Unveiling Urban Stress using Tweets:
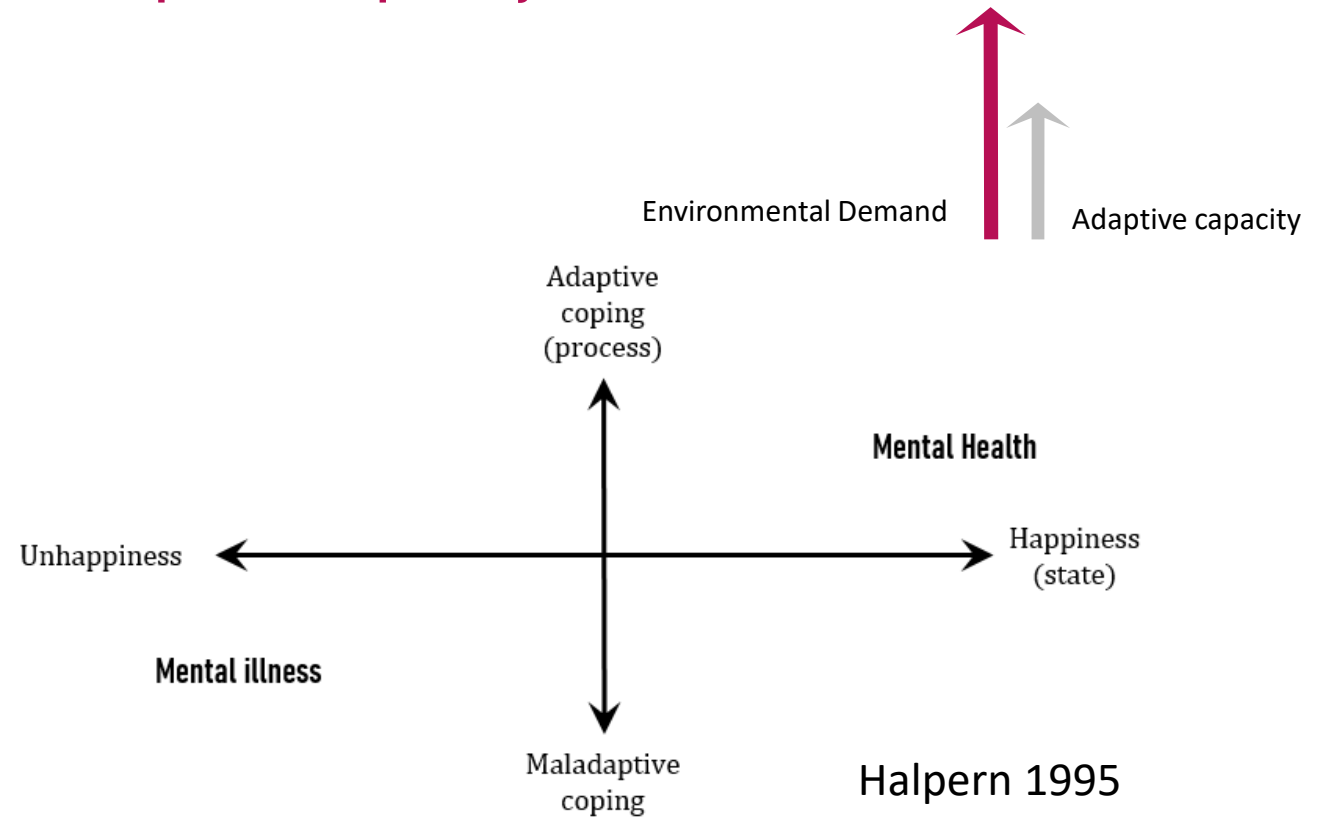## Modelling Impact of Built Environment Stressors on Mental Wellbeing

Florina Dutt , Subhrajit Guhathakurta
Georgia Institute of Technology

What is stress?

Stress is a psychological reaction of individuals when they perceive the environmental demand exceeds their adaptive capacity

Environmental Demand Adaptive capacity

Adaptive coping (process)

Mental Health

Unhappiness ← → Happiness (state)

Mental illness

Maladaptive coping

Halpern 1995

Why is it important in the **urban context** ?

Different type of stress experienced ?

	Minor	Major
Acute	Daily hassles, e.g., traffic, problem with work, etc.	Significant life events, e.g., death of close friend or family
Chronic	Environmental stressors e.g., noise, pollution, crowding, etc.	On-going difficulty, e.g., long-term health issues, poverty, etc.

Table 1 Different types of stress in the lifetime of a person [6].

Conflicting Theory

Domain of Psychology

David Halpern 1995 – **Mental Health and The Built Environment: More than bricks and Mortar ?**

G.W Evans 2003 – **Housing and Mental Health: A Review of the Evidence and a Methodological and Conceptual Critique**

Chu et al. 2004 -The impact on mental well-being of the urban and physical environment: an assessment of the evidence .

01 ENVIRONMENTAL STRESSORS

WEATHER

NOISE

POLLUTANTS

02 SOCIAL STRESSORS

CROWDING & HIGH DENSITY

HIGH RISE BUILDINGS

FEAR OF CRIME

NEIGHBORHOOD QUALITY

LIMITED SOCIAL PARTICIPATION

Conflicting Theory

Urban Planning

Frumkin et al 2004
Urban Sprawl and Public Health:
Designing, Planning, and
Building for Healthy
Communities

Putnam 2000 The
Collapse and Revival of
American Community

Strum & Cohen 2004.
Suburban sprawl and physical
and mental health

03 TRAFFIC STRESSORS

UNPREDICTABILITY

LACK OF CONTROL

04 SOCIAL STRESSORS

REDUCED SOCIAL CONTACT

LIMITED PHYSICAL
ACTIVITIES

UNPLEASANT BUILT
ENVIRONMENT

H. People are less stressed in areas with a higher degree of urbaneness.
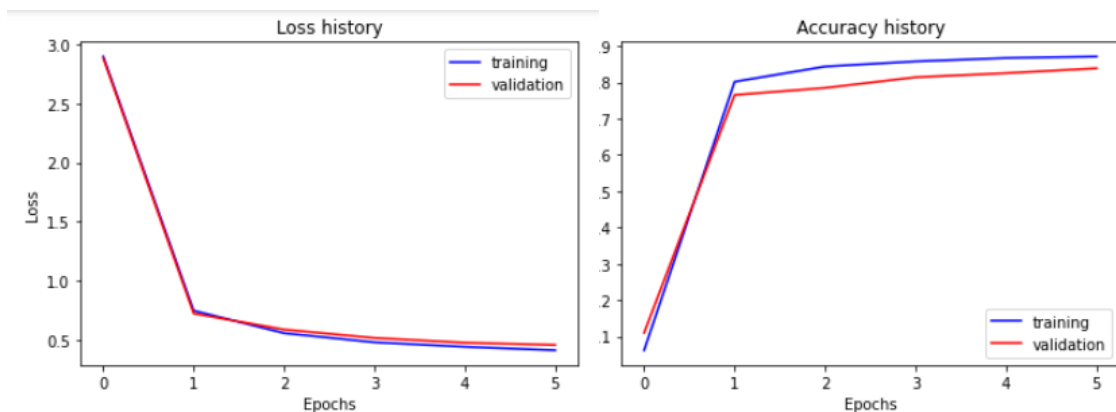
Built Environment
Variables
Considered

Land Use Diversity
Ground Coverage (setback)
Floor Area Ratio (density)
Percent Gridded Street Network
Access to MARTA Train Station

Results from the Tested model

	Predicted Class	
	De-Stress	Stress
True Class De-Stress	113,310	8690
Stress	597	7,403

Validation set confusion matrix

Loss history

Accuracy history

	Accuracy	Precision	F1-score
Stress	0.94	0.97	0.95
De-stress	0.93	0.94	0.92

Mapping De-Stress Tweets

Buckhead Village

@buckheadvillagedistrict

Midtown

@midtown_atl

Downtown
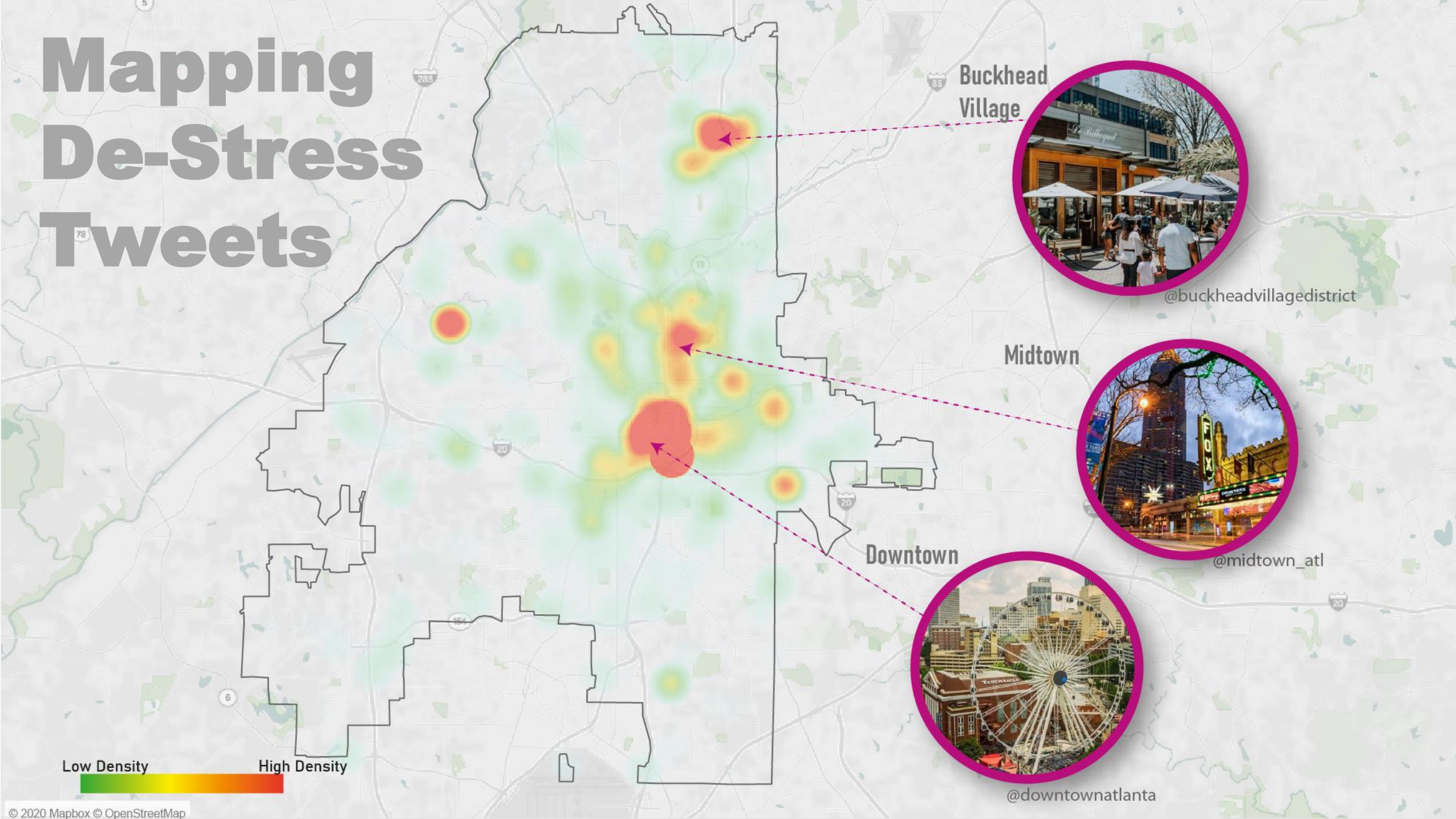
@downtownatlanta

Low Density High Density

© 2020 Mapbox © OpenStreetMap

ATL Neighborhoods Reporting Highest De-stressing Activities

1. Downtown & Castleberry Hill
2. Midtown
3. Buckhead
4. Old fourth Ward

Destressing Tweet Volume

Low
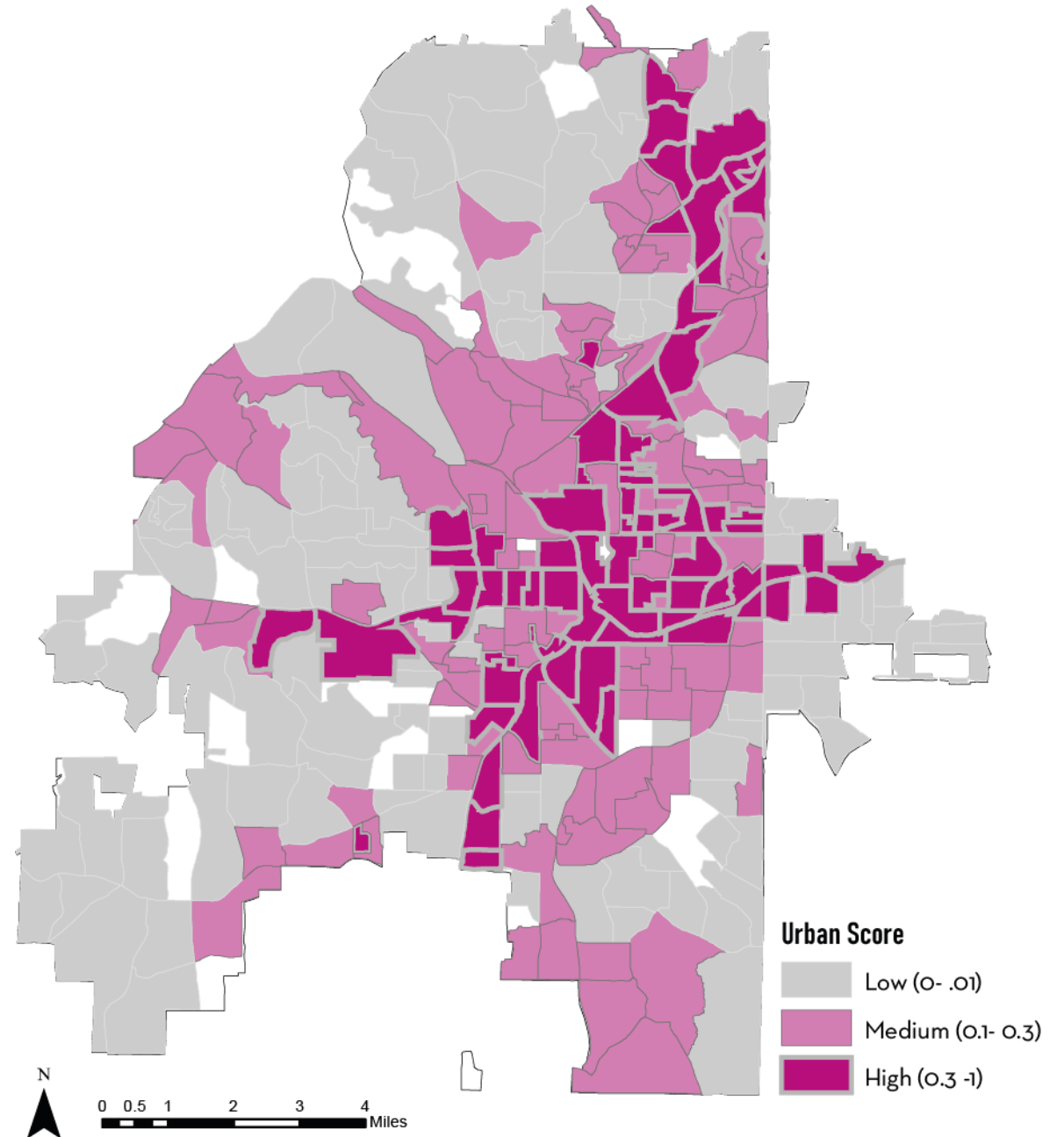
Medium

High

N
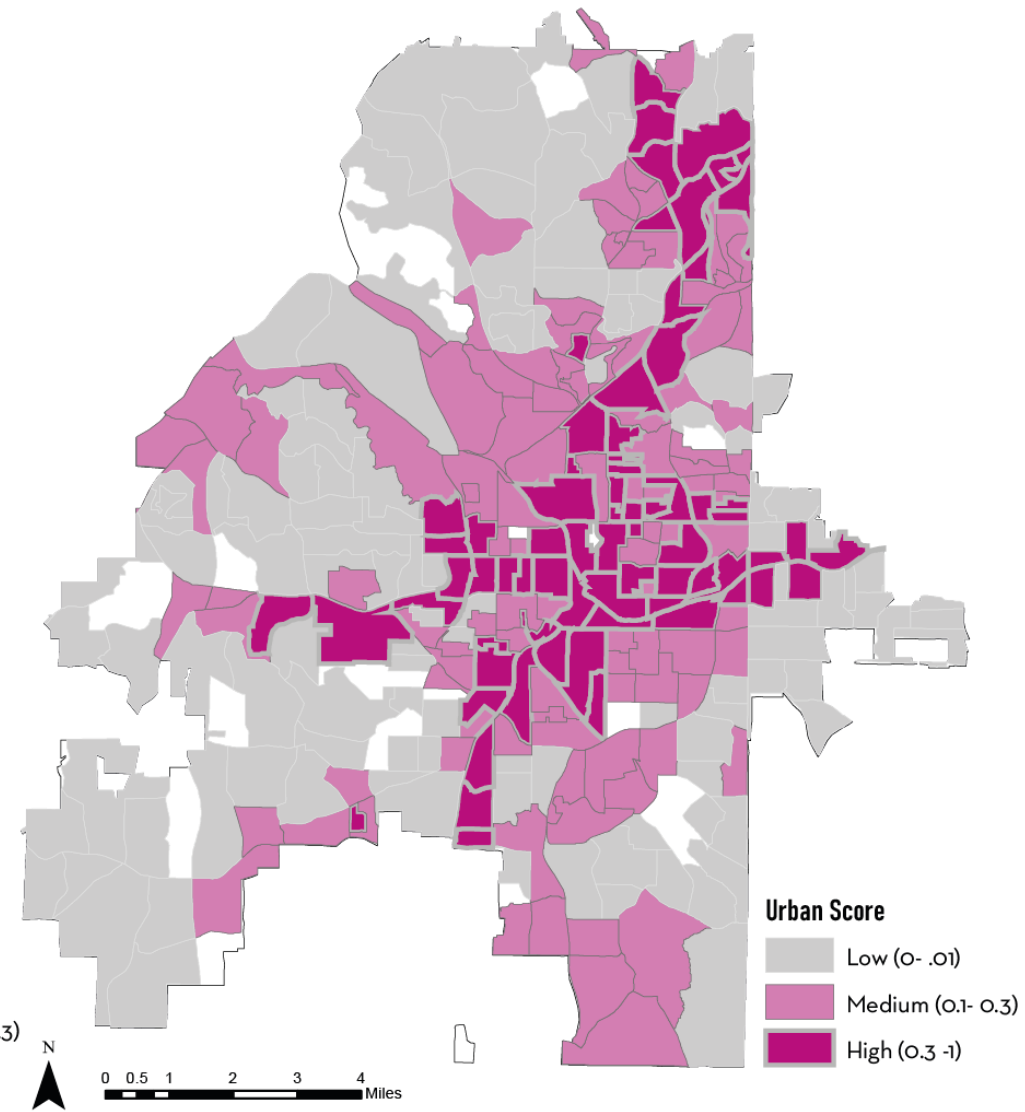
0 0.5 1   2   3   4
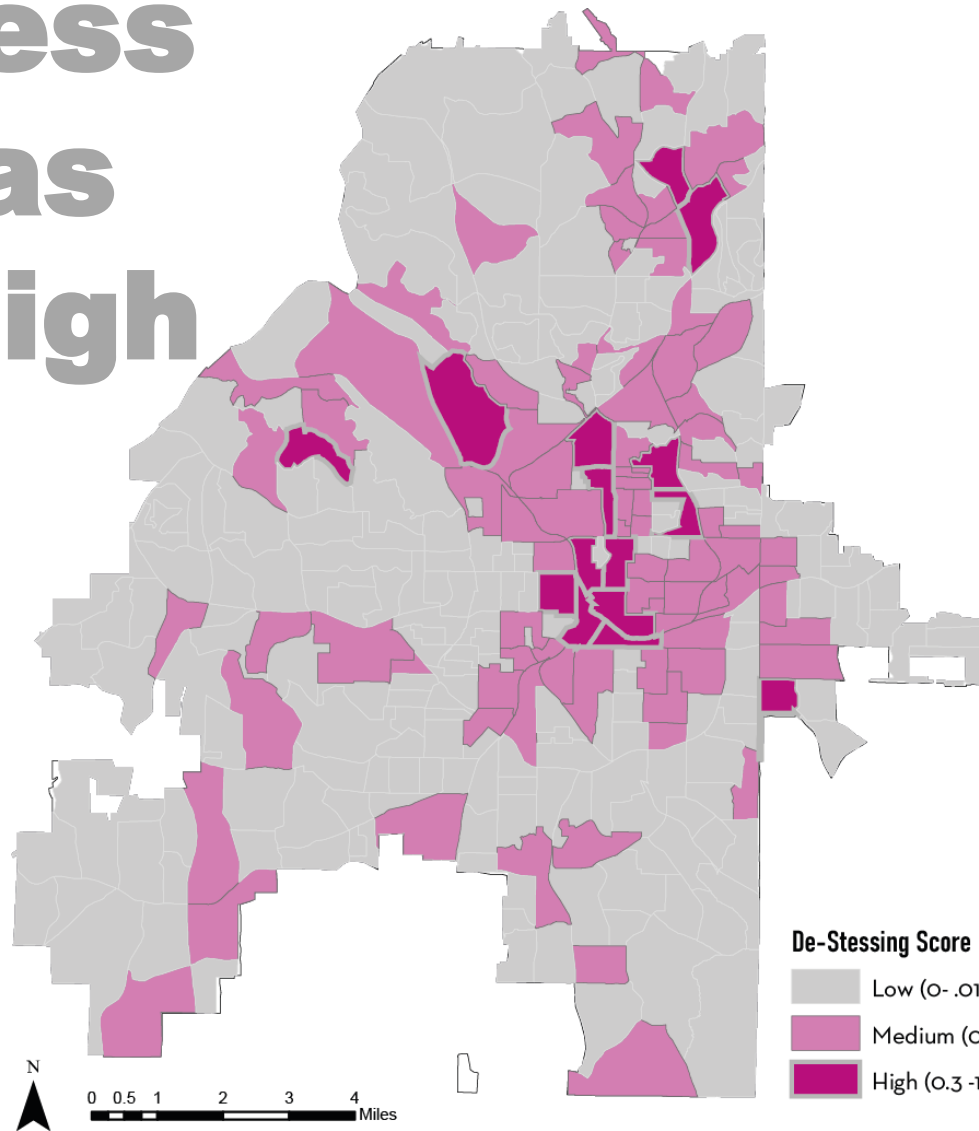Miles
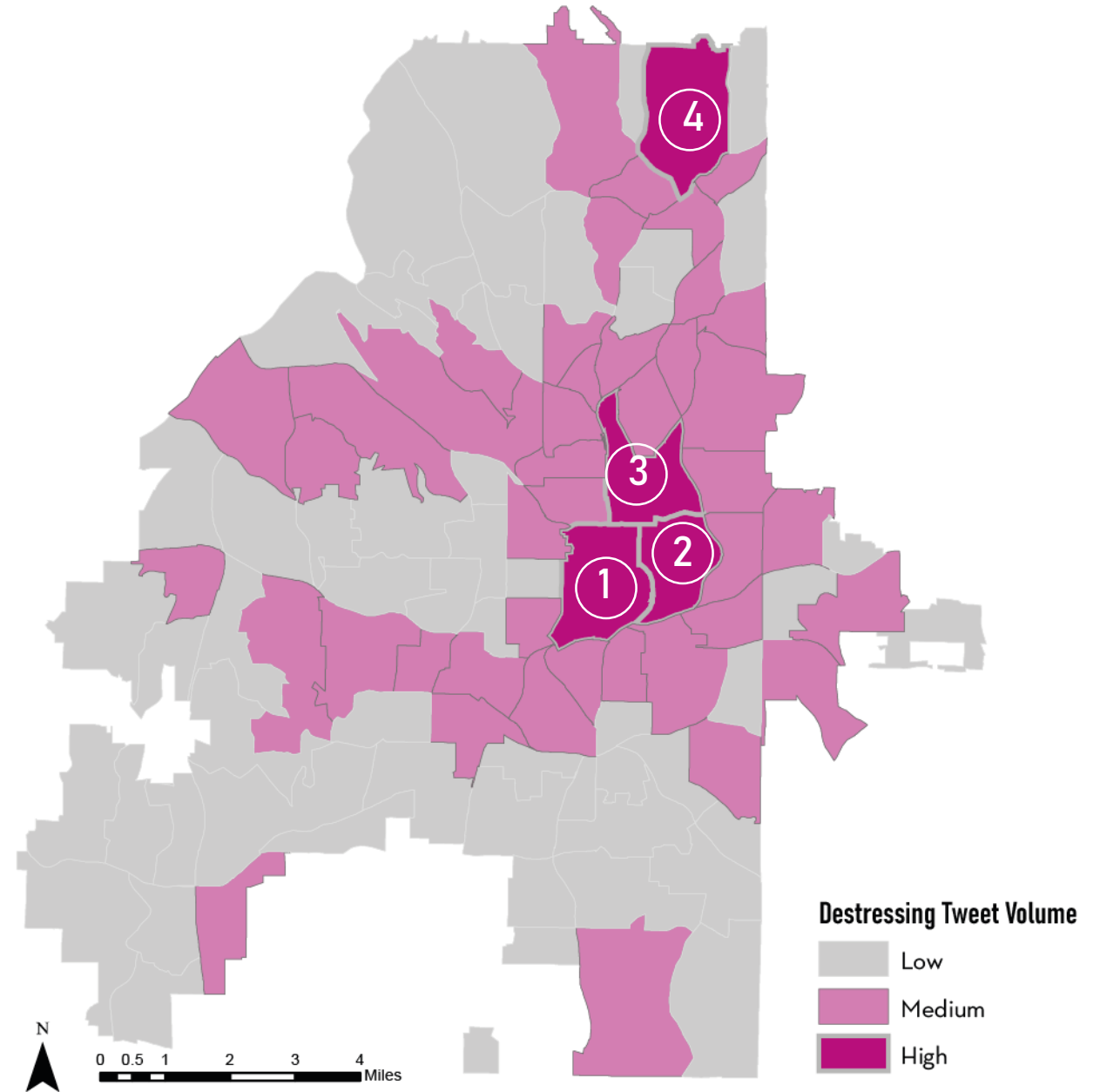
Mapping
Urban Score

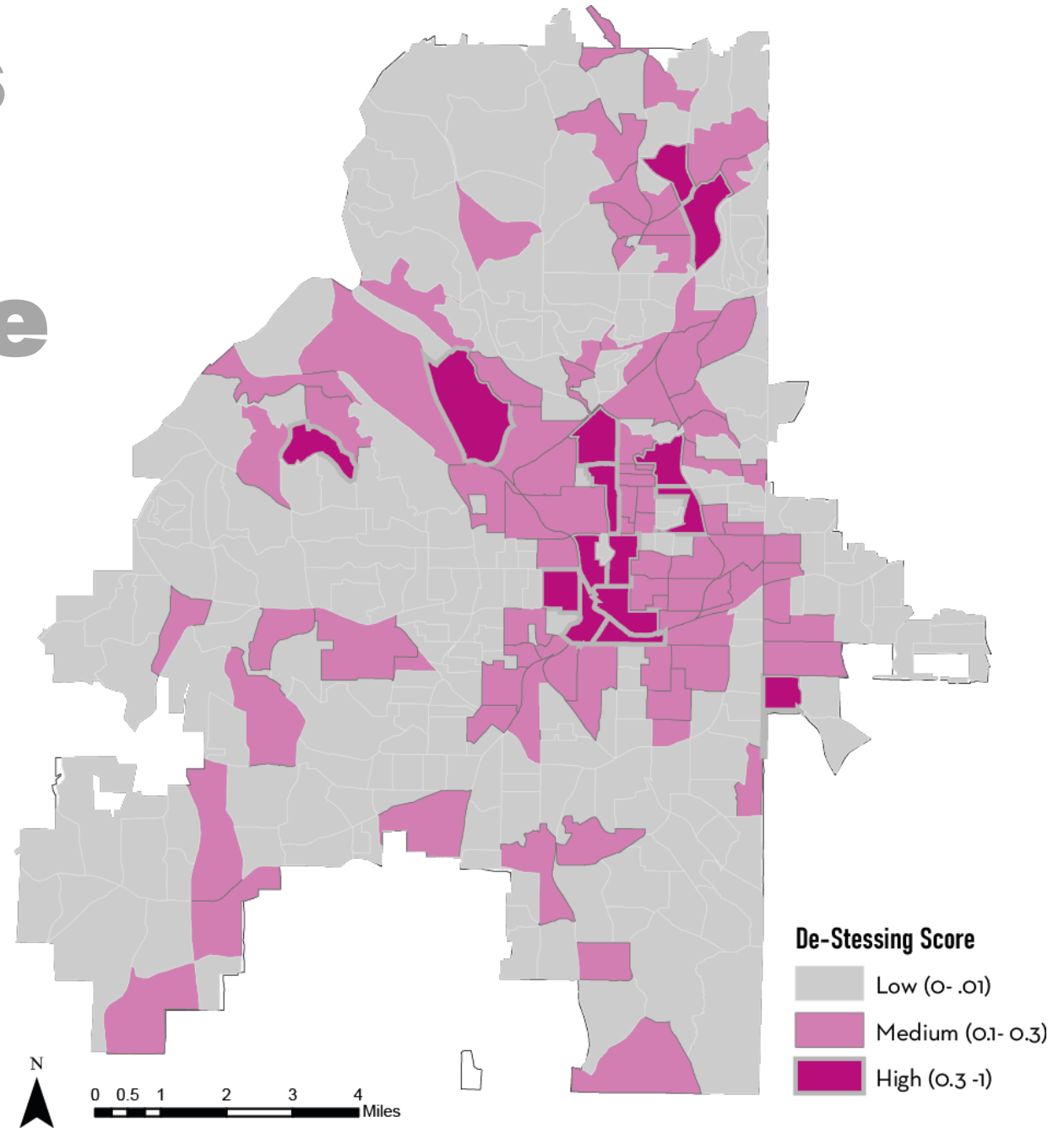Map of Atlanta Block Groups

The urban score is a composite
score generated using

Land Use Diversity
Ground Coverage (setback)
Floor Area Ratio (density)
Percent Gridded Street Network
Access to MARTA Train Station

Urban Score

Low (0- .01)

Medium (0.1- 0.3)

High (0.3 -1)

N

0 0.5 1   2   3   4
Miles

People De-stress in Areas with High Urban Score

De-Stessing Score

- Low (0- .01)
- Medium (0.1- 0.3)
- High (0.3 -1)

Urban Score

- Low (0- .01)
- Medium (0.1- 0.3)
- High (0.3 -1)

N
0 0.5 1 2 3 4 Miles

N
0 0.5 1 2 3 4 Miles

People De-stress in Areas with High Urban Score

Intensity of Destressing Activities (y-axis)

Urban Score (x-axis)

P value <.05

De-Stessing Score

Low (0- .01)

Medium (0.1- 0.3)

High (0.3 -1)

0 0.5 1 2 3 4 Miles

N
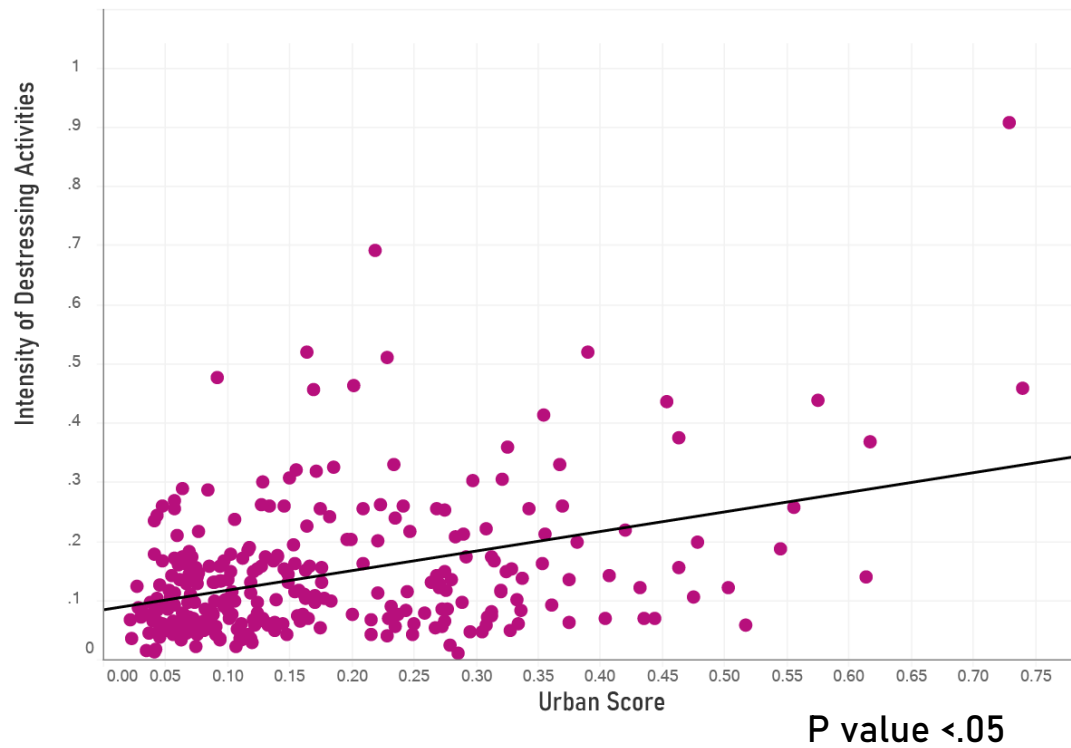
Topic Clusters

Cluster (group)

- **City & Public Amenities**
- **Events & games**
- **Food and Drinks**
- **Photography**
- **Relaxation**

City and Public Amenities – People describes how happy they are with the public amenities (park, trail, plaza, restaurants, museums) in the city.

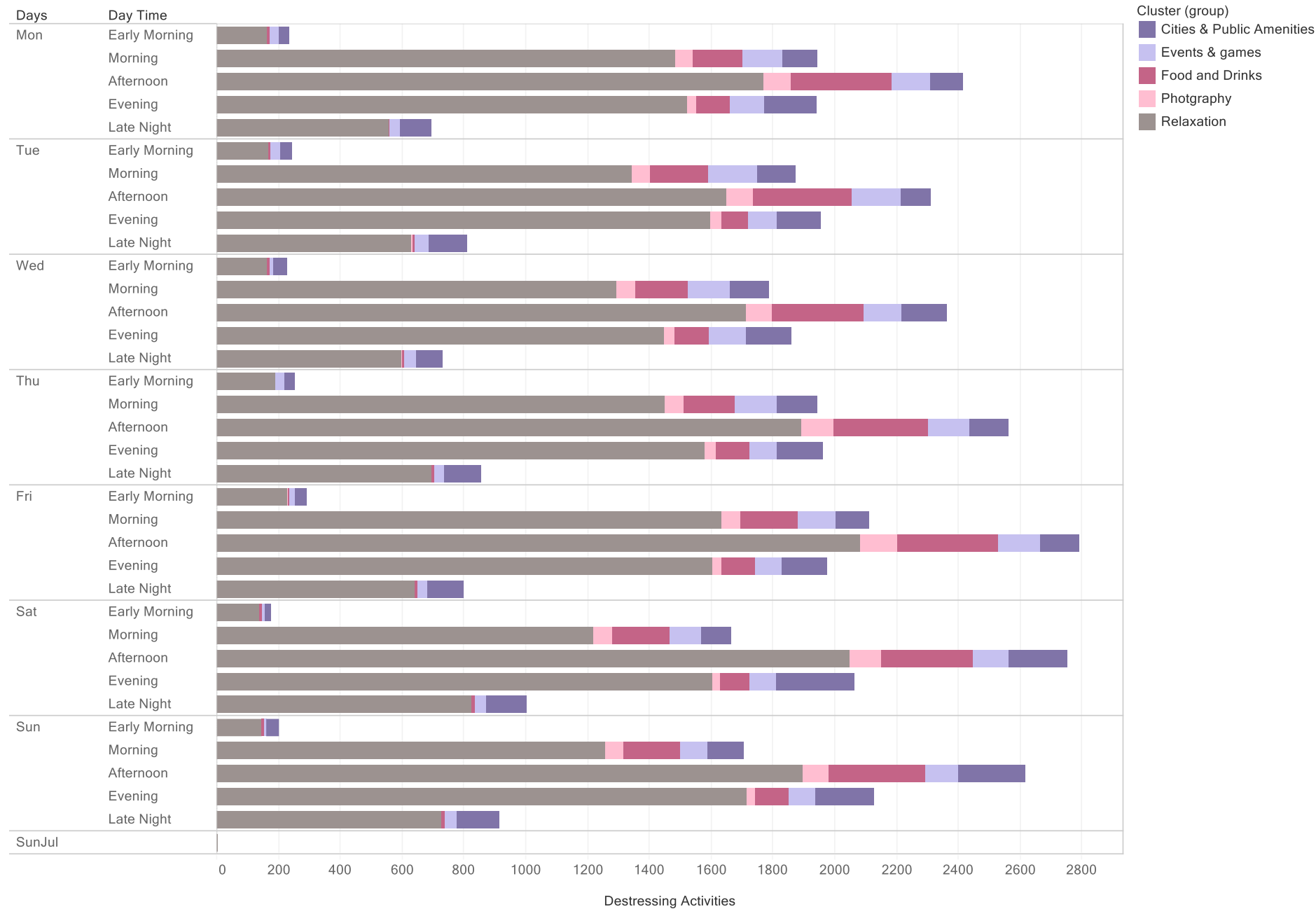**Games and Events** – People reported visiting weekend events, games, etc. for fun

Food and Drinks – People enjoyed drinking beer , wine or eating food on certain occasions.

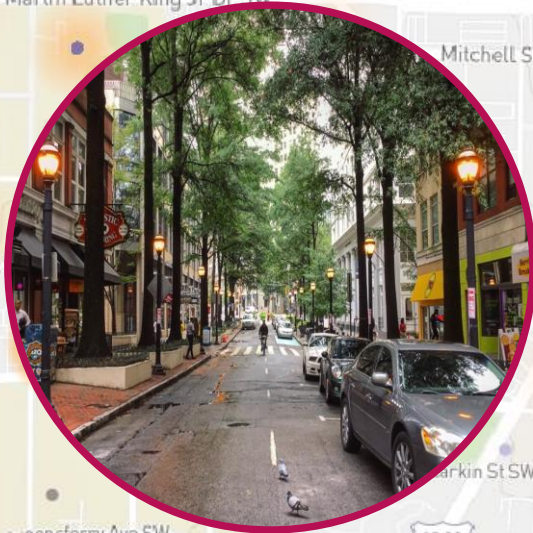**Photography**– People reported taking pictures or videos, and shared their Instagram posts.

Relaxation – People did various activities like yoga, strolling , taking a walk or even engaging in activities like gardening watching, television , cooking.

Getting insight from the Topic Clusters

In Atlanta people involve in more amount of de-stressing activities during the afternoon

Days	Day Time
Mon	Early Morning
	Morning
	Afternoon
	Evening
	Late Night
Tue	Early Morning
	Morning
	Afternoon
	Evening
	Late Night
Wed	Early Morning
	Morning
	Afternoon
	Evening
	Late Night
Thu	Early Morning
	Morning
	Afternoon
	Evening
	Late Night
Fri	Early Morning
	Morning
	Afternoon
	Evening
	Late Night
Sat	Early Morning
	Morning
	Afternoon
	Evening
	Late Night
Sun	Early Morning
	Morning
	Afternoon
	Evening
	Late Night
SunJul	

Cluster (group)
- Cities & Public Amenities
- Events & games
- Food and Drinks
- Photgraphy
- Relaxation

Destressing Activities

Downtown

Cluster (group)
- City & Public Amenities
- Events & games
- Food and Drinks
- Photography
- Relaxation
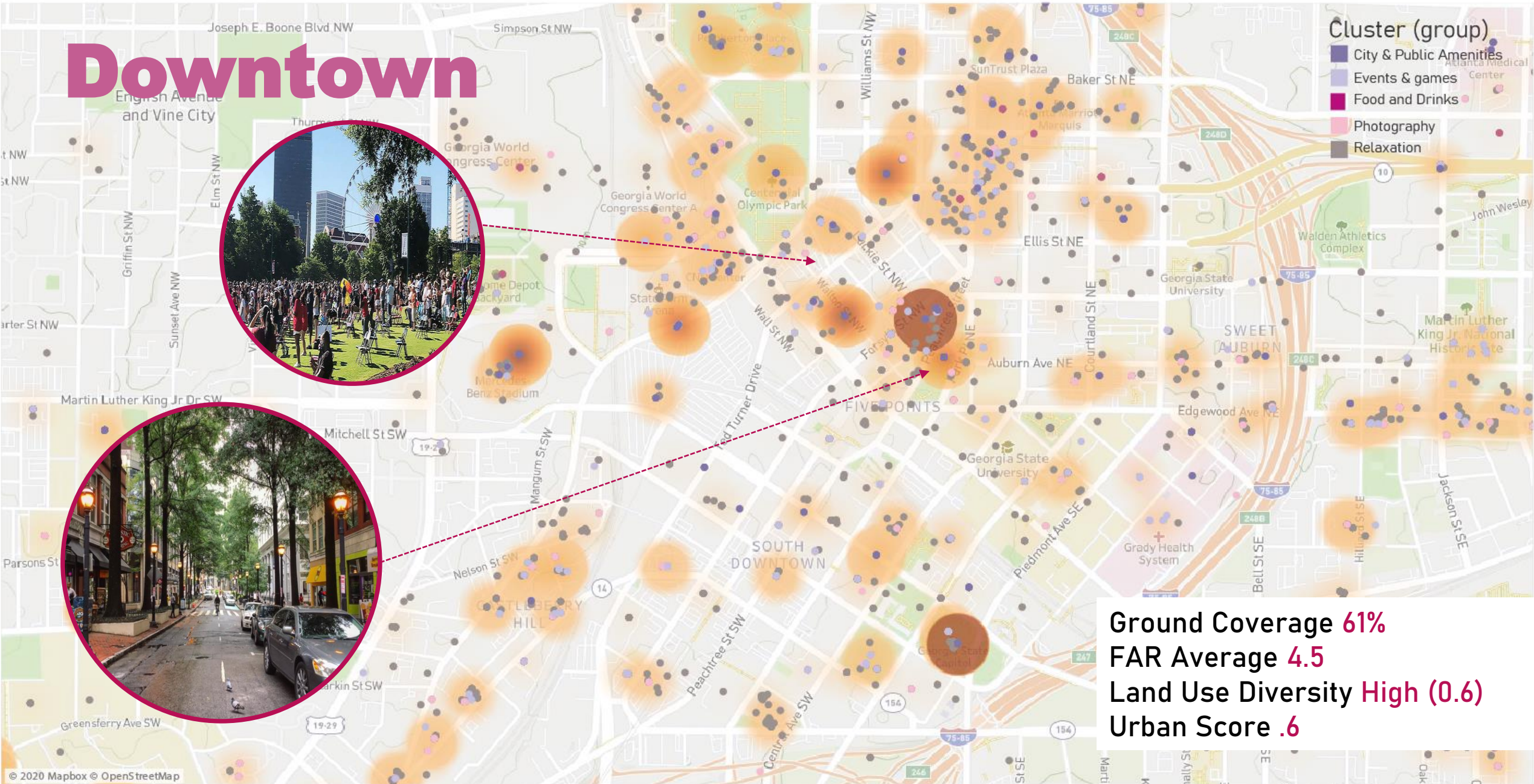
Ground Coverage **61%**
FAR Average **4.5**
Land Use Diversity **High (0.6)**
Urban Score **.6**

Hill Park

Cluster (group)

- 🟣 City & Public Amenities
- 🟪 Events & games
- 🟣 Food and Drinks
- 🩷 Photography
- ⚫ Relaxation

Ground Coverage 18%
FAR Average 1.8
Land Use Diversity High (0.3)
Urban Score .18

Ben Hill

Ground Coverage **5%**
FAR Average **0.1**
Land Use Diversity **High (0.1)**
Urban Score **.08**

Cluster (group)
- City & Public Amenities
- Events & games
- Food and Drinks
- Photography
- Relaxation

Mapbox © OpenStreetMap
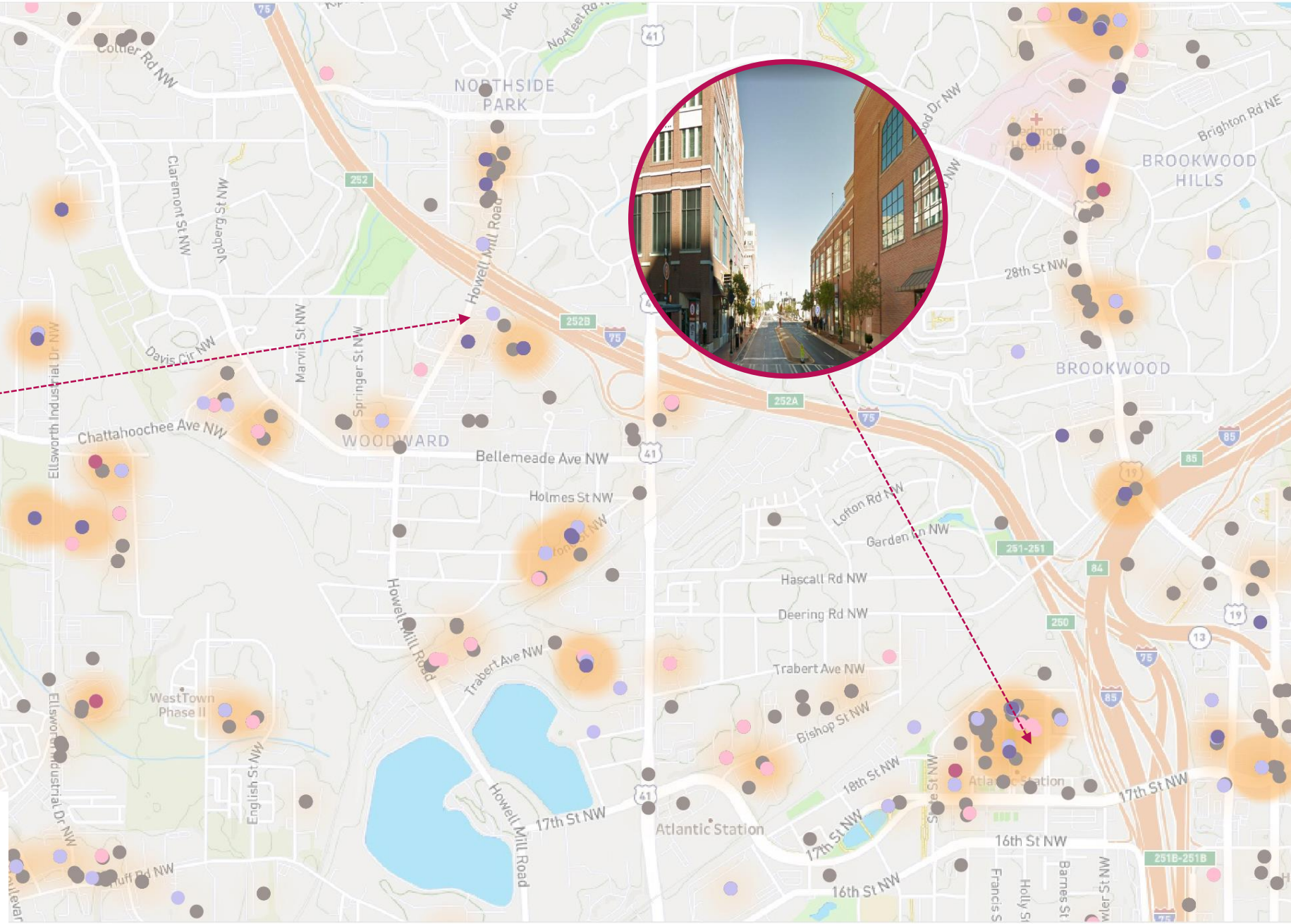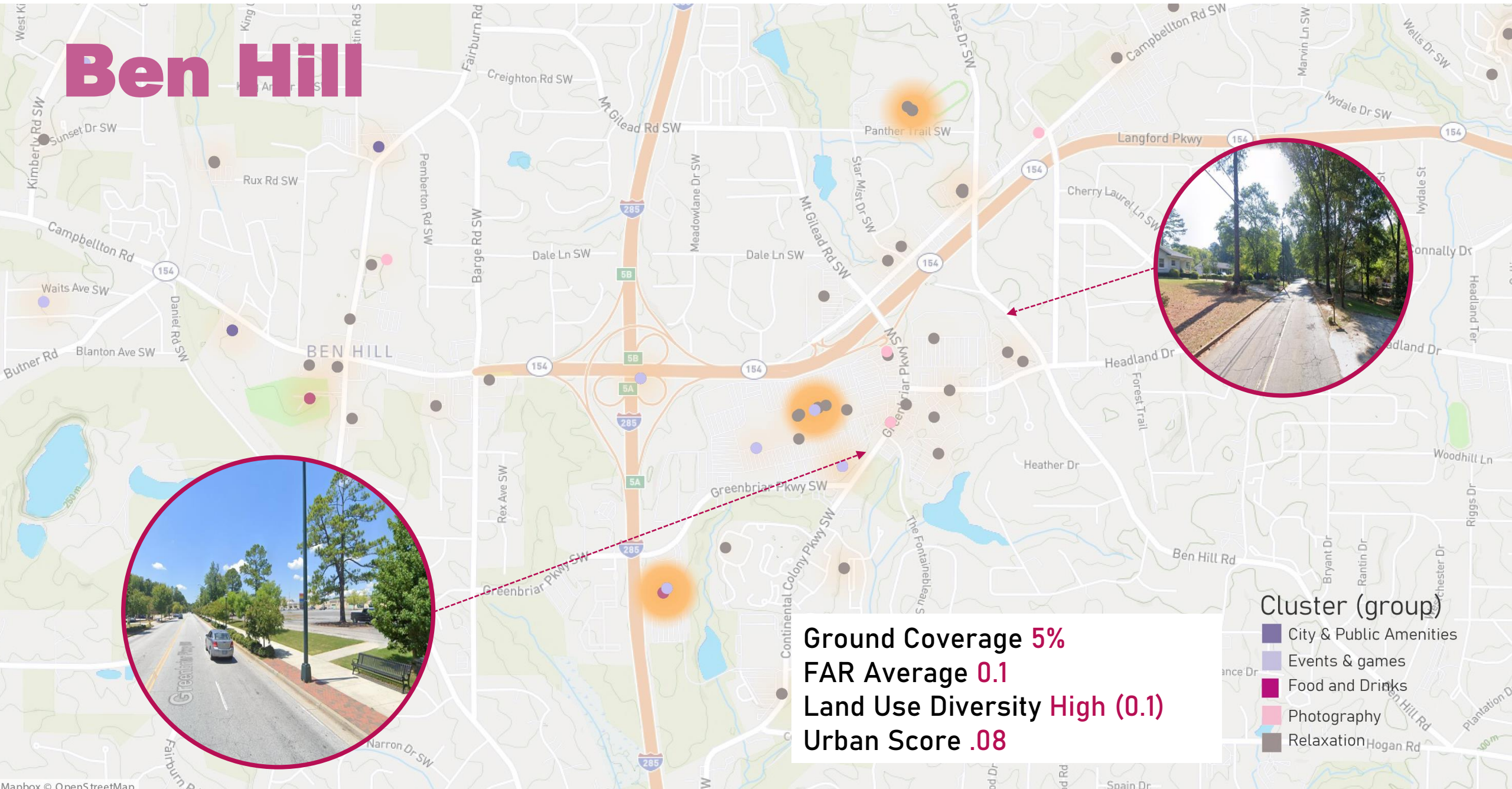
H. People are less **stressed** in areas with a higher degree of urbaneness.

Findings:

People engage in de-stress in neighborhoods with higher urban score.
i.e. neighborhoods with higher building density , smaller block sizes, higher proportion of gridded streets, and high land use diversity.

Future work in progress

Findings:

Adding fine grain Built environment and socio economic variable.

Assessing the stressed Tweets their topics.

Comparing more cities

Research
Implication

Can be used in the development of audit tool / check list for planners and designers

Provide cues for public awareness

Overall aims to encourage reduction in the mental health cost burden through investment in public amenities