



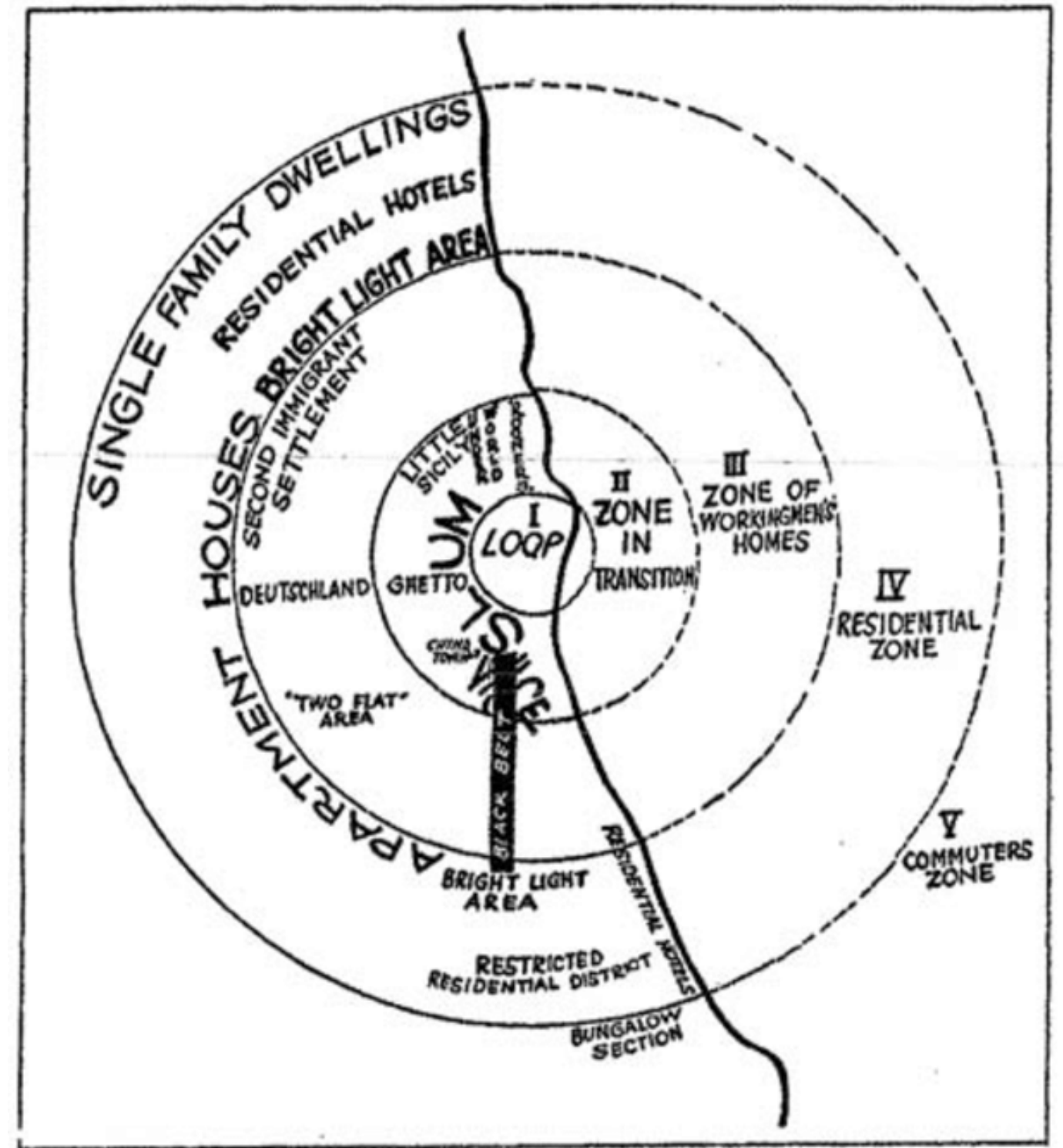
# THE BURGESS URBAN DEVELOPMENT MODEL

SUGGESTS THAT CITIES DEVELOP OUTWARD FROM A CBD WITH A PREDICTABLE RING PATTERNING OF SOCIAL CLASSES AND LAND USE.

WAS INNOVATIVE TO BOTH URBAN PLANNING AND SOCIOLOGY IN THAT IT FOR THE FIRST TIME TRIED TO IDENTIFY THE INTERWEAVINGS OF LAND-USE PATTERN WITH SOCIAL DYNAMICS.

VERY MUCH APPLICABLE TO POST-WAR SUBURBAN DEVELOPMENT IN THE UNITED STATES WHICH WAS DRIVEN BY OPRESSIVE RELATIONSHIPS BETWEEN SOCIAL CLASSES AND A PERCEIVED LOW DESIRABILITY OF DWELLING NEAR THE URBAN CORE.

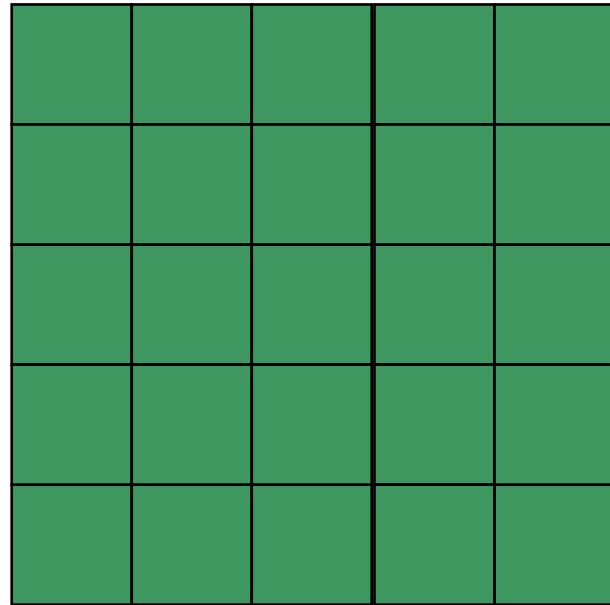
WHILE NEW MODELS MIGHT BETTER REPRESENT HOW CITIES DEVELOP NOW, THE BURGESS MODEL REMAINS AN EFFECTIVE WAY TO ASSESS THE HISTORICAL SPRAWL PATTERNS OF OF THE 1950S-1990S WHICH LEAVE THEIR MARK TODAY.





1

### ENVIRONMENT



GRID OF GREEN CELLS



2

### POPULATION

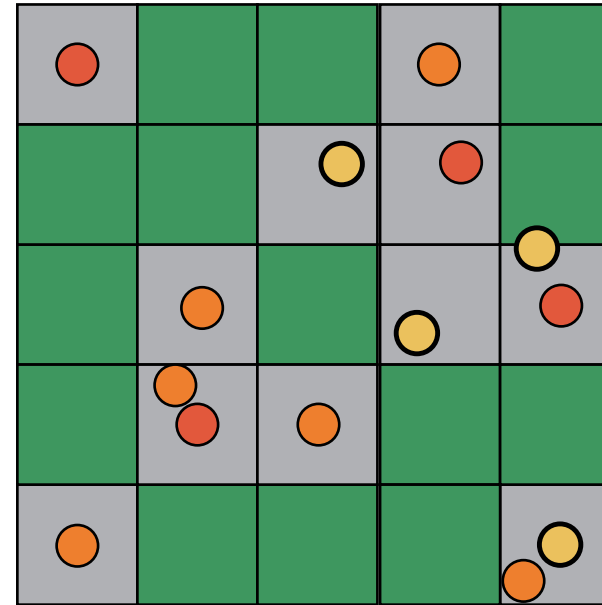


EACH GROUP IS POPULATED  
BASED ON THE GENERAL  
DENSITY BUT THE USER CAN  
INCREASE OR DECREASE THE  
RELATIVE DENSITY OF EACH  
GROUP



3

### SEEDING



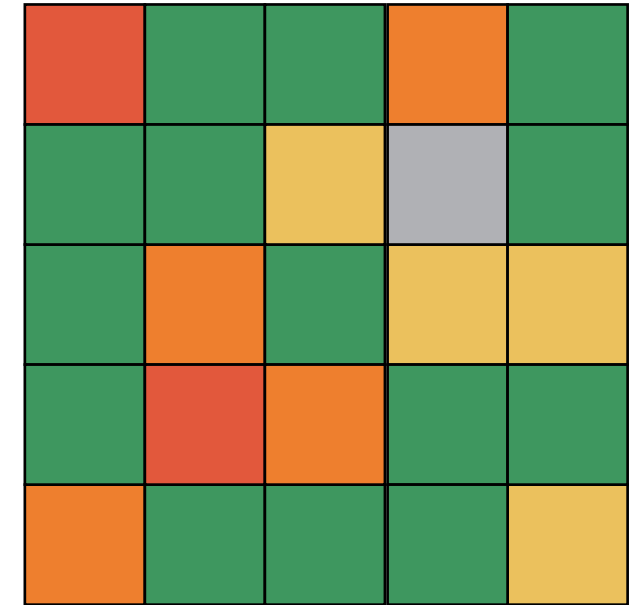
EACH SEGMENT OF THE  
POPULATION RANDOMLY  
SELECTS CELLS TO CONSIDER  
FOR DEVELOPMENT

SOME WILL OCCUPY THE SAME  
CELL. THE WEALTHIER ONE  
GETS FIRST CHOICE BUT IF THE  
WEALTHY ONE REJECTS THE  
CELL THE LESS WEALTHY ONE  
CAN CHOOSE TO DEVELOP IT



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### SELECTION



A HIGHER PREFERENCE  
VARIABLE MEANS THE AGENT  
WILL TOLERATE A HIGHER  
NUMBER OF NEIGHBORS IF  
REJECTED BY ALL AGENTS ON  
THE CELL, THE CELL BECOMES  
GRAY.

#### USER VARIABLES

##### Environment

Environment Width  0200 [

Environment Height  0200 [

##### Population

General Density  125 [

Relative Density of High Income  01 [1.

Relative Density of Medium Income  01 [1.

Relative Density of Low Income  01 [1.

##### Preferences

Crowding level acceptable to High Income  15

Crowding level acceptable to Medium Income  20

Crowding level acceptable to Low Income  30

Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

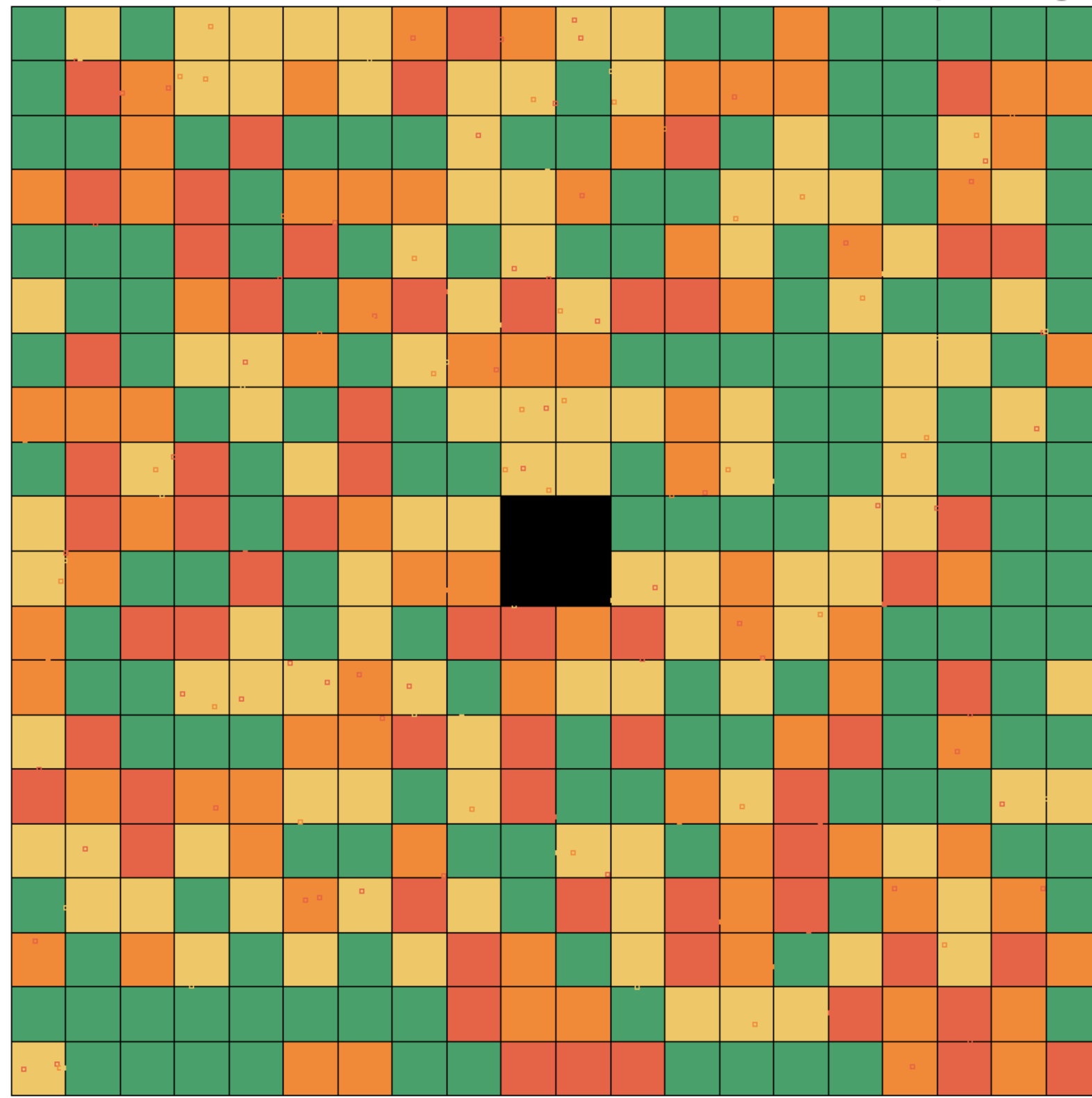
Preferences

- Crowding level acceptable to High Income 1
- Crowding level acceptable to Medium Income 2
- Crowding level acceptable to Low Income 3

Mobility

- High Income Mobility Level 0000 [0..1000] every
- Medium Income Mobility Level 0100 [0..1000] every
- Low Income Mobility Level 0010 [0..1000] every

BASE RUN: 1



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Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

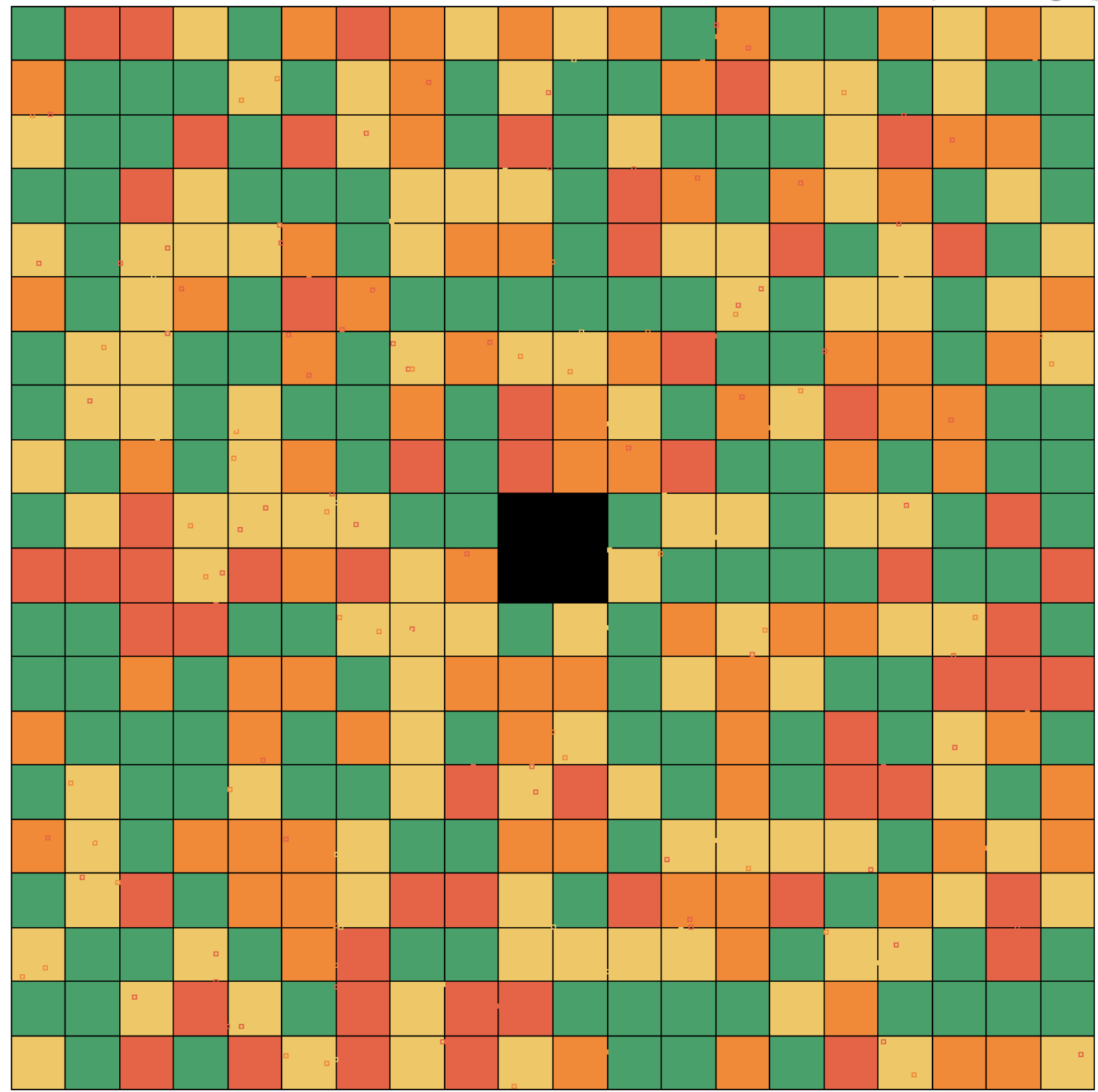
Preferences

- Crowding level acceptable to High Income 1
- Crowding level acceptable to Medium Income 2
- Crowding level acceptable to Low Income 3

Mobility

- High Income Mobility Level 1000 [0..1000] every
- Medium Income Mobility Level 0100 [0..1000] every
- Low Income Mobility Level 0010 [0..1000] every

BASE RUN: 2



Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

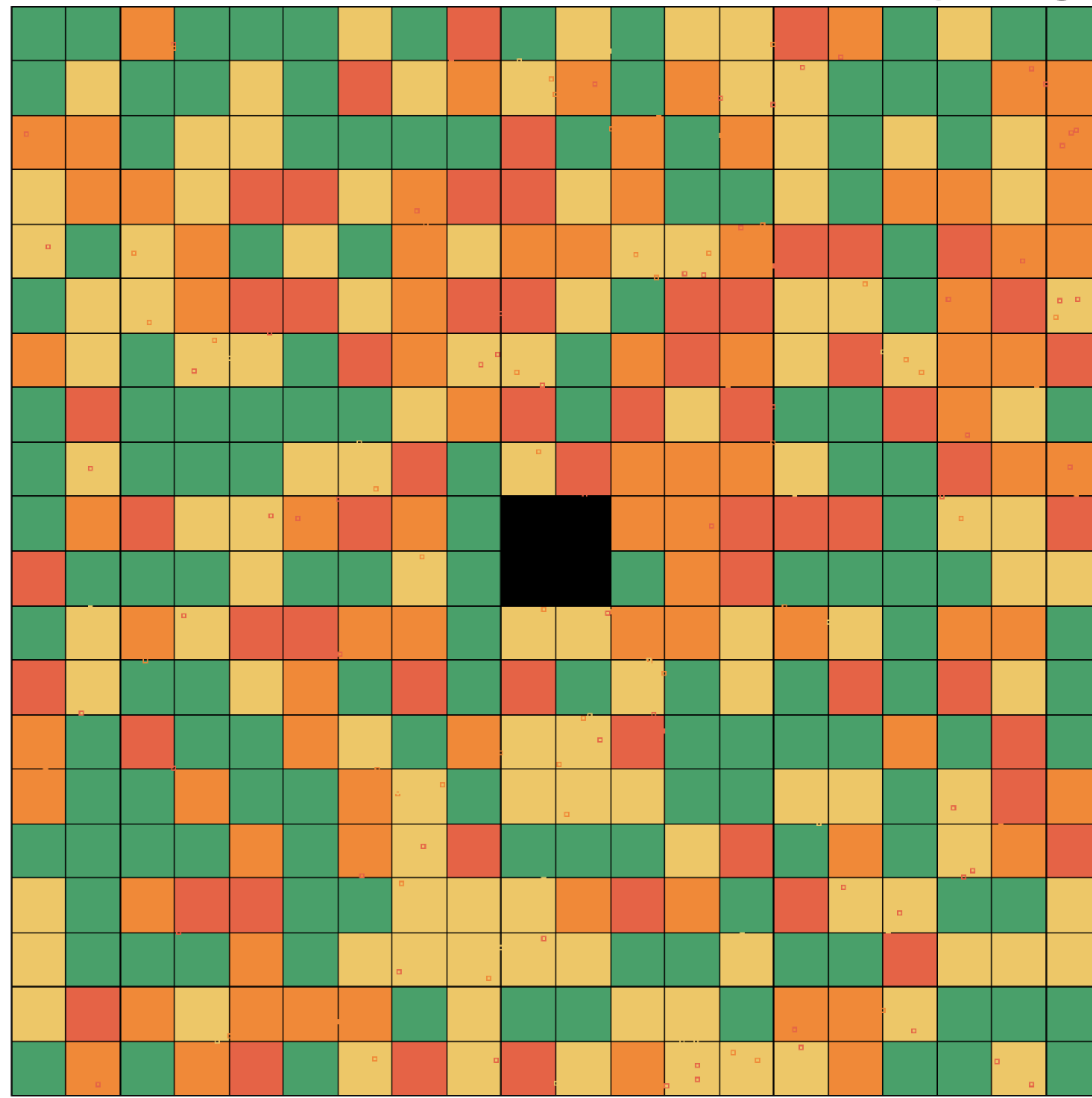
Preferences

- Crowding level acceptable to High Income 1:
- Crowding level acceptable to Medium Income 2:
- Crowding level acceptable to Low Income 3:

Mobility

- High Income Mobility Level 1000 [0..1000] every
- Medium Income Mobility Level 0100 [0..1000] every
- Low Income Mobility Level 0010 [0..1000] every

BASE RUN: 3



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**Environment**

Environment Width  0200 [10..1000] every 1

Environment Height  0200 [10..1000] every 1

City Center Size  10 [5..50] every 1

**Population**

General Density  125 [1..400] e

Relative Density of High Income  01 [1..10] ever

Relative Density of Medium Income  01 [1..10] ever

Relative Density of Low Income  01 [1..10] ever

**Preferences**

Crowding level acceptable to High Income  1:

Crowding level acceptable to Medium Income  2:

Crowding level acceptable to Low Income  3:

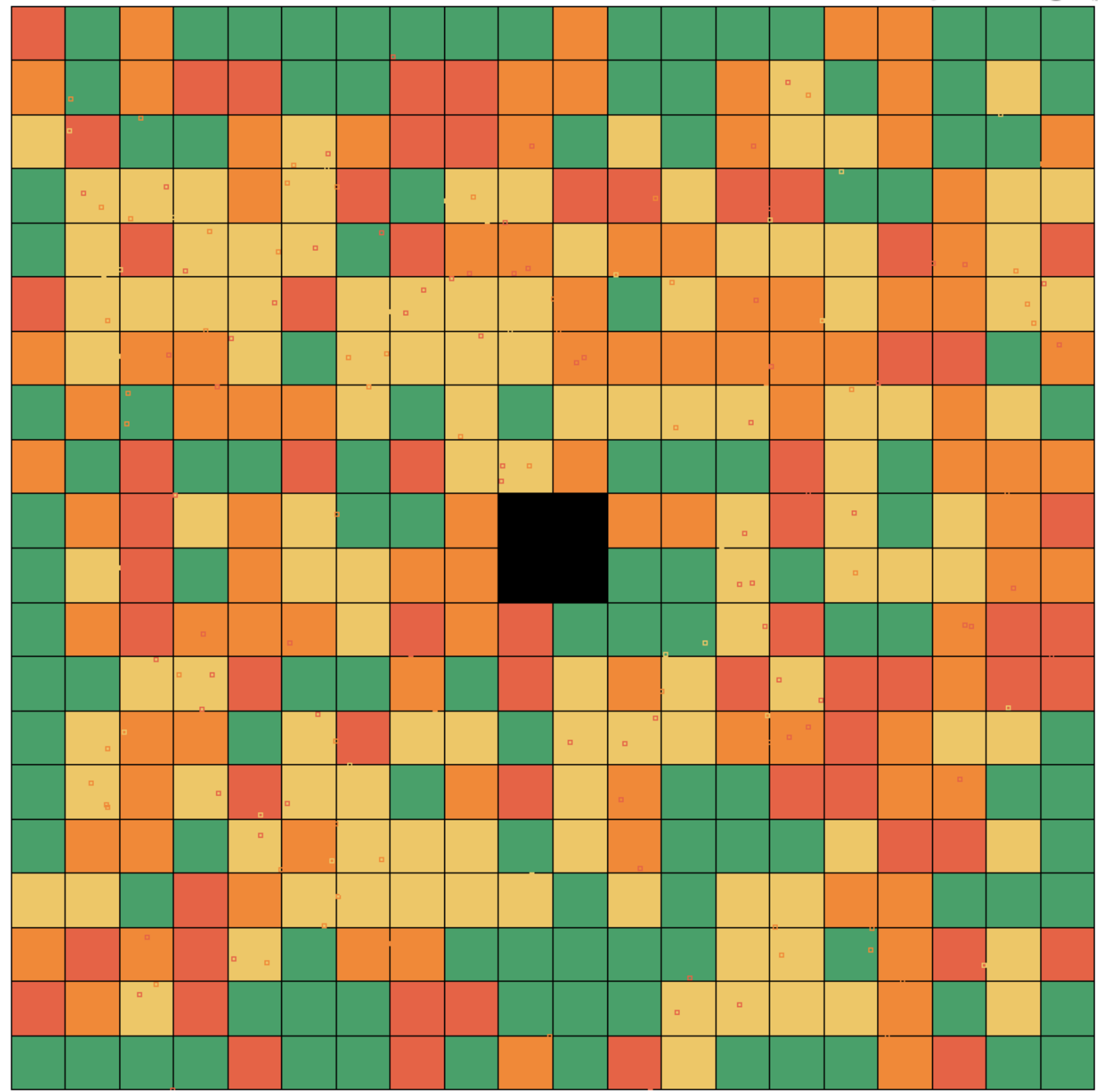
**Mobility**

High Income Mobility Level  1000 [0..1000] every

Medium Income Mobility Level  0100 [0..1000] every

Low Income Mobility Level  0050 [0..1000] every

**ADD IN THE CBD ATTRACTOR  
AND A TIME SEQUENCE**



Environment

Environment Width 0200 [10..1000] every 1

Environment Height 0200 [10..1000] every 1

City Center Size 10 [5..50] every 1

Population

General Density 125 [1..400] e

Relative Density of High Income 01 [1..10] ever

Relative Density of Medium Income 01 [1..10] ever

Relative Density of Low Income 01 [1..10] ever

Preferences

Crowding level acceptable to High Income 1:

Crowding level acceptable to Medium Income 2:

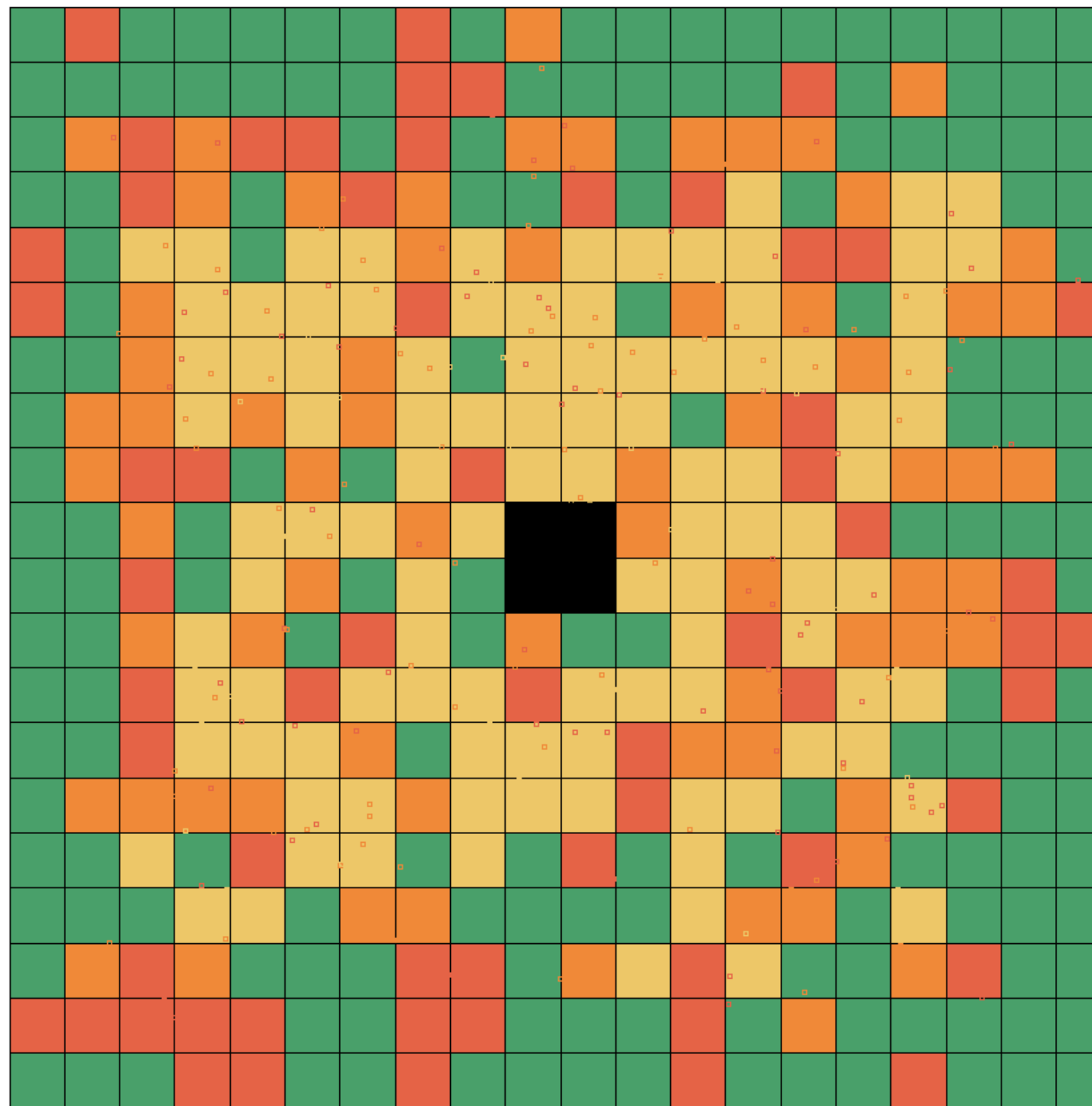
Crowding level acceptable to Low Income 3:

Mobility

High Income Mobility Level 1000 [0..1000] every

Medium Income Mobility Level 0100 [0..1000] every

Low Income Mobility Level 0050 [0..1000] every



20 CYCLES



Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

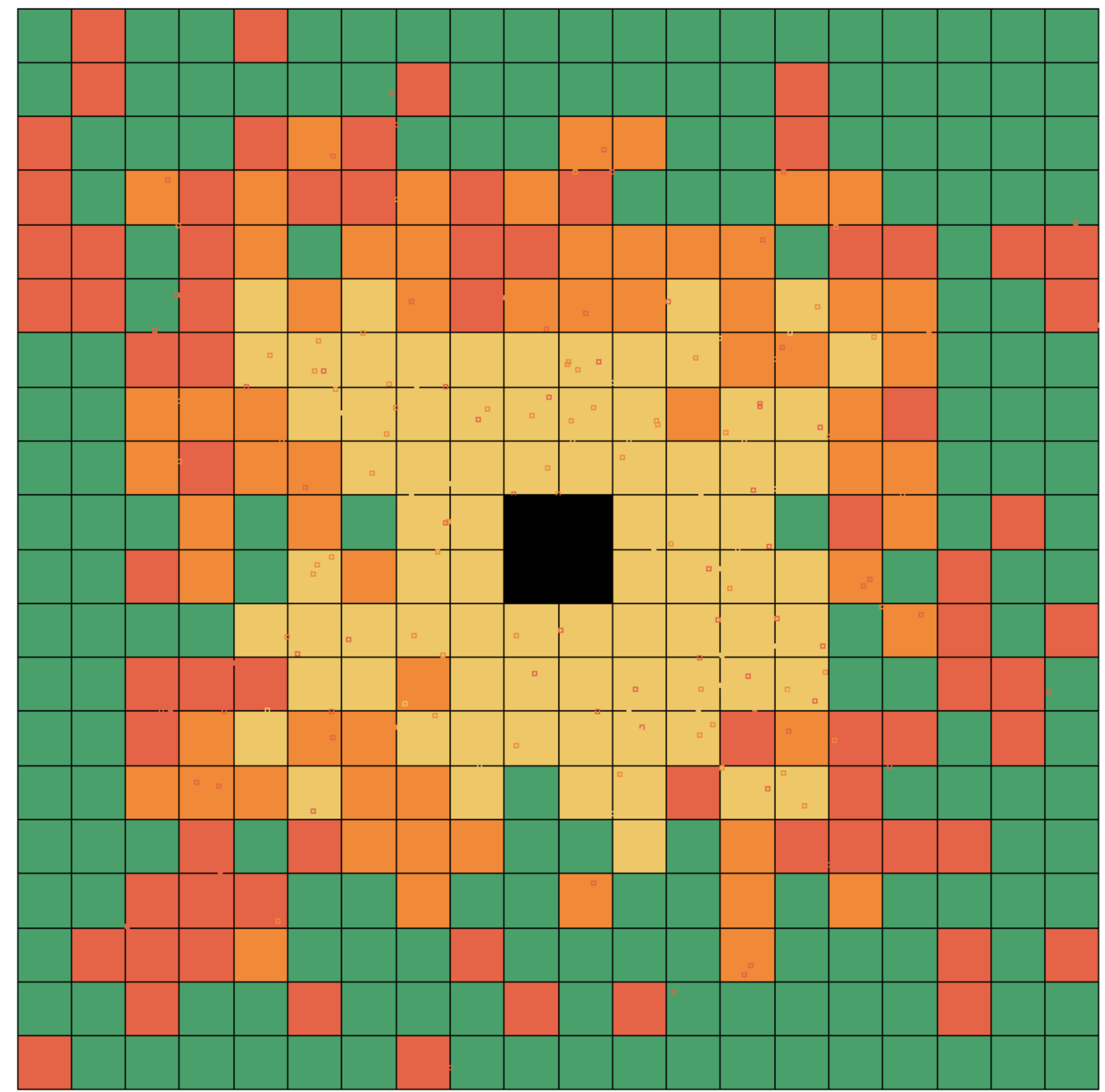
Preferences

- Crowding level acceptable to High Income 1:
- Crowding level acceptable to Medium Income 2:
- Crowding level acceptable to Low Income 3:

Mobility

- High Income Mobility Level 1000 [0..1000] every
- Medium Income Mobility Level 0100 [0..1000] every
- Low Income Mobility Level 0050 [0..1000] every

40 CYCLES



Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

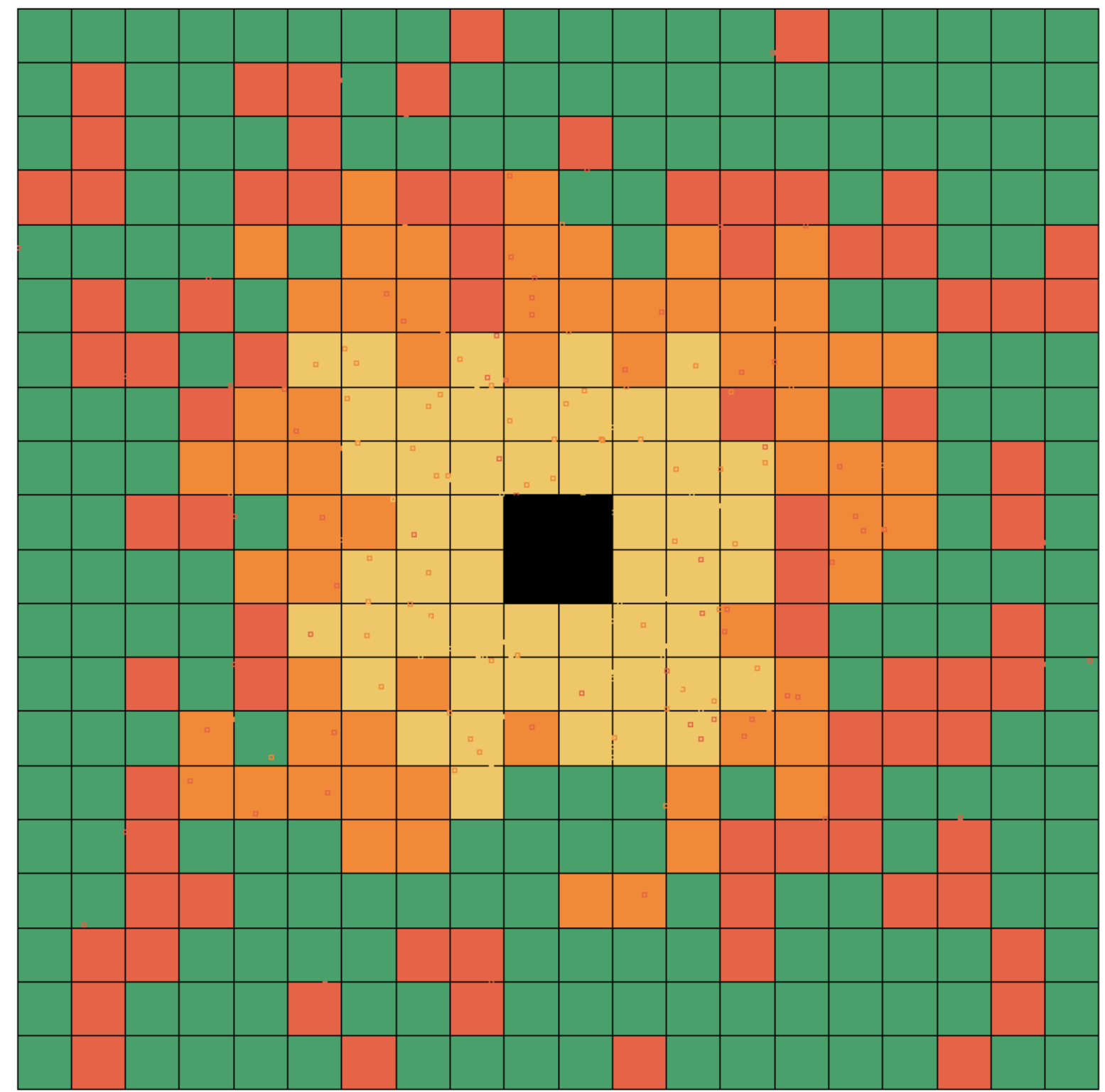
Preferences

- Crowding level acceptable to High Income 1:
- Crowding level acceptable to Medium Income 2:
- Crowding level acceptable to Low Income 3:

Mobility

- High Income Mobility Level 1000 [0..1000] every
- Medium Income Mobility Level 0100 [0..1000] every
- Low Income Mobility Level 0050 [0..1000] every

60 CYCLES



Environment

Environment Width 0200 [10..1000] every 1

Environment Height 0200 [10..1000] every 1

City Center Size 10 [5..50] every 1

Population

General Density 125 [1..400] e

Relative Density of High Income 01 [1..10] ever

Relative Density of Medium Income 01 [1..10] ever

Relative Density of Low Income 01 [1..10] ever

Preferences

Crowding level acceptable to High Income 1:

Crowding level acceptable to Medium Income 2:

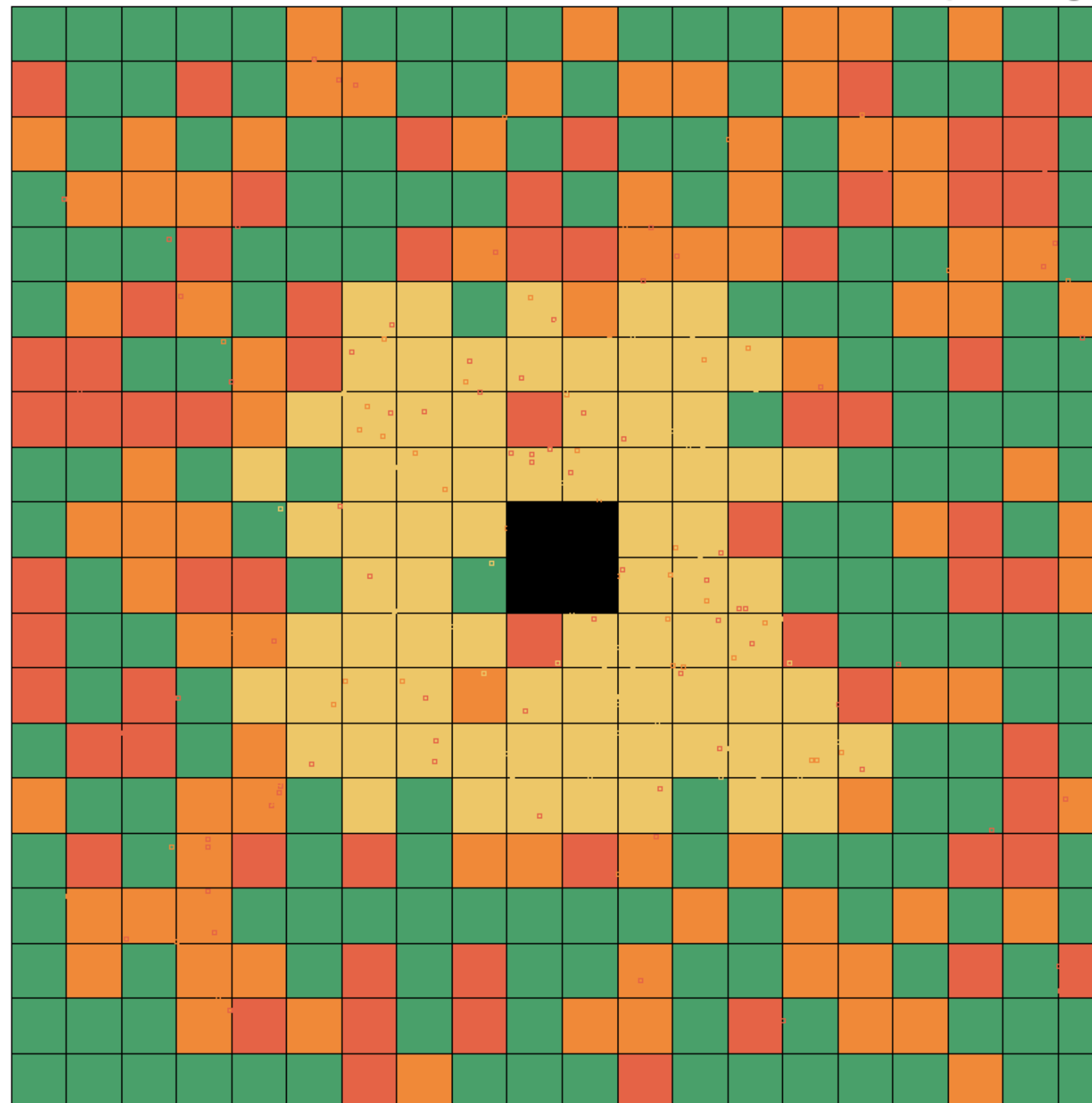
Crowding level acceptable to Low Income 3:

Mobility

High Income Mobility Level 1000 [0..1000] every

Medium Income Mobility Level 1000 [0..1000] every

Low Income Mobility Level 0050 [0..1000] every



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**GIVE HIGH INCOME AND MEDIUM INCOME THE SAME MOBILITY LEVEL**

REAL WORLD ANALOG:  
IN THE POST WAR PERIOD CARS  
BECOME AN AFFORDABLE TO  
MUCH OF THE MIDDLE CLASS

Experiment: 46 cycles elapsed

Model Sprawl2 / Experiment Sprawl

Models

Sprawl

**Environment**

Environment Width 0200 [10..1000] every 1

Environment Height 0200 [10..1000] every 1

City Center Size 10 [5..50] every 1

**Population**

General Density 125 [1..400] e

Relative Density of High Income 01 [1..10] ever

Relative Density of Medium Income 01 [1..10] ever

Relative Density of Low Income 01 [1..10] ever

**Preferences**

Crowding level acceptable to High Income 1

Crowding level acceptable to Medium Income 2

Crowding level acceptable to Low Income 3

**Mobility**

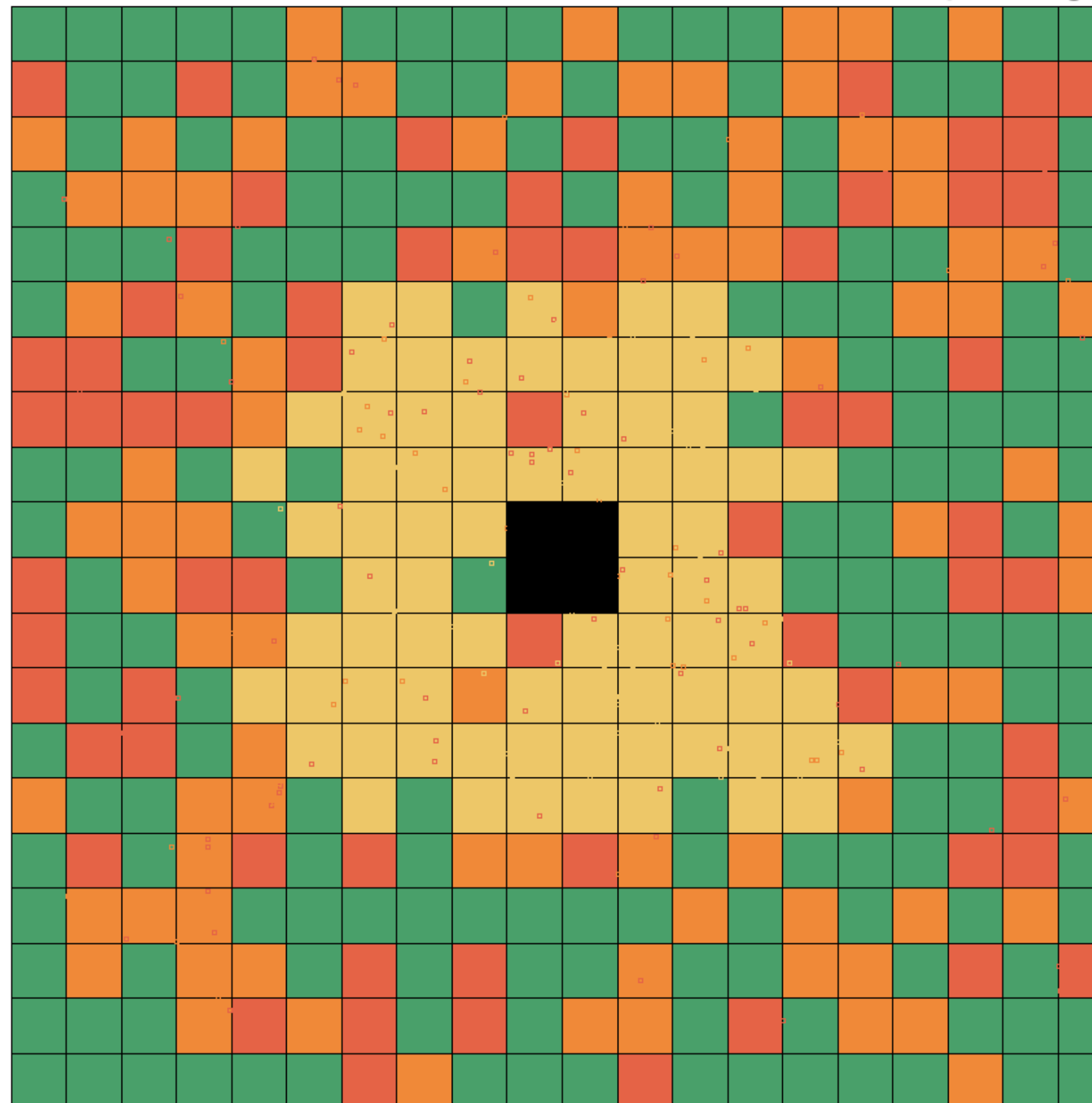
High Income Mobility Level 1000 [0..1000] every

Medium Income Mobility Level 1000 [0..1000] every

Low Income Mobility Level 0050 [0..1000] every

IMPROVING MEDIUM INCOME MOBILITY LEVELS APPEARS TO INCREASE SPRAWL SLIGHTLY

GAML reference (Ctrl)



Control icons: pause, refresh, zoom in, zoom out, pan, reset.

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**GIVE HIGH INCOME AND MEDIUM INCOME THE SAME MOBILITY LEVEL**

REAL WORLD ANALOG: IN THE POST WAR PERIOD CARS BECAME AN AFFORDABLE TO MUCH OF THE MIDDLE CLASS



Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

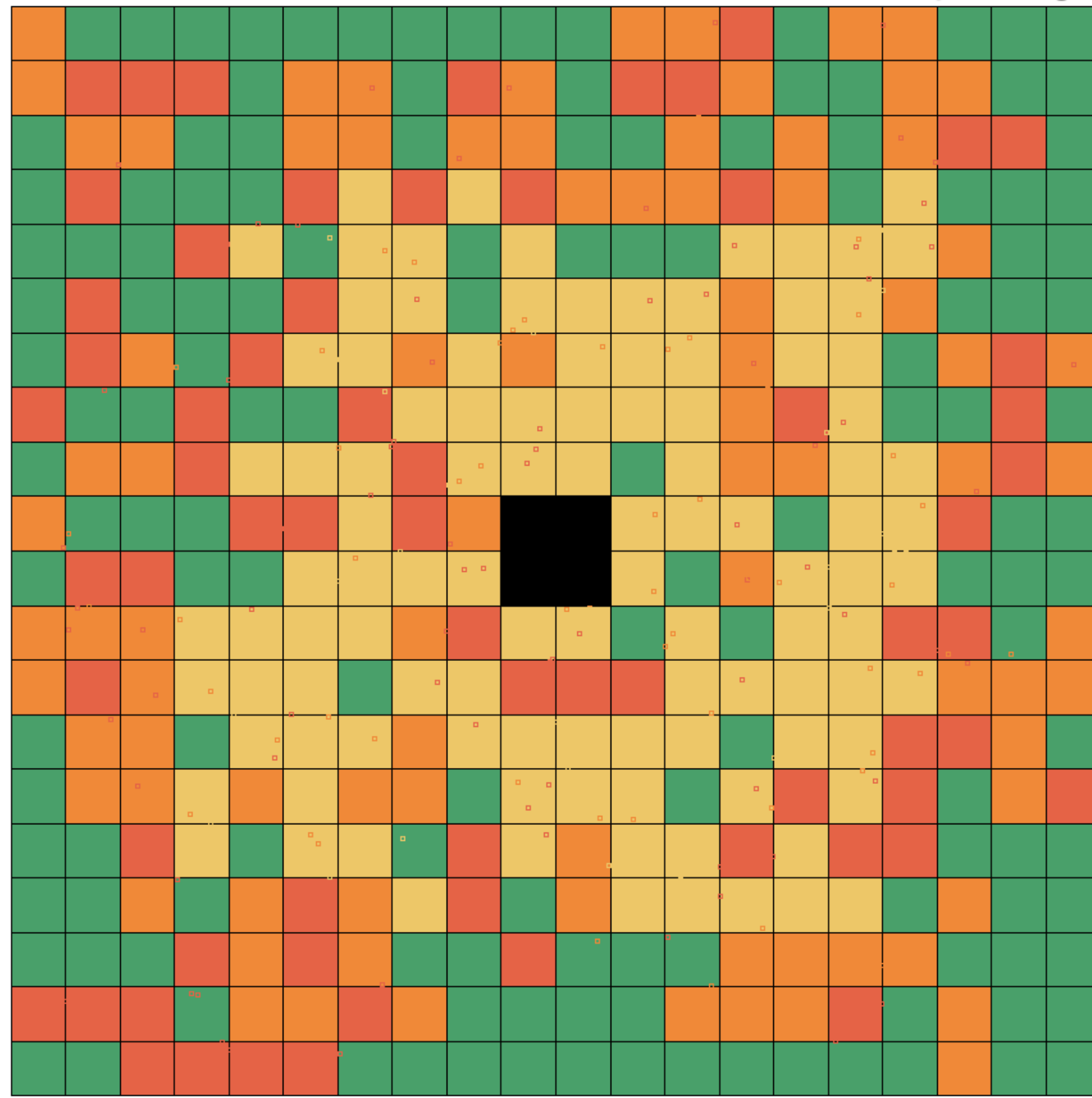
- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

Preferences

- Crowding level acceptable to High Income 1
- Crowding level acceptable to Medium Income 2
- Crowding level acceptable to Low Income 3

Mobility

- High Income Mobility Level 1000 [0..1000] every
- Medium Income Mobility Level 1000 [0..1000] every
- Low Income Mobility Level 0096 [0..1000] every



REAL WORLD ANALOG:  
INCREASED FUNDING AND  
SUBSIDIES FOR REGIONAL  
PUBLIC TRANSIT.

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# IMPROVE MOBILITY FOR LOW INCOME

Environment

Environment Width 0200 [10..1000]

Environment Height 0200 [10..1000]

City Center Size 10 [5..50] every

Population

General Density 125 [1..400] e

Relative Density of High Income 01 [1..10] ever

Relative Density of Medium Income 01 [1..10] ever

Relative Density of Low Income 01 [1..10] ever

Preferences

Crowding level acceptable to High Income 1

Crowding level acceptable to Medium Income 2

Crowding level acceptable to Low Income 3

Mobility

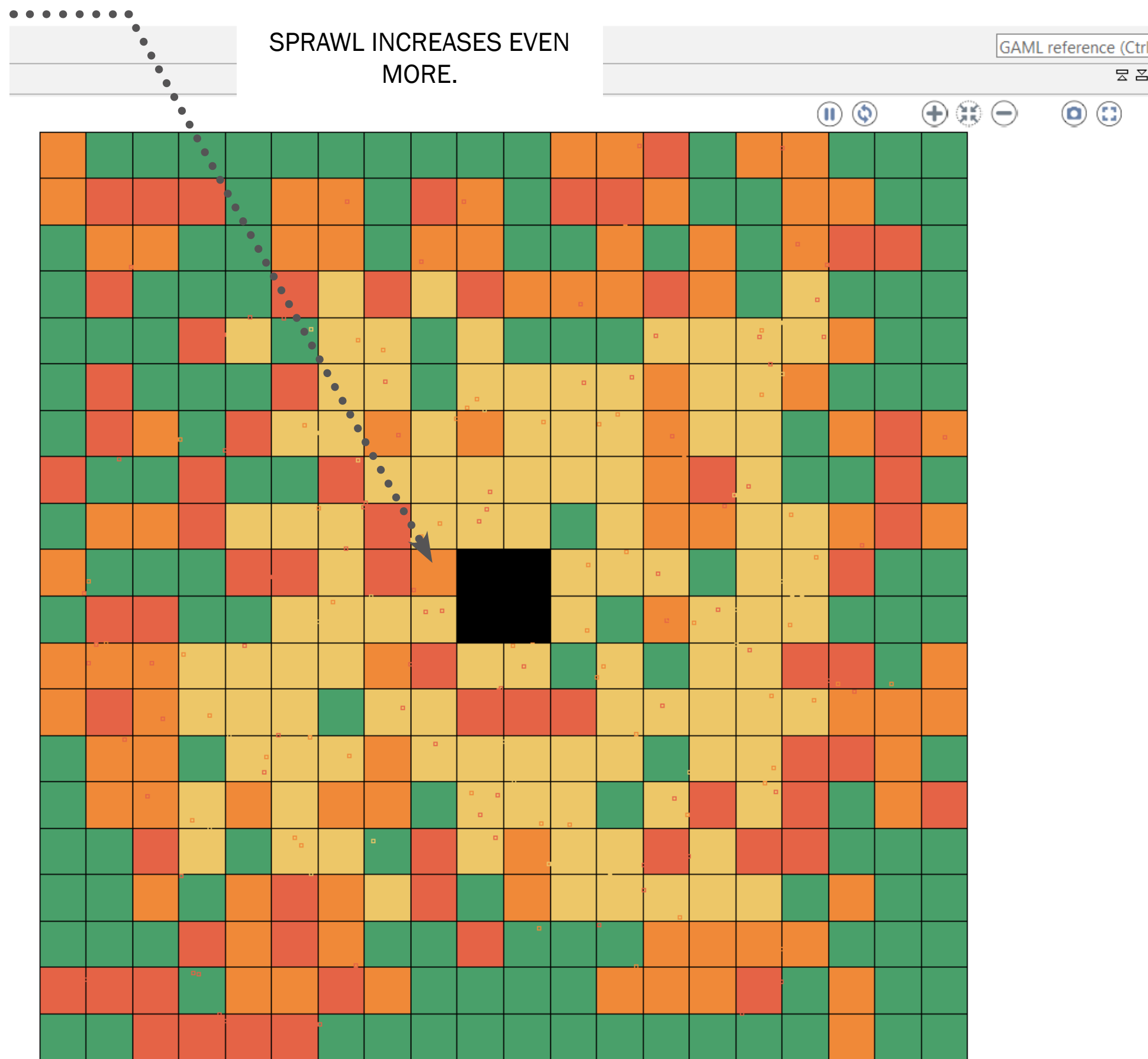
High Income Mobility Level 1000 [0..1000] every

Medium Income Mobility Level 1000 [0..1000] every

Low Income Mobility Level 0096 [0..1000] every

BECAUSE LOW INCOME ARE ABLE TO SPREAD OUT MORE, THERE ARE PLACES WITHIN THE FIRST RING WHICH ARE LESS CROWDED AND THUS ACCEPTED FOR HIGH INCOME AND MEDIUM INCOME DEVELOPMENTS

SPRAWL INCREASES EVEN MORE.



REAL WORLD ANALOG: INCREASED FUNDING AND SUBSIDIES FOR REGIONAL PUBLIC TRANSIT.

IMPROVE MOBILITY FOR LOW INCOME

Environment

Environment Width 0200 [10..1000] every 1

Environment Height 0200 [10..1000] every 1

City Center Size 10 [5..50] every 1

Population

General Density 125 [1..400] e

Relative Density of High Income 01 [1..10] ever

Relative Density of Medium Income 01 [1..10] ever

Relative Density of Low Income 01 [1..10] ever

Preferences

Crowding level acceptable to High Income 1

Crowding level acceptable to Medium Income 2

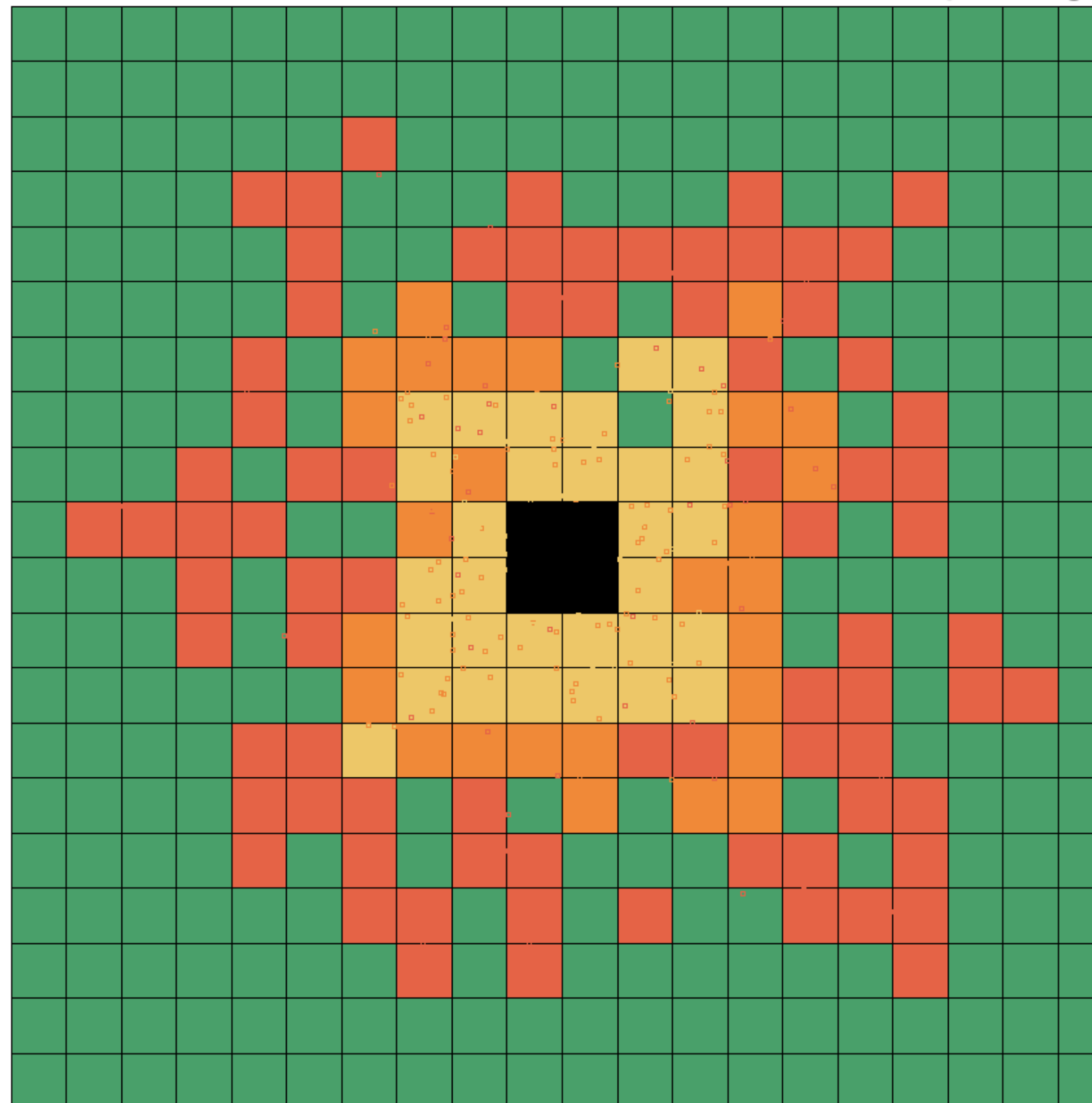
Crowding level acceptable to Low Income 3

Mobility

High Income Mobility Level 0117 [0..1000] every

Medium Income Mobility Level 0043 [0..1000] every

Low Income Mobility Level 0021 [0..1000] every



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**REDUCE ALL MOBILITY LEVELS BUT STILL GIVE WEALTHIER AGENTS MORE MOBILITY**

REAL WORLD ANALOG: PREWAR CONDITIONS WHERE TRANSIT WAS LIMITED TO STREETCARS AND AUTOMOBILES WERE A LUXURY

Experiment: 46 cycles elapsed

Model Sprawl2 / Experiment Sprawl

Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

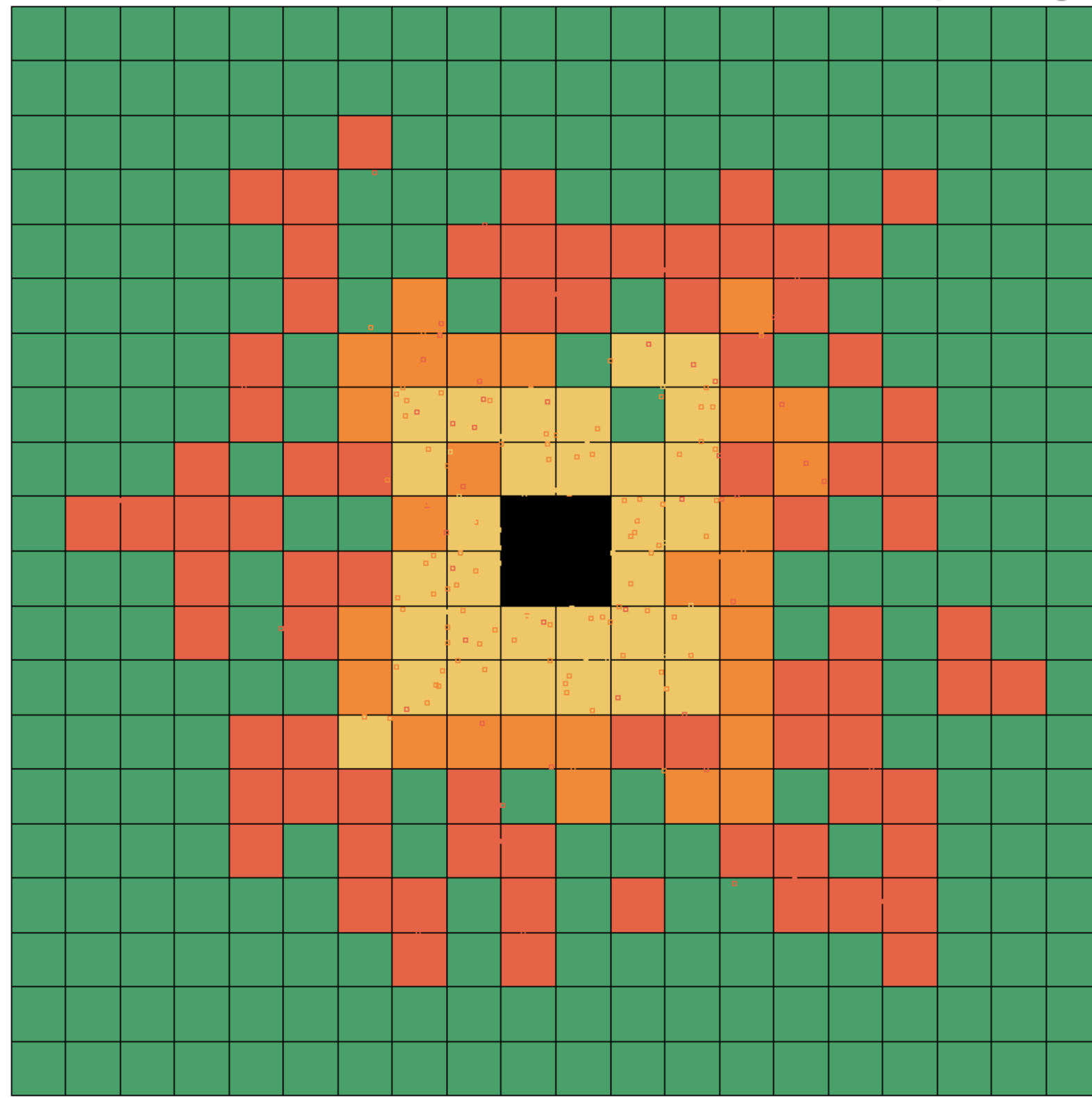
Preferences

- Crowding level acceptable to High Income 1
- Crowding level acceptable to Medium Income 2
- Crowding level acceptable to Low Income 3

Mobility

- High Income Mobility Level 0117 [0..1000] every
- Medium Income Mobility Level 0043 [0..1000] every
- Low Income Mobility Level 0021 [0..1000] every

THIS CREATES A SMALLER CONCENTRIC URBAN FORM WITH BURGESS' EXPECTED DEMOGRAPHIC RINGS



GAML reference (Ctrl)



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REDUCE ALL MOBILITY LEVELS BUT STILL GIVE WEALTHIER AGENTS MORE MOBILITY

REAL WORLD ANALOG: PREWAR CONDITIONS WHERE TRANSIT WAS LIMITED TO STREETCARS AND AUTOMOBILES WERE A LUXURY



Environment

Environment Width 0200 [10..1000] every 1

Environment Height 0200 [10..1000] every 1

City Center Size 10 [5..50] every 1

Population

General Density 125 [1..400] e

Relative Density of High Income 01 [1..10] ever

Relative Density of Medium Income 01 [1..10] ever

Relative Density of Low Income 01 [1..10] ever

Preferences

Crowding level acceptable to High Income 1:

Crowding level acceptable to Medium Income 2:

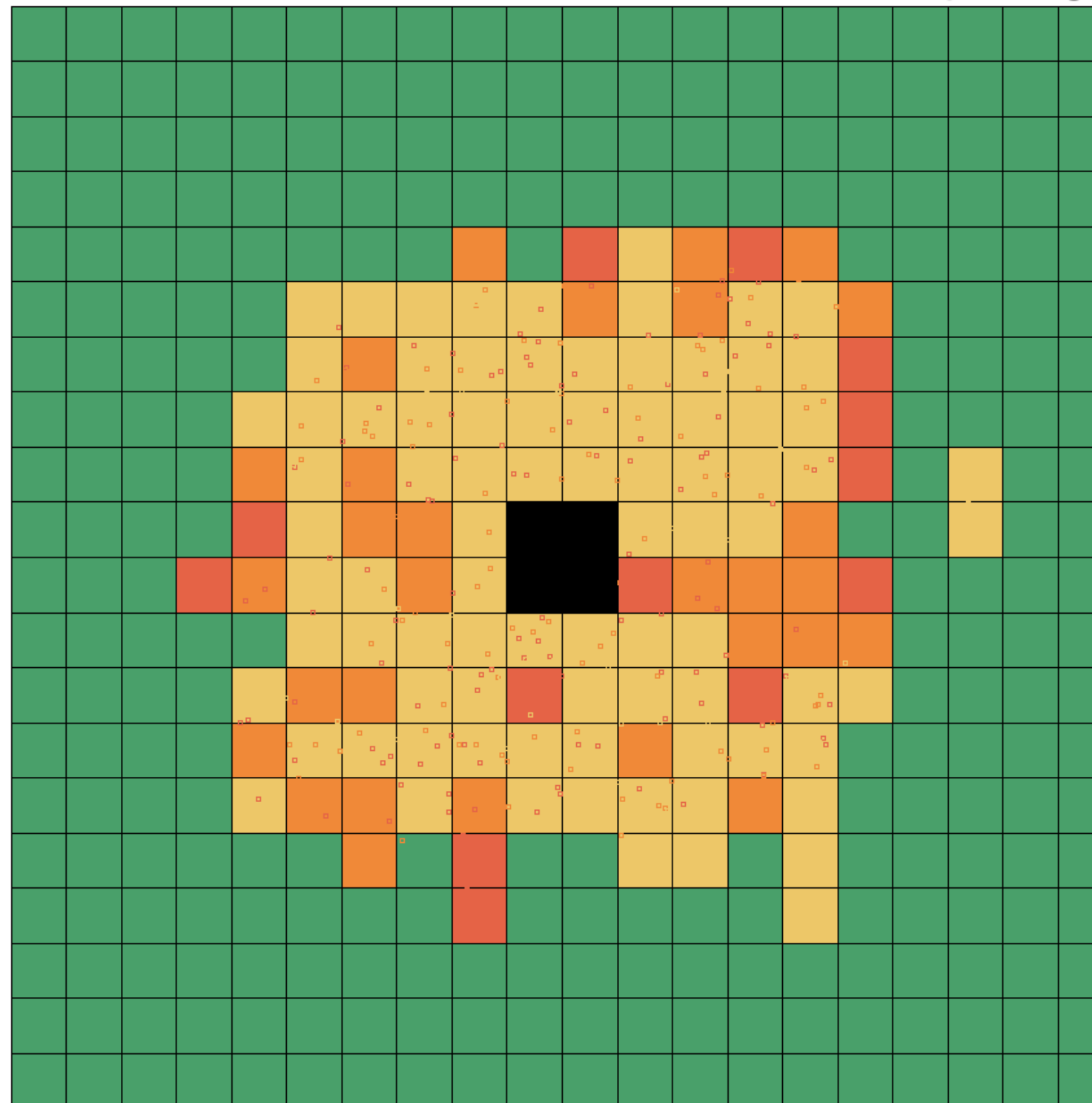
Crowding level acceptable to Low Income 3:

Mobility

High Income Mobility Level 0064 [0..1000] every

Medium Income Mobility Level 0064 [0..1000] every

Low Income Mobility Level 0064 [0..1000] every



REAL WORLD ANALOG:  
A UNIVERSAL BAN ON CARS

**GIVE EVERYONE UNIFORMLY LOW  
MOBILITY LEVELS**

Experiment: 46 cycles elapsed

Model Sprawl2 / Experiment Sprawl

Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

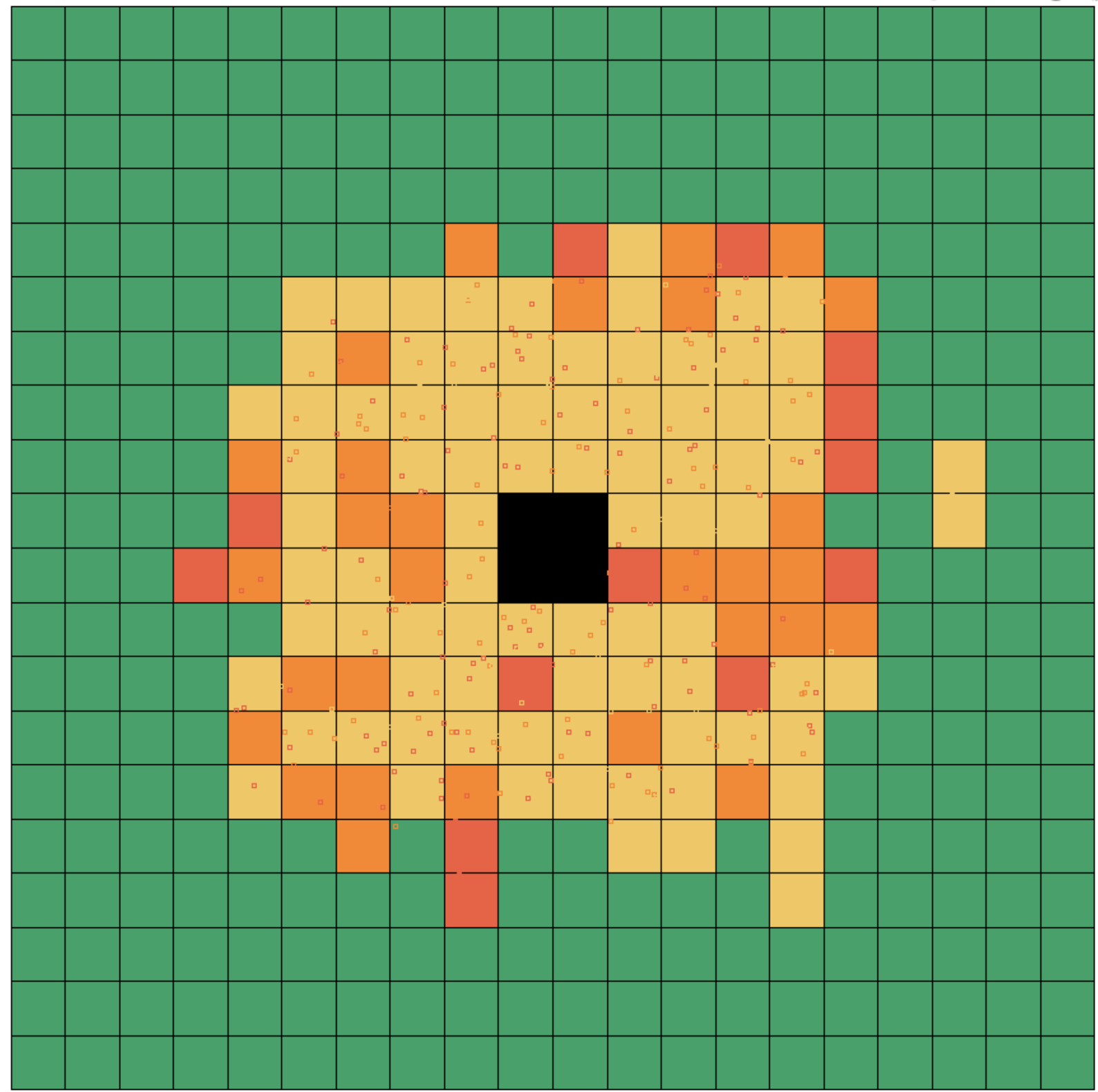
Preferences

- Crowding level acceptable to High Income 1:
- Crowding level acceptable to Medium Income 2:
- Crowding level acceptable to Low Income 3:

Mobility

- High Income Mobility Level 0064 [0..1000] every
- Medium Income Mobility Level 0064 [0..1000] every
- Low Income Mobility Level 0064 [0..1000] every

CROWDING SQUEEZES OUT MANY OF THE HIGH INCOME AND MEDIUM INCOME DEVELOPMENTS WITH THOSE REMAINING NEAR THE EDGES AND CREATING AN UNEXPECTED "ARM"



GAML reference (Ctrl)

⏸ ⏪ ⏩ ⏴ ⏵

**GIVE EVERYONE UNIFORMLY LOW MOBILITY LEVELS**

REAL WORLD ANALOG:  
A UNIVERSAL BAN ON CARS

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**Environment**

- Environment Width** — 0200 [10..1000] every 1
- Environment Height** — 0200 [10..1000] every 1
- City Center Size** — 10 [5..50] every 1

**Population**

- General Density** — 125 [1..400] e
- Relative Density of High Income** — 01 [1..10] ever
- Relative Density of Medium Income** — 01 [1..10] ever
- Relative Density of Low Income** — 01 [1..10] ever

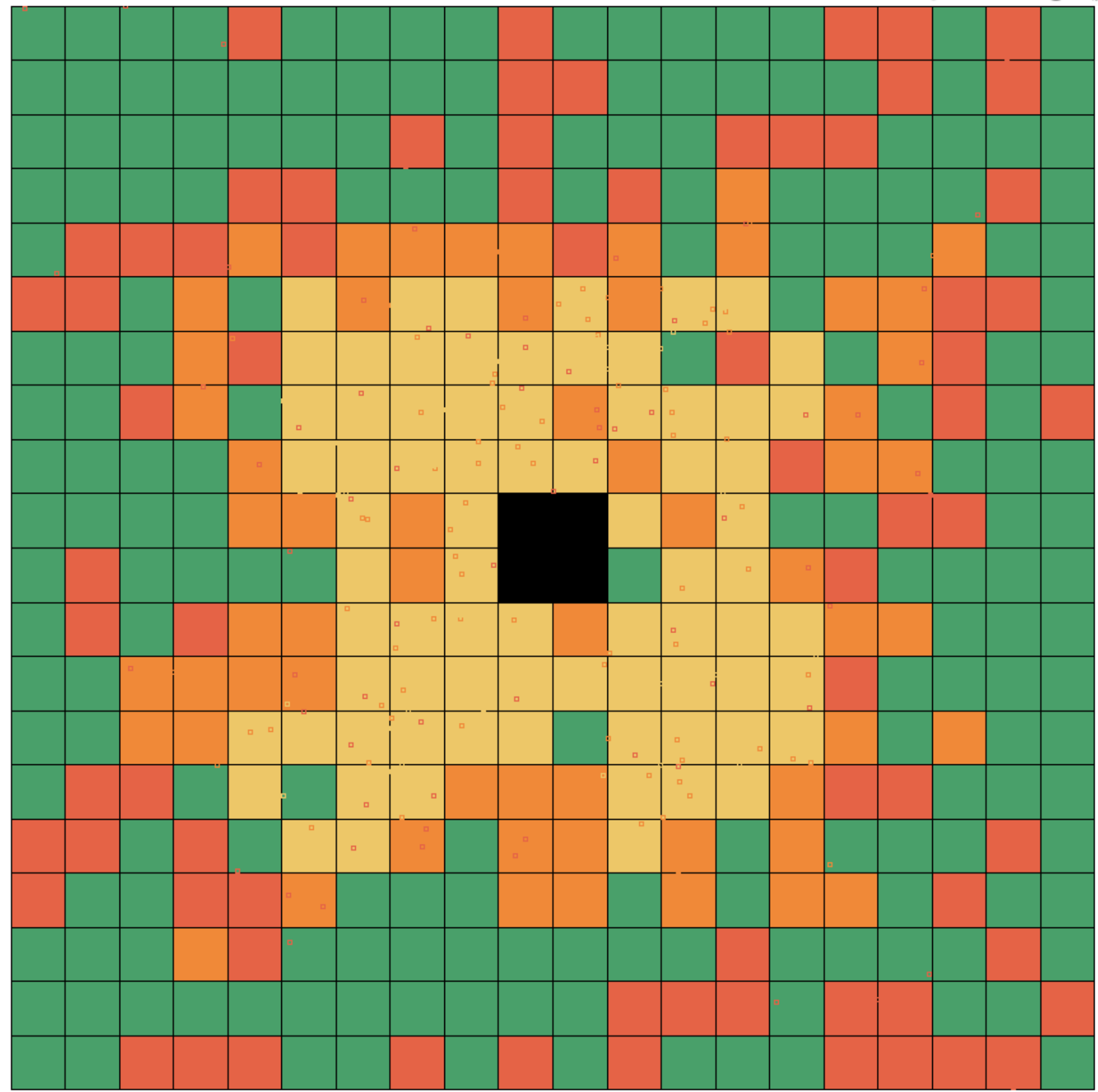
**Preferences**

- Crowding level acceptable to High Income** — 1:
- Crowding level acceptable to Medium Income** — 2:
- Crowding level acceptable to Low Income** — 3:

**Mobility**

- High Income Mobility Level** — 1000 [0..1000] every
- Medium Income Mobility Level** — 0100 [0..1000] every
- Low Income Mobility Level** — 0050 [0..1000] every

**RETURN TO BASELINE MOBILITY LEVELS**



Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

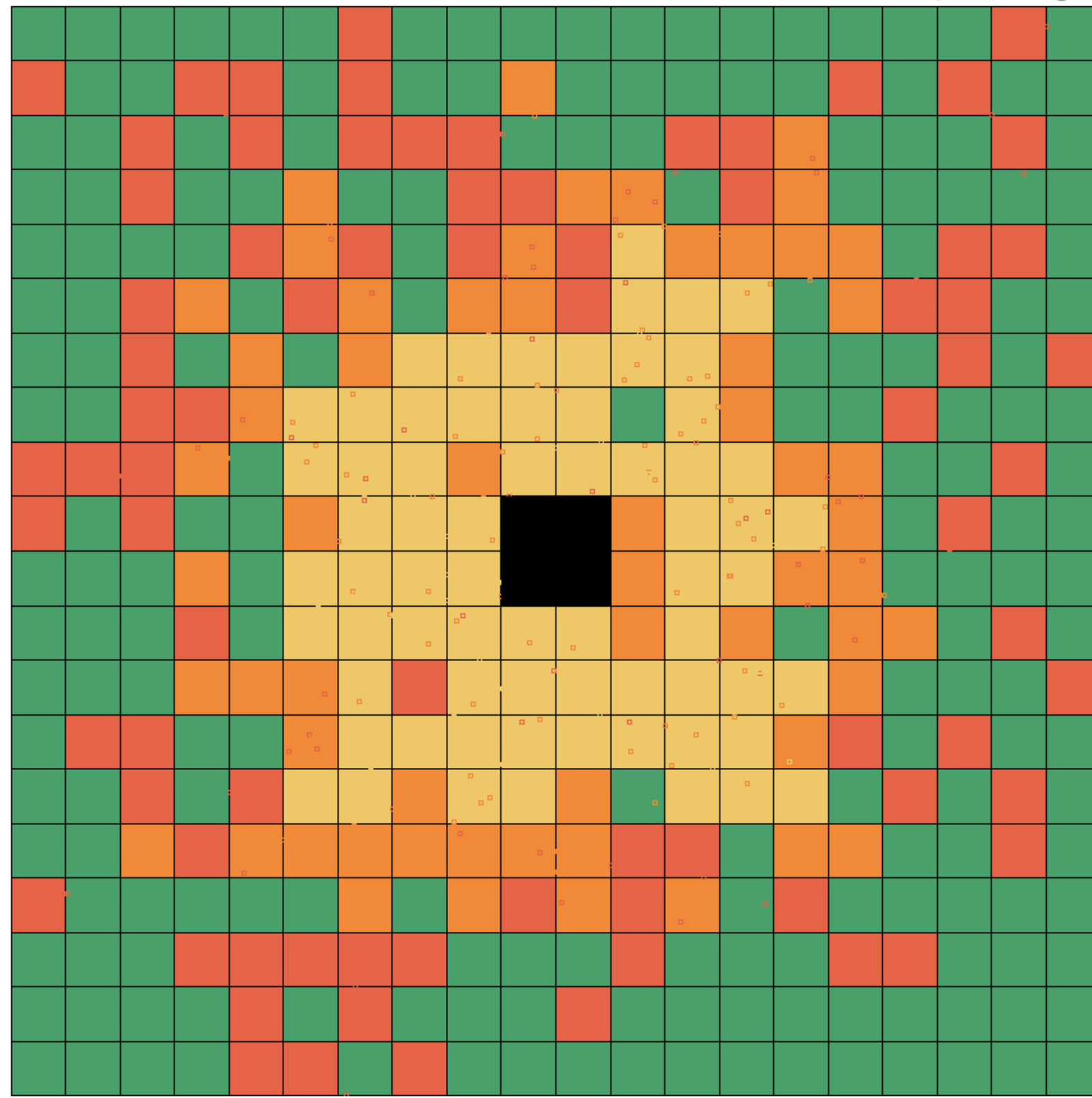
- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

Preferences

- Crowding level acceptable to High Income 2i
- Crowding level acceptable to Medium Income 2i
- Crowding level acceptable to Low Income 3i

Mobility

- High Income Mobility Level 1000 [0..1000] every
- Medium Income Mobility Level 0100 [0..1000] every
- Low Income Mobility Level 0050 [0..1000] every



REAL WORLD ANALOG:  
IMPROVEMENTS TO URBAN  
SANITATION, CRIME AND  
AESTHETICS LIKE THAT WHICH  
HAPPENED IN NYC IN THE 1990S

# INCREASE CROWDING THRESHOLD OF HIGH INCOME



Experiment: 46 cycles elapsed

Model Sprawl2 / Experiment Sprawl

Environment

- Environment Width: 0200 [10..1000] every 1
- Environment Height: 0200 [10..1000] every 1
- City Center Size: 10 [5..50] every 1

Population

- General Density: 125 [1..400] e
- Relative Density of High Income: 01 [1..10] ever
- Relative Density of Medium Income: 01 [1..10] ever
- Relative Density of Low Income: 01 [1..10] ever

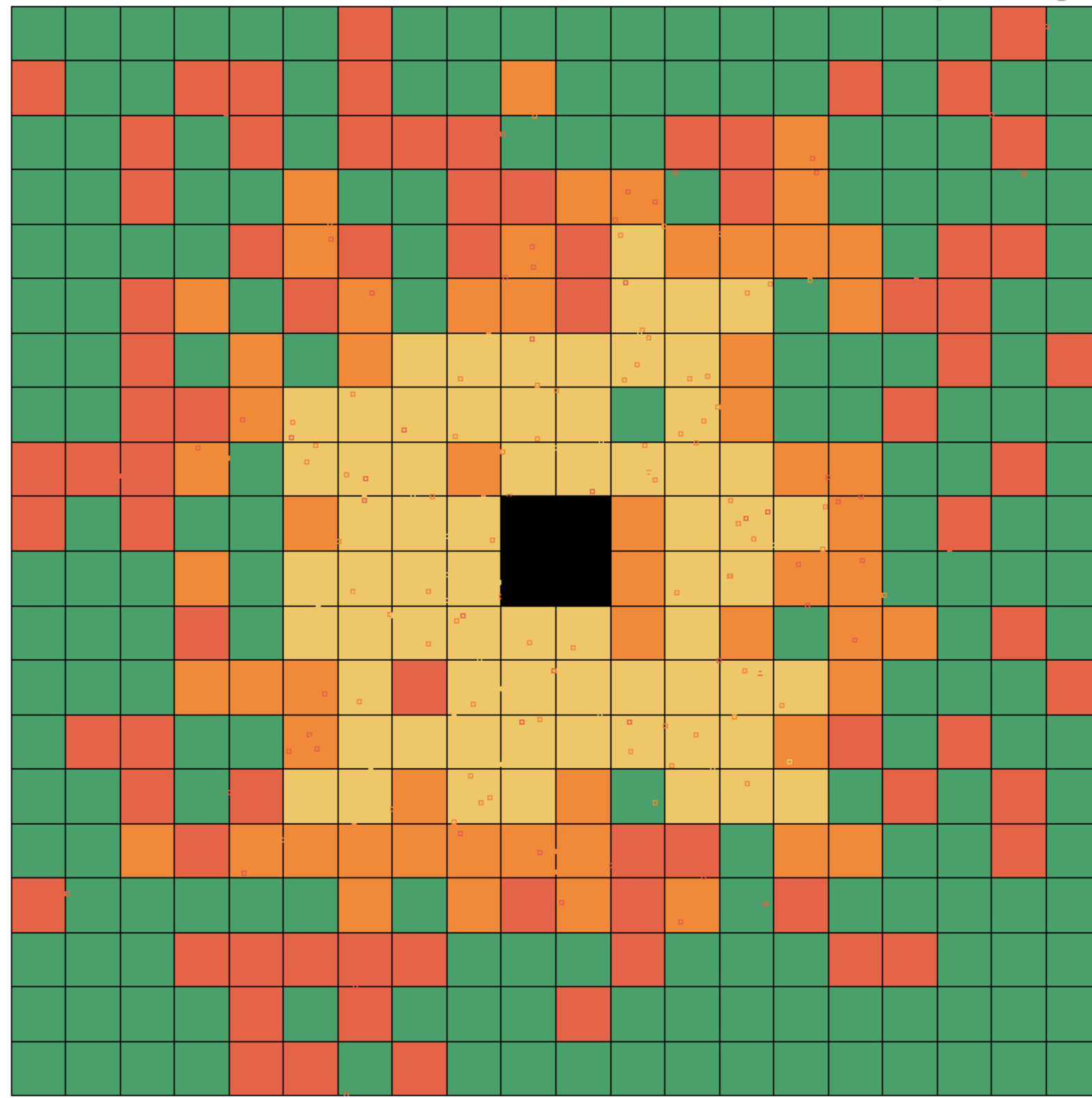
Preferences

- Crowding level acceptable to High Income: 2i**
- Crowding level acceptable to Medium Income: 2i
- Crowding level acceptable to Low Income: 3i

Mobility

- High Income Mobility Level: 1000 [0..1000] every
- Medium Income Mobility Level: 0100 [0..1000] every
- Low Income Mobility Level: 0050 [0..1000] every

THE HIGH INCOME DID NOT GENTRIFY THE CORE AS I HAD EXPECTED, POSSIBLY BECAUSE WHILE THEY TOLERATE CROWDING NOW, THEY DO NOT HAVE A STRONG ATTRACTOR TO THE CBD AS LONG AS THEIR MOBILITY IS HIGH



GAML reference (Ctrl)

Navigation icons: zoom in, zoom out, pan, etc.

**INCREASE CROWDING THRESHOLD OF HIGH INCOME**

REAL WORLD ANALOG: IMPROVEMENTS TO URBAN SANITATION, CRIME AND AESTHETICS LIKE THAT WHICH HAPPENED IN NYC IN THE 1990S

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Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

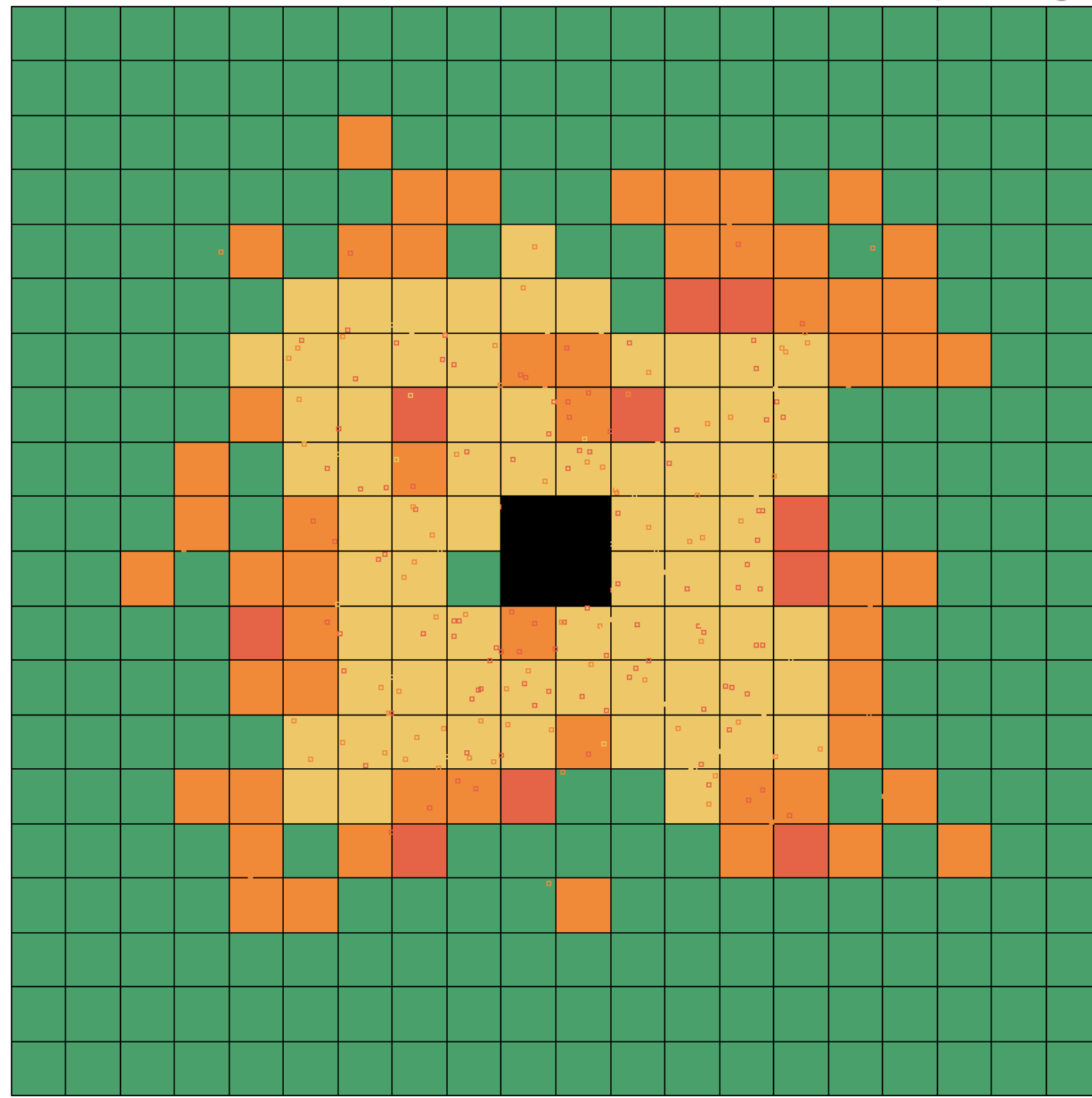
- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

Preferences

- Crowding level acceptable to High Income 50
- Crowding level acceptable to Medium Income 20
- Crowding level acceptable to Low Income 30

Mobility

- High Income Mobility Level 0053 [0..1000] every
- Medium Income Mobility Level 0100 [0..1000] every
- Low Income Mobility Level 0050 [0..1000] every



REAL WORLD ANALOG:  
VOLUNTARY ADOPTION OF  
"URBAN" CAR FREE LIFESTYLES  
BY THE WEALTHY

# DECREASE HIGH INCOME MOBILITY

Experiment: 46 cycles elapsed

Model Sprawl2 / Experiment Sprawl

Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

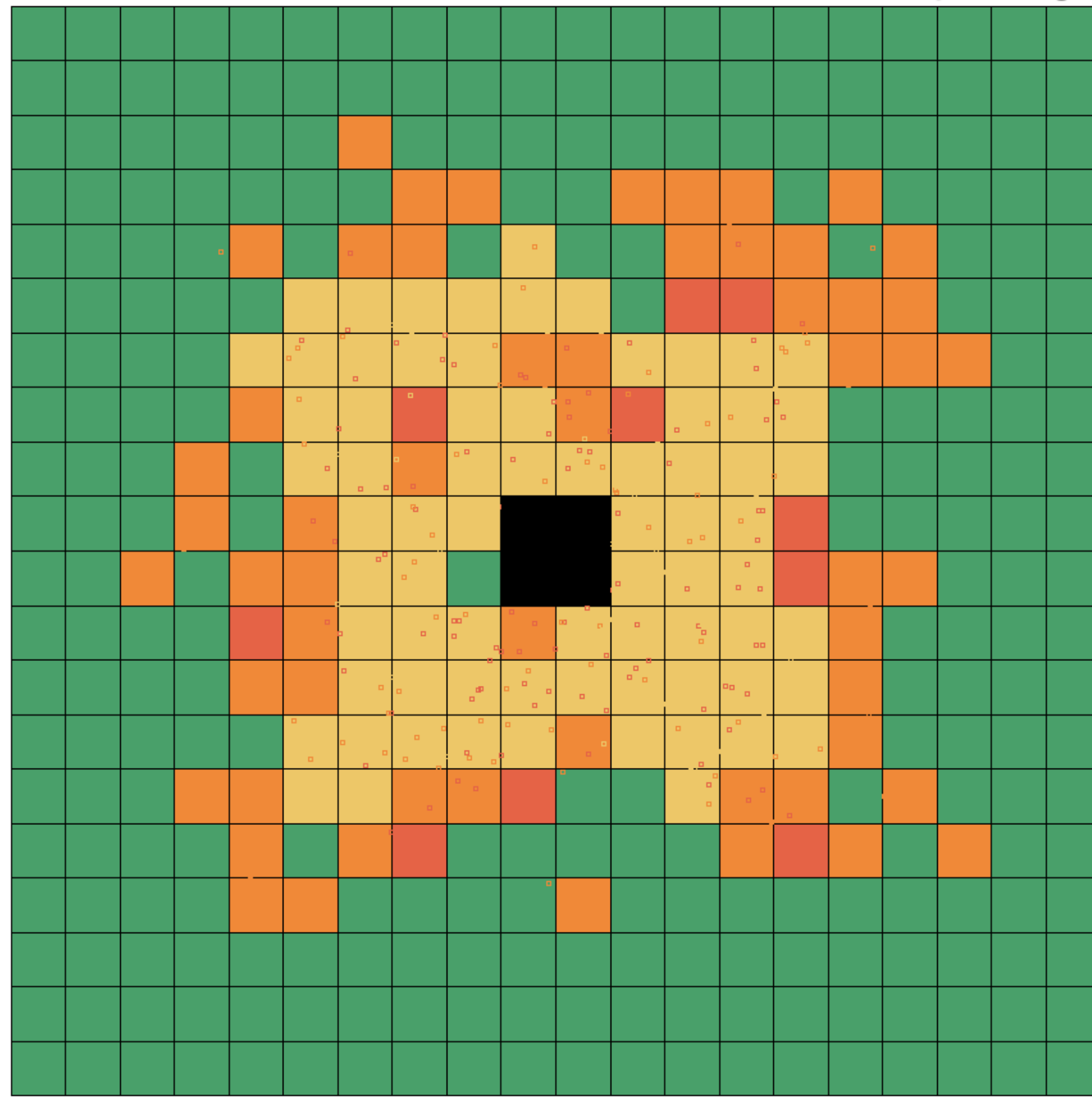
Preferences

- Crowding level acceptable to High Income 50
- Crowding level acceptable to Medium Income 20
- Crowding level acceptable to Low Income 30

Mobility

- High Income Mobility Level 0053 [0..1000] every
- Medium Income Mobility Level 0100 [0..1000] every
- Low Income Mobility Level 0050 [0..1000] every

THE HIGH INCOME STILL FAILED TO GENTRIFY THE CORE AND INSTEAD DEVELOPED VERY LITTLE. REASON UNCLEAR...



REAL WORLD ANALOG: VOLUNTARY ADOPTION OF "URBAN" CAR FREE LIFESTYLES BY THE WEALTHY

DECREASE HIGH INCOME MOBILITY

Environment

Environment Width 0200 [10..1000] every 1

Environment Height 0200 [10..1000] every 1

City Center Size 10 [5..50] every 1

Population

General Density 125 [1..400] e

Relative Density of High Income 01 [1..10] ever

Relative Density of Medium Income 01 [1..10] ever

Relative Density of Low Income 01 [1..10] ever

Preferences

Crowding level acceptable to High Income 50

Crowding level acceptable to Medium Income 20

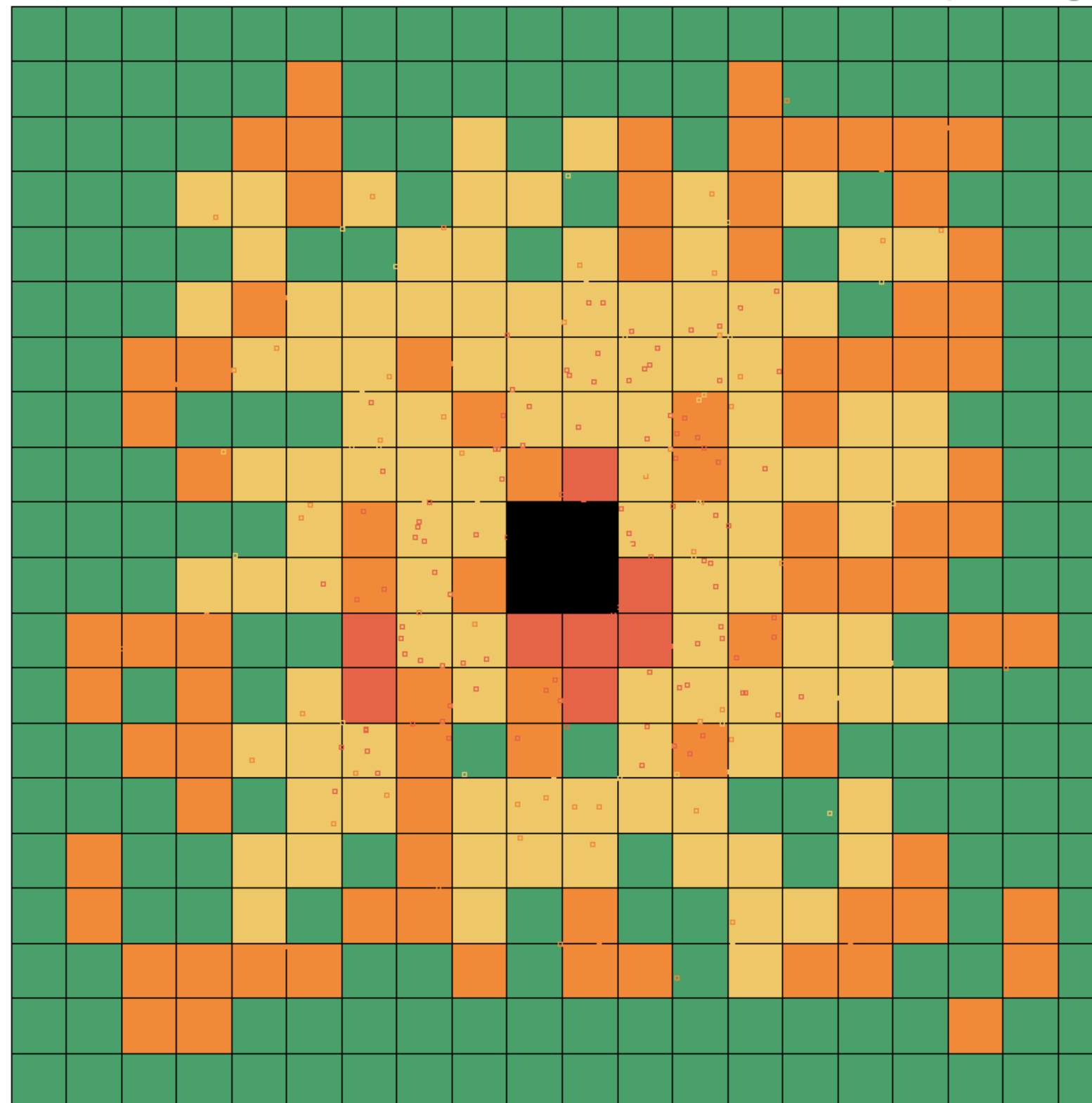
Crowding level acceptable to Low Income 30

Mobility

High Income Mobility Level 0053 [0..1000] every

Medium Income Mobility Level 0202 [0..1000] every

Low Income Mobility Level 0106 [0..1000] every



REAL WORLD ANALOG:  
POST-INDUSTRIAL WELFARE  
STATE URBAN GENTRIFICATION



**INCREASE LOW AND MIDDLE  
INCOME MOBILITY WHILE HIGH  
INCOME REMAINS STRONGLY  
ATTRACTED TO CBD**

Experiment: 48 cycles elapsed

Model Sprawl2 / Experiment Sprawl

Environment

- Environment Width 0200 [10..1000] every 1
- Environment Height 0200 [10..1000] every 1
- City Center Size 10 [5..50] every 1

Population

- General Density 125 [1..400] e
- Relative Density of High Income 01 [1..10] ever
- Relative Density of Medium Income 01 [1..10] ever
- Relative Density of Low Income 01 [1..10] ever

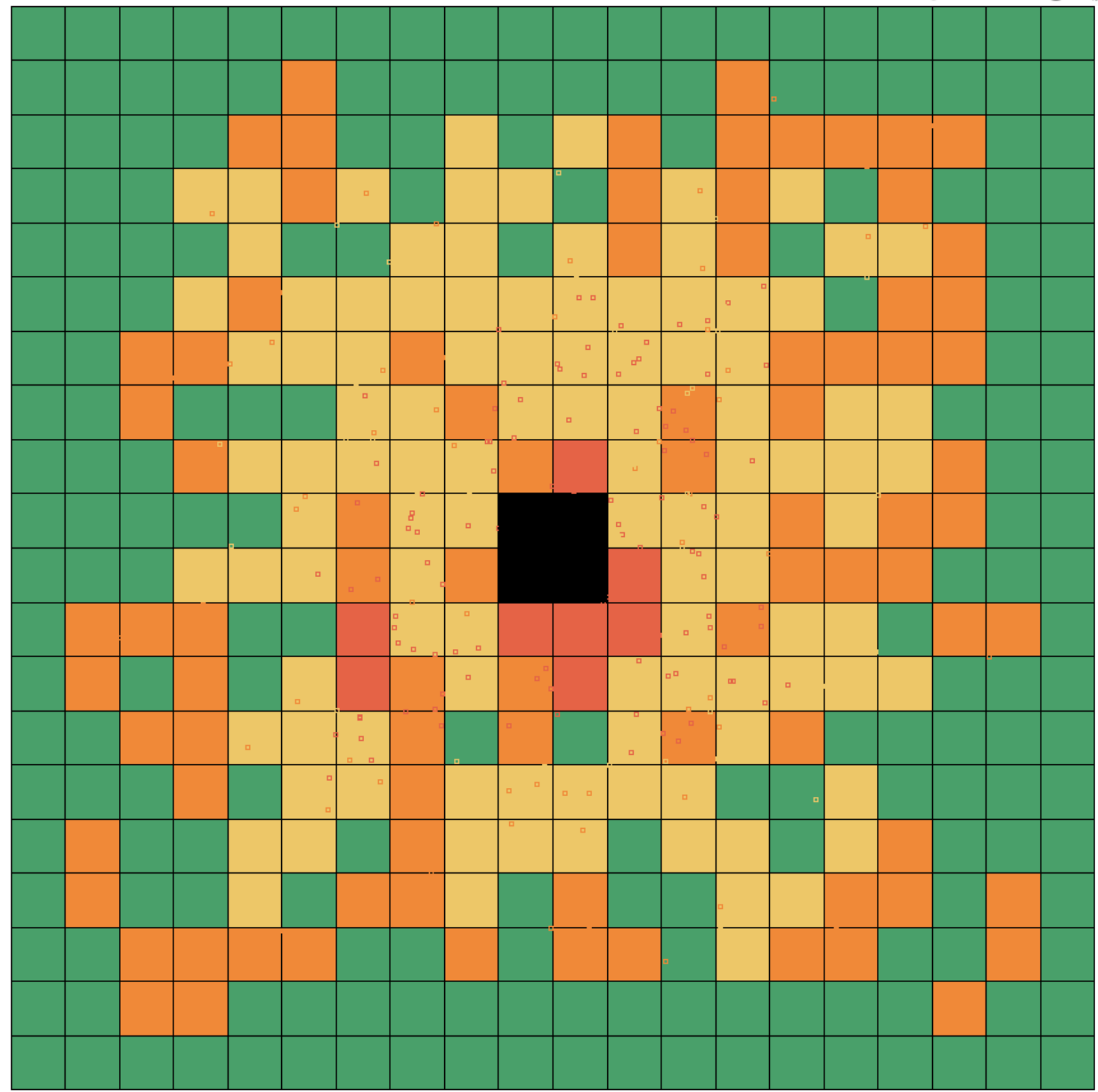
Preferences

- Crowding level acceptable to High Income 50
- Crowding level acceptable to Medium Income 20
- Crowding level acceptable to Low Income 30

Mobility

- High Income Mobility Level 0053 [0..1000] every
- Medium Income Mobility Level 0202 [0..1000] every
- Low Income Mobility Level 0106 [0..1000] every

A SMALL DENSE GENTRIFIED CORE FORMS AROUND THE CBD, MEANWHILE THE GREATER SPREAD OF LOW INCOME ALLOWS LOW ENOUGH DENSITY TO SUPPORT MIDDLE INCOME GROUPS NEAR THE URBAN CORE.



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