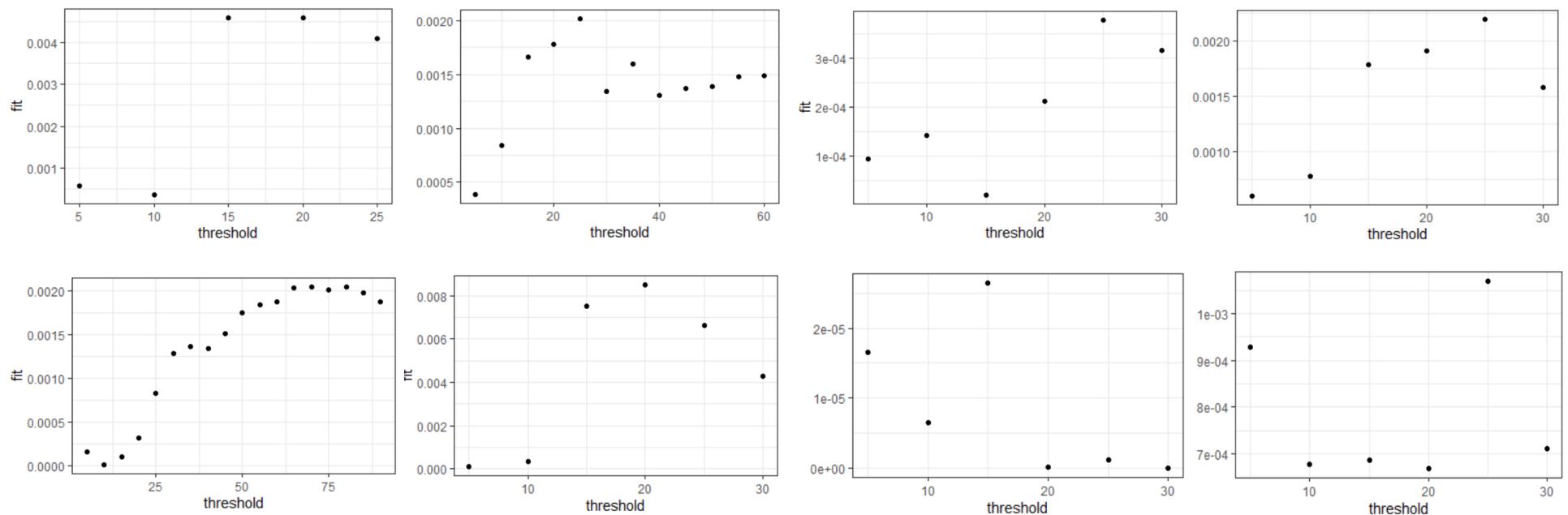
## Correlation between walkability and public sentiment

Sentiment Analysis on Weibo posted in social media



## Correlation between walkability and public sentiment

Regression Analysis on the relationship between the walkability to facilities and public sentiment to determine the best fits of threshold of walking distance (restaurant, greenspace, school, hospital, busstop, entertainment, small business and shopping)



## Correlation between walkability and public sentiment

Refined Regression model on the relationship between the walkability to facilities and public sentiment

---

```
lm(formula = positive_p ~ restaurant_access_15 + school_access_25 +
    hospital_access_25 + busstop_access_70 + greenspace_access_25 +
    leis_access_20 + public_access_15 + shopping_access_25, data = weibo_clip)

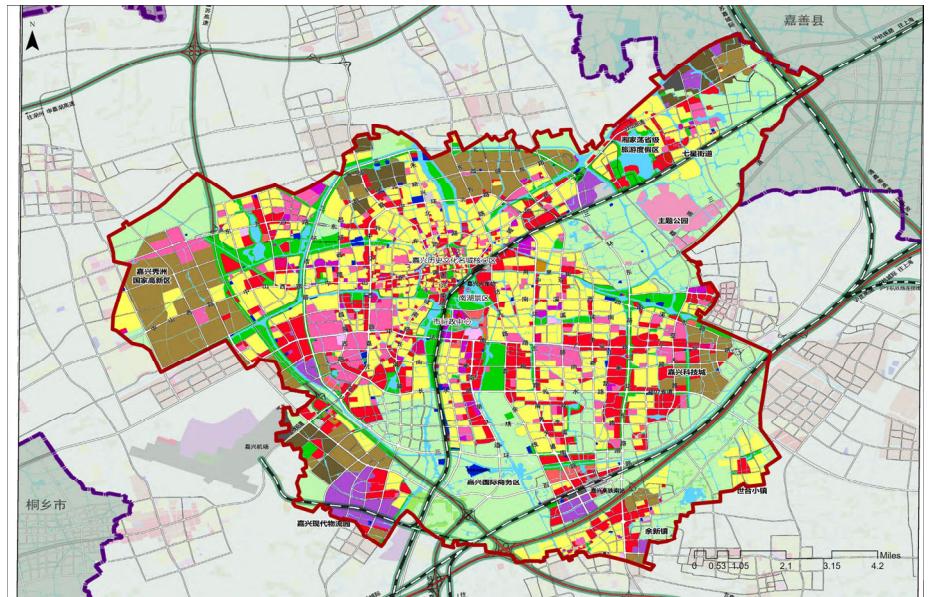
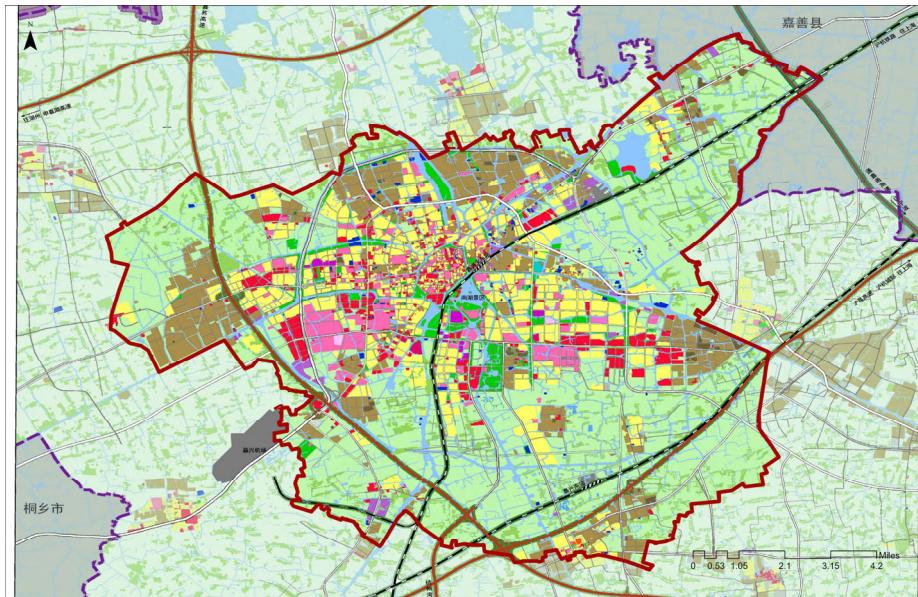
Residuals:
    Min      1Q  Median      3Q     Max 
-0.96538  0.04476  0.11587  0.15264  0.22117 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept) 8.109e-01 3.962e-03 204.646 < 2e-16 ***
restaurant_access_15 7.591e-05 3.728e-05  2.036 0.04175 *  
school_access_25 -3.216e-03 1.481e-03 -2.171 0.02992 *  
hospital_access_25 -6.332e-04 4.852e-04 -1.305 0.19193  
busstop_access_70  3.145e-05 5.259e-06  5.980 2.29e-09 ***
greenspace_access_25 1.018e-03 4.092e-04  2.488 0.01286 *  
leis_access_20     3.127e-03 2.869e-04 10.900 < 2e-16 ***
public_access_15   -9.001e-04 3.263e-04 -2.758 0.00582 ** 
shopping_access_25 -2.736e-03 1.488e-03 -1.839 0.06599 .  
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.287 on 13688 degrees of freedom
Multiple R-squared:  0.0147,  Adjusted R-squared:  0.01413 
F-statistic: 25.53 on 8 and 13688 DF,  p-value: < 2.2e-16
```

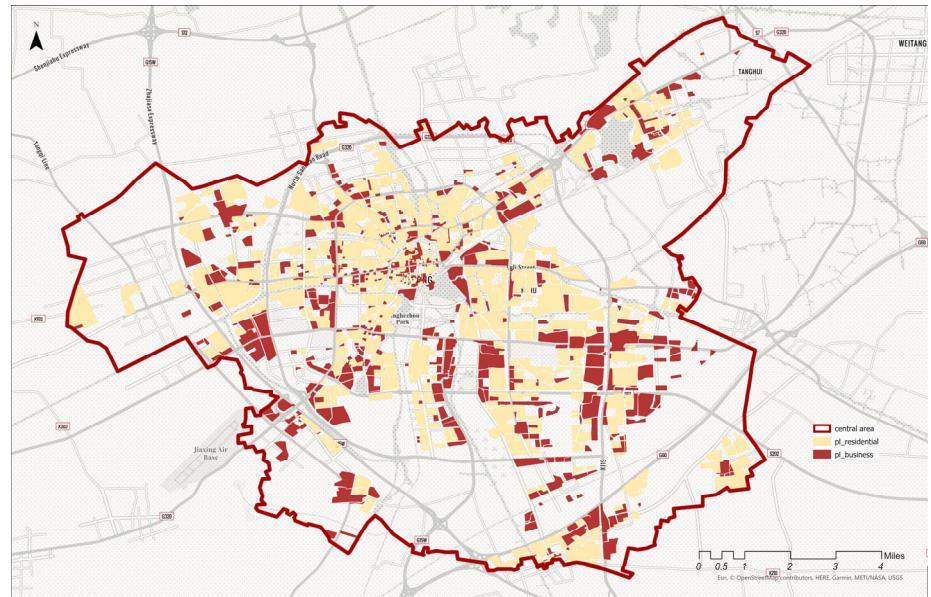
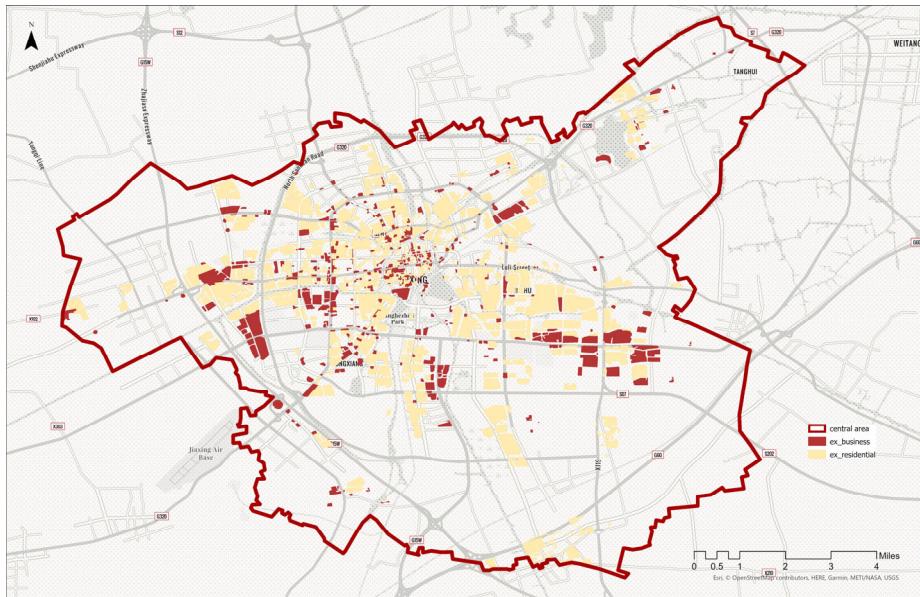
## Prediction based on planning documents

Comparative study of planning documents (existing in 2017 vs planned for 2020)



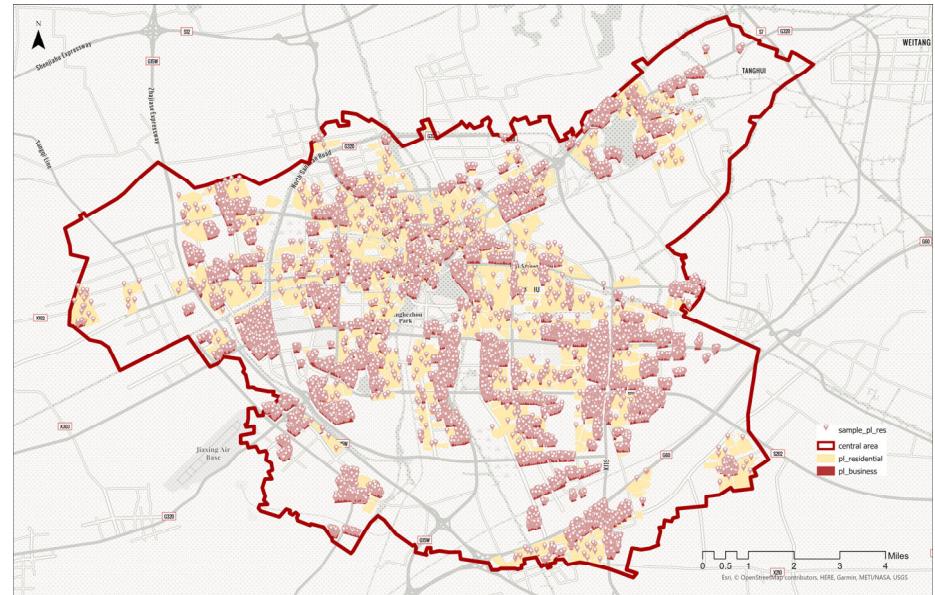
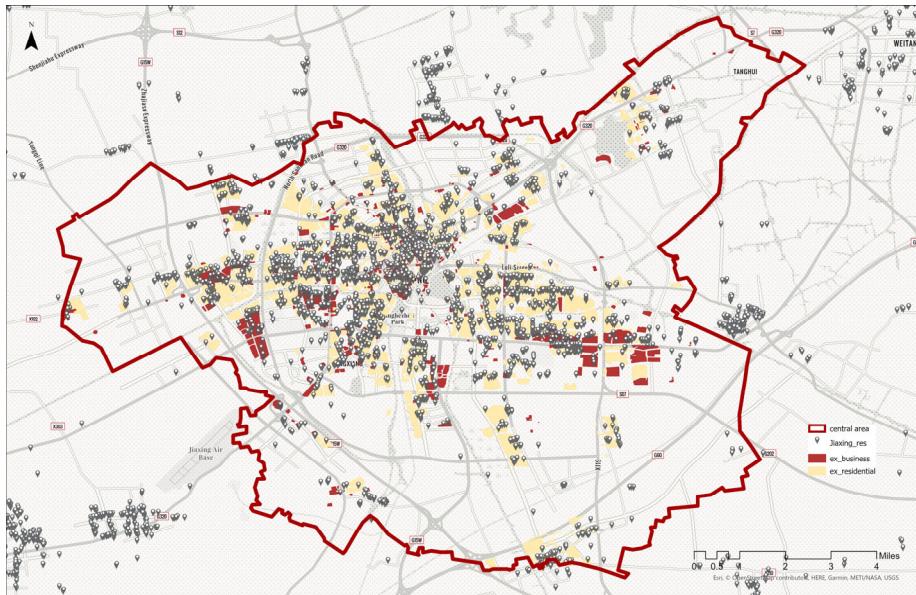
## Prediction based on planning documents

Comparative study of planning documents (existing vs planned) (Take business zones and residential zones for example)



## Prediction based on planning documents

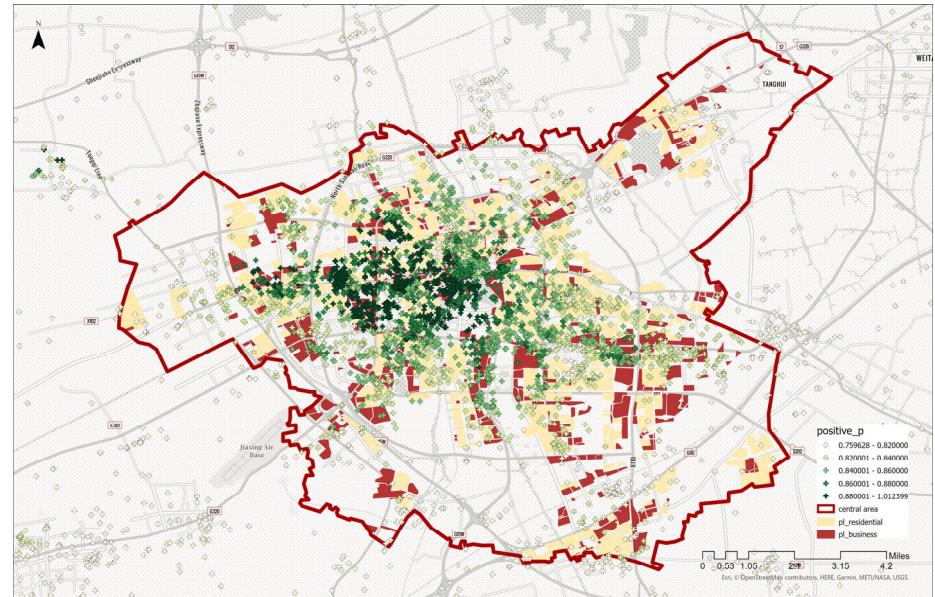
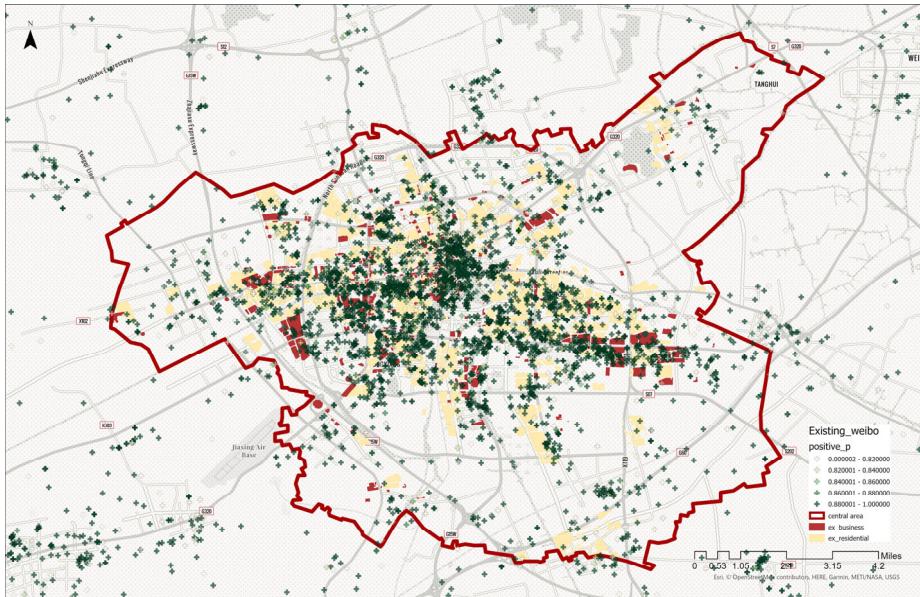
Prediction of restaurant locations (existing vs planned) (Take restaurant for example)



## Prediction based on planning documents

Difference : -0.05610443

Perdition of public sentiment (existing vs planned)



## Difficulties and Limitation

---

- How to improve the confidence level of quantitative models by involving more characteristics of the built environment?
- How confident to say the public sentiment represents the preference of urban space? How about population distribution?
- How to design different scenarios for future urban planning, providing a better space for the public, doubling the green space or decreasing the shopping stores?

# Thesis Check-in

Interaction analysis (2% confidence level)

Coefficients:

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	8.188e-01	6.977e-03	117.369	< 2e-16 ***
restaurant_access_15	1.759e-04	5.390e-05	3.263	0.00111 **
school_access_25	-3.332e-03	1.485e-03	-2.244	0.02485 *
hospital_access_25	-7.008e-04	4.859e-04	-1.442	0.14922
busstop_access_70	3.215e-05	5.271e-06	6.100	1.09e-09 ***
greenspace_access_25	1.048e-03	4.097e-04	2.559	0.01052 *
leis_access_20	3.087e-03	2.884e-04	10.703	< 2e-16 ***
public_access_15	-8.632e-04	3.266e-04	-2.643	0.00823 **
shopping_access_25	-2.591e-03	1.491e-03	-1.733	0.08217 .
TypeHoliday	6.325e-03	7.985e-03	0.792	0.42832
TypeWeekend	3.467e-04	5.670e-03	0.061	0.95125
TimeslotAfternoon	-5.841e-03	8.760e-03	-0.667	0.50490
TimeslotEarlymorning	-6.580e-03	8.834e-03	-0.745	0.45636
TimeslotMidnight	-3.682e-03	1.501e-02	-0.245	0.80624
TimeslotMorning	-1.377e-02	1.127e-02	-1.222	0.22171
TimeslotSunset	-3.269e-03	1.006e-02	0.325	0.74513
weatherRainy	-1.107e-02	5.982e-03	-1.850	0.06430 .
weatherSmog	-7.573e-03	1.086e-01	-0.070	0.94439
weatherSnow	-1.293e-04	2.195e-02	-0.006	0.99530
weatherSunny	-4.271e-03	5.984e-03	-0.714	0.47583
restaurant_access_15:TimeslotAfternoon	-1.291e-04	7.593e-05	-1.703	0.08901 .
restaurant_access_15:TimeslotEarlymorning	-1.712e-04	8.412e-05	-2.035	0.04189 *
restaurant_access_15:TimeslotMidnight	-1.410e-04	1.308e-04	-1.078	0.28087
restaurant_access_15:TimeslotMorning	-1.826e-04	9.807e-05	-1.862	0.06263 .

(Intercept)

	Estimate	Std. Error	t value	Pr(> t )
restaurant_access_15	8.232e-01	6.759e-03	121.807	< 2e-16 ***
school_access_25	7.476e-05	3.735e-05	2.002	0.04532 *
hospital_access_25	-1.063e-03	2.239e-03	-0.475	0.63487
busstop_access_70	-6.747e-04	4.857e-04	-1.389	0.16485
greenspace_access_25	3.188e-05	5.269e-06	6.050	1.49e-09 ***
leis_access_20	1.046e-03	4.098e-04	2.552	0.01074 *
public_access_15	3.085e-03	2.886e-04	10.687	< 2e-16 ***
shopping_access_25	-8.731e-04	3.265e-04	-2.674	0.00751 **
TypeHoliday	-2.618e-03	1.490e-03	-1.757	0.07900 .
TypeWeekend	4.235e-04	5.671e-03	0.075	0.94048
TimeslotAfternoon	-1.056e-02	8.177e-03	-1.292	0.19644
TimeslotEarlymorning	-1.474e-02	8.543e-03	-1.725	0.08448 .
TimeslotMidnight	-1.556e-02	1.382e-02	-1.126	0.26028
TimeslotMorning	-2.479e-02	1.060e-02	-2.339	0.01934 *
TimeslotSunset	-3.385e-03	9.390e-03	-0.361	0.71846
WeatherRainy	-1.108e-02	5.983e-03	-1.852	0.06406 .
WeatherSmog	-7.943e-03	1.086e-01	-0.073	0.94169
WeatherSnow	4.073e-05	2.196e-02	0.002	0.99852
WeatherSunny	-4.126e-03	5.982e-03	-0.690	0.49042
school_access_25:TimeslotAfternoon	-3.623e-03	3.425e-03	-1.058	0.29023
school_access_25:TimeslotEarlymorning	-2.274e-03	3.935e-03	-0.578	0.56344
school_access_25:TimeslotMidnight	1.095e-03	5.627e-03	0.195	0.84577
school_access_25:TimeslotMorning	-1.415e-03	4.563e-03	-0.310	0.75656
school_access_25:TimeslotSunset	-9.770e-03	4.238e-03	-2.305	0.02115 *

(Intercept)

	Estimate	Std. Error	t value	Pr(> t )
restaurant_access_15	8.204e-01	7.085e-03	115.801	< 2e-16 ***
school_access_25	7.695e-05	3.736e-05	2.060	0.03943 *
hospital_access_25	-3.408e-03	1.485e-03	-2.295	0.02174 *
busstop_access_70	-1.546e-04	5.519e-04	-0.280	0.77936
greenspace_access_25	3.193e-05	5.268e-06	6.062	1.38e-09 ***
leis_access_20	1.059e-03	4.098e-04	2.584	0.00978 ***
public_access_15	3.082e-03	2.885e-04	10.683	< 2e-16 ***
shopping_access_25	-8.693e-04	3.265e-04	-2.663	0.00776 **
TypeHoliday	-2.685e-03	1.491e-03	-1.801	0.07165 .
TypeWeekend	6.162e-03	7.984e-03	0.772	0.44024
TimeslotAfternoon	3.135e-04	5.669e-03	0.055	0.95590
TimeslotEarlymorning	-1.050e-02	9.160e-03	-1.146	0.25173
TimeslotMidnight	-1.374e-02	9.469e-03	-1.451	0.14683
TimeslotMorning	-6.343e-03	1.540e-02	-0.412	0.68041
TimeslotSunset	-1.025e-02	1.190e-02	-0.861	0.38924
WeatherRainy	3.962e-03	1.054e-02	0.376	0.70693
WeatherSmog	-1.126e-02	5.981e-03	-1.883	0.05969
WeatherSnow	-6.521e-03	1.086e-01	-0.060	0.95210
WeatherSunny	-4.505e-03	5.982e-03	-0.753	0.45146
hospital_access_25:TimeslotAfternoon	-4.071e-04	5.276e-04	-0.772	0.44031
hospital_access_25:TimeslotEarlymorning	-3.159e-04	5.841e-04	-0.541	0.58865
hospital_access_25:TimeslotMidnight	-6.759e-04	9.201e-04	-0.735	0.46262
hospital_access_25:TimeslotMorning	-1.474e-03	6.996e-04	-2.107	0.03513 *
hospital_access_25:TimeslotSunset	-1.806e-03	6.708e-04	-2.692	0.00711 **

Coefficients:

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	8.212e-01	7.055e-03	116.400	< 2e-16 ***
restaurant_access_15	7.509e-05	3.736e-05	2.010	0.04446 *
school_access_25	-3.273e-03	1.486e-03	-2.203	0.02760 *
hospital_access_25	-6.599e-04	4.856e-04	-1.359	0.17418
busstop_access_70	3.145e-05	5.271e-06	5.968	2.47e-09 ***
greenspace_access_25	1.071e-03	4.098e-04	2.614	0.00895 **
leis_access_20	3.561e-03	4.230e-04	8.419	< 2e-16 ***
public_access_15	-8.643e-04	3.269e-04	-2.644	0.00821 **
shopping_access_25	-2.517e-03	1.490e-03	-1.690	0.09107 .
TypeHoliday	6.534e-03	7.985e-03	0.818	0.41324
TypeWeekend	6.282e-04	5.670e-03	0.111	0.91178
TimeslotAfternoon	-3.967e-03	8.834e-03	-0.449	0.65336
TimeslotEarlymorning	-8.777e-03	8.981e-03	-0.977	0.32846
TimeslotMidnight	-1.435e-02	1.500e-02	-0.957	0.33859
TimeslotMorning	-1.476e-02	1.121e-02	-1.316	0.18810
TimeslotSunset	-1.982e-02	1.072e-02	-1.849	0.06444 .
WeatherRainy	-1.086e-02	5.981e-03	-1.816	0.06935 .
WeatherSmog	-5.812e-03	1.086e-01	-0.054	0.95730
WeatherSnow	7.957e-04	2.195e-02	0.036	0.97108
WeatherSunny	-4.192e-03	5.981e-03	-0.701	0.48334
leis_access_20:TimeslotAfternoon	-1.259e-03	6.148e-04	-2.047	0.04067 *
leis_access_20:TimeslotEarlymorning	-1.112e-03	6.860e-04	-1.620	0.10519
leis_access_20:TimeslotMidnight	9.111e-05	1.084e-03	0.084	0.93304
leis_access_20:TimeslotMorning	-1.400e-03	8.019e-04	-1.746	0.08084 .
leis_access_20:TimeslotSunset	5.198e-04	7.145e-04	0.727	0.46698

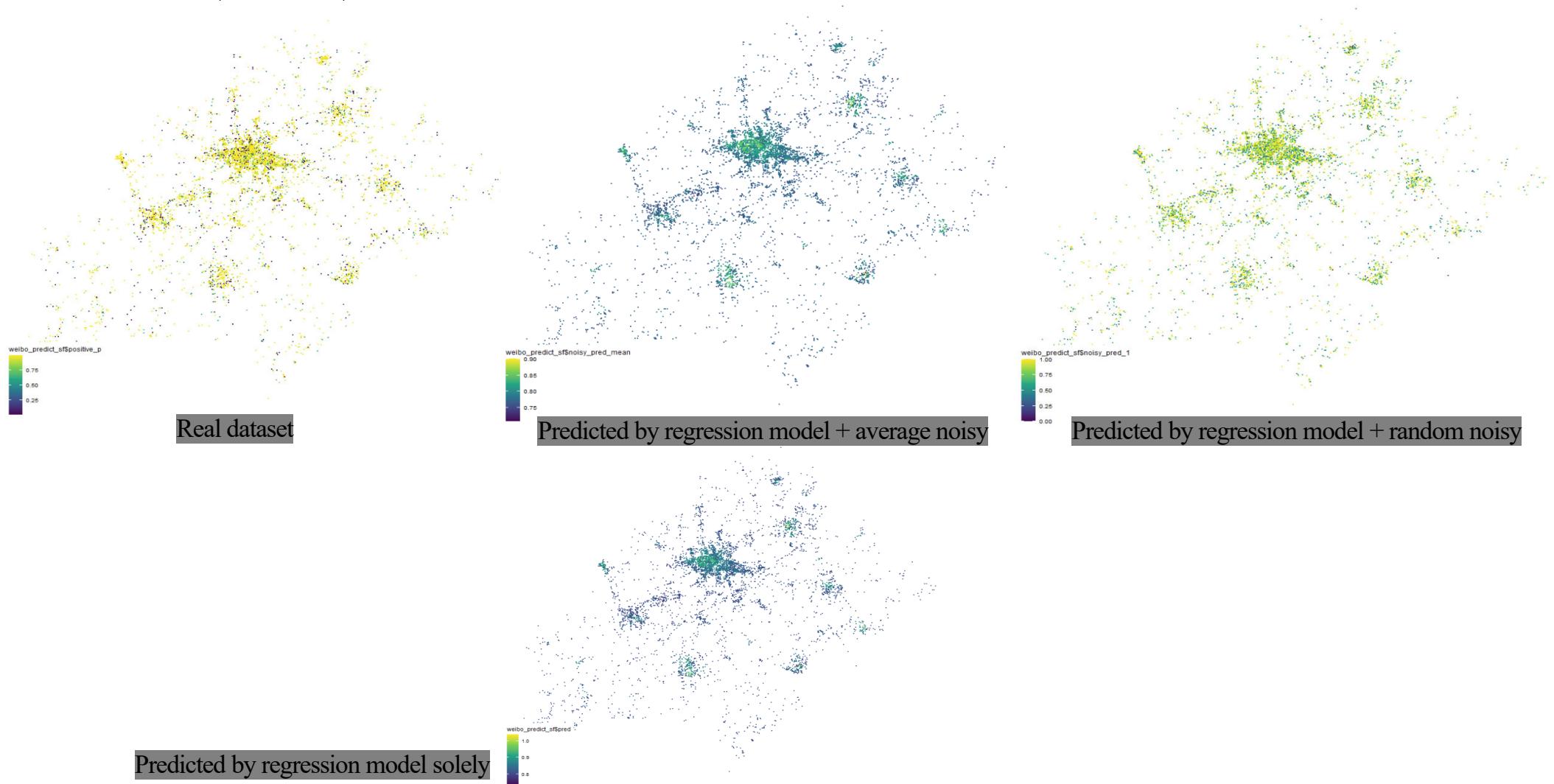
(Intercept)

	Estimate	Std. Error	t value	Pr(> t )
restaurant_access_15	8.211e-01	6.762e-03	121.429	< 2e-16 ***
school_access_25	7.813e-05	3.736e-05	2.091	0.03655 *
hospital_access_25	-3.446e-03	1.485e-03	-2.321	0.02030 *
busstop_access_70	-6.966e-04	4.857e-04	-1.434	0.15149
greenspace_access_25	3.189e-05	5.269e-06	6.052	1.47e-09 ***
leis_access_20	1.056e-03	4.096e-04	2.577	0.00996 **
public_access_15	3.087e-03	2.884e-04	10.706	< 2e-16 ***
shopping_access_25	-8.655e-04	3.265e-04	-2.651	0.00804 **
TypeHoliday	-1.833e-04	1.803e-03	-0.102	0.91899
TypeWeekend	5.870e-03	7.983e-03	0.735	0.46218
TimeslotAfternoon	2.857e-04	5.669e-03	0.050	0.95981
TimeslotEarlymorning	-8.404e-03	8.281e-03	-1.015	0.31023
TimeslotMidnight	-1.382e-02	8.615e-03	-1.604	0.10868
TimeslotMorning	-1.258e-02	1.382e-02	-0.911	0.36244
TimeslotSunset	-1.150e-02	1.074e-02	-1.070	0.28443
WeatherRainy	-3.814e-04	5.901e-03	-0.040	0.96798
WeatherSmog	-1.132e-02	5.981e-03	-1.893	0.05841 .
WeatherSnow	-5.775e-03	1.085e-01	-0.053	0.95757
WeatherSunny	-6.918e-04	2.194e-02	-0.032	0.97485
shopping_access_25:TimeslotAfternoon	-4.525e-03	5.982e-03	-0.756	0.44943
shopping_access_25:TimeslotEarlymorning	-3.008e-03	2.013e-03	-1.494	0.13525
shopping_access_25:TimeslotMidnight	-1.619e-03	2.259e-03	-0.717	0.47353
shopping_access_25:TimeslotMorning	-4.444e-04	3.643e-03	-0.122	0.90290
shopping_access_25:TimeslotSunset	-6.947e-03	2.698e-03	-2.575	0.01003 *

Predicted by regression model solely

# Thesis Check-in

Limitation of Perdition model (2% confidence level)

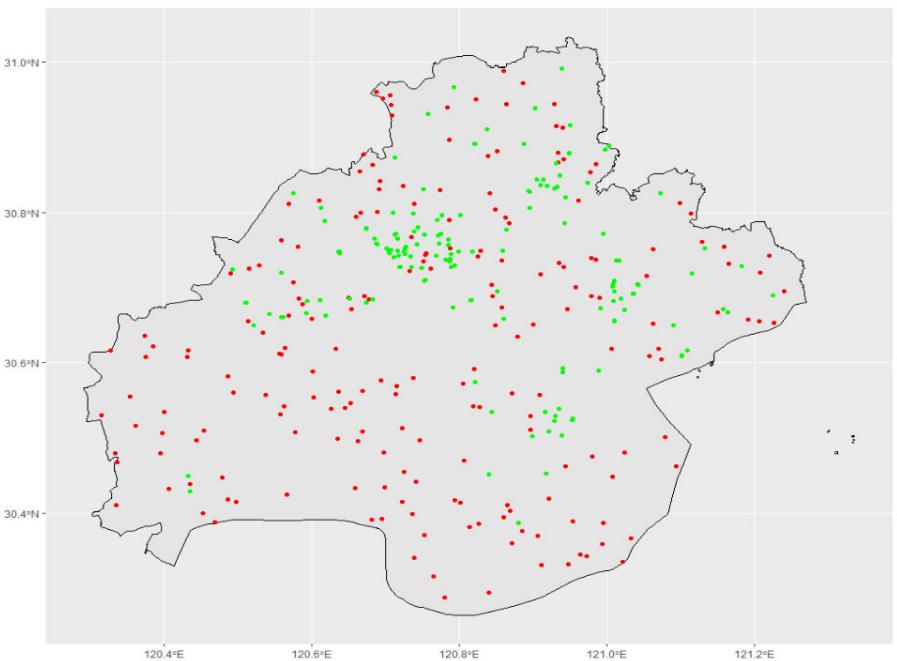
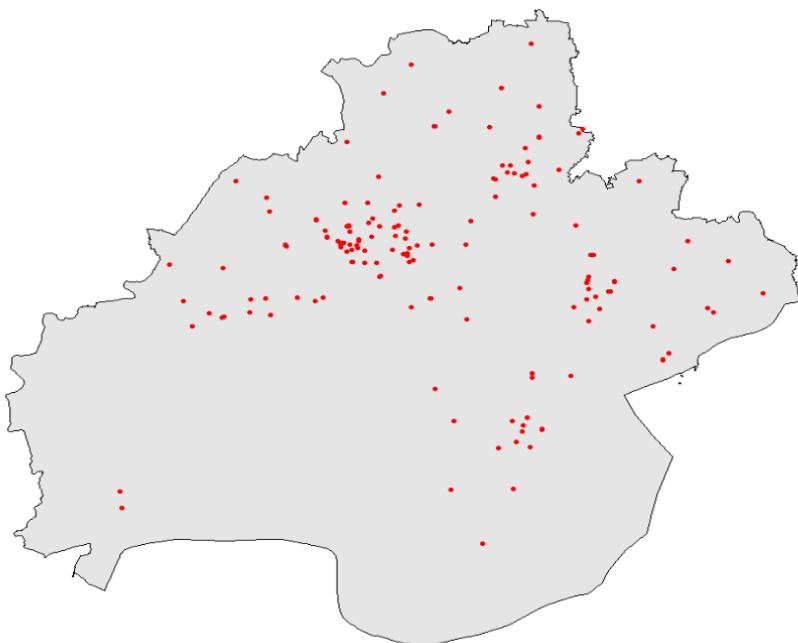


## Thesis Check-in

---

scenario 2: double the number of school spreading out the city

Red: original school;  
Green: doubled school

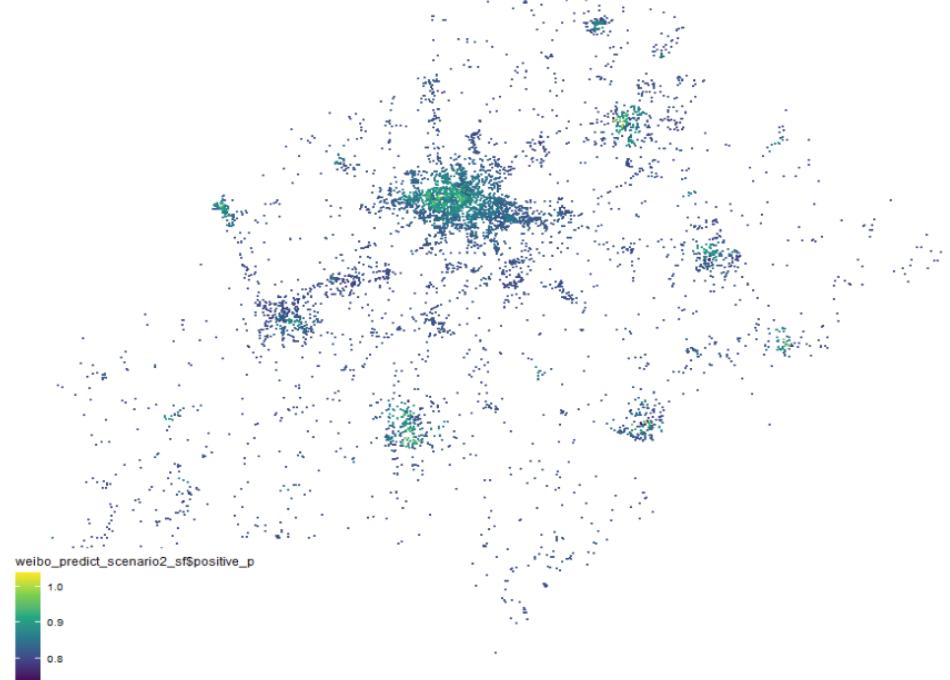
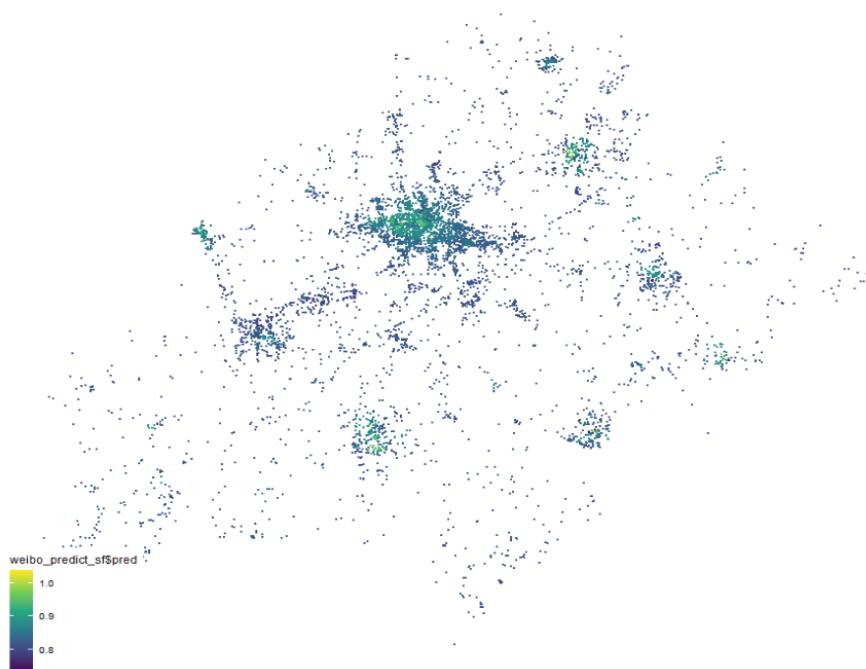


# Thesis Check-in

---

scenario 2: double the number of school spreading out the city

Difference : -0.000220465

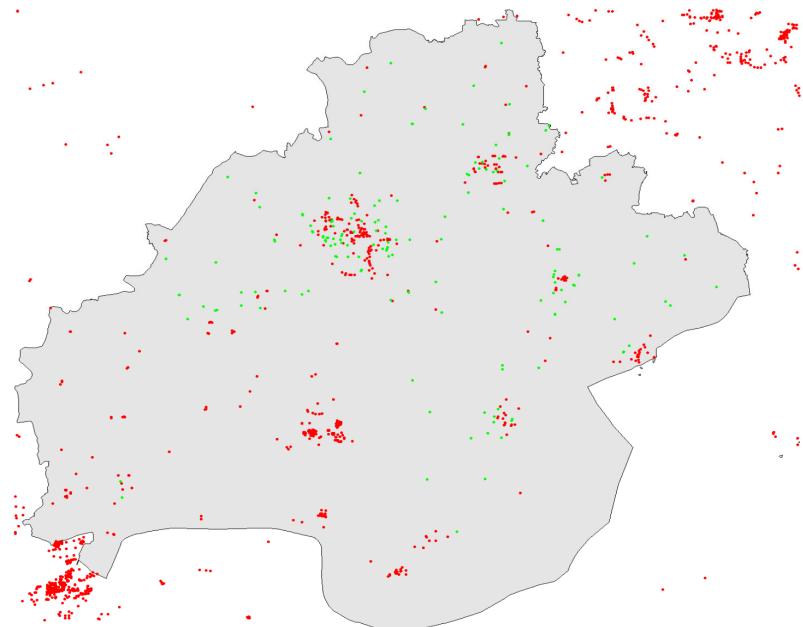
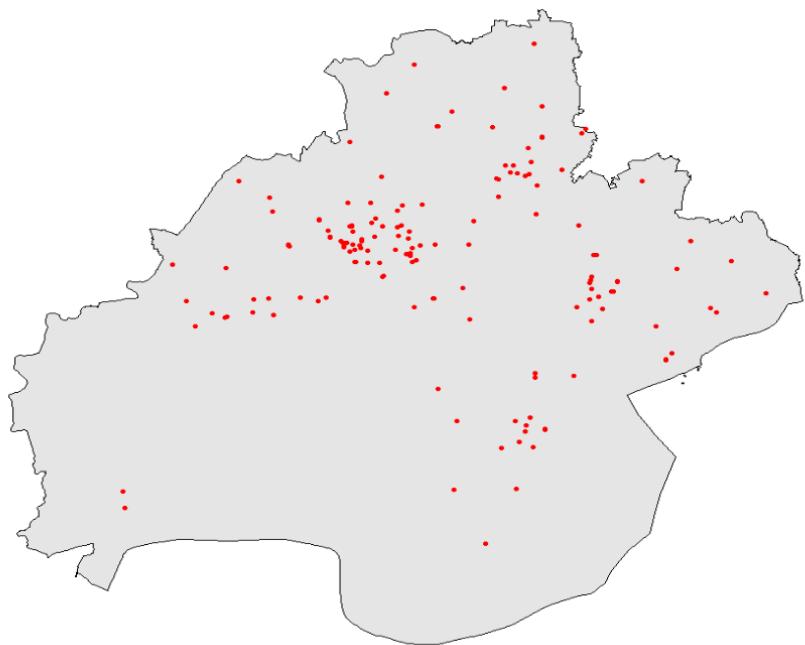


# Thesis Check-in

---

scenario 3: turn school into greenspace

Red: original green space;  
Green: previous school

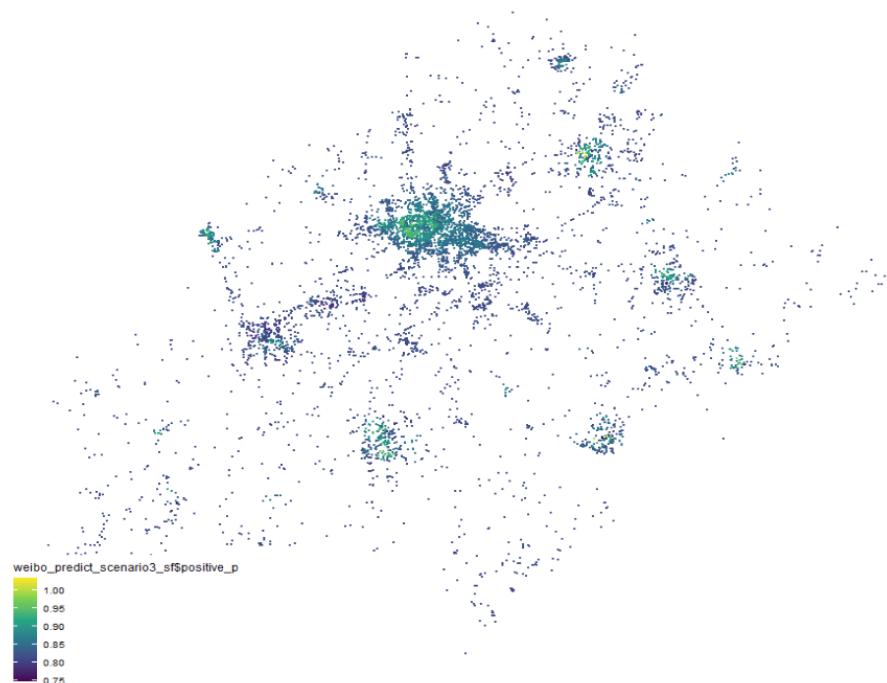
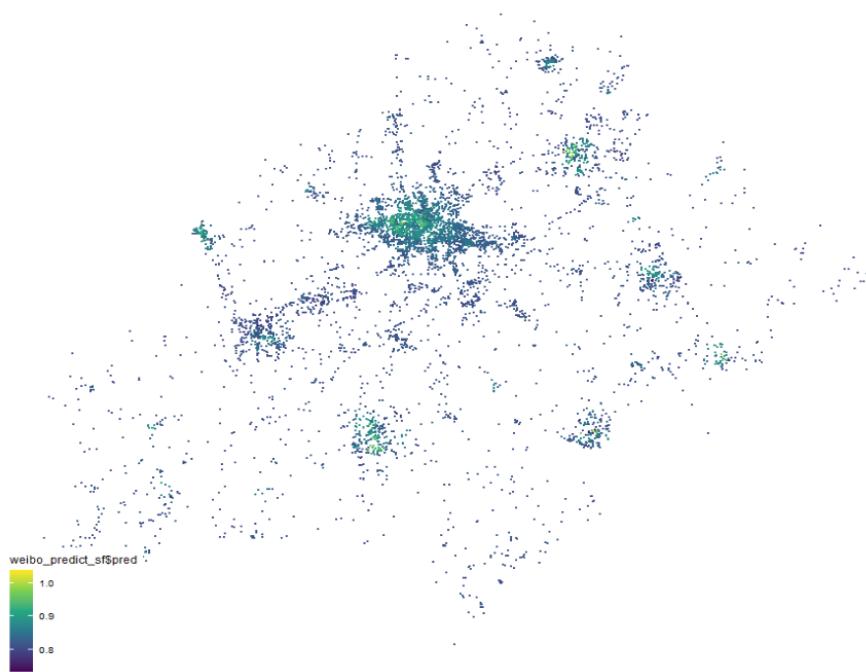


# Thesis Check-in

---

scenario 2: double the number of school spreading out the city

Difference : 0.003981223



## What's next

---

- Written methodology;
- Better illustration;
- Interactive maps as final works.

