SOUTH FLORIDA REGIONAL TRANSPORTATION AUTHORITY

Strategic Regional Transit Plan

December 2008

Chapter 10:

Land Use Scenarios

(Chapter 10 originally prepared January 2008)

LAND USE SCENARIOS
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1.0 INTRODUCTION

As part of the Strategic Regional Transit Plan, the South Florida Regional Transportation Authority (SFRTA) explored the effect of sustained growth and land use policies on the need for transit services. The forecast for future growth in the South Florida region using existing land use policies shows a fairly even distribution of population and employment growth across the region to the year 2030. The three land use scenarios created for transit network testing take into consideration the redistribution of population and employment growth to concentrate new growth in regional activity centers (RACs), community redevelopment areas (CRAs), and transit station areas (SAs). The scenarios are not intended to compete with or replace comprehensive planning, but rather show how changing land use policies or encouraging existing CRA plans would affect transit needs and use.

2.0 METHODOLOGY

For this exercise, a portion of the growth in population and employment in the South Florida region between the base year of 1999 and horizon year of 2030 is considered transferable to a zone that relates to the proposed land use policies. Three types of planning areas are considered to be desirable for an increase in population and/or employment: RACs, CRAs, and SAs.

Regional Activity Centers (RACs)

Several conditions were considered in identifying RACs in the South Florida region. Demographic data for the Year 2030 was used to identify major destinations with potential as transit hubs. Areas with a high concentration of jobs in 2000, and those that were projected to experience significant employment growth between the years 2000 and 2030 were designated as major employment centers. Additionally, Developments of Regional Impact were also mapped to assist in identifying multi-use trip generators. Local comprehensive plans were also consulted to identify activity centers. In all, 34 RACs were identified.

Community Redevelopment Areas (CRAs)

CRAs within the South Florida region were identified from existing county and city plans as areas subject to redevelopment in the future and where local governments desire change.

Transit Station Areas (SAs)

SAs consist of those stations associated with a fixed guideway alternative tested in the Screen Two Evaluation. The SAs considered are only those associated with alternatives that include dedicated rights-of-way such as some bus rapid transit options, commuter rail, light rail, and Metrorail.

2.1 LAND USE SCENARIOS

Varying distributions of population and employment demonstrate the effect of concentrating growth as well as the effect of mixed use development on the ridership

model. Three different land use scenarios were built focusing on the designated planning areas. The first scenario, 2030 RACs or CRAs, concentrates population growth in CRAs and employment growth in existing RACs. The second scenario mixes population and employment growth in the CRAs and RACs. The third scenario mixes population and employment growth in SAs.

Areas that are not designated as RACs, CRAs, or SAs are designated as non-receiving zones. Of these non-receiving zones, only zones that experience growth between the base year 1999 and horizon year 2030 are flagged as donor zones and contribute a portion of their growth.

Tables 1 and **2** show the distribution of land use characteristics between donor TAZs and receiver TAZs by population and by employment for the three land use scenarios.

Table 1 – Population Distribution of Land Use Characteristics by Donors and Receivers

Scenario	**Contribution from Donors**	**Receiving Share from Donors**		
		CRA	**RAC**	**SA**
1. CRA only	-25%	100%	0%	0%
2. CRA + RAC	-25%	67%	33%	0%
3. SA only	-25%	0%	0%	100%

Table 2 – Employment Distribution of Land Use Characteristics by Donors and Receivers

Scenario	**Contribution from Donors**	**Receiving Share from Donors**		
		CRA	**RAC**	**SA**
1. RAC only	-25%	0%	100%	0%
2. CRA + RAC	-25%	33%	67%	0%
3. SA only	-25%	0%	0%	100%

In the first scenario, each donor zone contributes 25% of the growth expected from 1999 to 2030, aggregated into a donor pool. The donor pool is then allocated to receiving zones based on the designation of that zone and the zone's household or employment attribute proportionate relative to all RACs, all CRAs, or all SAs in 1999. For this scenario, all zones designated as CRAs receive 100% of the donor household contributions, while the RACs receive 100% of the donor employment contributions. Other receiving zones do not receive anything from the donor pool.

For the second scenario, donor zones contribute 25% of their growth to the donor pool and are allocated to RACs and CRAs for households (33% to RACs and 67% to CRAs) and employment (67% to RACs, 33% allocated to CRAs).

In the third scenario, donor zones contribute 25% of their growth, and only the SAs receive from the donor pool both additional household and employment land use attributes.

The amount deducted from donor zones was aggregated in a pool from the total household and total employment attributes then distributed proportionally to the population of the receiving zones based on 1999 data. A donor zone was deducted the amount specified in the scenarios in **Tables 1** and **2** only if there was growth in that zone between 1999 and 2030. Based on the current data, **Table 3** shows the distribution that would result from the 25% donor scenario.

Table 3 – Aggregate Results for Donor Contribution of 25% of Growth

Measure	Palm Beach	Broward	Miami-Dade
1999 Households w/o Children	376,801	493,091	499,866
1999 Households w/ Children	117,565	180,276	268,035
1999 Total Employment	447,054	632,155	1,191,594
2030 Households w/o Children	568,433	628,037	692,759
2030 Households w/ Children	190,394	306,618	392,131
2030 Total Employment	771,059	944,601	1,590,237
Incr Households w/o Children	191,632	134,946	192,893
Incr Households w/ Children	72,829	126,342	124,096
Incr Total Employment	324,005	312,446	398,643
Donor Area Households w/o Children	164,946	98,217	125,494
Donor Area Households w/ Children	61,217	91,232	92,103
Donor Area Total Employment	213,282	233,157	169,672
Low Scenario Households w/o Children	41,237	24,554	31,374
Low Scenario Households w/ Children	15,304	22,808	23,026
Low Scenario Total Employment	61,556	62,685	50,001

2.2 ADDITIONAL RULES

To circumvent penalizing donor-flagged zones with low growth in household and employment attributes, an additional rule was imposed to designate non-receiving zones with household or employment growth greater than 20% over the 1999 amount as a donor zone for the household data. Zones which experienced growth less than 20% were designated as non-contributing zones (i.e., household or employment numbers were left untouched). To illustrate this concept, suppose a potential donor zone has 100 households in 1999. To satisfy the 20% growth threshold, it would need to grow by at least 20 households to 120 households in 2030. If this growth threshold is satisfied, the zone is considered a donor zone and thus contributes 25% of the growth experienced from 1999 to 2030, or 5 households, to the donor pool. If the zone grows by less than 20% (e.g., by 10 households to 110 in 2030), it does not donate any portion of the growth to the donor pool. Imposing this threshold prevents penalizing low growth in small zones.

With the addition of this growth threshold, there are four different zone classifications: declining zones (i.e., non-receiving zones that experience a loss in total households or total employment), non-contributing zones (i.e., non-receiving zones with growth that is less than 20% over the 1999 amount), donor zones (i.e., non-receiving zones with growth above 20% over the 1999 amount), and receiving zones. Moveable attributes are thus restricted to donor and receiving zones only. Donor zones contribute 25% of their growth from 1999 to 2030 to an aggregate donor pool. The donor pool is then allocated to the receiving zones based on a zone's 1999 proportion of households or employment attribute to the total of its receiving type (i.e., total for all RACs, CRAs, SAs, or combinations). As an illustration, if the total number of households for all CRAs in 1999 was 10,000, and a zone designated as an CRA contained 100 households in 1999, that zone would receive 1% of the donor pool in addition to the growth experienced from 1999 to 2030.

Ratios

Once the final total household and total employment was computed, a ratio of the new growth value to the base (2030 trend) growth was calculated to distinguish declining, non-contributing, donor, and receiving zones and to allow for the calculation of the employment attributes. For the household data, a ratio was calculated for each attribute, as it is assumed that they are quasi-independent of each other (i.e., total population is not perfectly correlated with total households). A single ratio based on total employment growth was used to calculate the appropriate changes in the components of the employment data, since moveable attributes were additive to the total employment.

Ratios that are greater than 1 indicate that the zone is a receiver TAZ that is receiving a proportion of the donor pool. Ratios that are between 0 and 1 indicate that the zone is a donor zone that has contributed a percentage of its growth to the aggregate donor pool. These ratios would be 0.75 in each of the scenarios defined in **Tables 1** and **2**. Ratios that equal 1 indicate that either a zone is a declining zone, a non-contributing zone, or is a zone designated as a receiver, but is not receiving an allocation from the donor pool for that particular scenario (e.g., in the population scenario 1, only CRAs receive donor characteristics; however, nothing happens to the RACs and SAs and their ratio remains at 1). There are instances when ratios are negative; this indicates that the zone is a receiver zone that originally lost households or employment, but due to the re-distribution of growth, has gained households or employment. This intuitively follows the design of these scenarios, since the receiver zones may be redevelopment areas that were originally losing population or employment but due to land use alterations, have reversed the trend (as indicated by the negative ratio).

Since some components in the employment attributes experienced growth while others experienced losses, new rules needed to be developed to apply the single ratio across all additive components. The objectives of this modification were to avoid exacerbating losses and also to avoid diminishing losses from donor areas. Thus, four additional rules were designed to counter the four observed cases where directly applying the ratio would detract from the objectives. The following section illustrates four cases from which the aforementioned rules attempt to address.

Cases

These ratios are based on the total employment land use attributes and neglect the component magnitudes. This becomes an issue when there is an overall growth (or loss) reflected in the total amount, and there are both growth and losses in the components. **Table 4** demonstrates four cases from the employment data in which directly applying the ratio obtained from the total growth will result in counterintuitive component values.

Table 4 – Four Cases Illustrating Counterintuitive Component Values (Employment Data)

Case	TAZ ID	Growth	Indust-rial	Service	Comm-ercial	Employ Total	Ratio
Pos, Pos	3	Base	8	0	-2	6	
		New	6	0	-1.5	4.5	0.75
Neg, Pos	162	Base	-17	1600	52	1635	
		New	-30.855	2904.32	94.39	2967.856	1.815
Pos, Neg	635	Base	-213	-10	180	-43	
		New	9487.02	445.4	-8017.2	1915.17	-44.54
Neg, Neg	3396	Base	-34	34	-1	-1	
		New	1783.98	-1783.98	52.47	52.47	-52.47

The first case is an example of a positive-positive scenario, where there are positive numbers and a positive ratio. For this case, the TAZ is a donor that is giving up a portion of the growth to the aggregate donor pool. This case is counterintuitive since the ratio diminishes the loss that the Commercial category experiences. As in the total case, it is probably best to leave the categories with losses alone (i.e., do not improve or worsen the trend). The issue then becomes where to allocate the “excess” 0.5 Commercial attribute so as to balance the total employment.

In the second case, there is a negative number that is multiplied by a positive ratio, making that number even more negative. Again, this is counterintuitive as a negative component should not be worsened. As in the first case, there needs to be a rule that re-allocates the remaining growth, since the other categories will experience less growth once the Industrial attribute is fixed.

Both the third and fourth cases demonstrate the counterintuitive effects of a negative ratio that can occur in receiving zones. Often times, the net change in employment or household is very small, and due to the increase received from donor zones, result in a larger positive number. The ratio thus becomes a large negative number. This would not be a problem if all attributes were negative, however, in these cases there is a positive number that would, if multiplied by the negative ratio, suddenly become negative. Additionally, while the net sum of the components is equal or near equal to the total employment or household value, the magnitude is much greater.

This would produce negative employment component values in the revised 2030 data. Perhaps a rule that considers the proportion of negative growth and positive growth would be better suited in finding more appropriate, reasonable component values.

Rules

As a general rule, all components in a zone with a ratio of 1 are left alone (i.e., they are declining zones, non-contributing zones, or receiver zones that do not get a share of the donor pool for a particular policy scenario).

1. For a positive number, N, with a positive ratio, R:

$$N_{new} = N + \frac{N}{\sum N_{pos}} \times \left(\sum N_{Total} - \sum N' \right)$$

The new adjusted number is the number *N* plus the proportion the number is to total positive numbers multiplied by the difference between the new total (calculated separately) and all numbers not *N*. Essentially, what this rule does is disregard the negative growth components and appropriate the new growth by the proportion of positive growth in each category.

2. For a positive number, N, with a negative ratio, R:

$$N_{new} = N + \frac{N}{\left(\sum N_{pos} - \sum N_{neg} \right)} \times \left(\sum N_{Total} - \sum N' \right)$$

The only difference here is that the number is proportioned according to the difference in the sum of positive and the sum of negative numbers. This is intended to capture the variation in growth rather than base the allocation simply on the total sum (which is usually small).

3. For a negative number, N, with a negative ratio, R:

$$N_{new} = N + \frac{N}{\left(\sum N_{neg} - \sum N_{pos} \right)} \times \left(\sum N_{Total} - \sum N' \right)$$

This is very similar in structure to the second rule, except that in this rule, care is taken to ensure that the number is increased (not decreased) by constructing the second term to be positive.

4. For a negative number, N, with a positive ratio, R:

$$N_{new} = N$$

This is the simplest rule in which a negative number cannot be made more or less negative by a positive ratio. The positive numbers in the zone will receive the “excess” amount proportional to the share of positive numbers (as per the first rule).

3.0 RESULTS AND DISCUSSION

Figures that identify each zone's designation as either a receiving zone or a non-receiving zone are located at the end of the document. **Figures 1** through **4** depict receiving zones, while **Figures 5** and **6** show the non-receiving zones. **Figure 1** identifies RACs, CRAs, SAs, and combinations (i.e., zones that are classified as more than one receiving zone type). **Figures 2** through **4** identify the RACs, CRAs, and SAs respectively, as mutually exclusive of each other. A general trend found is that zones with all three receiving type designations (i.e., the zone was a RAC, CRA, and SA) existed in or near the central business districts (CBDs) of West Palm Beach, Fort Lauderdale, and Miami. **Tables 5** and **6** show the number of zones designated as declining (i.e., zones that are losing household or employment), non-contributing (i.e., zones that are growing by less than 20% over the 1999 numbers), donor, and receiving zones. These tables, along with **Figure 1**, show that Miami-Dade County has the highest number of receiving zones and also has the best spatial distribution of the receiving zones with respect to Broward and Palm Beach counties. Broward and Palm Beach counties have a majority of their receiving zones near the Florida turnpike and Interstate 95 corridors. However, due to the proximity of those corridors in Palm Beach County, most of the receiving zone activity in that county occurs in a narrow, concentrated area.

Figure 5 displays the non-receiving zones for total employment, while **Figure 6** shows non-receiving zones for total households. There are more zones that are either declining or are not growing enough to meet the donor threshold for employment attributes than for household attributes. In Palm Beach County, most of the growth occurs on the western parts of the county where there is currently little development. Growth in Broward County is located primarily in the western suburbs of Fort Lauderdale, while growth in Miami-Dade occurs in the south and southwest portions of the county.

One important finding is the actual number of households and employment moved. Although Miami-Dade County has the highest total numbers of both households and employment amongst the three counties, **Tables 5** and **6** show that it also has the highest combined declining and non-contributing zones. **Tables 7** and **8** show the number of households and employment respectively, moved for each of the three scenarios.

Table 5 – Number of Zones by Designation and County for Total Households

County	Total TAZs	Declining Zones	Non-Contributing Zones	Donor Zones	Receiving Zones
Palm Beach	1,150	203	128	666	153
Broward	924	74	150	477	223
Miami-Dade	1,500	198	224	618	460

Table 6 – Number of Zones by Designation and County for Total Employment

County	Total TAZs	Declining Zones	Non-Contributing Zones	Donor Zones	Receiving Zones
Palm Beach	1,150	224	200	573	153
Broward	924	100	224	377	223
Miami-Dade	1,500	223	313	504	460

Table 7 – Moving Households from Donor Zone to Receiving Zones

County	1999 Total HH	HH Growth	% Growth over 1999	Moving HH	% of Growth
Palm Beach	494,366	264,461	53.49%	62,582	23.66%
Broward	673,367	262,788	39.03%	48,364	18.40%
Miami-Dade	767,901	316,989	41.28%	57,193	18.04%

Table 8 – Moving Employment from Donor Zone to Receiving Zones

County	1999 Total Emp	Emp Growth	% Growth over 1999	Moving Emp	% of Growth
Palm Beach	447,054	324,005	72.48%	57,556	17.76%
Broward	632,155	318,167	50.33%	55,956	17.59%
Miami-Dade	1,191,594	398,643	33.45%	41,159	10.32%

Both **Tables 7** and **8** show that while Miami-Dade has the most growth in households and employment, it has the lowest percentage of that growth being moved due to the constraints imposed by the growth threshold. The number of employment entities moving in Miami-Dade County is significantly lower than the other two counties (10.32% compared to 17.76% and 17.59%). For both household and employment attributes, Palm Beach County has the highest proportion moving from donor zones to receiving zone, but as Tables 5 and 6 show, has the highest number of donor zones coupled with the fewest number of receiving zones amongst the three counties. This implies that the growth will be concentrated in zones which already have substantial household or employment numbers.

Figures 7 through **9** display the allocated number of employment establishments to the corresponding receiving zones for land use scenario 1, 2, and 3, respectively. The allocation number corresponds to the absolute growth over the 2030 base land use employment numbers. Subsequently, **Figures 10** through **12** show the employment growth from 1999 to 2030, including the allocation, in absolute numbers for receiving zones for scenarios 1, 2, and 3. Comparing and contrasting the allocation and absolute numbers allows one to distinguish that in many cases, the allocation from the donor zones is relatively small compared to the growth projected for 2030.

Figures 13 through **15** show the absolute household increase due to the allocation process, while **Figures 16** through **18** show the growth to 2030 plus the allocation. One interesting point is that there are more receiving zones that do not receive any growth from the allocation of households than there are in the allocation of employment. This is due to having allocated attributes according to the proportion of land use data that existed in 1999. Thus, the receiving zones with no growth from the allocation indicate that there were no households to begin with in 1999. In most cases, the no-growth zones from the allocation were also no-growth zones for the absolute growth to 2030.

Table 7 shows the resulting effect each land use scenario has had on regional transit trips. Increases in transit trips and the percent change over the 2030 base land use policy are included.

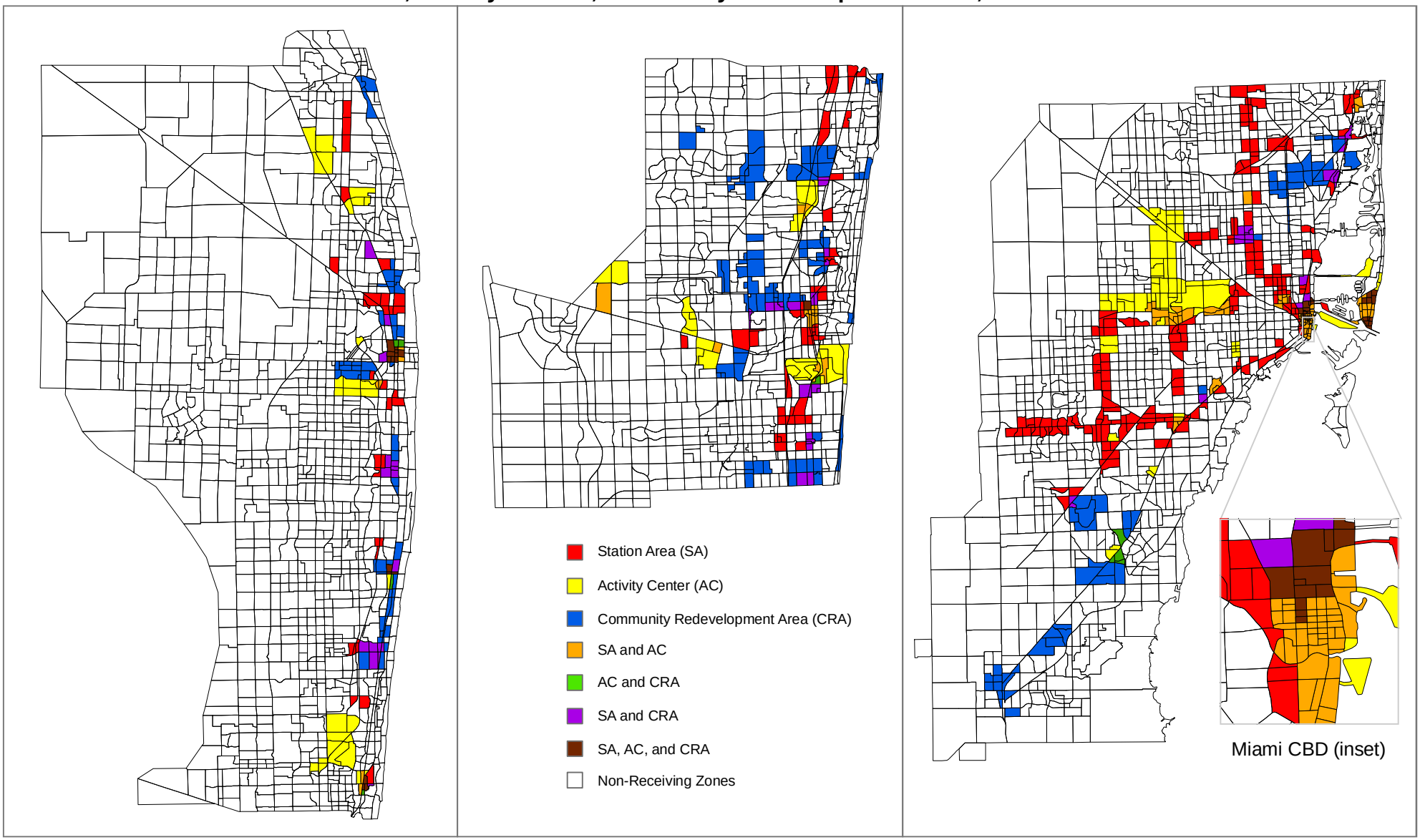
Table 7 – Impact of Land Use Scenario on Regional Transit Trips

Land Use Scenario	County	Total Transit Trips	Transit Trip Increase over 2030 Base	% Increase
1	Regional	496,509	47,560	10.59%
2	Regional	495,211	46,262	10.30%
3	Regional	500,106	51,157	11.39%

In examining **Table 7**, land use scenario 3 (allocating all household and employment growth from donor pool to SAs) yields the highest increase in transit trips, with an increase of 51,157 regional trips that amounts to an 11.39% increase over the 2030 base land use policy. This makes sense intuitively, as the more concentrated the development is around fixed-guideway transit stations, there are more opportunities and higher accessibility to transit options.

Figure 1
All Receiving Zones

Station Areas, Activity Centers, Community Redevelopment Areas, and Combinations

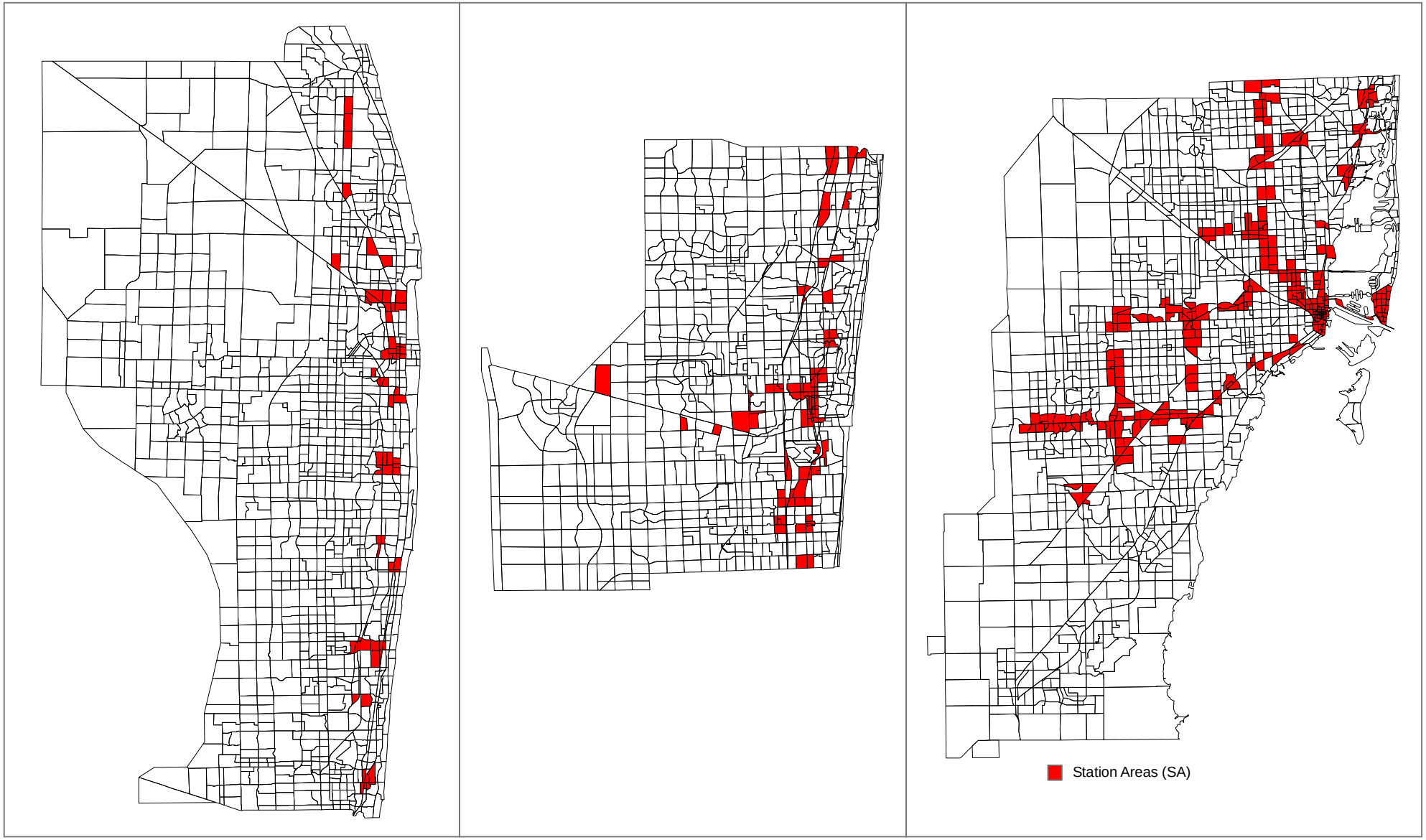


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 2
Station Areas

Receiving Zones with Fixed Guideway Transit Designated as Station Areas



Palm Beach County **Broward County** **Miami-Dade County**

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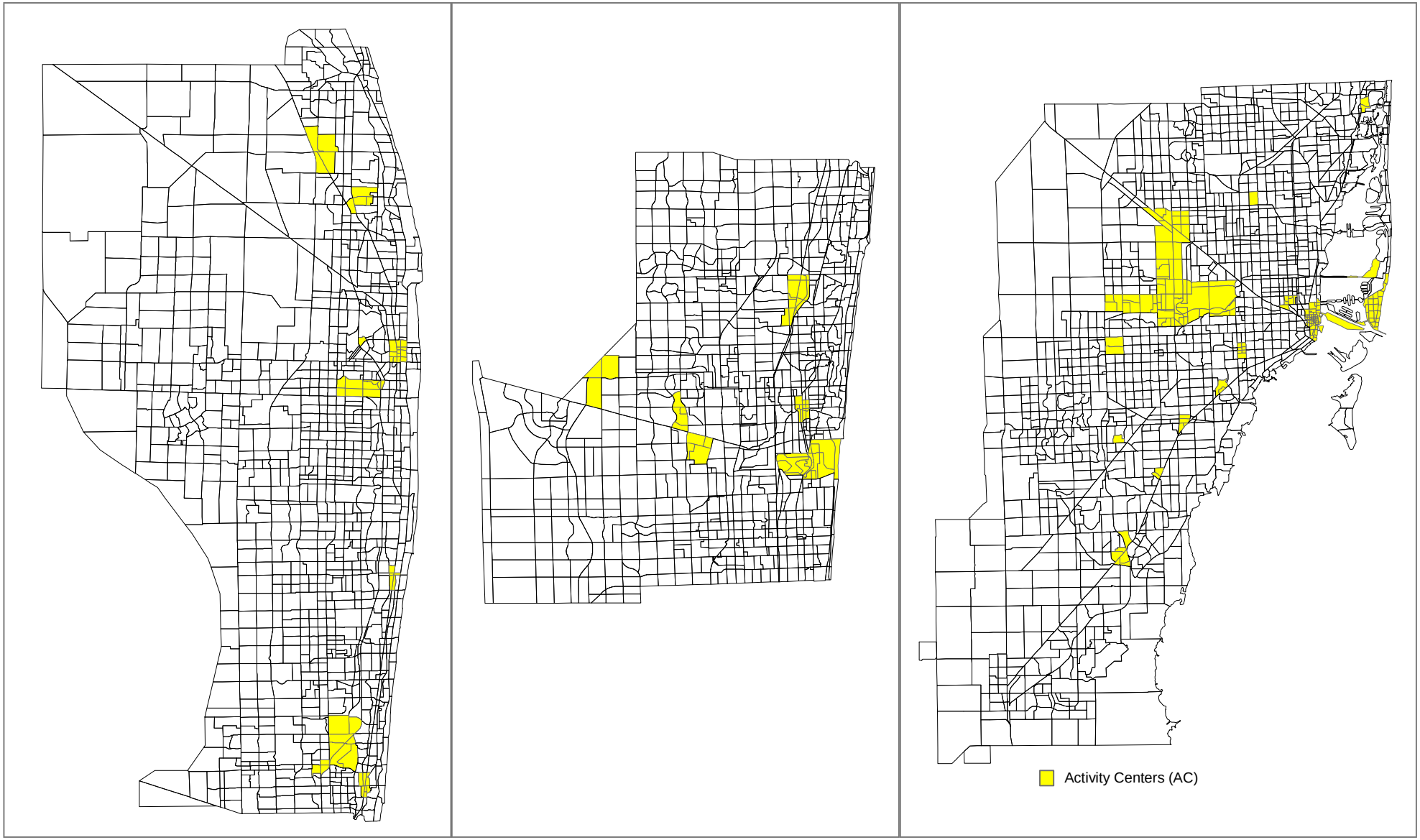
Figure 3
Activity Centers

Receiving Zones Designated as Activity Centers



Palm Beach County **Broward County** **Miami-Dade County**

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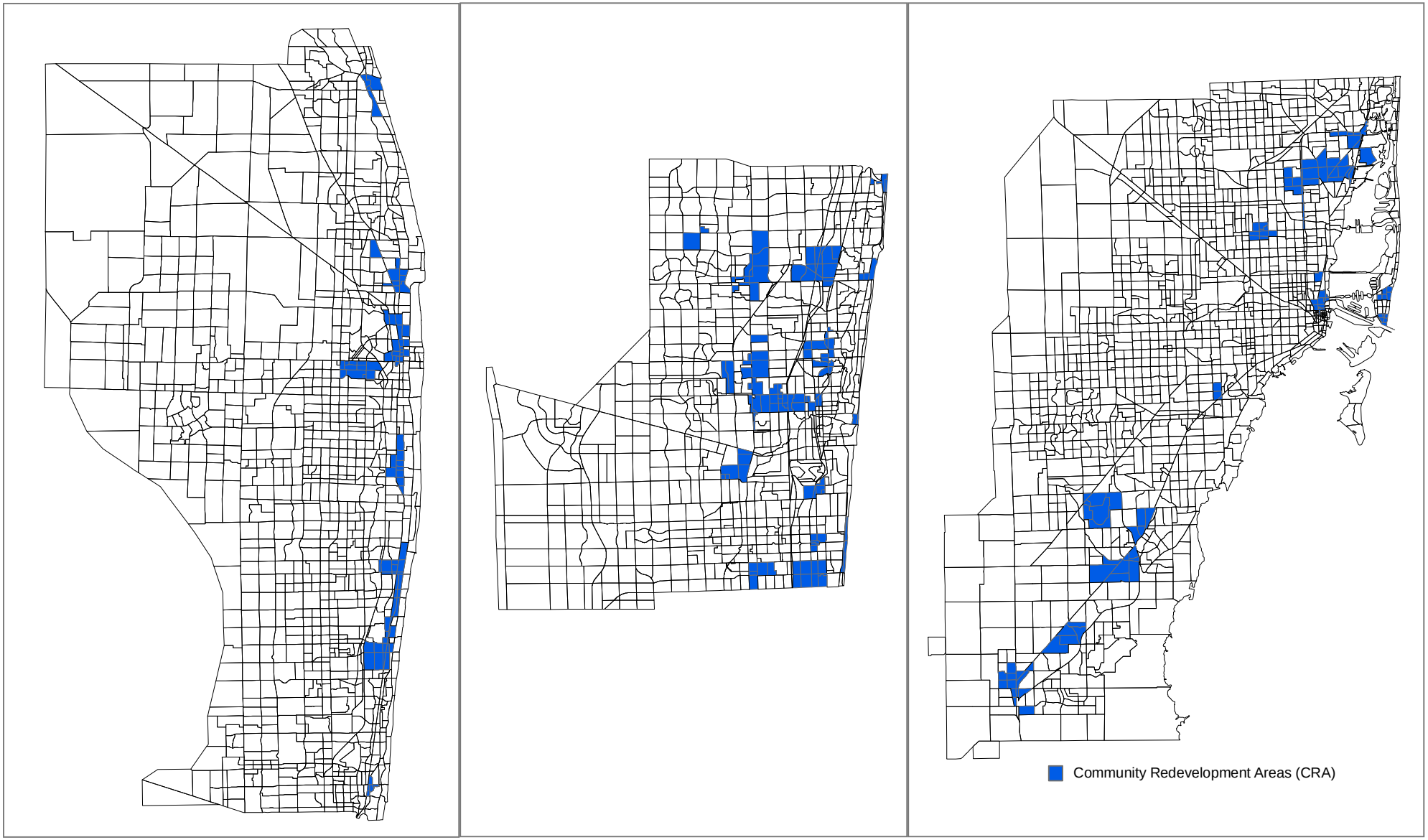
Figure 4
Community Redevelopment Areas

Receiving Zones Designated as Community Redevelopment Areas



Palm Beach County **Broward County** **Miami-Dade County**

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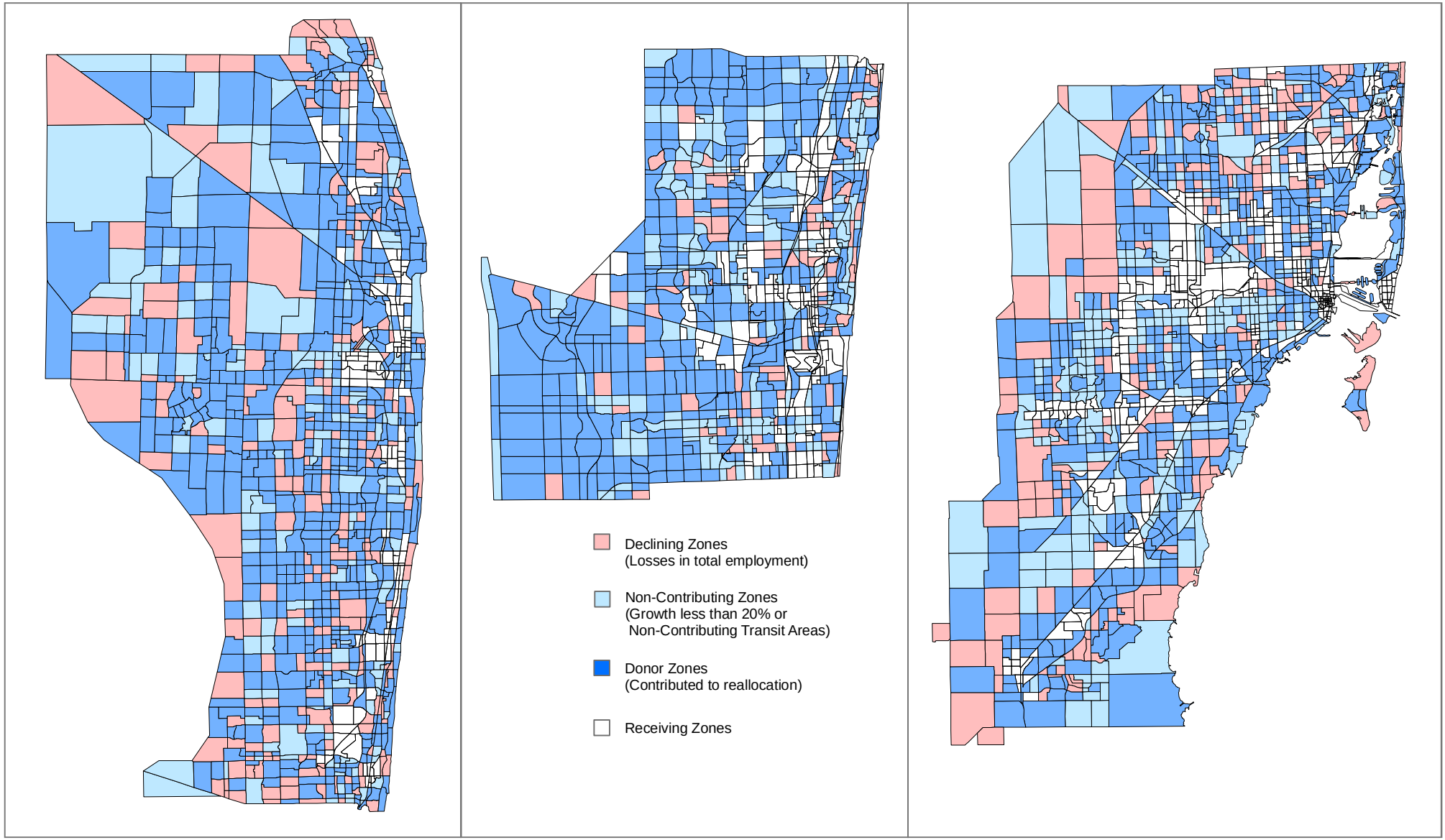
Figure 5
Non-Receiving Zones

Declining Zones, Non-Contributing Zones, and Donor Zones for Total Employment



Palm Beach County **Broward County** **Miami-Dade County**

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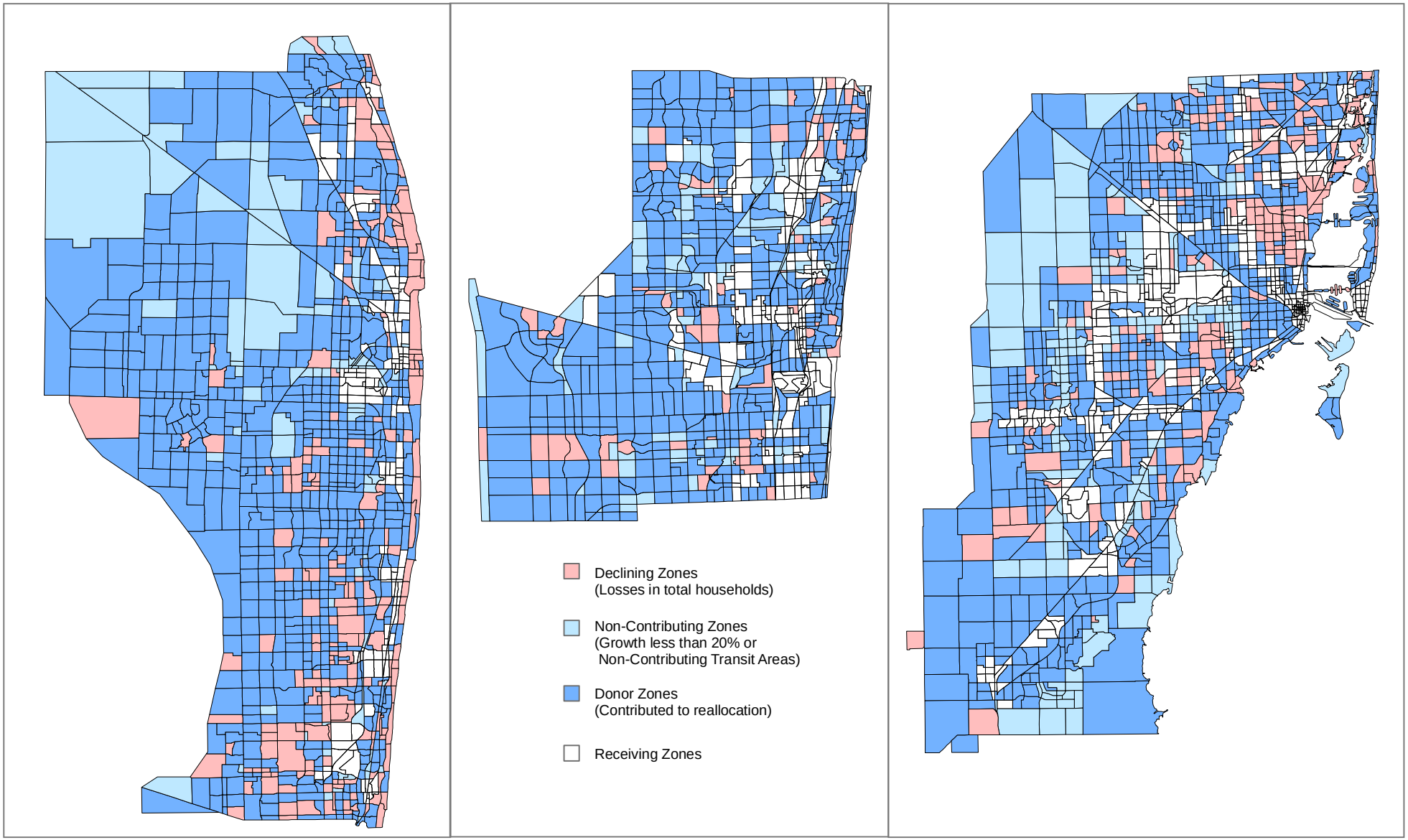
Figure 6
Non-Receiving Zones

Declining Zones, Non-Contributing Zones, and Donor Zones by Total Households

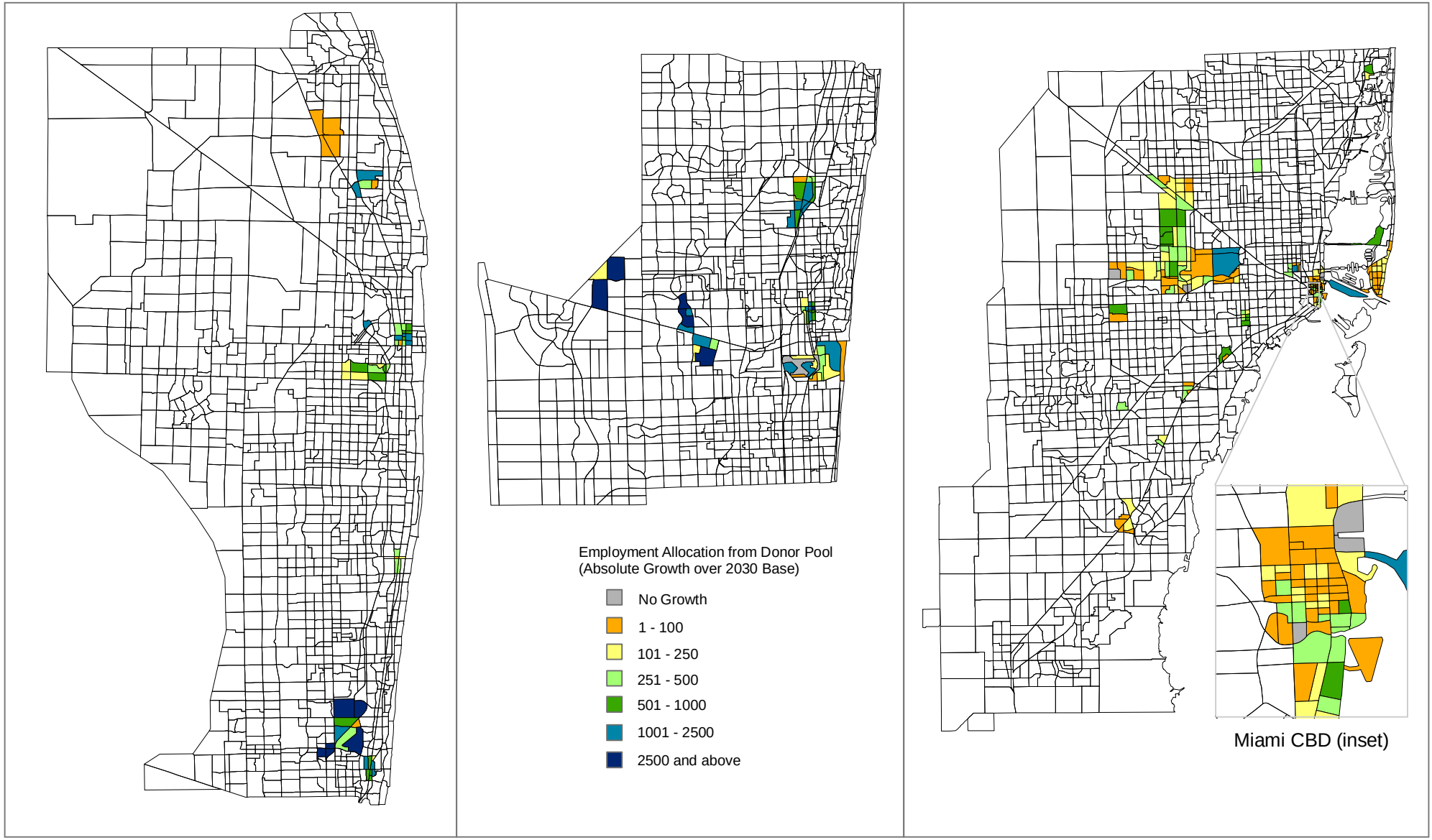


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 7
Employment Allocation

Employment Allocation According to Scenario 1 Distribution

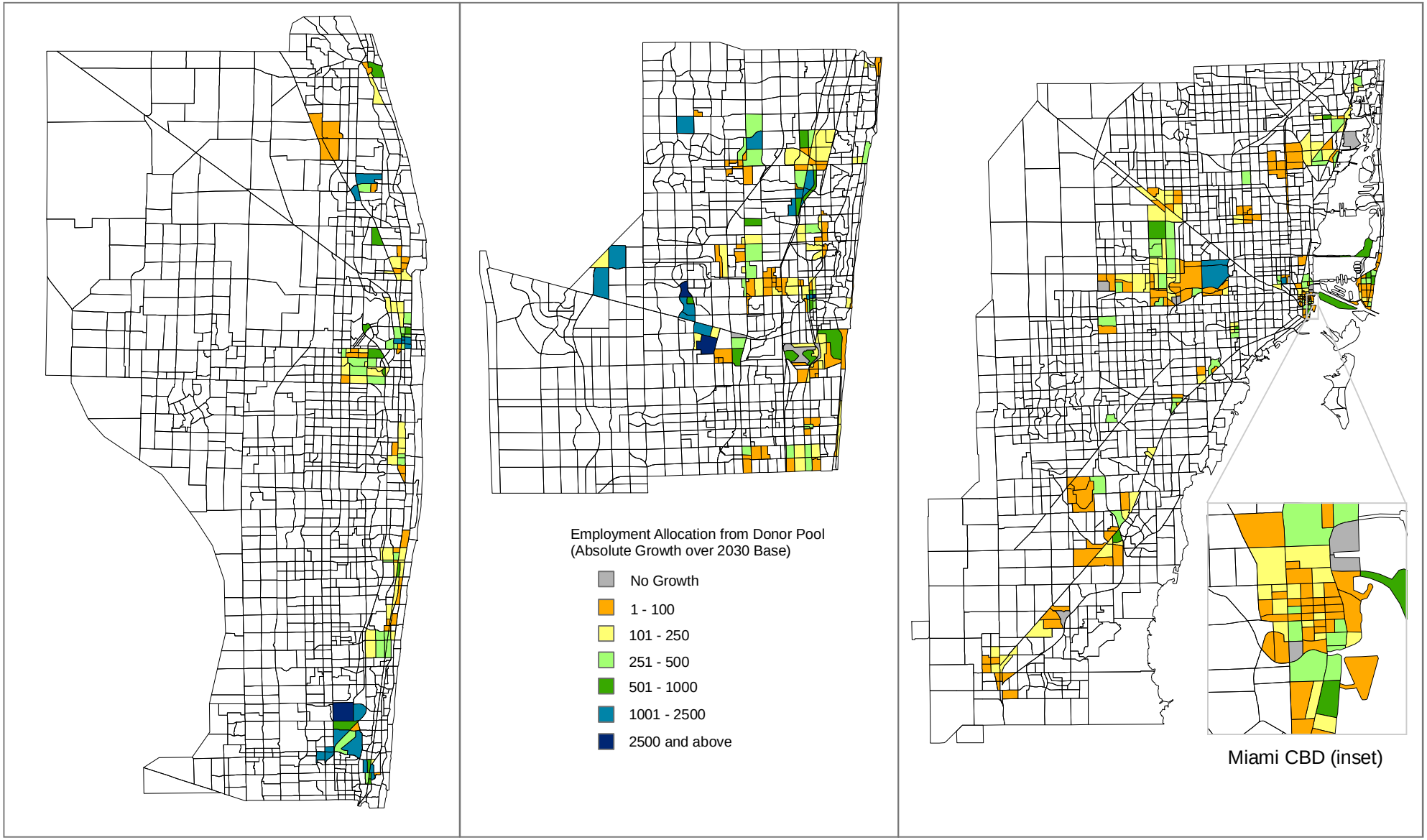


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 8
Employment Allocation

Employment Allocation According to Scenario 2 Distribution

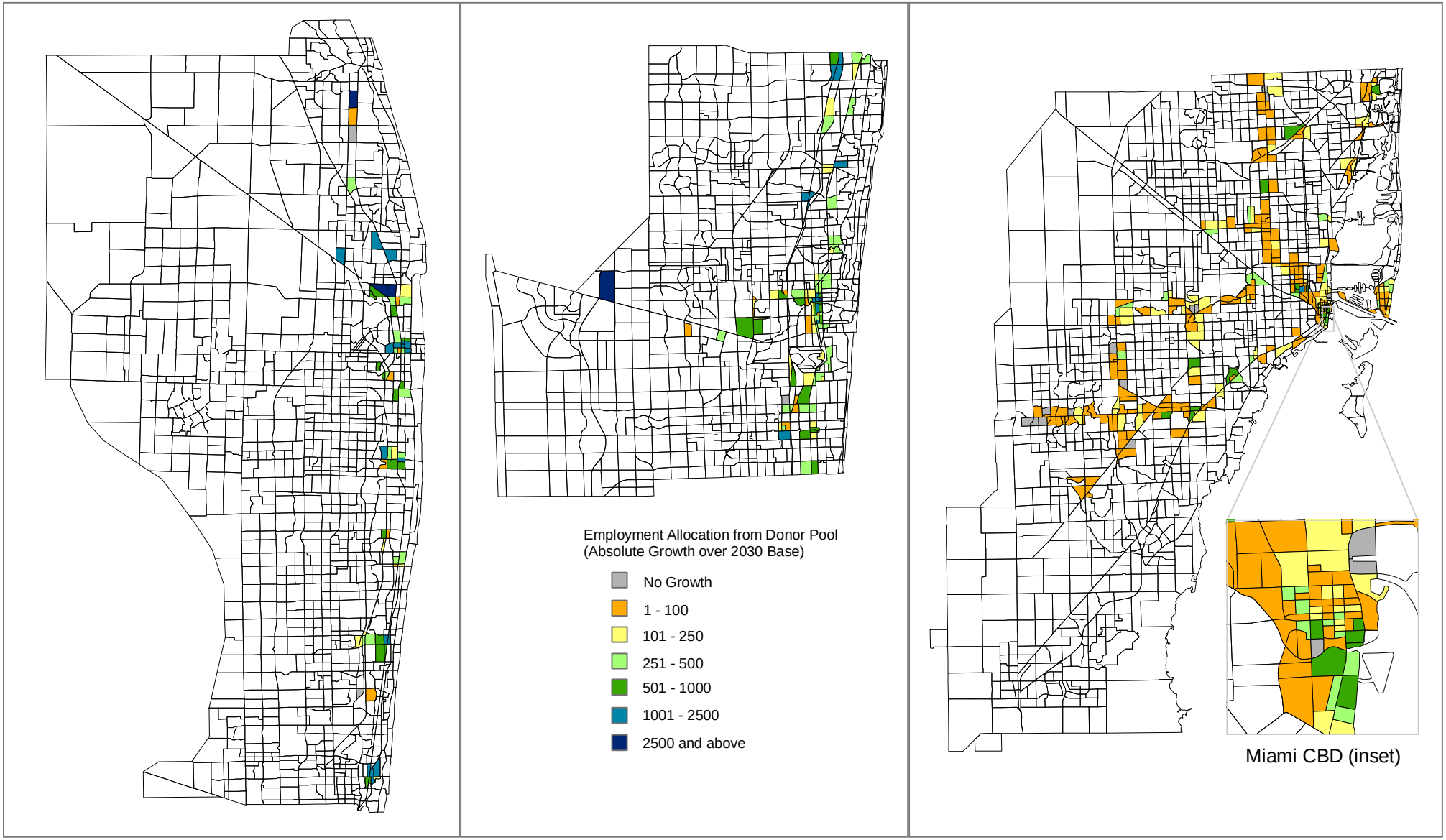


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 9
Employment Allocation

Employment Allocation According to Scenario 3 Distribution

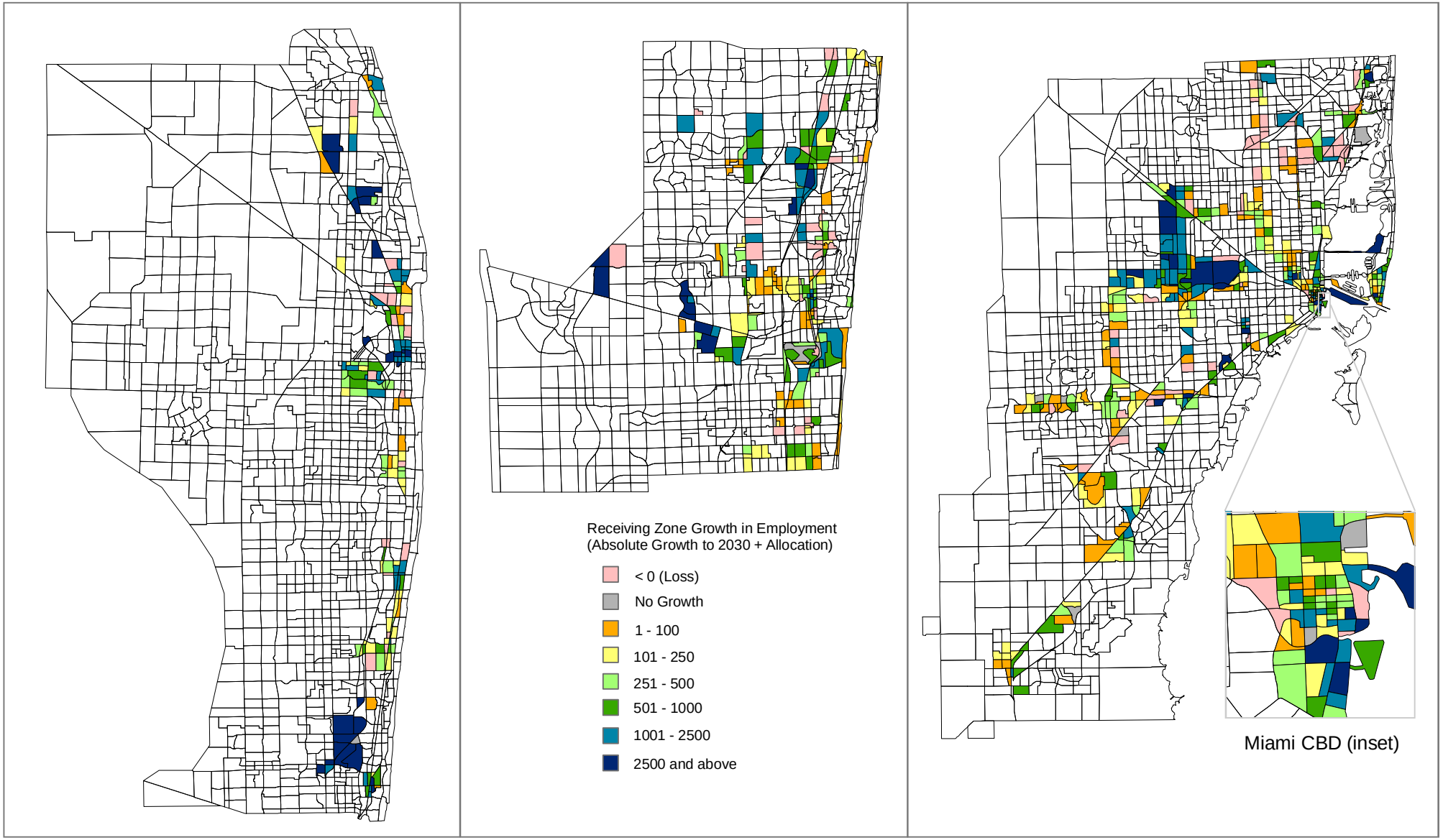


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 10
Employment Growth in Receiving Zones

Employment Growth in Absolute Numbers According to Scenario 1 Distribution

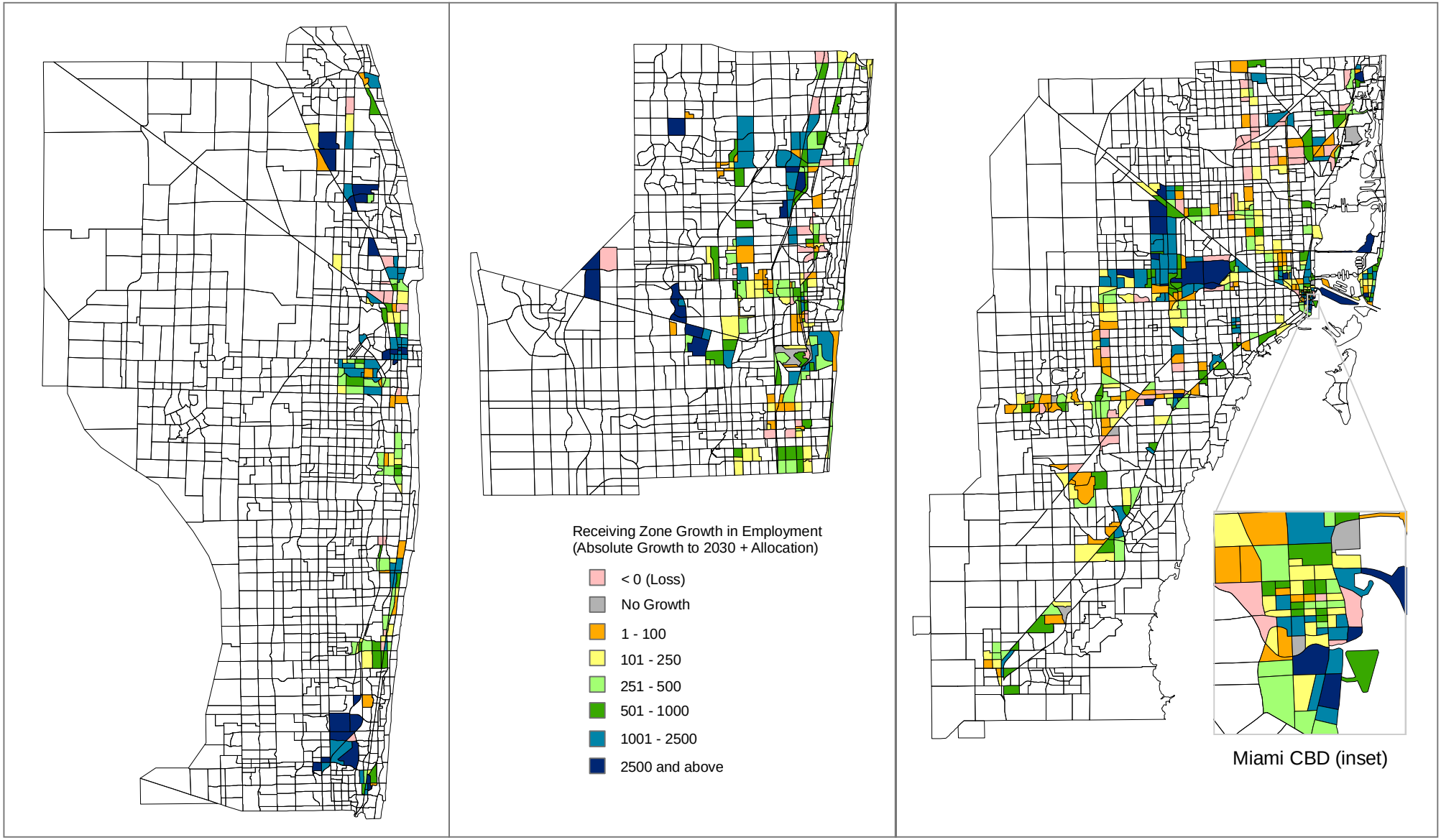


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 11
Employment Growth in Receiving Zones

Employment Growth in Absolute Numbers According to Scenario 2 Distribution

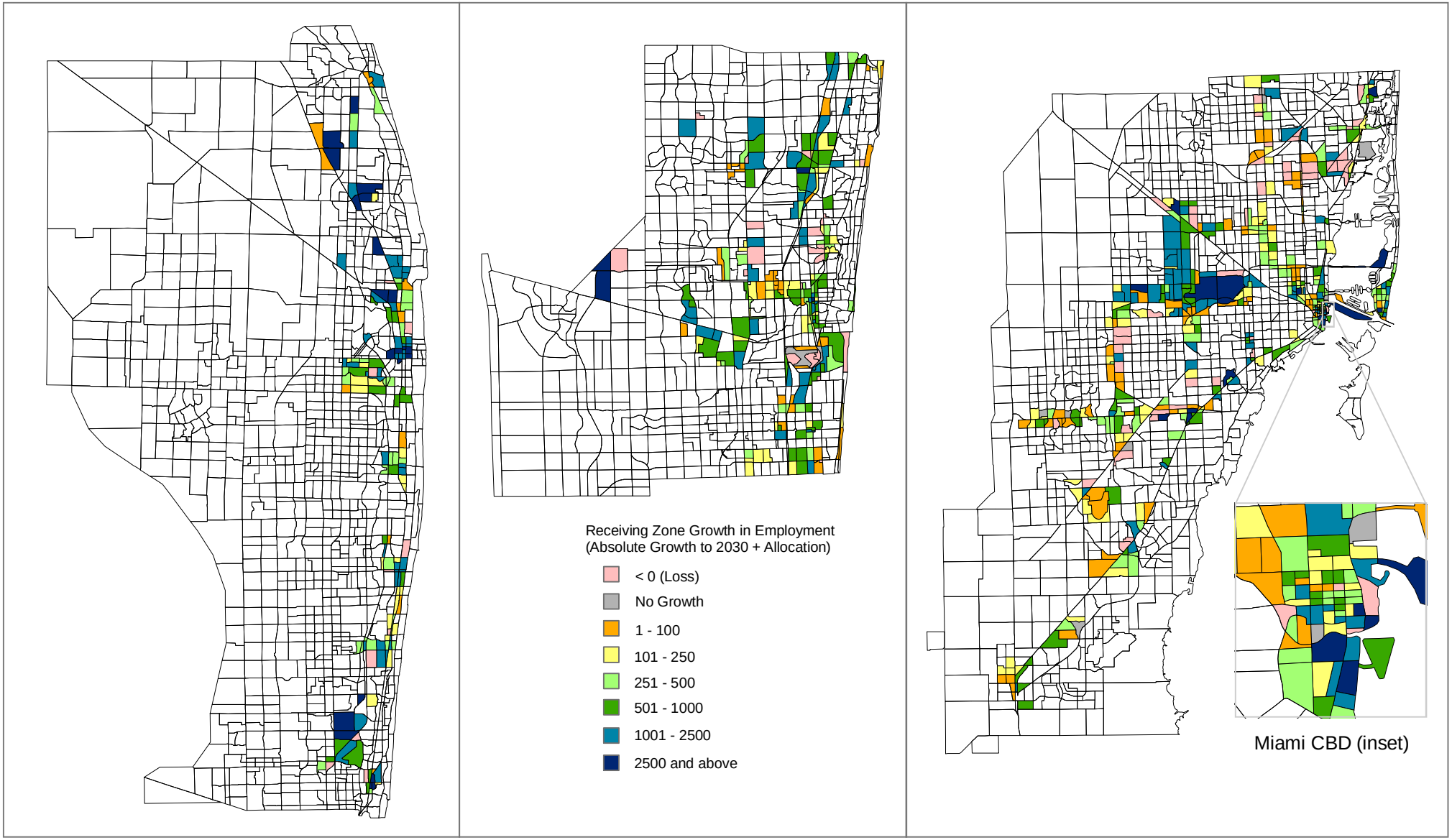


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 12
Employment Growth in Receiving Zones

Employment Growth in Absolute Numbers According to Scenario 3 Distribution

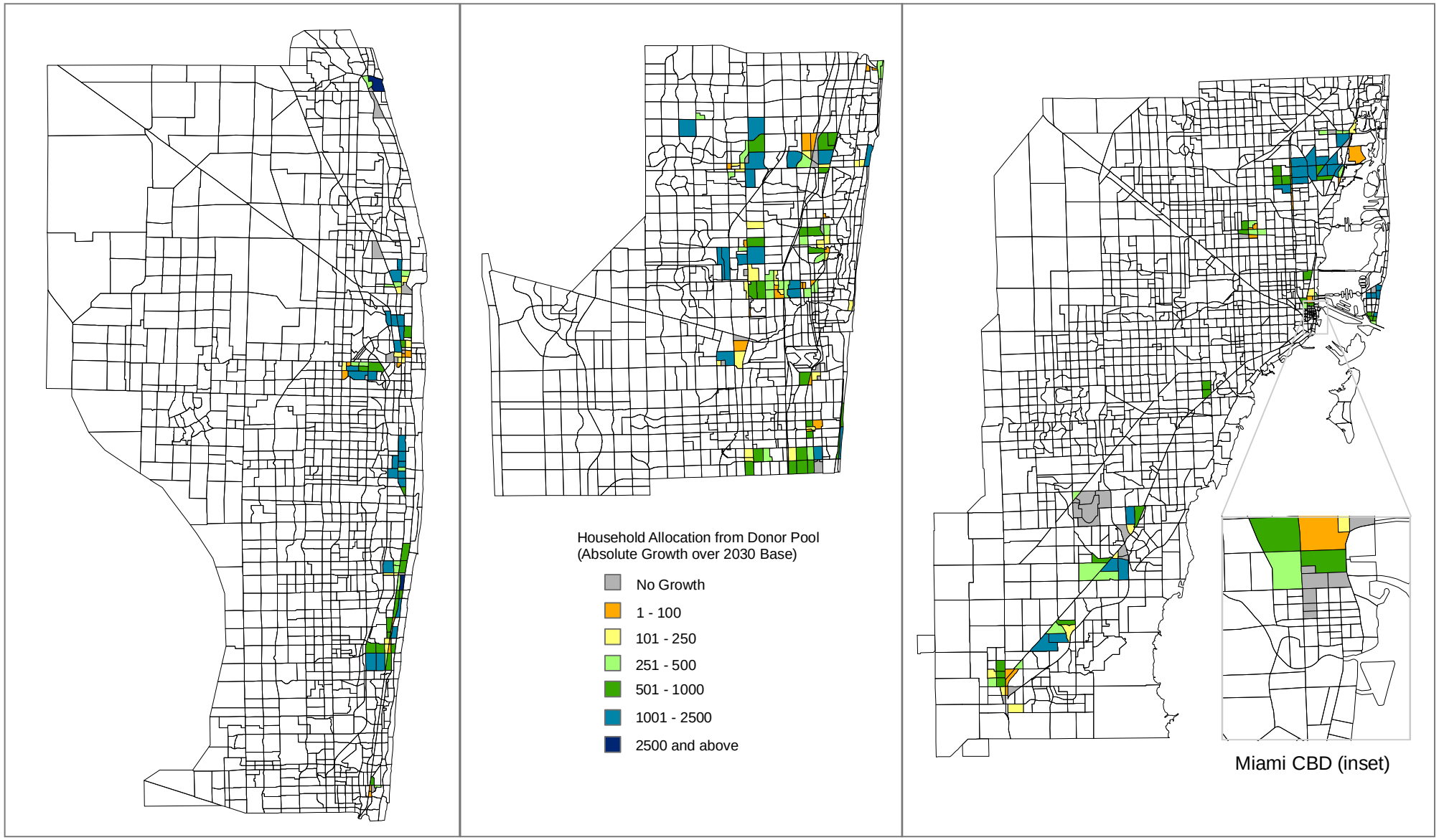


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 13
Household Allocation

Household Allocation According to Scenario 1 Distribution

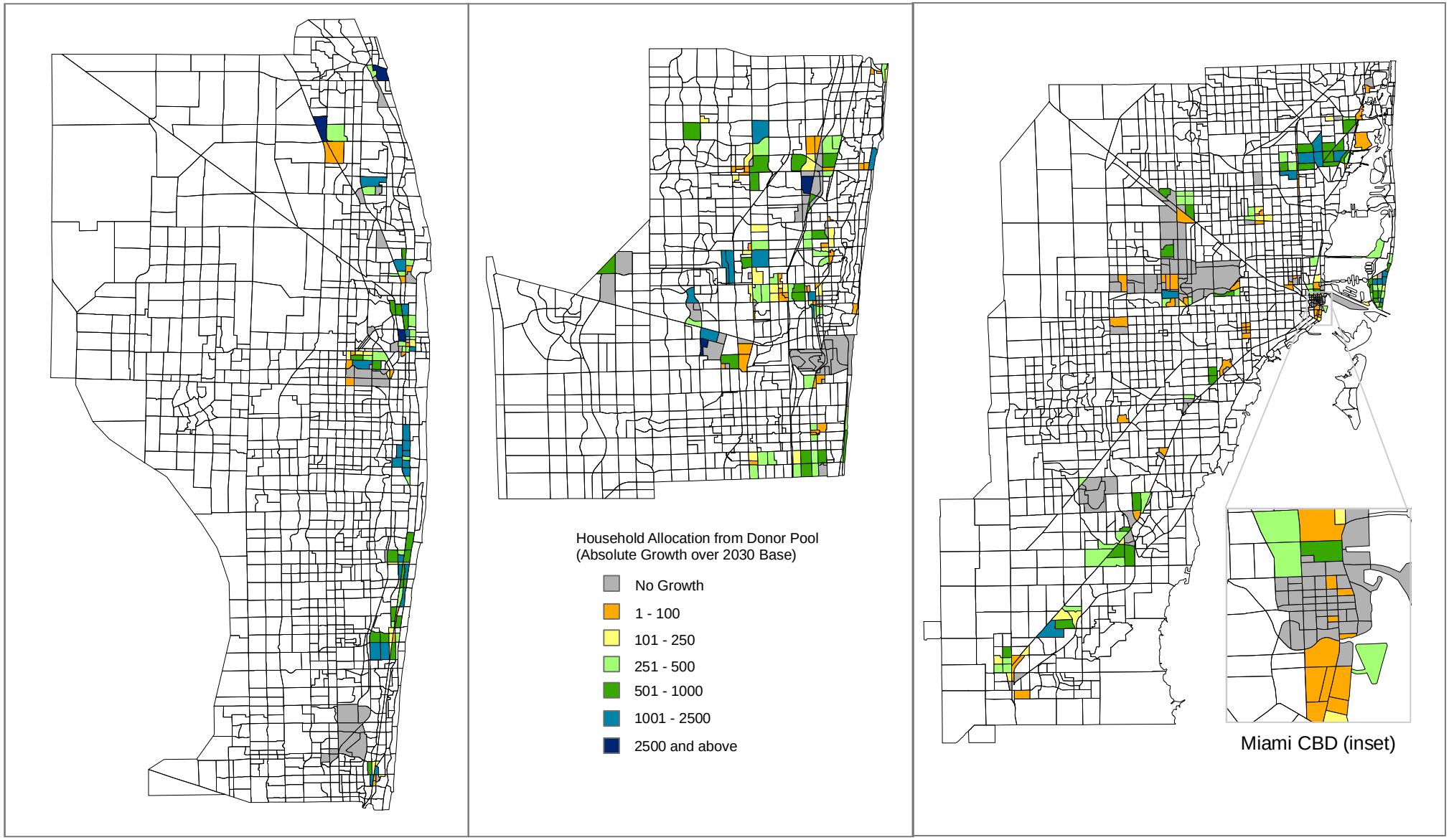


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 14
Household Allocation

Household Allocation According to Scenario 2 Distribution

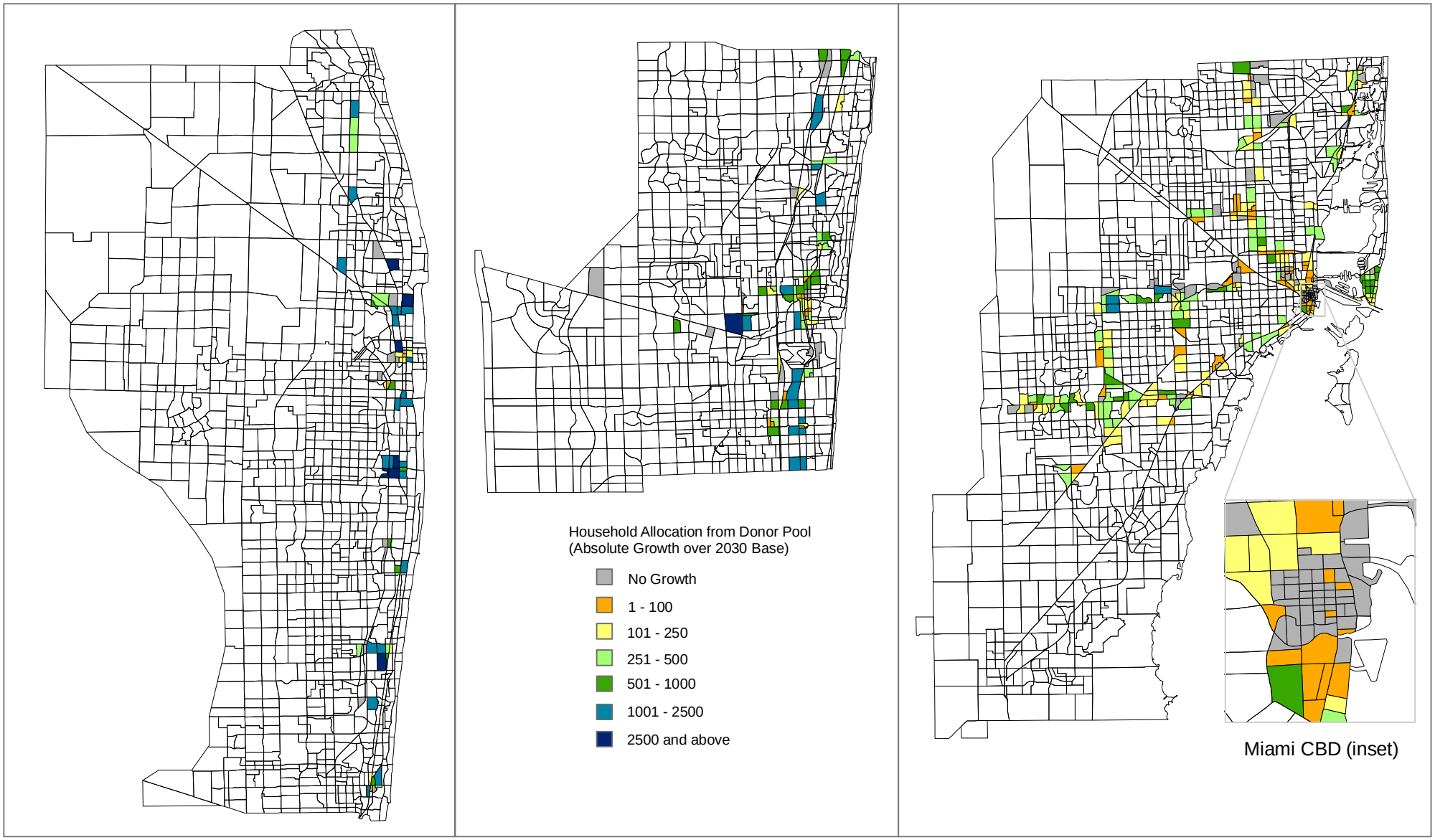


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 15
Household Allocation

Household Allocation According to Scenario 3 Distribution

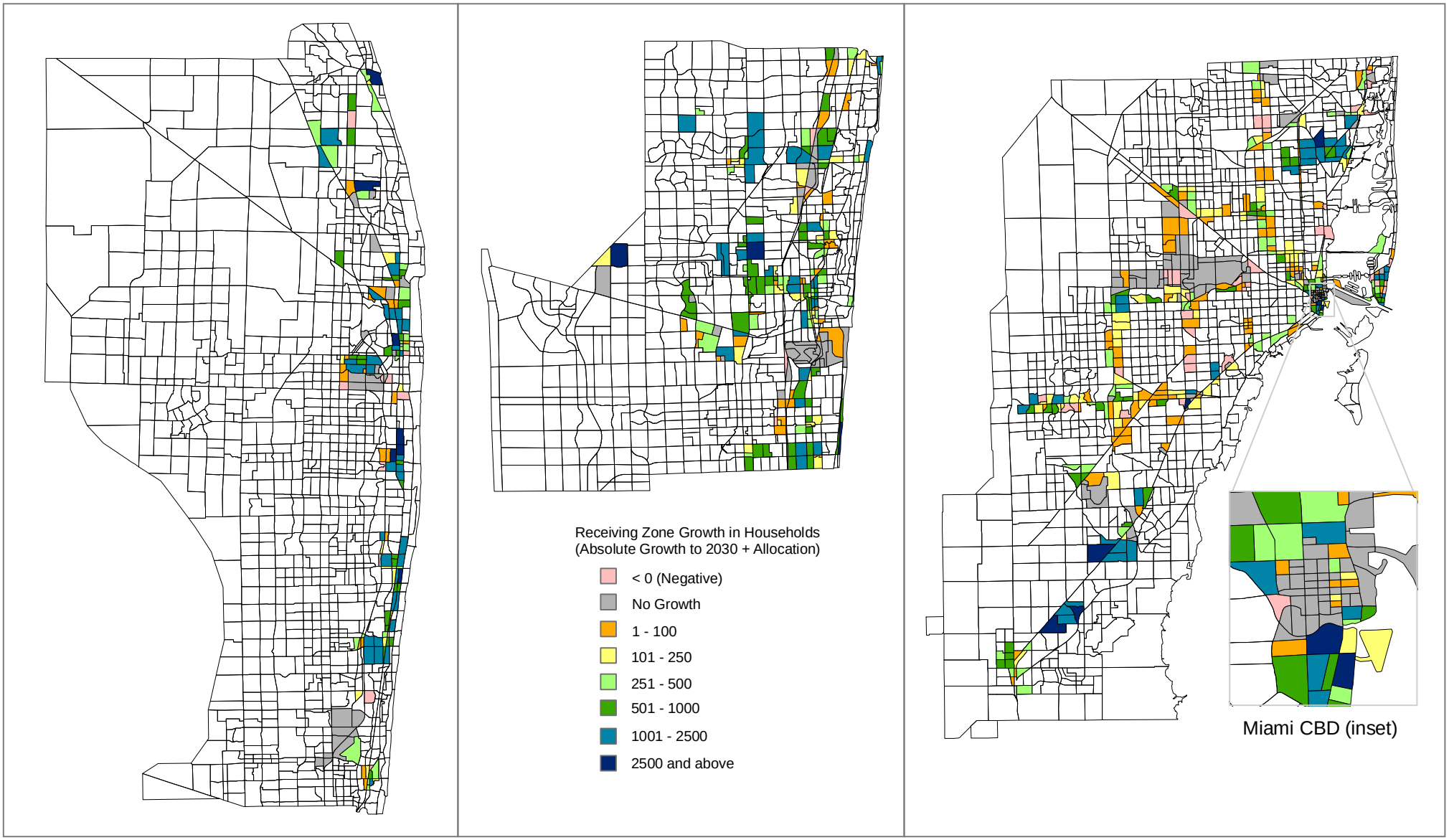


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 16
Household Growth in Receiving Zones

Household Growth in Absolute Numbers According to Scenario 1 Distribution

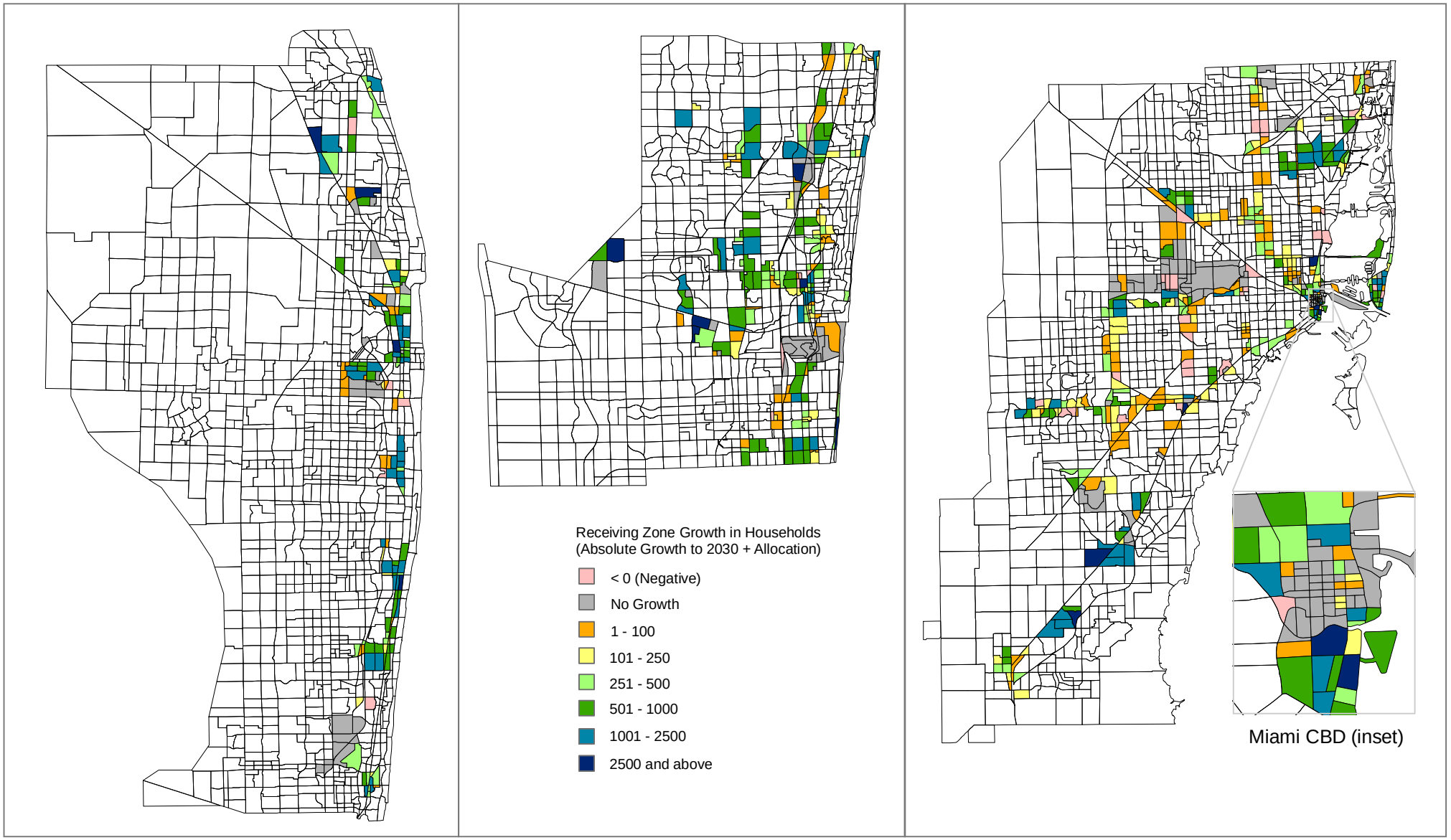


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,656,384

Figure 17
Household Growth in Receiving Zones

Household Growth in Absolute Numbers According to Scenario 2 Distribution

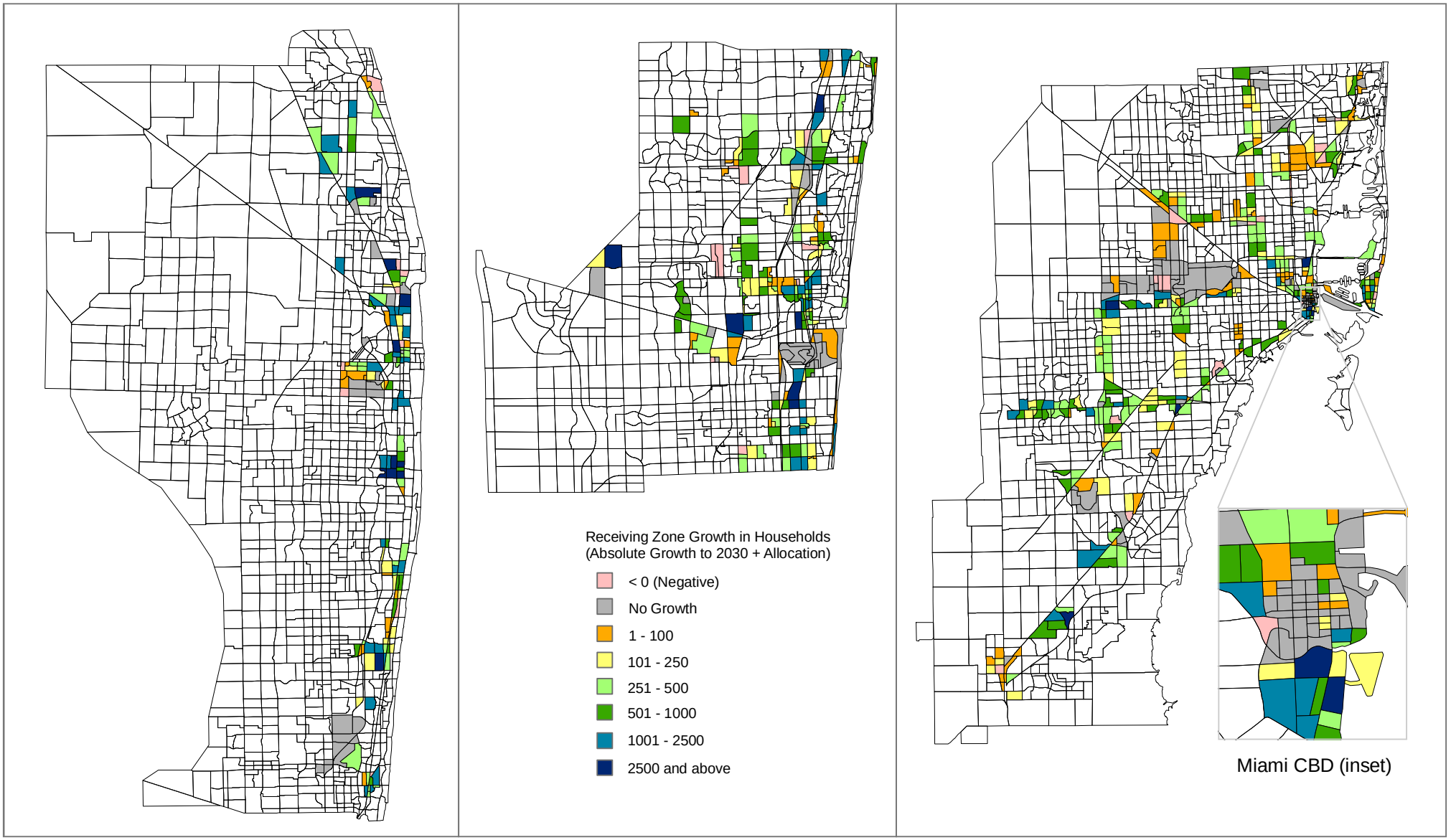


Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,686,384

Figure 18
Household Growth in Receiving Zones

Household Growth in Absolute Numbers According to Scenario 3 Distribution



Palm Beach County **Broward County** **Miami-Dade County**

Scale = 1:1,686,384