ARC Forecasting and the PECAS Spatial Economic Model: Overview

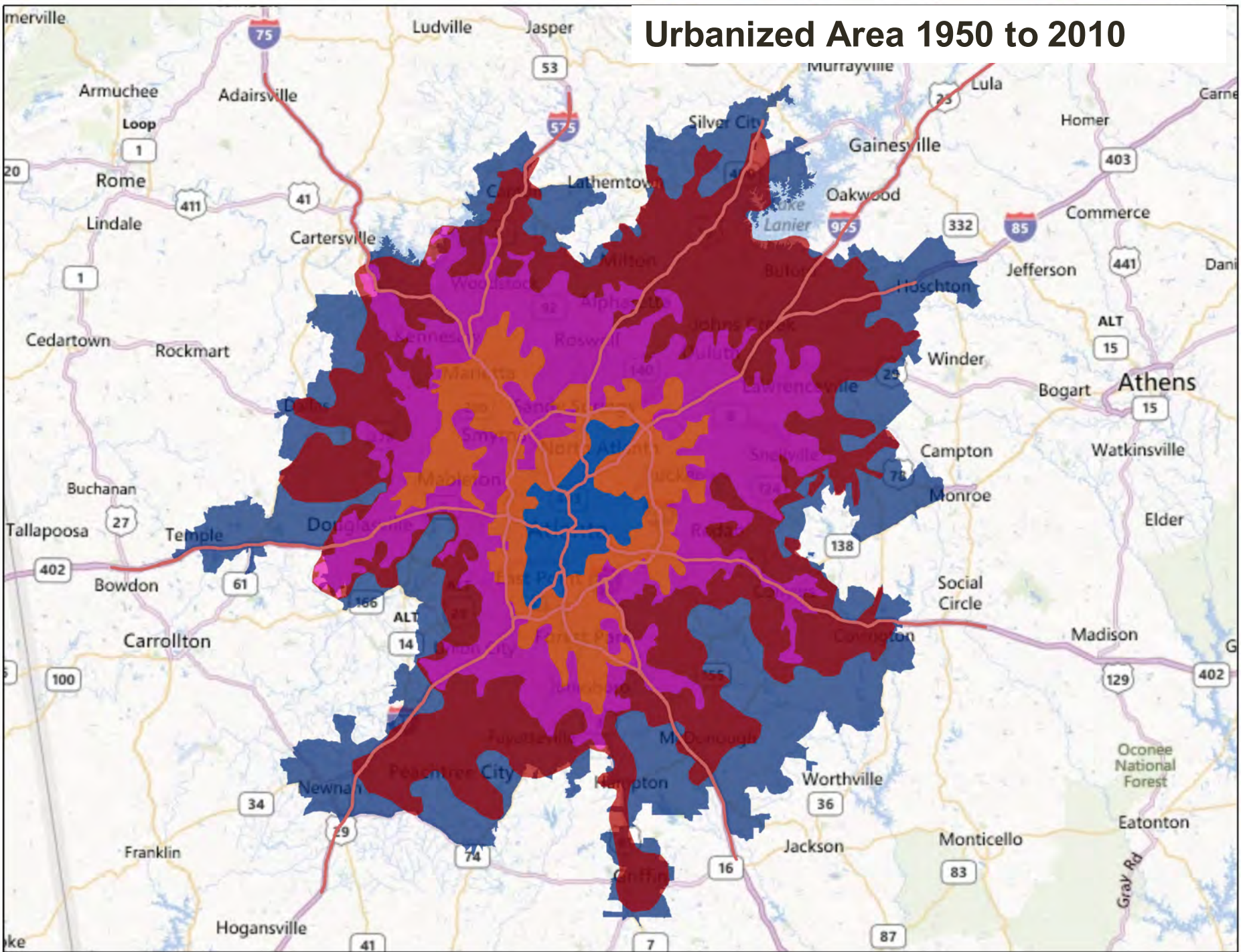Jim Skinner

Atlanta Regional Commission

2016

Urbanized Area 1950 to 2010

The Metropolitan Atlanta region has grown into a complex combination of counties, municipalities and jurisdictional boundaries. This map series reflects the various planning areas of the Atlanta Regional Commission (ARC) and seeks to promote a greater understanding of our rapidly expanding region. Please refer to the user notes accompanying each map for explanation of map content and clarification of acronyms and definitions.

The Atlanta Region

Atlanta Regional Commission
40 Courtland St. NE
Atlanta, Georgia 30303
404-463-3100
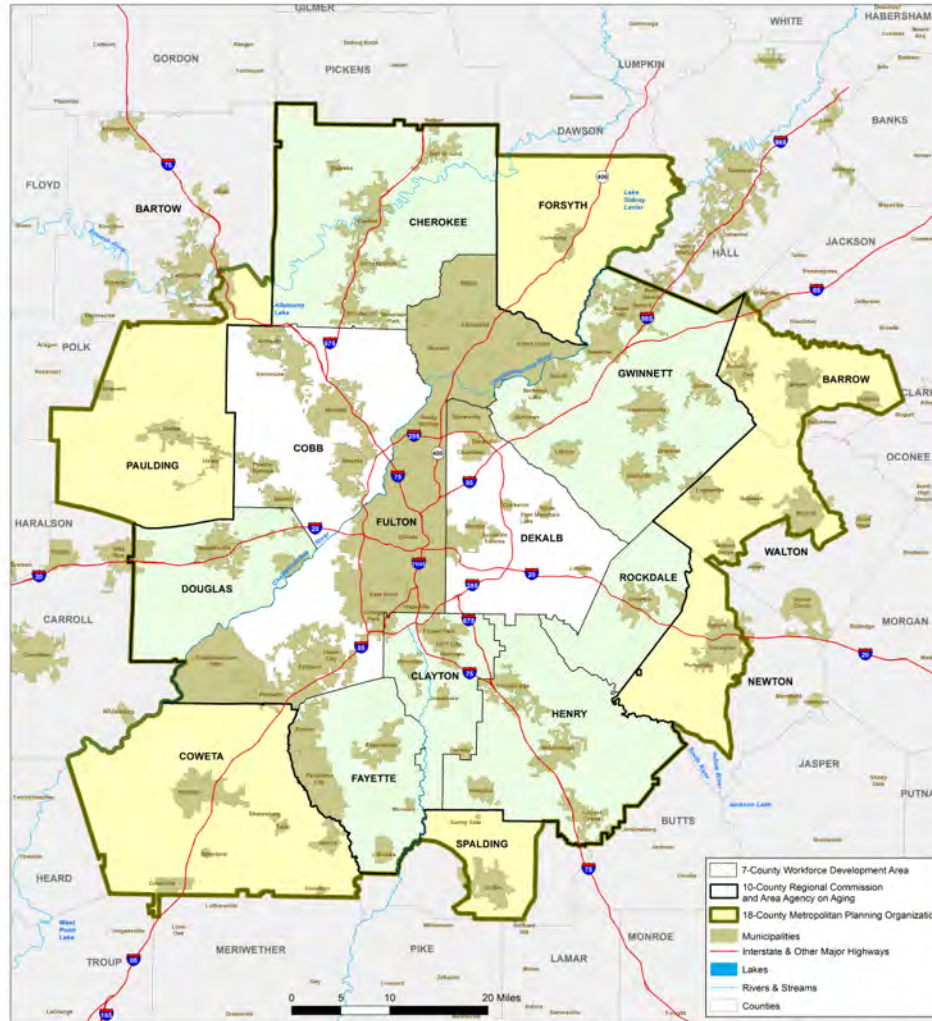www.atlantaregional.com

State of Georgia Regional Commissions

The Atlanta Regional Commission is one of 12 Regional Commissions (RCs), as currently established by the Board of the Department of Community Affairs according to OCGA 50-8-30, in order "to develop, promote and assist in establishing coordinated and comprehensive planning, to assist local governments, and promote the essential public interests of the state and its citizens." RCs are multi-county planning and development agencies serving municipal and county governments, providing professional technical assistance to state and federal agencies as well as to local governments in advancing quality growth and development. Georgia's RCs are involved in such activities as comprehensive planning, land use development, historic preservation, aging services, revolving loan funds, business retention and development, affordable housing, global economics, tourism, defense conversion, workforce development, coordinated transportation, telecommunications and technology, geographic information systems and disaster mitigation planning.

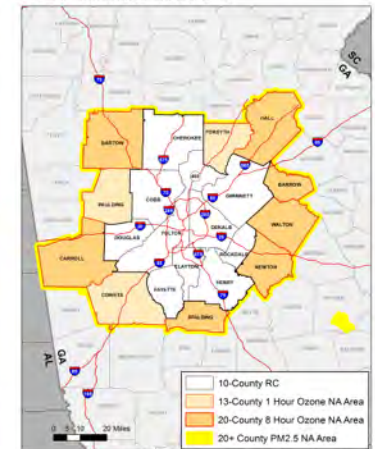## Metropolitan North Georgia Water Planning District

This map represents the boundary of the Metropolitan North Georgia Water Planning District, which provides water resource plans, policies and coordination for metropolitan Atlanta. The District has developed regional plans for stormwater management, wastewater treatment and water supply and water conservation. The 15-county Water Planning District includes the ten counties in the ARC plus five additional counties (Bartow, Coweta, Forsyth, Hall, & Paulding). For more information please consult www.northgeorgiawater.org.

Legend:
- 10-County RC
- 15-County MNGWPD
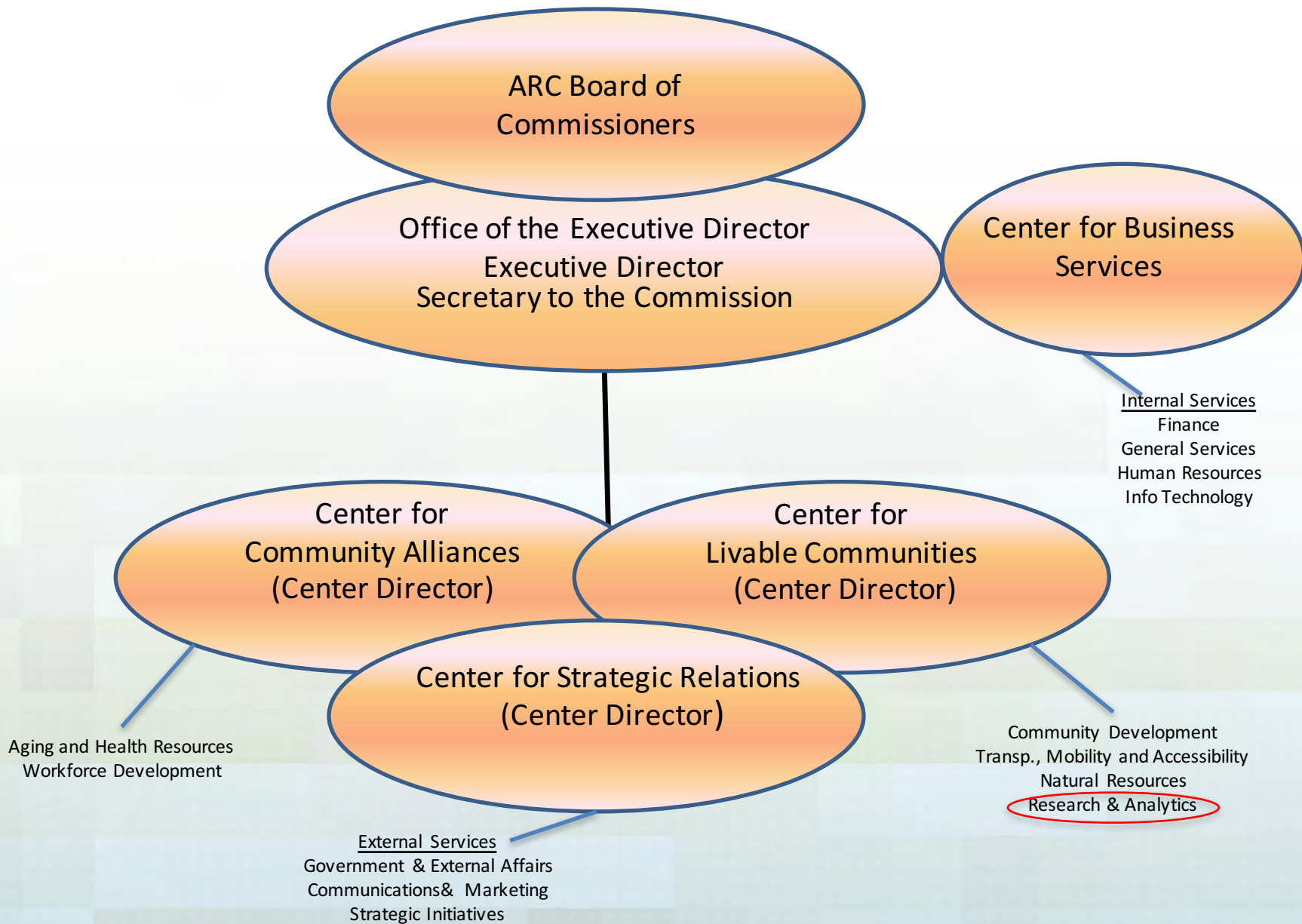
U.S. EPA Non-Attainment Areas

This map represents each of the air quality non-attainment area (NA) boundaries that affect the Atlanta metro area. The 13-county non-attainment area for the one-hour ozone standard, in place for the last 15 years, was revoked in 2005. A revised, more stringent eight-hour ozone standard is now in place, resulting in an expansion of the Atlanta non-attainment area to include 20 counties. In addition, a new fine particulate matter standard (PM2.5) is now in place. The non-attainment area under this standard includes the 20-county, eight-hour ozone nonattainment area, plus a small portion of Heard and Putnam counties.

Legend:
- 10-County RC
- 13-County 1 Hour Ozone NA Area
- 20-County 8 Hour Ozone NA Area
- 20+ County PM2.5 NA Area

U.S. Census Bureau Statistical Areas

This map represents the expanded Atlanta Metropolitan Statistical Area (MSA) from its previous 20-county area to a 28-county "Atlanta-Sandy Springs-Marietta" MSA. The larger 33-county "Atlanta-Sandy Springs-Gainesville, GA-AL" Combined Statistical Area (CSA) includes the 28 counties of the MSA, along with the Gainesville (GA) MSA and the micropolitan statistical areas of Cedartown, LaGrange and Thomaston (GA) plus Valley (AL). The U.S. Office of Management and Budget (OMB) defines CSAs, MSAs and the smaller micropolitan statistical areas nationwide according to published standards applied to U.S. Census Bureau data. These various statistical areas describe substantial core areas of population together with adjacent communities having a high degree of economic and social integration, often illustrated with high rates of commuting from the adjacent areas to job locations in the core. For more information, please consult http://www.census.gov/population/www/estimates/metrodef.html.

Legend:
- 10-County RC
- 28-County MSA
- 33-County CSA

Central map legend

- 7-County Workforce Development Area
- 10-County Regional Commission and Area Agency on Aging
- 18-County Metropolitan Planning Organization
- Municipalities
- Interstate & Other Major Highways
- Lakes
- Rivers & Streams
- Counties

This map represents ARC's Workforce Development Area (WFD), Regional Commission (RC), Area Agency on Aging (AAA) and Metropolitan Planning Organization (MPO) boundaries which are defined as follows:

- The Workforce Development Area (WFD) is a seven-county area created by agreement of county chief-elected officials, administered by the Atlanta Regional Commission and funded for training and employment activities under the federal Workforce Investment Act (WIA). For more information on ARC's Workforce Development programs and services please consult www.atlantaregional.com/workforce/workforce.html.

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10/2010

ARC Board of Commissioners

Office of the Executive Director
Executive Director
Secretary to the Commission

Center for Business Services

Internal Services
Finance
General Services
Human Resources
Info Technology

Center for Community Alliances
(Center Director)

Center for Livable Communities
(Center Director)

Center for Strategic Relations
(Center Director)

Aging and Health Resources
Workforce Development

Community Development
Transp., Mobility and Accessibility
Natural Resources
Research & Analytics

External Services
Government & External Affairs
Communications & Marketing
Strategic Initiatives

regional impact + local relevance

ARC
ATLANTA REGIONAL COMMISSION

4

The Atlanta Region

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State of Georgia Regional Commissions

Northwest Georgia, Georgia Mountains, Northeast Georgia, Atlanta Regional Commission, Three Rivers, Central Savannah River Area, Middle Georgia, River Valley, Heart of Georgia Altamaha, Coastal Regional Commission, Southwest Georgia, Southern Georgia

0   50   100 Miles

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Metropolitan North Georgia Water Planning District

BARTOW, CHEROKEE, FORSYTH, HALL, PAULDING, COBB, GWINNETT, FULTON, DEKALB, DOUGLAS, ROCKDALE, COWETA, FAYETTE, CLAYTON, HENRY
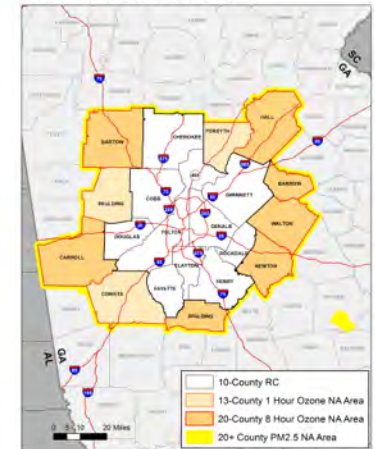
0 5 10   20 Miles

10-County RC
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Main map legend

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10-County Regional Commission and Area Agency on Aging
18-County Metropolitan Planning Organization
Municipalities
Interstate & Other Major Highways
Lakes
Rivers & Streams
Counties

0 5 10   20 Miles

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10/2010

Why and What?: New Directions

1. Regional Forecasting
   - IPEF was outdated (70s, FORTRAN) and limited
   - REMI was the choice
2. Small Area Forecasting
   - D/E was limited, and support had disappeared
   - PECAS was the choice, long-term
   - TAZ-D as a bridge
3. Travel Demand Model
   - 4- Step to Activity-Based

TAZ-D

- TAZ-D developed in collaboration with PBSJ
  - Used new Regional Controls--REMI
  - Shares from E6 work used at superdistrict level
  - Spatial factors used to allocate to grid, back to TAZ
- Initial series developed late Spring 2009
- Review with local planners May-early July 2009
  - 23 meetings

Forecasts Status/ Timeline

- Plan 2040 Adopted in 2010 (REMI,TAZ-D, 4-step)

- Plan2040 Update (for 20 counties): Spring to early summer 2013 (REMI, Hybrid, 4-Step)

- Major Plan Update (The Atlanta Region's Plan) 2015-2016

  - New model sets ABM and PECAS (to an extent)

- Going forward

  - Further levels of implementation

  - New model areas (urbanized area change)
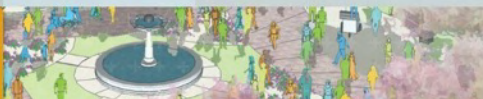
ARC
ATLANTA REGIONAL COMMISSION

ARC Forecast Flow
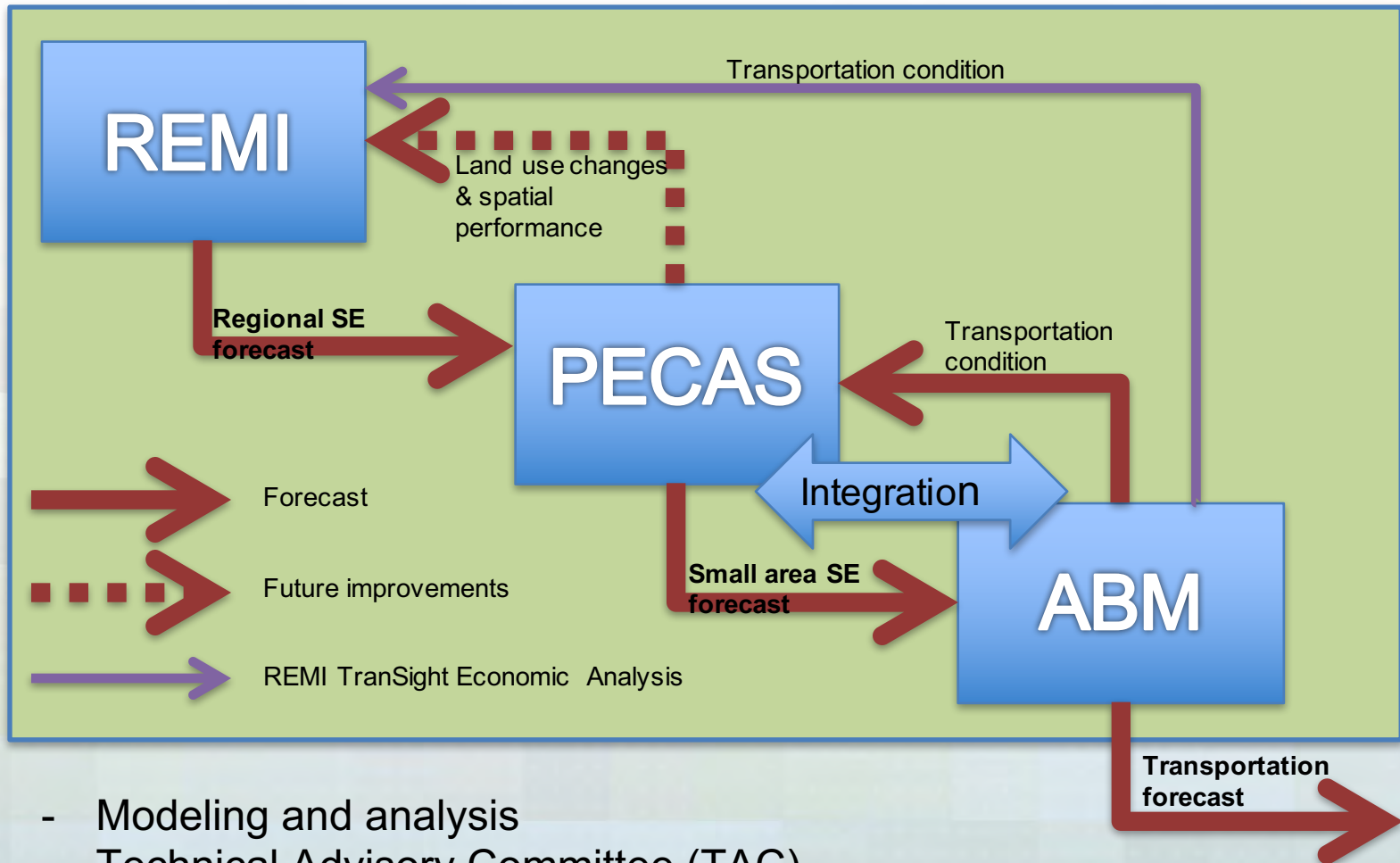
- Modeling and analysis
- Technical Advisory Committee (TAC)
- Local government review
- *Challenges and opportunities*

regional impact + local relevance

ATLANTA REGIONAL COMMISSION

Forecast Process for Last Full Plan Development

Activity	Regional Forecast	Small-Area Activity Allocation (AA) Module	Small-Area Spatial Development (SD) Module	(Interaction with) Travel Demand Model
Geography	20-County area	Super District	Parcel	Traffic Analysis Zones
Number of Zones	21 (Up from 3)	78 (groups of tracts)	2 million	5,873
Model	REMI	PECAS	PECAS	Javascript from PECAS
Theory	Input-Output; Econometric; GE; Economic Geography	Three-Level Nested Logit- Model (Gen Eq: Input-Output Economic)	Monte-Carlo; Logit Model for Demand Allocation	Land Use Transportation Interaction (Transport Costs)
Output	Total Population by Cohort Total Employment by Sector (2 & 3 dig NAICS) Economic Activity Totals	Economic Activity Interactions and Resulting Locations, Generation of Space Demand (More/Less)	Space Supply (More/Less) and Allocation by Type	Households by Income; Employment by Sector

ARC Forecasts

Why we forecast?
-Key Component of RTP/ RDP/ WD Plans…

Regional SE forecasting
- REMI replaced IPEF
- 20 / 21 Counties
- Economic activities
- Households
- Population
- Employment

Small area SE forecasting
- PECAS/TAZD replaced DRAM/EMPAL
- 2,000 zones for TBM
- 6,000 zones for ABM

Transportation forecasting
-Migrated to
Activity Based Model

2,000 zones   6,000 zones

REMI Models

PI⁺
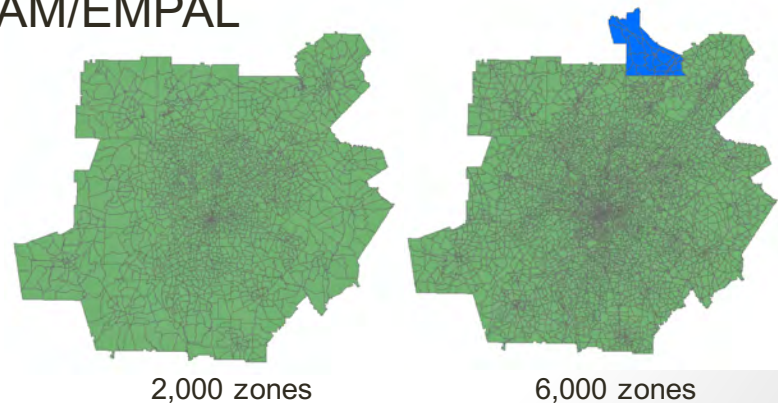
- Comprehensive modeling estimating economic and demographic effects

- Up to 169 industry sectors across 3,089 U.S. counties including 6,000+ fully adjustable policy variables updated yearly

- In the Atlanta region, 20 counties, 70 sectors including 6,000 policy variables updated annually

TranSight

- Comprehensive tool for evaluating the total economic effects of changes to transportation systems

- Integrates travel demand data, data on emissions, safety valuation factors, etc., and 3 additional transportation-related cost matrices

- In the Atlanta region, 9 sensitivity simulations, 4 transportation priority scenarios, 10+ economic impact studies and a one of a kind socio-economic forecast for a regional transportation referendum

More?
http://www.remi.com/products

Detailed Model Structure
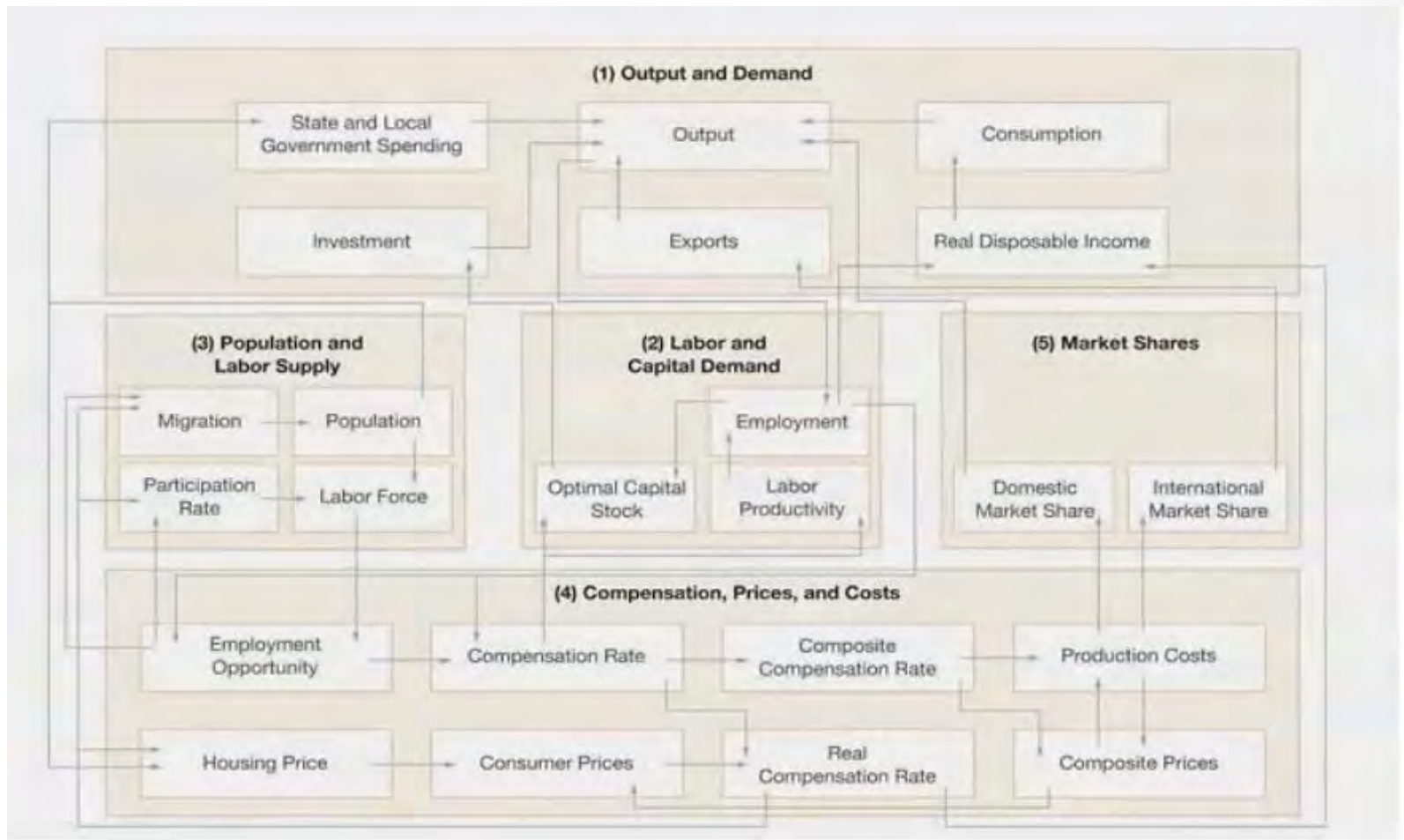
New Economic Geography Linkages
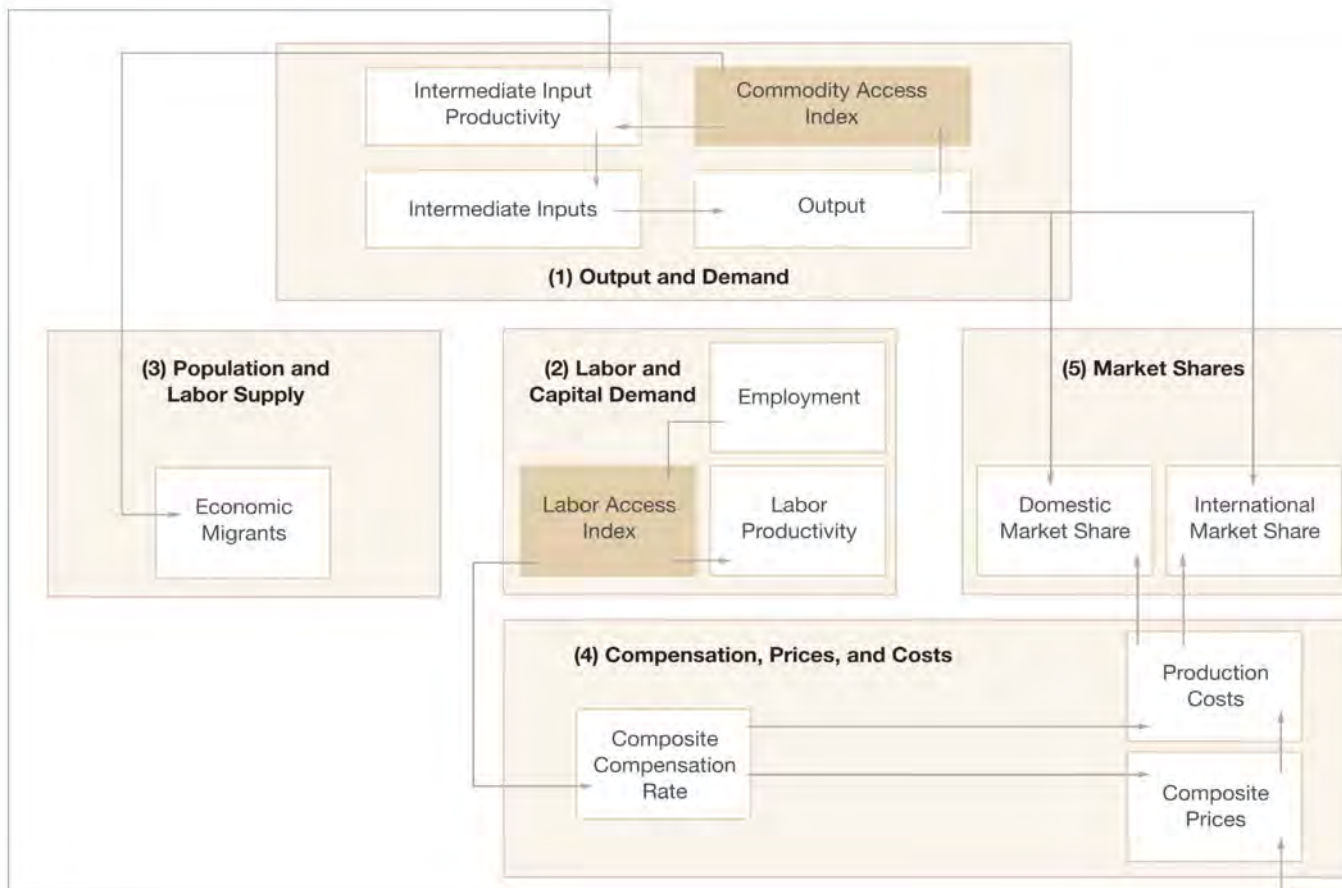
THE ARC TRAVEL DEMAND FORECASTING - WHERE DO WE START?

Travel Behavior (Surveys)

Existing/Planned Transportation System

Land Use & Socio-Economic Characteristics (PECAS)

The Regional Travel Demand Activity-Based Model Set

(The "ABM")
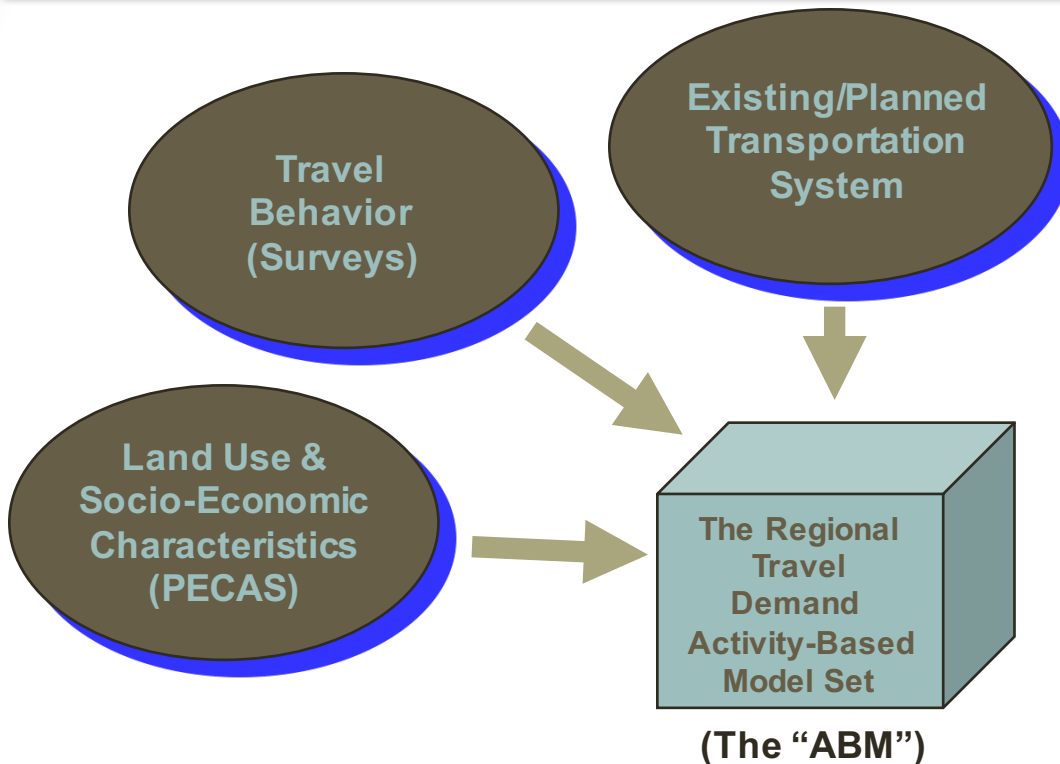
- ARC has maintained ..
  - A 4-Step Model based on <u>trips</u> (= Trip-Based Model)
  - MIGRATED TO An Activity-Based Model based on <u>tours</u>

- ABM aims at predicting which activities are conducted where, when, for how long, with whom, the transportation mode involved and ideally also the implied route decisions

- ABM reflects the scheduling of activities in time and space

Daily "Activity" - Example
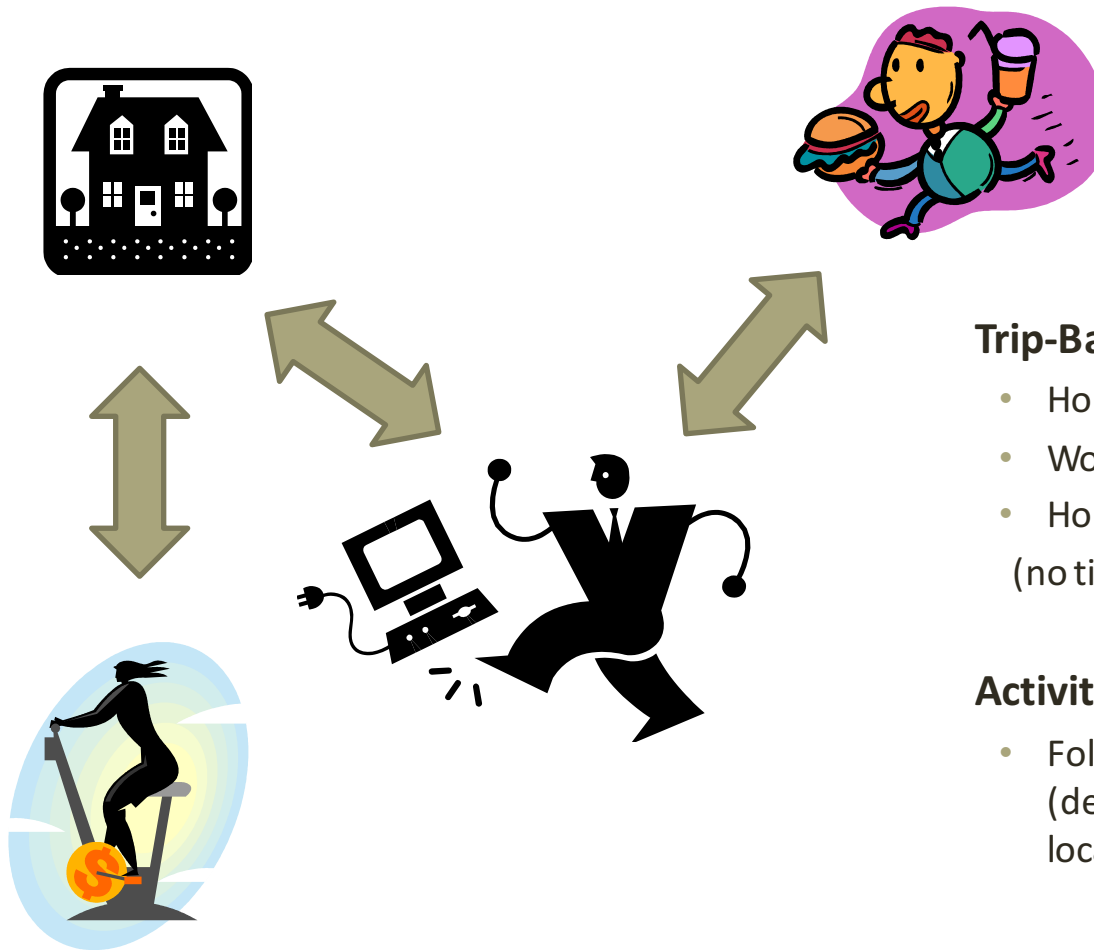
Trip-Based Model

- Home-Work: 2 trips
- Work-Eat: 2 trips
- Home-Gym: 2 trips

(no time-stamps, sequences)

Activity-Based Model

- Follows daily activity patterns (departure time, duration, location, frequency, mode)

ARC's Activity-Based Model: Coordinated Travel – Regional Activity-based Modeling Platform (CT-RAMP)

- Main features:
  - Explicit intra-household interactions and Coordinated Daily Activity Patterns (CDAP)
  - Continuous temporal dimension (hourly)
  - Integration of activity generation, location, and Time-Of-Day sub-models
  - JAVA-based package with TP+ Graphical User Interface

Activity-Based Models in the U.S.
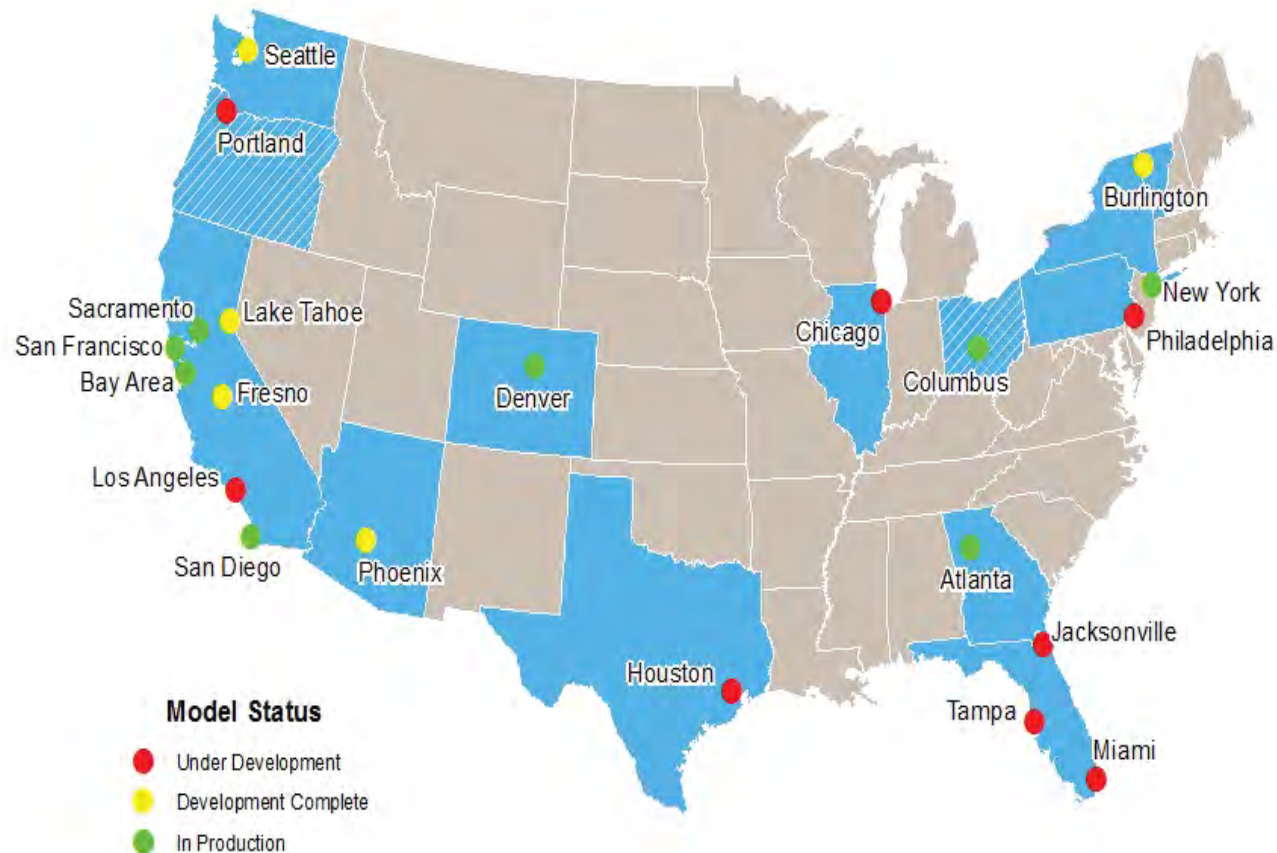
The "New" LU Allocation Model (PECAS)

- PECAS (Production, Exchange and Consumption Allocation System)
  - Developed by Drs Doug Hunt and John Abraham of University of Calgary
  - Based on sound economic theory, incorporating I-O modeling approach; achieves equilibrium
  - Two Modules, run Sequentially and Annually –
    - Activity Allocation (AA) Module: equilibrium exchange and consumption prices are established by larger zone (LUZ)
    - Space Development (SD) Module: based on pricing (rents) from AA and development costs, rational "developer" makes decision or non-decision to develop space in given smaller zones (TAZ) until the market 'clears'
  - *Work Reviewed by the REMI/PECAS Technical Advisory Group (TAG)*

On the Shoulders of...

- Portland and Oregon
- Baltimore
- California
  - Statewide
  - San Diego (SANDAG)
  - LA (SCAG)
- International
- Calgary
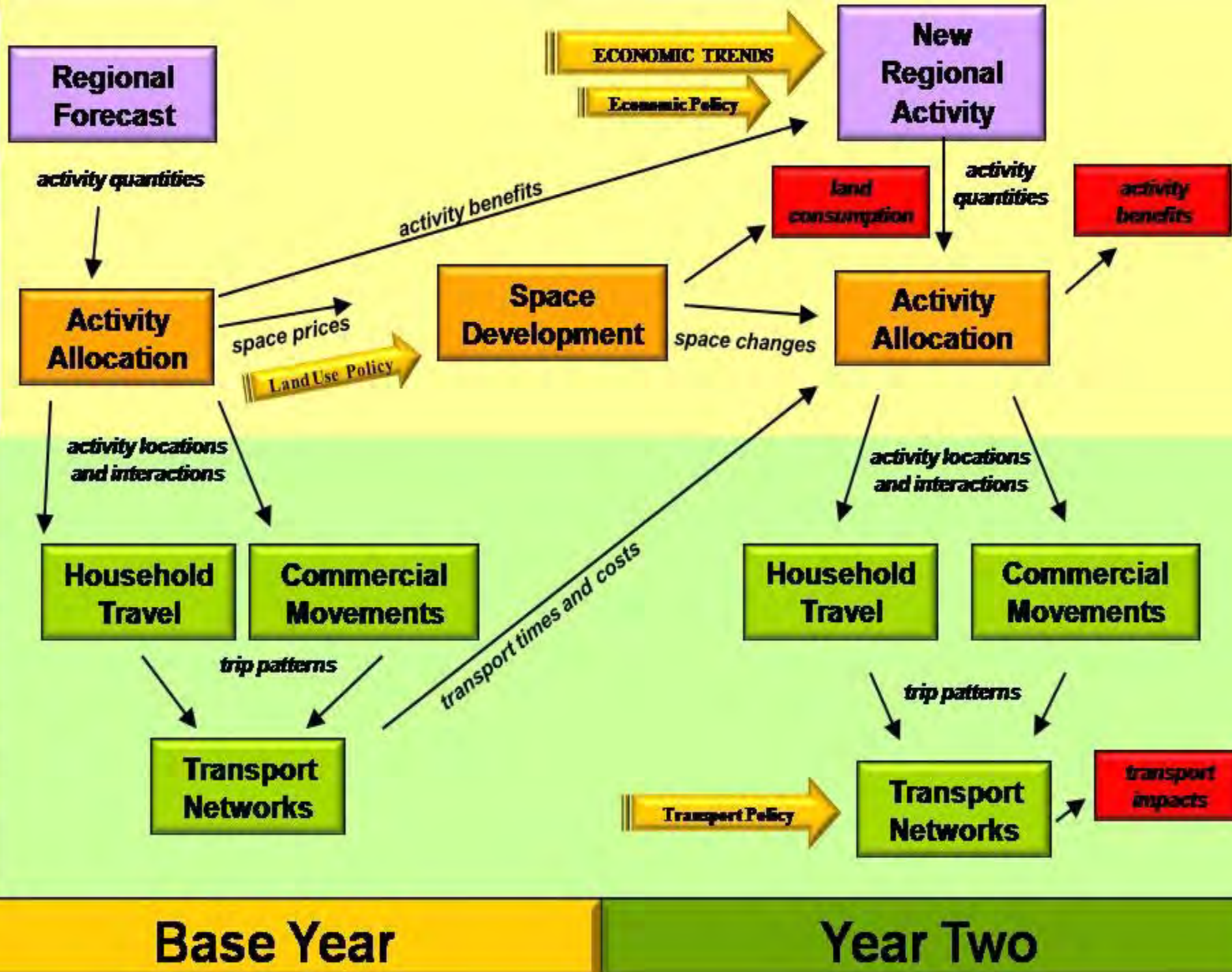
Treatment of Space (Land Areas and Locations)
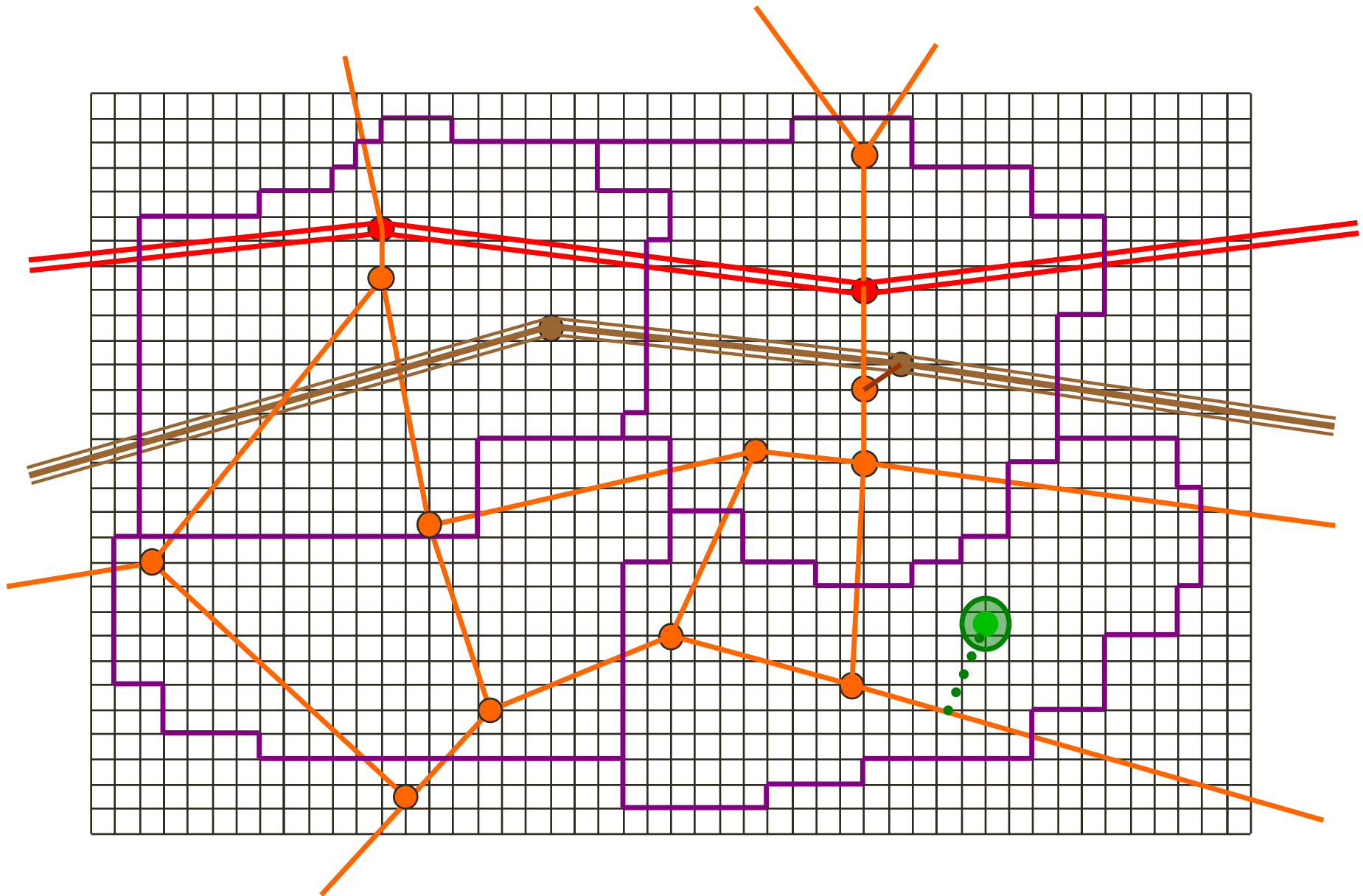
Treatment of Space

parcel or grid cell site

Treatment of Space

transport analysis zone (TAZ)

Treatment of Space

land use zone (LUZ)

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System Components and Treatment of Time
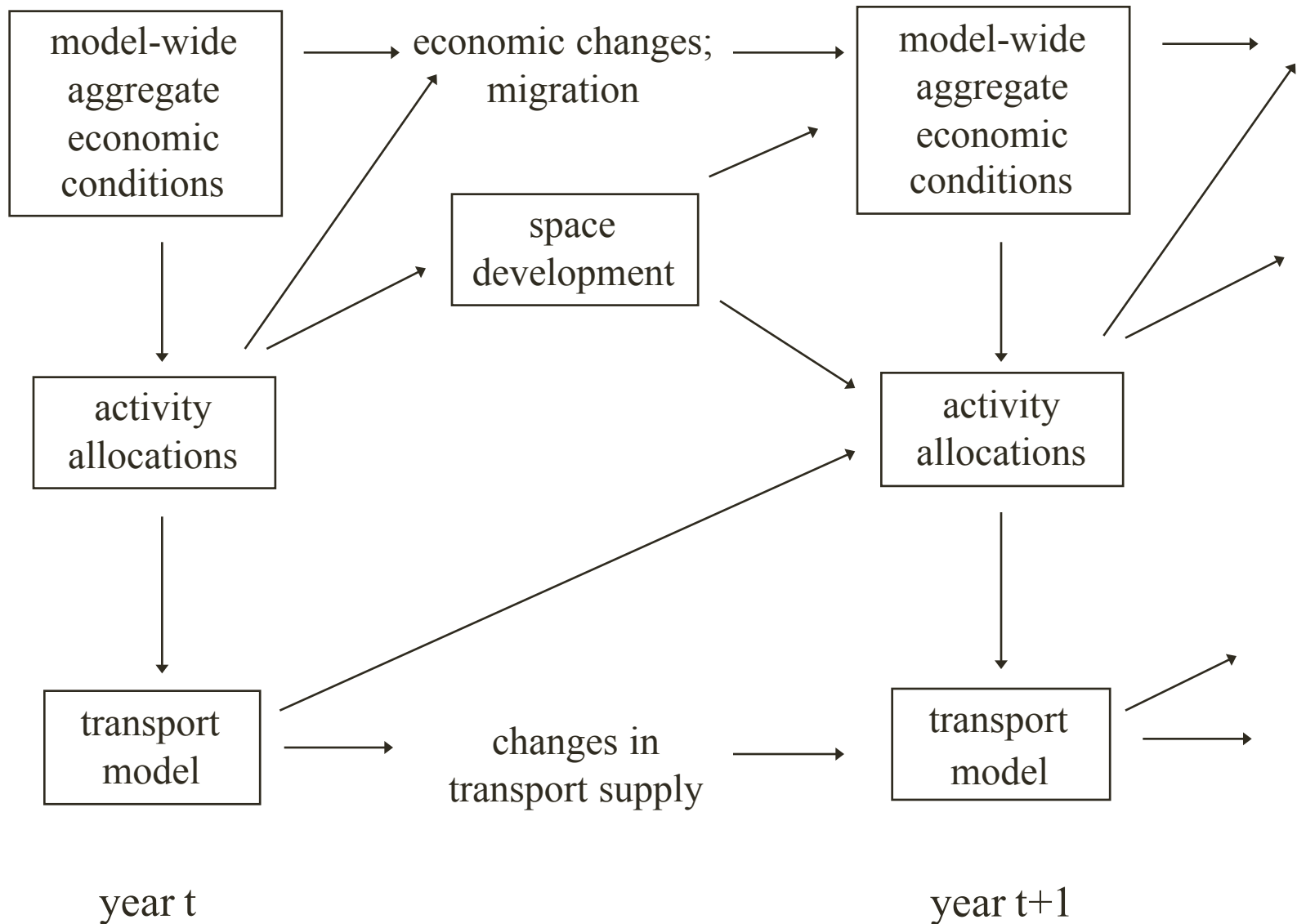
System Components and Treatment of Time
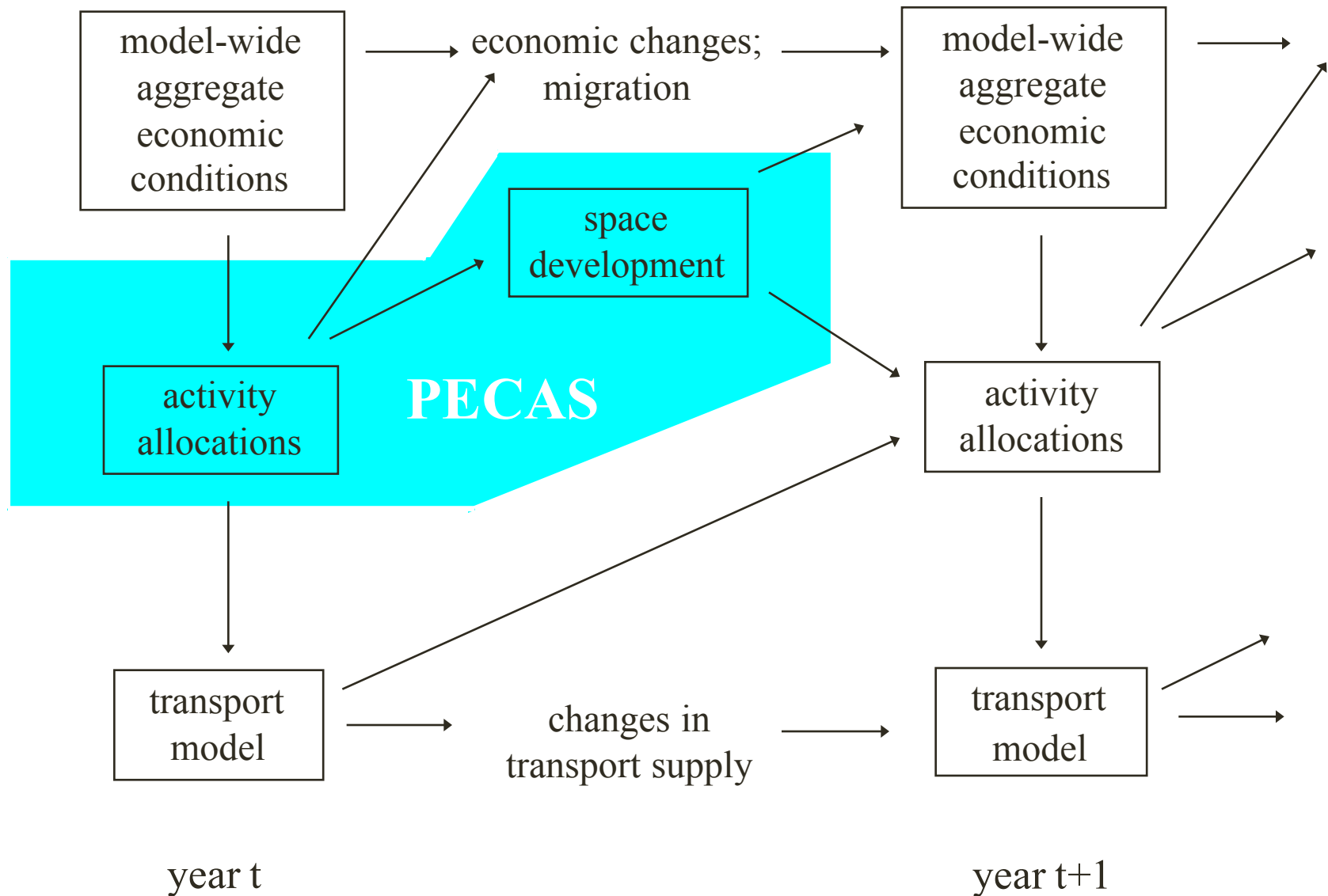
Just 5 Basic Choices

1: Where to locate

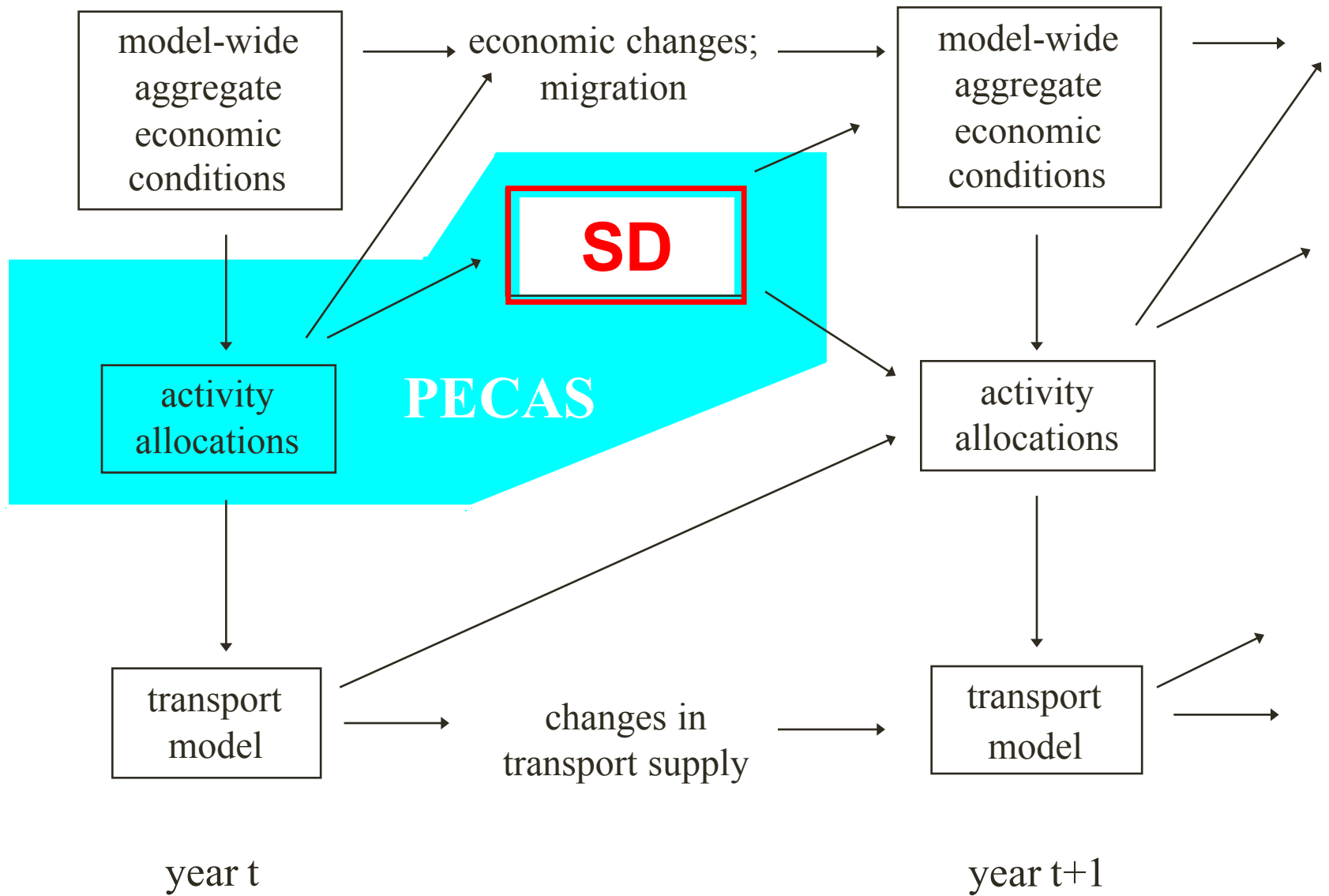2: What to make and what to consume in the process (called the 'technology' to use)

3: Where to buy what is consumed and where to sell what is made

4: What type of space (floorspace, buildings) to build
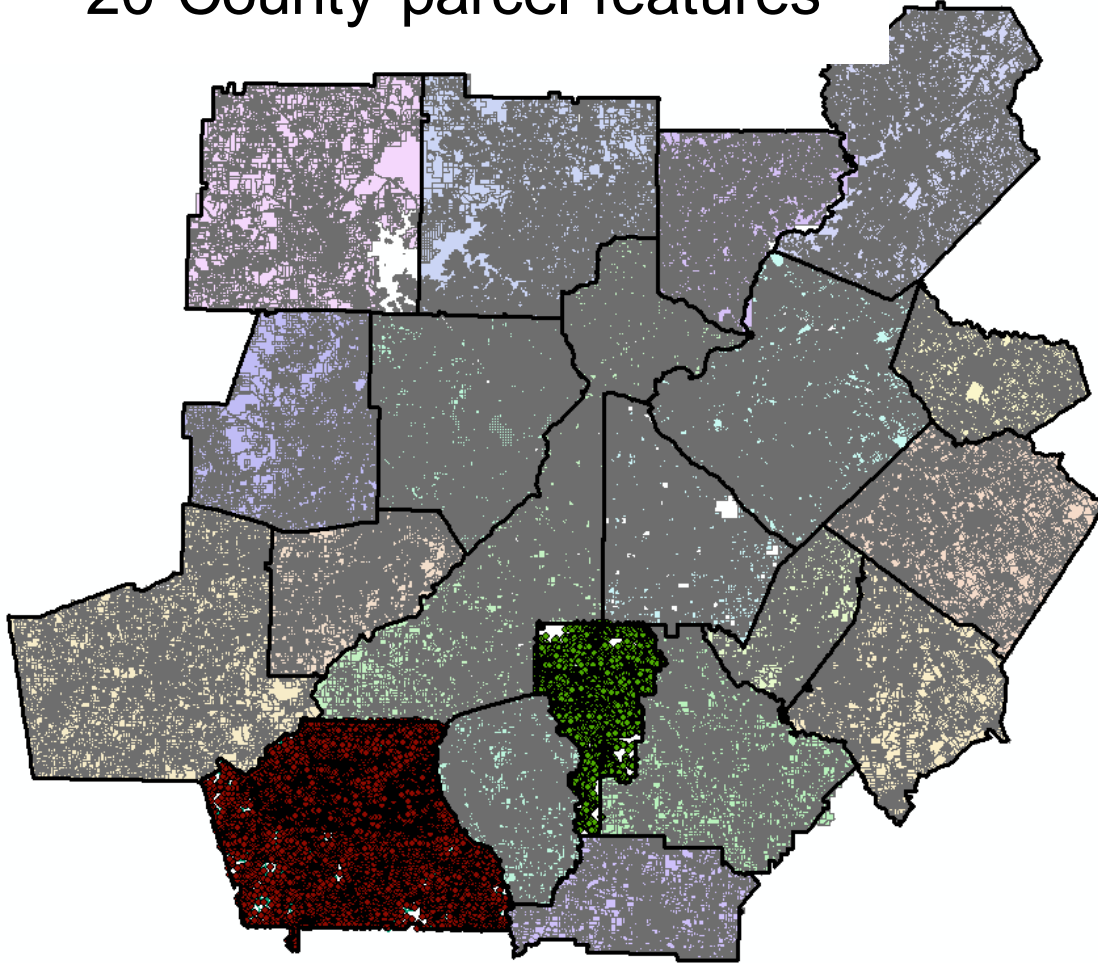
5: How much space to build

The interactions among these

Last 2 of the 5 Choices

1: Where to locate

2: What to make and what to consume in the process (called the 'technology' to use)

3: Where to buy what is consumed and where to sell what is made

4: What type of space (floorspace, buildings) to build

5: How much space to build

The interactions among these

model-wide
aggregate
economic
conditions
→ economic changes;
migration
→ model-wide
aggregate
economic
conditions
→

space
development

activity
allocations

PECAS

activity
allocations

transport
model
→ changes in
transport supply
→ transport
model

year t

year t+1

model-wide aggregate economic conditions → economic changes; migration → model-wide aggregate economic conditions

SD

PECAS

activity allocations

activity allocations

transport model → changes in transport supply → transport model

year t

year t+1
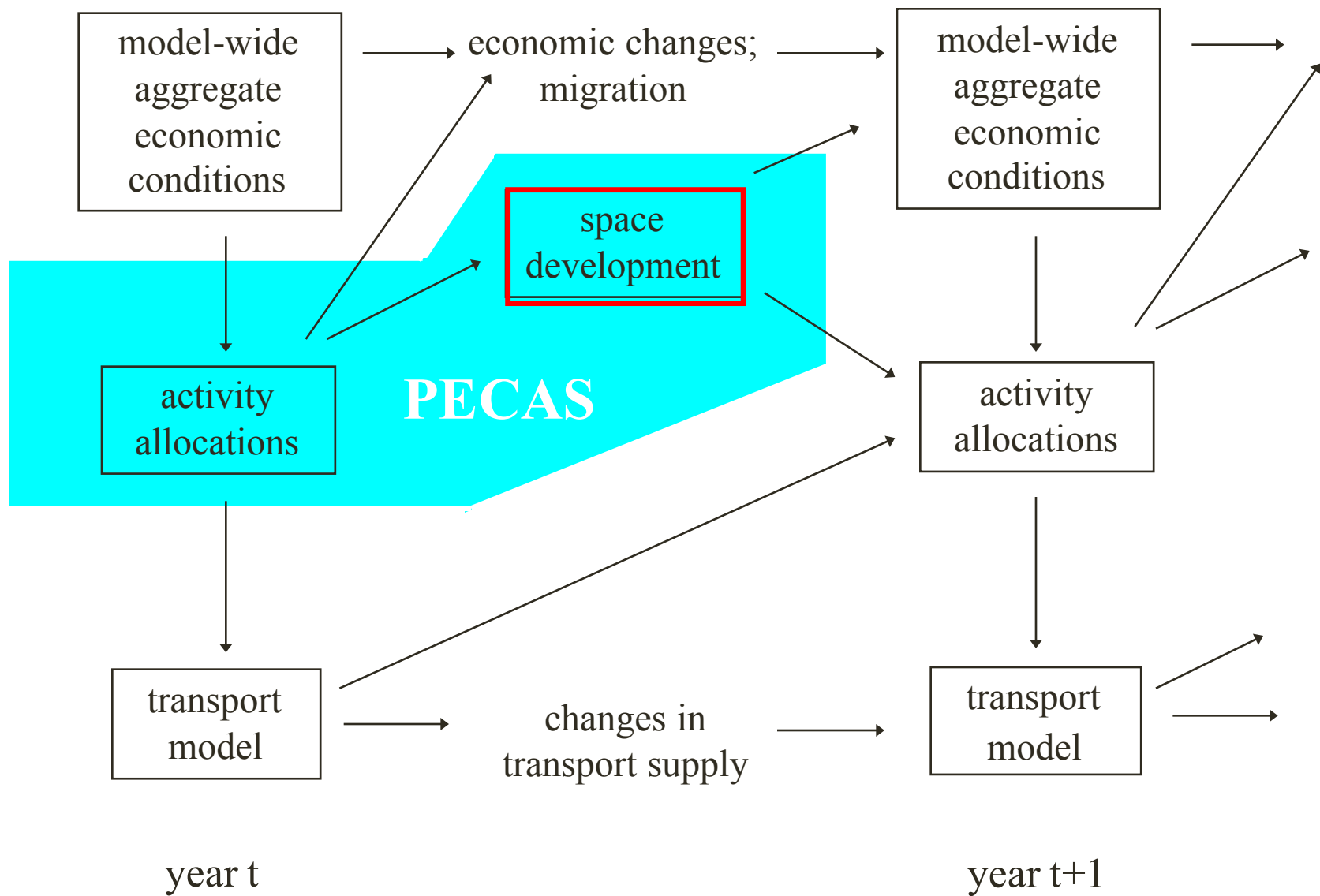
SD: Parcel Level Data

– 20-County parcel features

County	Parcels
Barrow	28,184
Bartow	42,167
Carroll	50,633
Cherokee	93,866
Clayton	88,723
Cobb	228,690
Coweta	55,348
DeKalb	230,888
Douglas	39,140
Fayette	42,808
Forsyth	77,639
Fulton	341,017
Gwinnett	260,371
Hall	77,103
Henry	72,839
Newton	44,374
Paulding	59,670
Rockdale	34,780
Spalding	29,616
Walton	36,561
Total	**1,934,417**

Space Dev
joint discr ... choic

Rent less amortized construction cost _per unit space_

Additional Rent less development costs _per unit land_

$$RU_{hjp} = T_{hjp}.j + lTr_{hjp} + l\varepsilon_s + l\varepsilon_q$$

Space quantity (building size)

Land quantity (parcel size)

Stochastic error terms

- **Future space type h** (development type)

- **Future space quantity j** (building space area)

- On parcel _p_ of size _l_ currently containing quantity _b_ of space type v

- Zoning restricts _j_ to range

$$\left\lfloor Q_{hp}^{\min}, Q_{hp}^{\max} \right\rfloor$$

derelict

no change

more the same

different types

min   max
quantities

min   max
quantities

Nested logit structure

New space type   Add space   Renovate   No change   Demolish   Derelict

Quantity   Quantity

multi-level nested discrete-continuous logit
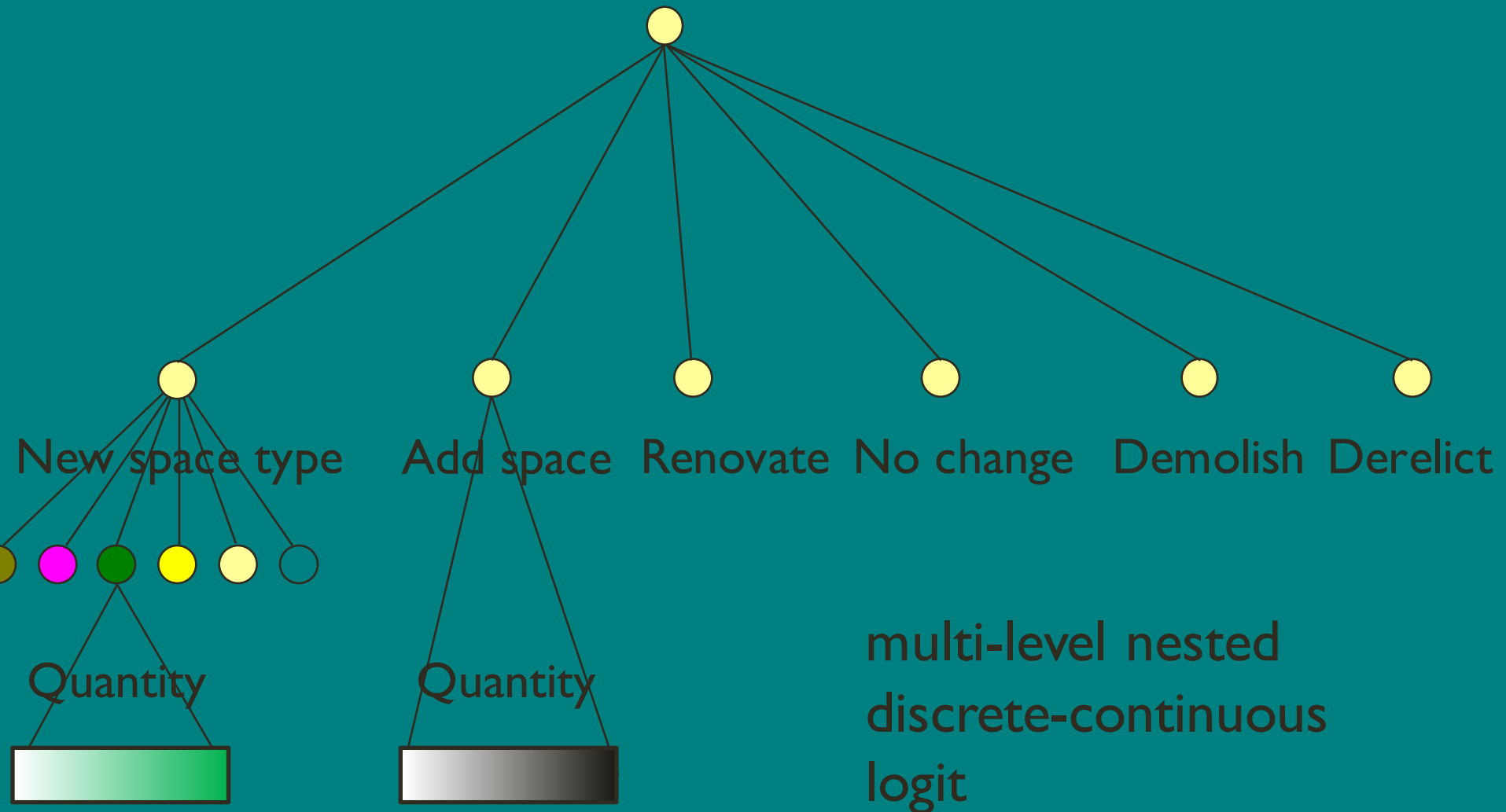
Simulating Space Type: Sampling Distribution

$$\Pr(h) = \frac{\exp\left(\dfrac{\widetilde{V}_h}{l}\right)}{\displaystyle\sum_{h' \in S} \exp\left(\dfrac{\widetilde{V}_{h'}}{l}\right)}$$

evaluating integral over range of permitted intensities

$$\widetilde{V}_h = \frac{l}{\mu_q} \ln\left(\left. \frac{l e^{\mu_q\left(T_{hjp}\frac{j}{l} + Tr_{hjp}\right)}}{\mu_q T_{hjp}} \right|_{j=Q_{hp}^{\min}}^{Q_{hp}^{\max}} \right)$$

Space Development:
Simulation of Transitions

parcel-by-parcel
microsimulation

logit models

derelict
no change
more the same
mid density residential
commercial
industrial
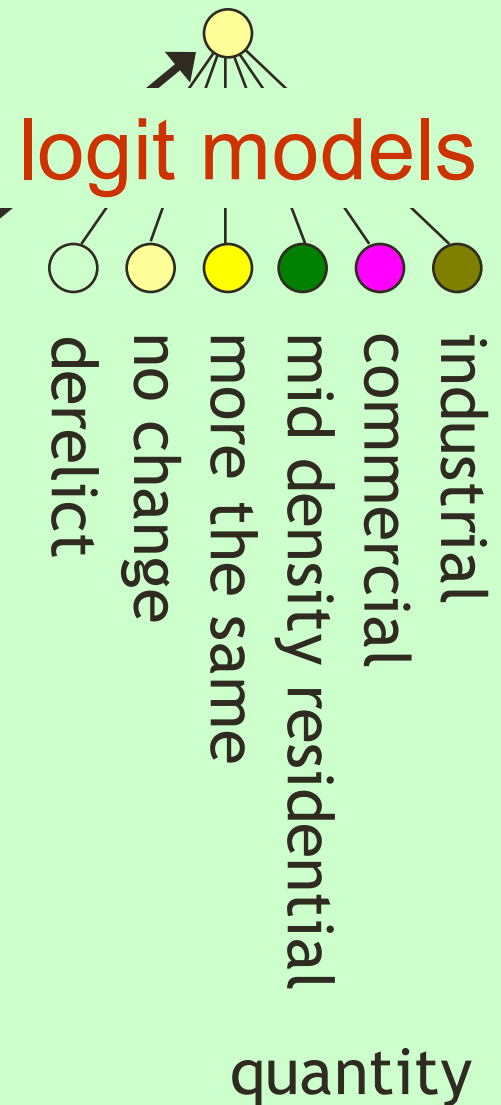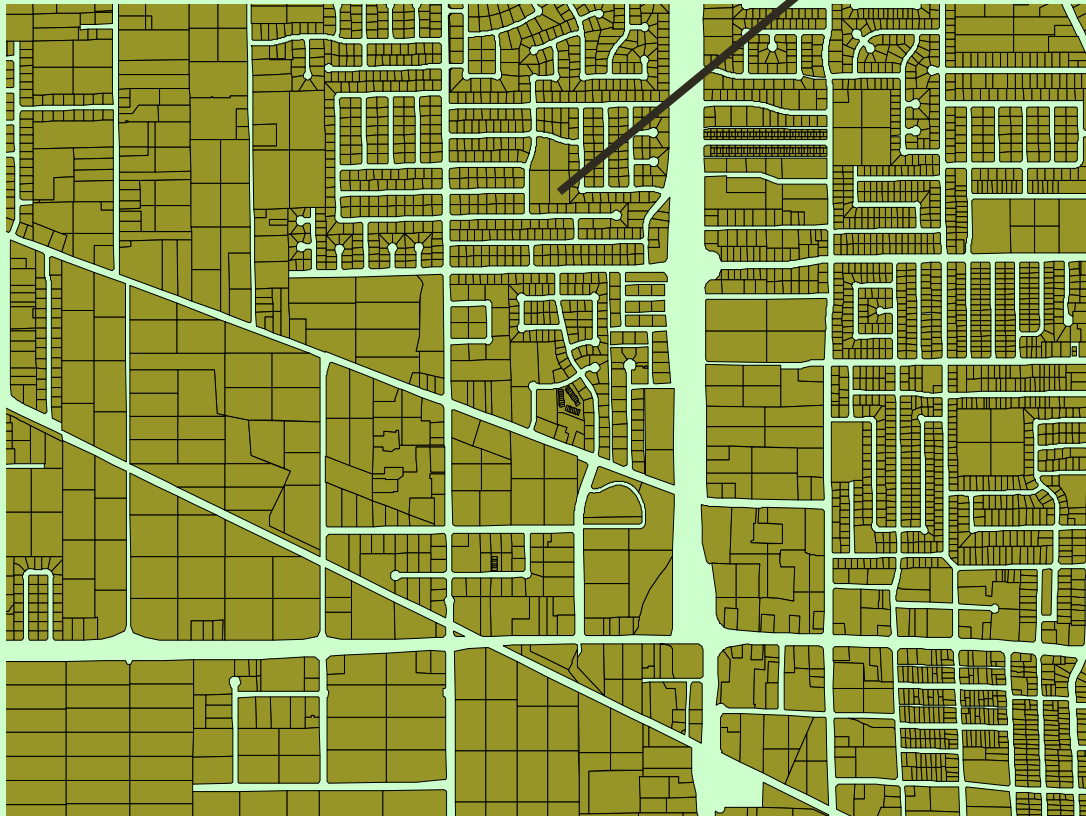
quantity

zoning dictates
set of alternatives

Space Development:
Transition Quantities

aggregate
results to TAZ
and LUZ zones

SD Database Tables
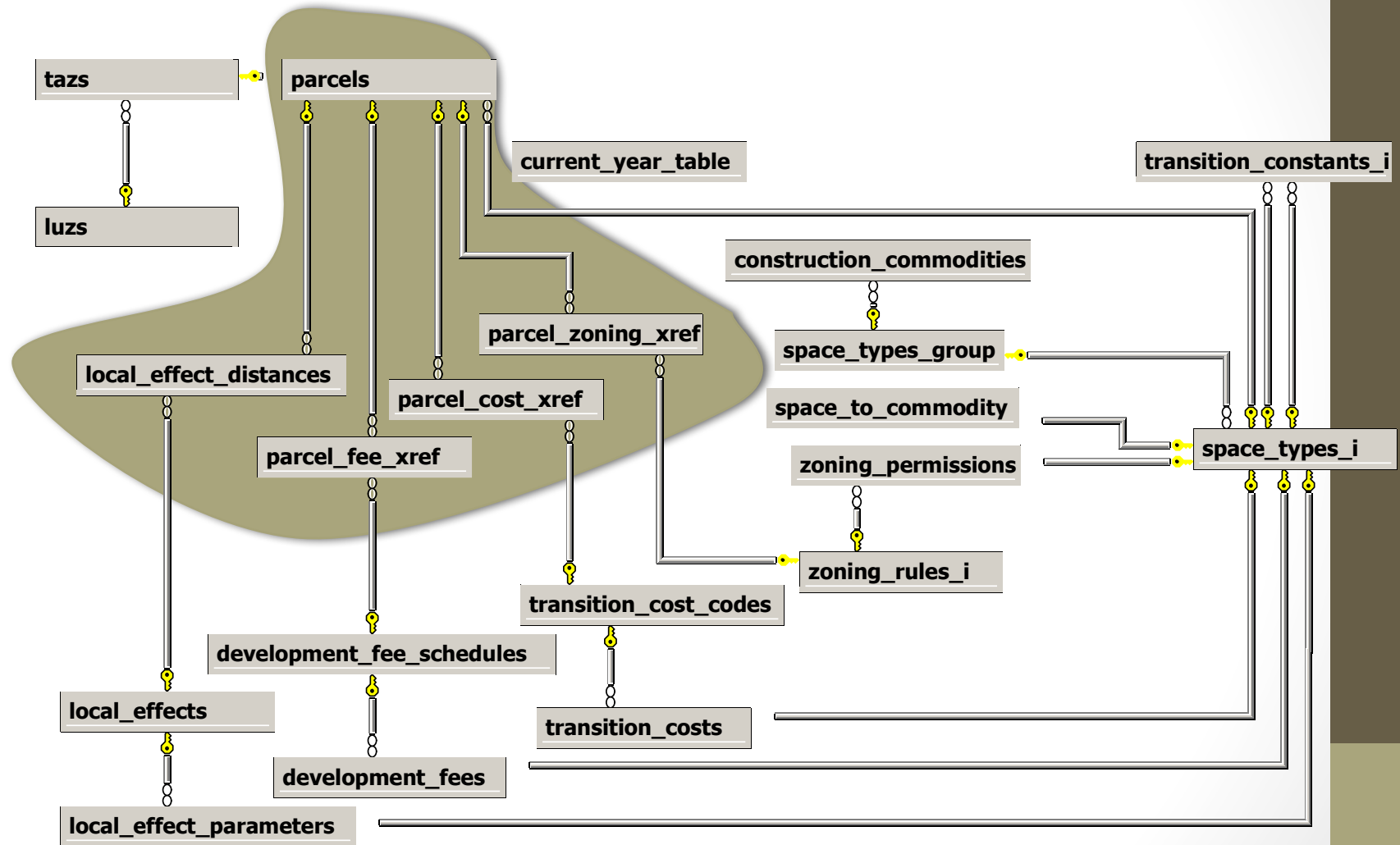
SD GIS Layers

- Base "parcels" (grid cell, parcels)
- Cost polygons (zip codes, slopes, water table, soil) spatially joined to get cost schedule ID
- Fee polygons (cities, school board districts, other jurisdictions) spatially joined to get fee schedule ID
- Local effect feature classes, minimum distance to each affect
  - rent modifier
- Zoning polygons

w23.luzs

Column	Type	
luz_number	integer	« pk nn »
luz_name	character varying	

w23.space_taz_limits

Column	Type	
taz	integer	« pk fk nn »
space_types_group_id	integer	« pk fk nn »
max_quantity	double precision	
year_effective	integer	« pk nn »

w23.taz_limit_groups

Column	Type
space_types_group_id	integer
space_types_group_name	character varying(150)

w23.taz_limit_space_types

Column	Type	
space_type_id	integer	« pk nn »
space_types_group_id	integer	« fk nn »

w23.current_year_table

Column	Type	
current_year	integer	« pk nn »

w23.sitespec_parcels

Column	Type	
pecas_parcel_num	bigint	« pk fk nn »
siteid	integer	« pk fk nn »
space_type_id	integer	« pk nn »
space_quantity	double precision	« nn »
land_area	double precision	« nn »
year_effective	integer	« nn »
update_parcel	boolean	« nn »

w23.sitespec_site_amounts

Column	Type	
site_id	integer	« pk nn »
space_type_id	integer	« pk fk nn »
year	integer	« pk nn »
quantity	double precision	

w23.transition_constants_i

Column	Type	
from_space_type_id	integer	« pk fk nn »
to_space_type_id	integer	« pk fk nn »
transition_constant	double precision	

w23.parcels

Column	Type	
parcel_id	character varying	
pecas_parcel_num	bigint	« pk nn »
year_built	integer	
taz	integer	« fk »
space_type_id	integer	« fk »
space_quantity	double precision	
land_area	double precision	
available_services_code	integer	
is_derelict	boolean	
is_brownfield	boolean	

w23.tazs

Column	Type	
taz_number	integer	« pk nn »
luz_number	integer	« fk nn »
county_fips	integer	

w23.local_effect_distances

Column	Type	
pecas_parcel_num	bigint	« pk fk nn »
local_effect_id	integer	« pk fk nn »
local_effect_distance	double precision	
year_effective	integer	« pk nn »

w23.parcel_fee_xref

Column	Type	
pecas_parcel_num	bigint	« pk fk nn »
fee_schedule_id	integer	« fk »
year_effective	integer	« pk nn »

w23.parcel_cost_xref

Column	Type	
pecas_parcel_num	bigint	« pk fk nn »
cost_schedule_id	integer	« fk »
year_effective	integer	« pk nn »

w23.parcel_zoning_xref

Column	Type	
pecas_parcel_num	bigint	« pk fk nn »
zoning_rules_code	integer	« fk »
year_effective	integer	« pk nn »

w23.space_types_i

Column	Type	
space_type_id	integer	« pk nn »
space_type_name	character varying	« uq »
space_type_code	character varying	« uq »
age_rent_discount	double precision	
density_rent_discount	double precision	
age_maintenance_cost	double precision	
add_transition_const	double precision	
new_from_transition_const	double precision	
renovate_transition_const	double precision	
renovate_derelict_const	double precision	
demolish_transition_const	double precision	
derelict_transition_const	double precision	
no_change_transition_const	double precision	
new_type_dispersion_parameter	double precision	
gv_dispersion_parameter	double precision	
gz_dispersion_parameter	double precision	
gw_dispersion_parameter	double precision	
gk_dispersion_parameter	double precision	
nochange_dispersion_parameter	double precision	
intensity_dispersion_parameter	double precision	
maintenance_cost	double precision	
space_type_group_id	integer	« fk »
cost_adjustment_factor	double precision	
construction_capacity_tuning_parameter	double precision	
converting_factor_for_space_type_group	double precision	
below_step_point_adjustment	double precision	
above_step_point_adjustment	double precision	
step_point	double precision	
step_point_adjustment	double precision	
min_intensity	double precision	
max_intensity	double precision	
new_to_transition_const	double precision	

w23.local_effects

Column	Type	
local_effect_id	integer	« pk nn »
local_effect_name	character varying	
rent_local_effect	boolean	
cost_local_effect	boolean	

w23.transition_cost_codes

Column	Type	
cost_schedule_id	integer	« pk nn »
high_capacity_services_installation_cost	double precision	
low_capacity_services_installation_cost	double precision	
brownfield_cleanup_cost	double precision	
greenfield_preparation_cost	double precision	

w23.zoning_rules_i

Column	Type	
zoning_rules_code	integer	« pk nn »
zoning_rules_code_name	character varying	
no_change_possibilities	boolean	
dereliction_possibilities	boolean	
demolition_possibilities	boolean	
renovation_possibilities	boolean	
addition_possibilities	boolean	
new_development_possibilities	boolean	

w23.development_fee_schedules

Column	Type	
fee_schedule_id	integer	« pk nn »

w23.local_effect_parameters

Column	Type	
local_effect_id	integer	« pk fk nn »
space_type_id	integer	« pk fk nn »
function_type	integer	
max_dist	double precision	
theta_parameter	double precision	

w23.transition_costs

Column	Type	
cost_schedule_id	integer	« pk fk nn »
space_type_id	integer	« pk fk nn »
demolition_cost	double precision	
renovation_cost	double precision	
addition_cost	double precision	
construction_cost	double precision	
renovation_derelict_cost	double precision	

w23.development_fees

Column	Type	
fee_schedule_id	integer	« pk fk nn »
space_type_id	integer	« pk fk nn »
development_fee_per_unit_space_initial	double precision	
development_fee_per_unit_land_initial	double precision	
development_fee_per_unit_space_ongoing	double precision	
development_fee_per_unit_land_ongoing	double precision	

w23.zoning_permissions

Column	Type	
zoning_rules_code	integer	« pk fk nn »
space_type_id	integer	« pk fk nn »
min_intensity_permitted	double precision	
max_intensity_permitted	double precision	
acknowledged_use	boolean	
penalty_acknowledged_space	double precision	
penalty_acknowledged_land	double precision	
services_requirement	integer	

w23.space_types_group

Column	Type	
space_types_group_id	integer	« pk nn »
space_types_group_name	character varying(150)	
cost_adjustment_damping_factor	double precision	

w23.construction_commodities

Column	Type	
cc_commodity_id	integer	« pk nn »
cc_commodity_name	character varying(150)	
space_types_group_id	integer	« fk »
converting_factor	double precision	

w23.exchange_results

Column	Type	
commodity	character varying	« pk nn »
luz	integer	« pk nn »
price	double precision	
internal_bought	double precision	

w23.space_to_commodity

Column	Type	
space_type_id	integer	« pk fk nn »
aa_commodity	character varying	« pk fk nn »
weight	real	« nn »

TAZ Limits and Site Spec

Construction Costs

- Predominantly from GIS system for different costs by location and space type
- Modified by density shaping function which is two lines and a step increment
  - Low density cost (e.g wood framing)
  - Higher density cost (e.g. concrete)
  - Step increment (e.g. underground parking)

Chart legend:
- Base net revenue
- Adjustment
- Total

Y-axis: $800,000.00, $600,000.00, $400,000.00, $200,000.00, $0.00, ($200,000.00), ($400,000.00), ($600,000.00), ($800,000.00)

X-axis: 0, 50000, 100000, 150000, 200000

Square feet constructed (on 1 acre parcel)

Rich Density Shapes Emerge
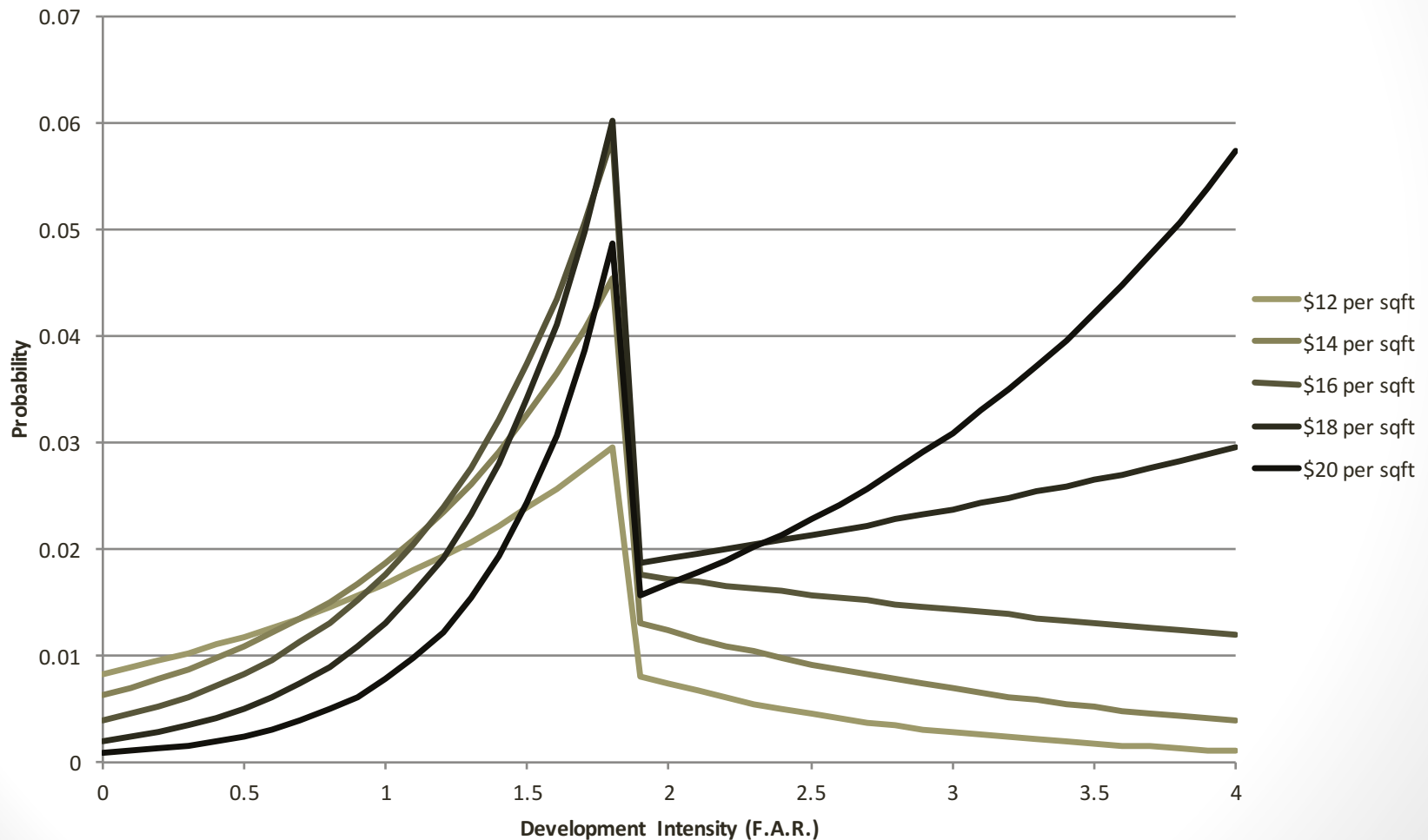
Floorspace Synthesis

- Complete inventory of buildings does not exist, and even where inventory data do exist it is:
  - Inconsistent with employment/population data
  - Inconsistent with simplified use rate and type in the model
- Generate synthetic built form inventory by assigning TAZ level totals to grids/parcels
  - Based on competitive scoring algorithm driven by any existing data and land suitability information
- Like a synthetic population for travel modelling
- Realistic pattern and marginal distributions with regard to age, location, zoning, etc.

FS Synthesizer: Initial Fulton Results

Synthesized Fulton County Parcels
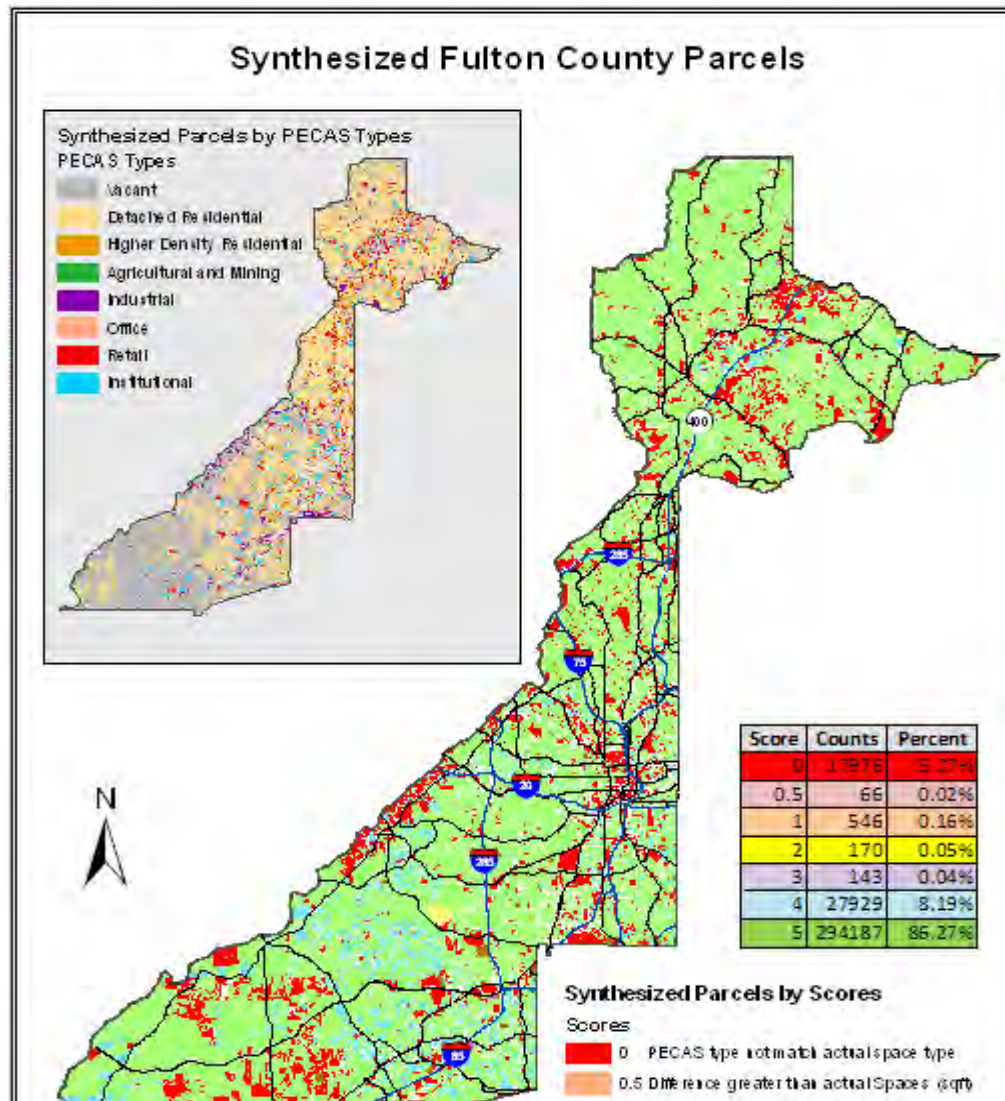
SD Database Tables / Columns

model-wide aggregate economic conditions → economic changes; migration → model-wide aggregate economic conditions →

space development

PECAS

activity allocations

activity allocations

transport model → changes in transport supply → transport model

year t

year t+1

Superdistrict Zones (78)

First 3 of 5 Choices

1: Where to locate

2: What to make and what to consume in the process (called the 'technology' to use)

3: Where to buy what is consumed and where to sell what is made

4: What type of space (floorspace, buildings) to build

5: How much space to build

The interactions among these

Additional utility associated with location *l* for activity *a*

Additional utility associated with technology option *p*

$$U^a_{lpe_1e_2\dots e_n} = V_l + \varepsilon^a_l + V_p + e_{lp} + \sum_{n=1\dots N_p} \left| \alpha_{pn} \right| s_{pn} \left(V_{e_nl} + \varepsilon_{e_nlp} \right)$$

Quantity of commodity produced or consumed under technology option *p*

Utility of exchanging and shipping one unit of Commodity between *l* and *e*

- **Tec**

$$\alpha_p = \{ \alpha_{p1}, \qquad\qquad\qquad\qquad\qquad\qquad st \quad (\alpha_{p1}, \alpha_{p2}, \dots, \alpha_{pn}, \dots, \alpha_{pN_p})$$
for how much of Commodity c_{pn} is produced (or consumed, if α_{pn} negative) per unit of activity *a*

- **Exchange location** e_n for each commodity exchanged

Economic Interactions
Production - Exchange

1: production allocation

2: technology selection

3: selling allocations

buying allocations

3-level nested logit model

Composite utility for set of locations used for consumer surplus

Composite utility for set of technology options combines accessibilities

Composite utilities for sets of selling or buying locations are accessibilities

allocating produced commodities to selling locations

allocating consumed commodities to buying locations

Interactions Among First 3 of 5 Choices

1: Where to locate

2: What to make and what to consume in the process (called the 'technology' to use)

3: Where to buy what is consumed and where to sell what is made

4: What type of space (floorspace, buildings) to build

5: How much space to build

The interactions among these

Economic Interactions:
Production - Exchange - Consumption
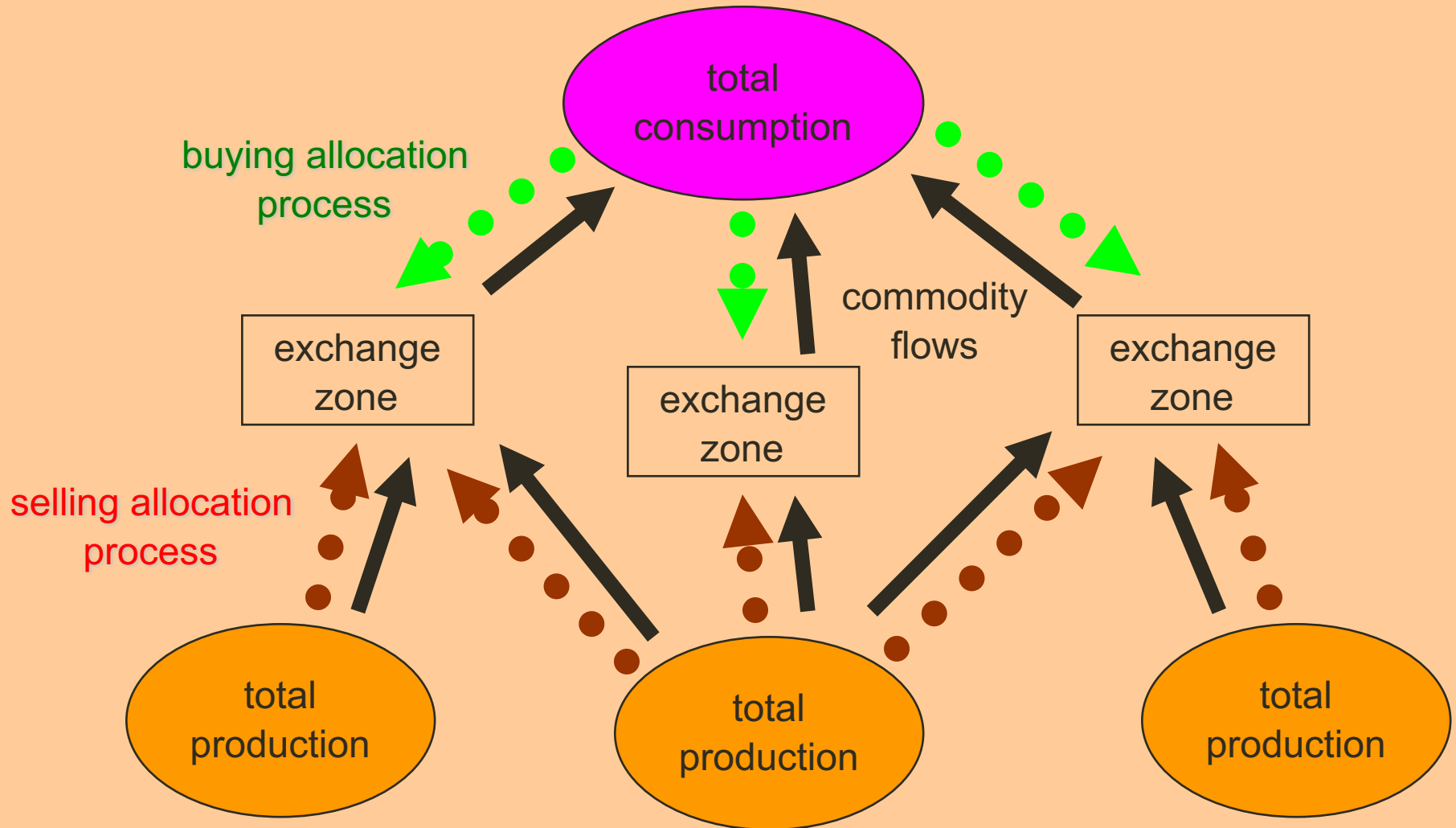
IMPLAN Data
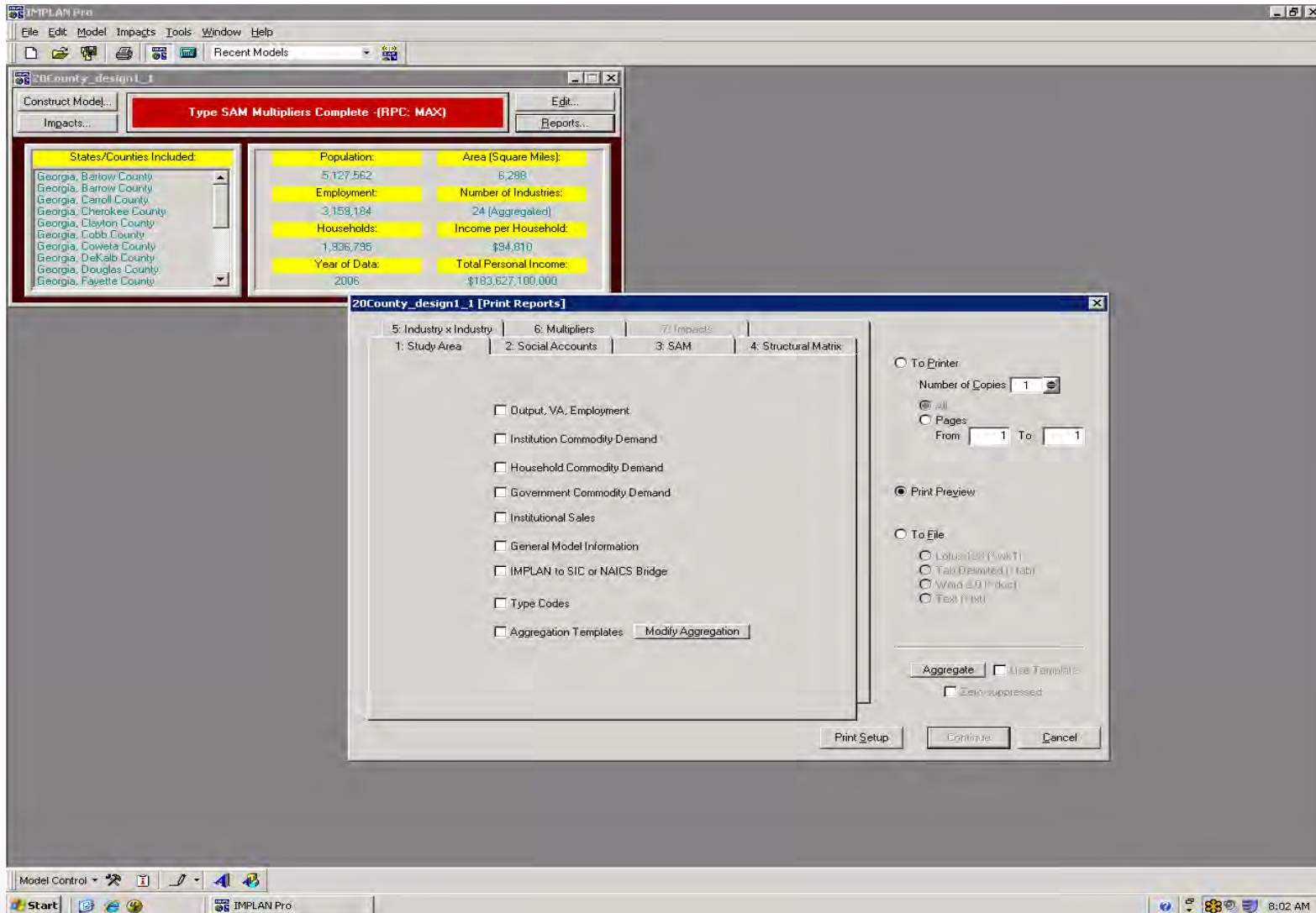
PUMS Data: Occ by Income
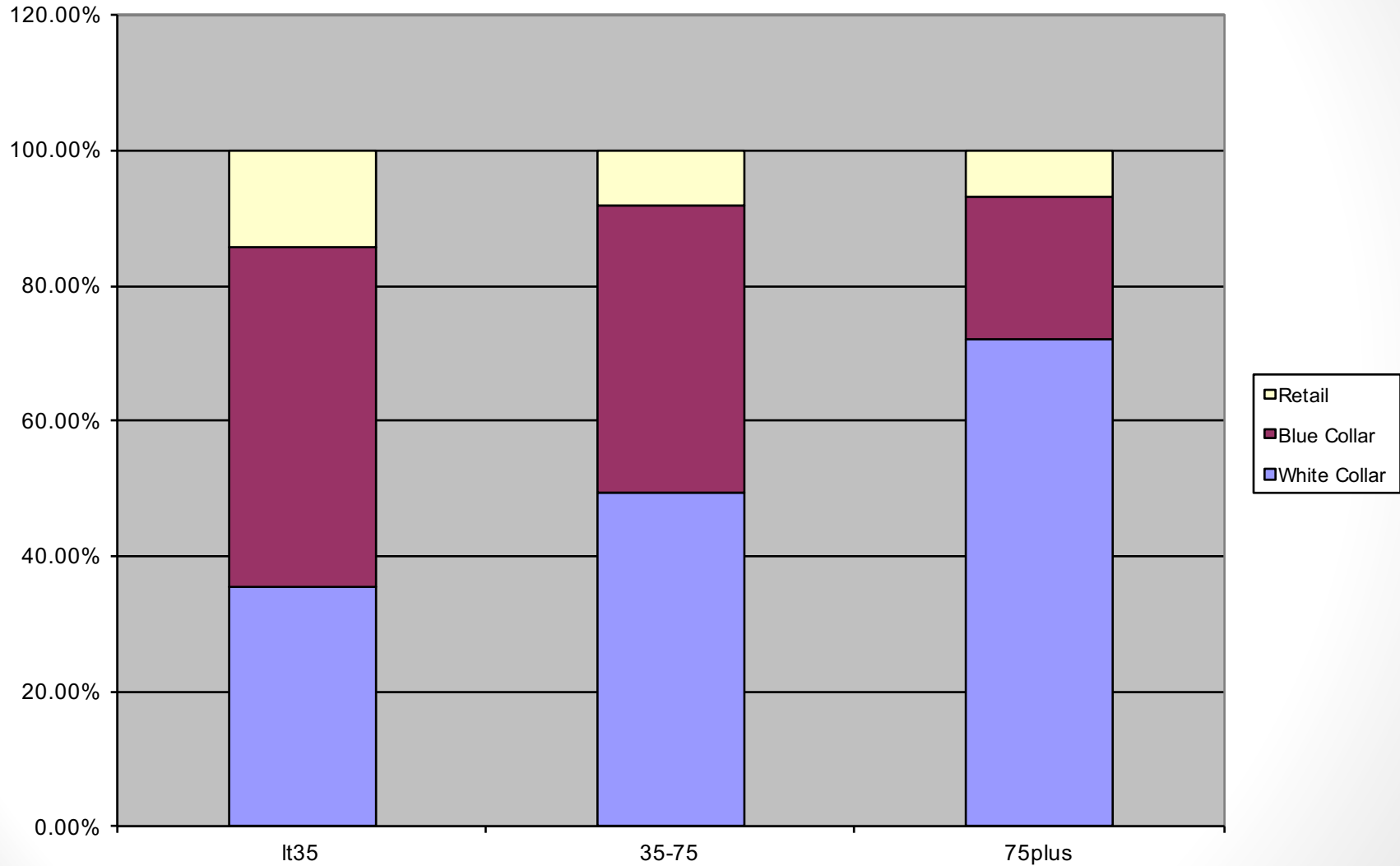
PUMS Data: Occ by Industry

Travel Demand Model Skims

SE Forecasting

Economic value of white collar labor occupations

Interactions Among All 5 Basic Choices

1: Where to locate

2: What to make and what to consume in the process (called the 'technology' to use)

3: Where to buy what is consumed and where to sell what is made

4: What type of space (floorspace, buildings) to build

5: How much space to build

The interactions among these

Interactions Among System Components

model-wide aggregate economic conditions → economic changes; migration → model-wide aggregate economic conditions →

economic attractions

development activity

activity totals

space development

space rents

space quantities

activity allocations

activity allocations

commodity flows

transport generalised costs

transport model → changes in transport supply → transport model

year t   year t+1

SE Forecasting

Visualization and mapping

-MapIt, WEAVE application

Building a query for CommodityZUtilities.csv

List of attributes in the file:	quantity
First scenario (X):	W04
Operator:	Minus (X-Y)
Second scenario (Y):	NB01
Start year:	2005
End year:	2040
Commodity\Commodity Group:	Labour
Aggregate grouping function: * only effecive when selelcting a Group	● Sum() ○ Average() ○ Count()
Buy(B) or Sell(S):	B

Create DB view

- View "NB01_Labour_130703_101316_with_geom" was successfully created!

Show map!   Interactive View
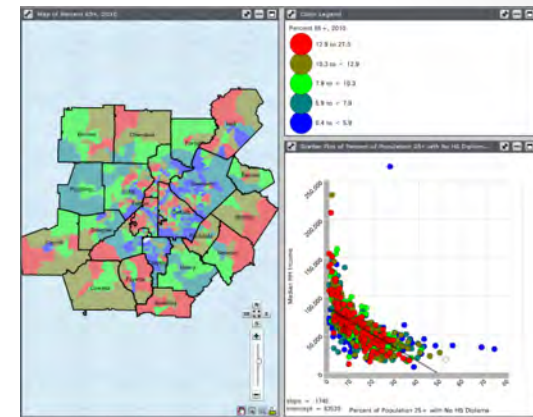
The ATLANTA Model   Search Google   Search

Welcome to HBA Specto Map It Application! (Beta 3.1.2)

● Work with one scenario ○ Compare two scenarios

Ple·
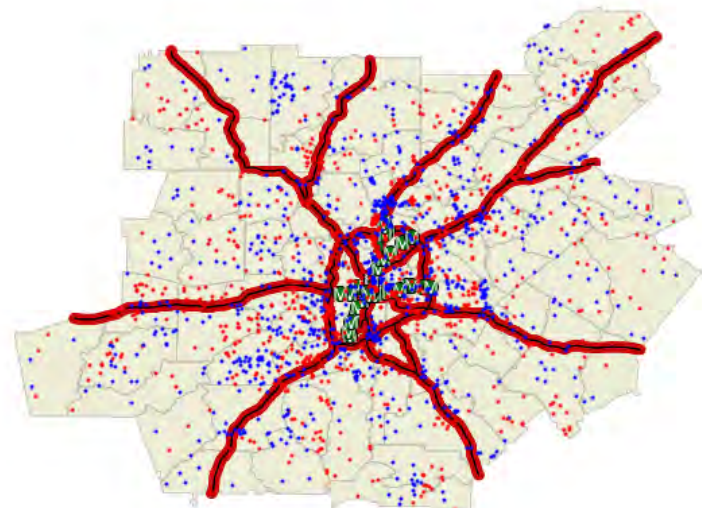
Source:

Where We're At--Overview

- **A Functioning Model**
  - **Calibrated AA and SD**
  - **Reactive to Travel Model**
  - **Results Generally Making Sense**
    - ➤ **Caveats re: Data Errors**
    - ➤ **Caveats re: Reality and Model Conflicts**
- **Integrated Partially with REMI**
- **Integrated Manually with ABM**
- **Scenario Testing**
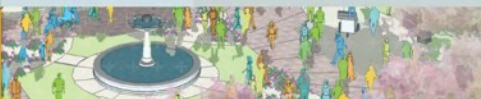
regional impact + local relevance

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Values of TCU Prod 05-20

W02a_AI08TCUProd_120515_085228_with_geom

Export as a Shapefile View Change Dots
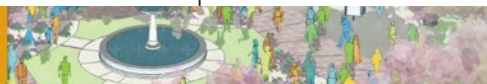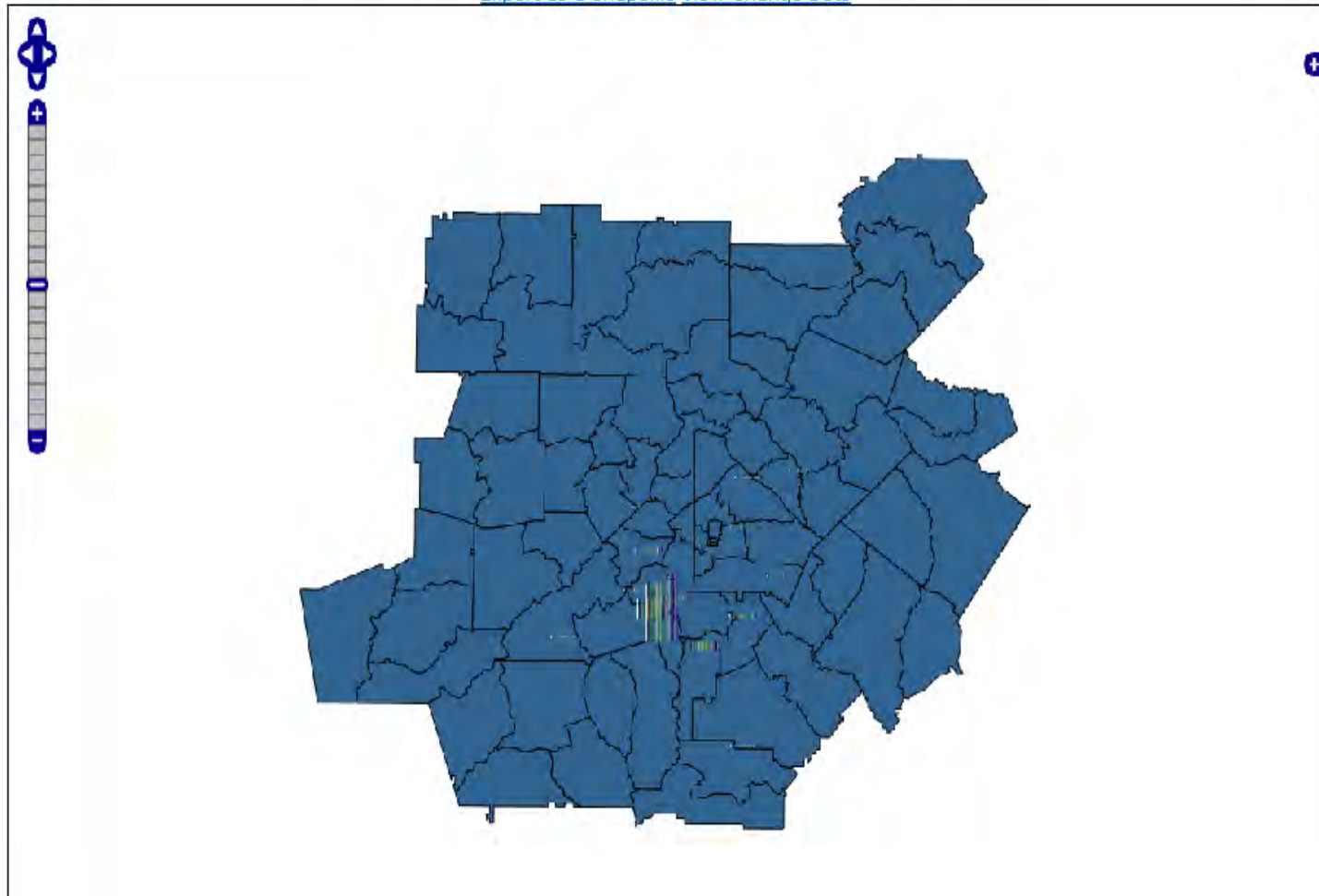
Change in TCU Prod 05-20

W02a_AIO8TCUProd_120515_085228_with_geom
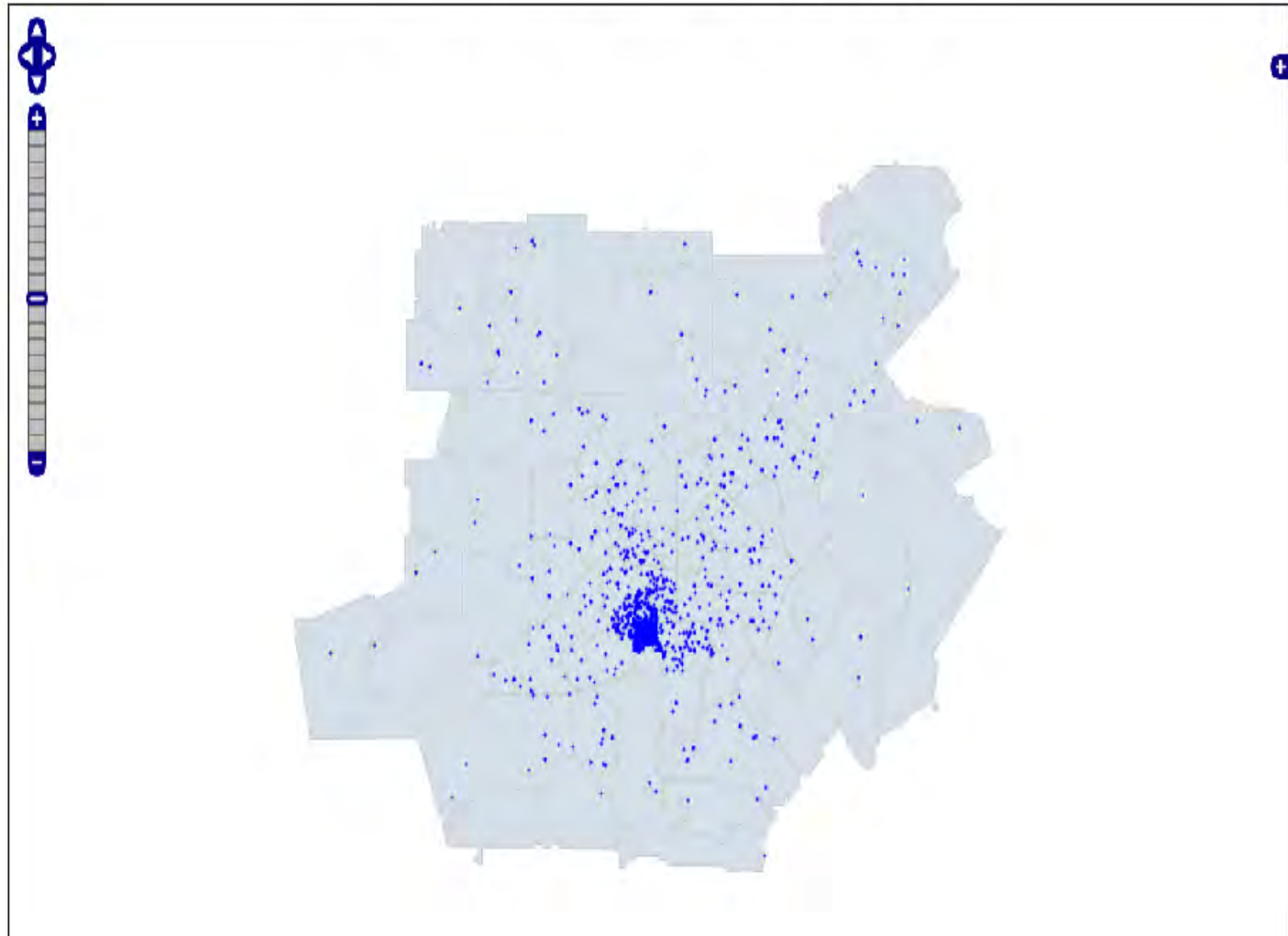
Change in Prof. Svs 05-20

W02a_AI12PTSci_120515_122503_with_geom
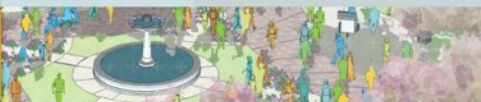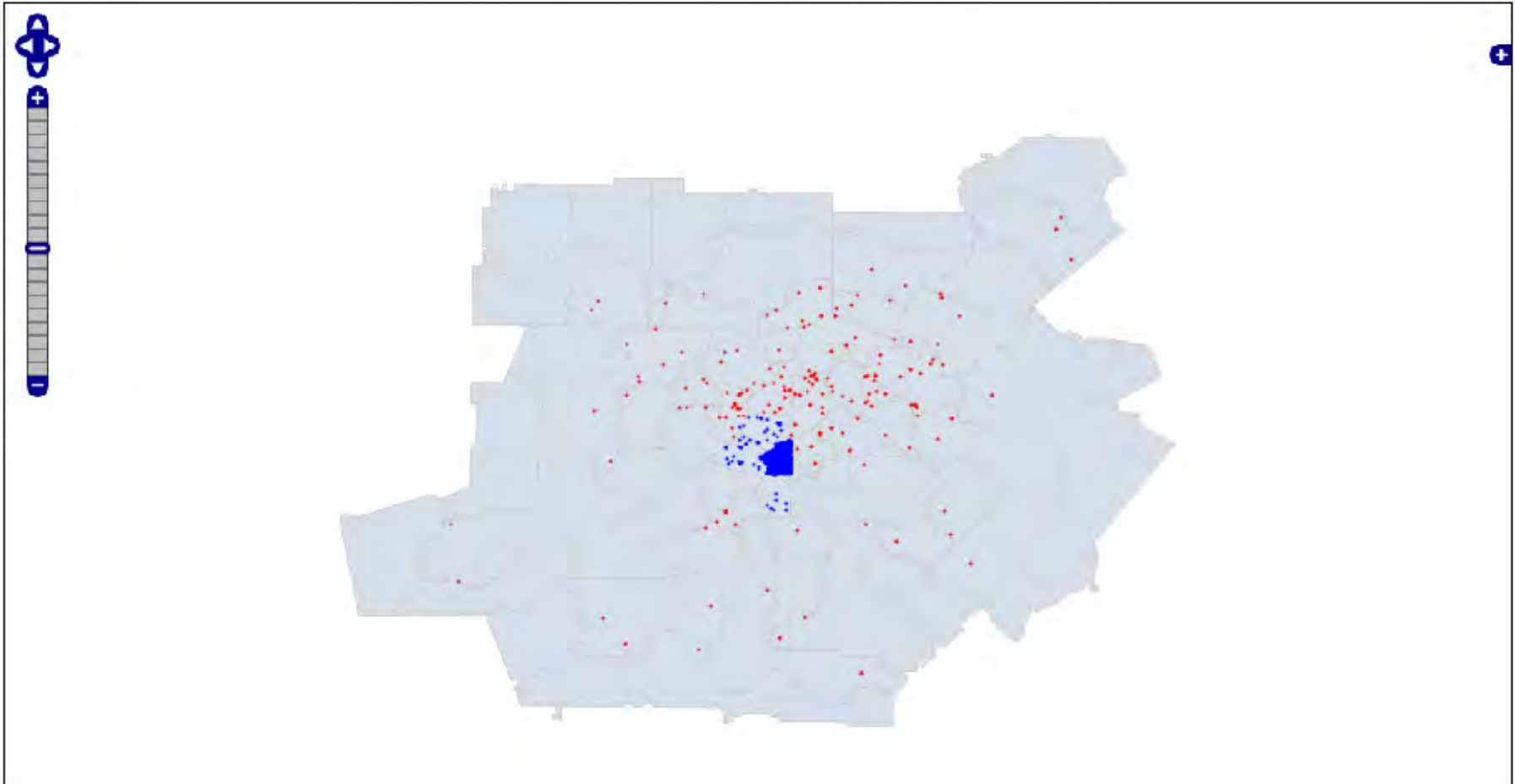
PECAS Scenario Test Example

Scenario name	Scenario Description
W04b	This is the base case scenario non-integrated with the transportation model
I01f	This is the base case scenario fully integrated with the transportation model, including the projects from the "PLAN 2040"
NB01	This is a scenario for policy analysis fully integrated with the transportation model and assuming no changes in transportation infrastructure
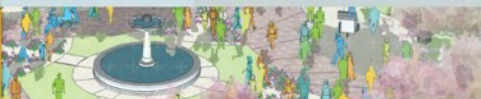
W04b Base: Change in Households (left); Jobs (right) between 2005 and 2022
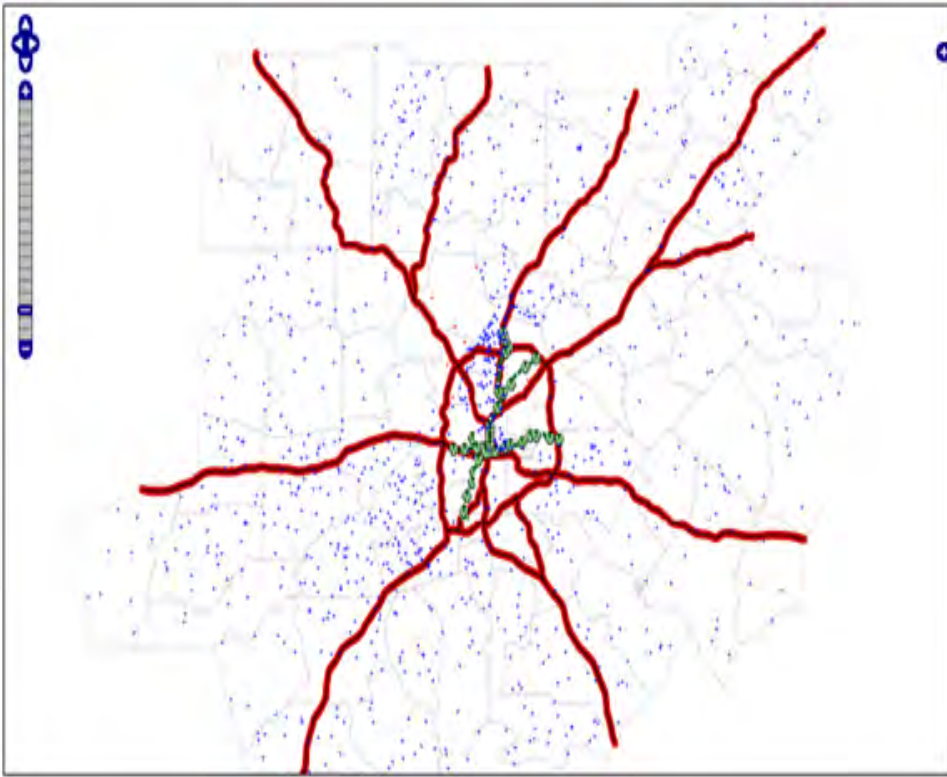
Blue dot = 600 Households

Blue dot = 600 Jobs

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Households: **Difference** between l01f and NB01 in 2040

DRAFT

2040 Households
- ■ -3907 – -1201
- ■ -1200 – -501
- ■ -500 – -201
- ■ -200 – -61
- ■ -60 – -1
- □ 0 – 99
- □ 100 – 199
- □ 200 – 399
- ■ 400 – 799
- ■ 800 – 1599
- ■ 1600 – 3000
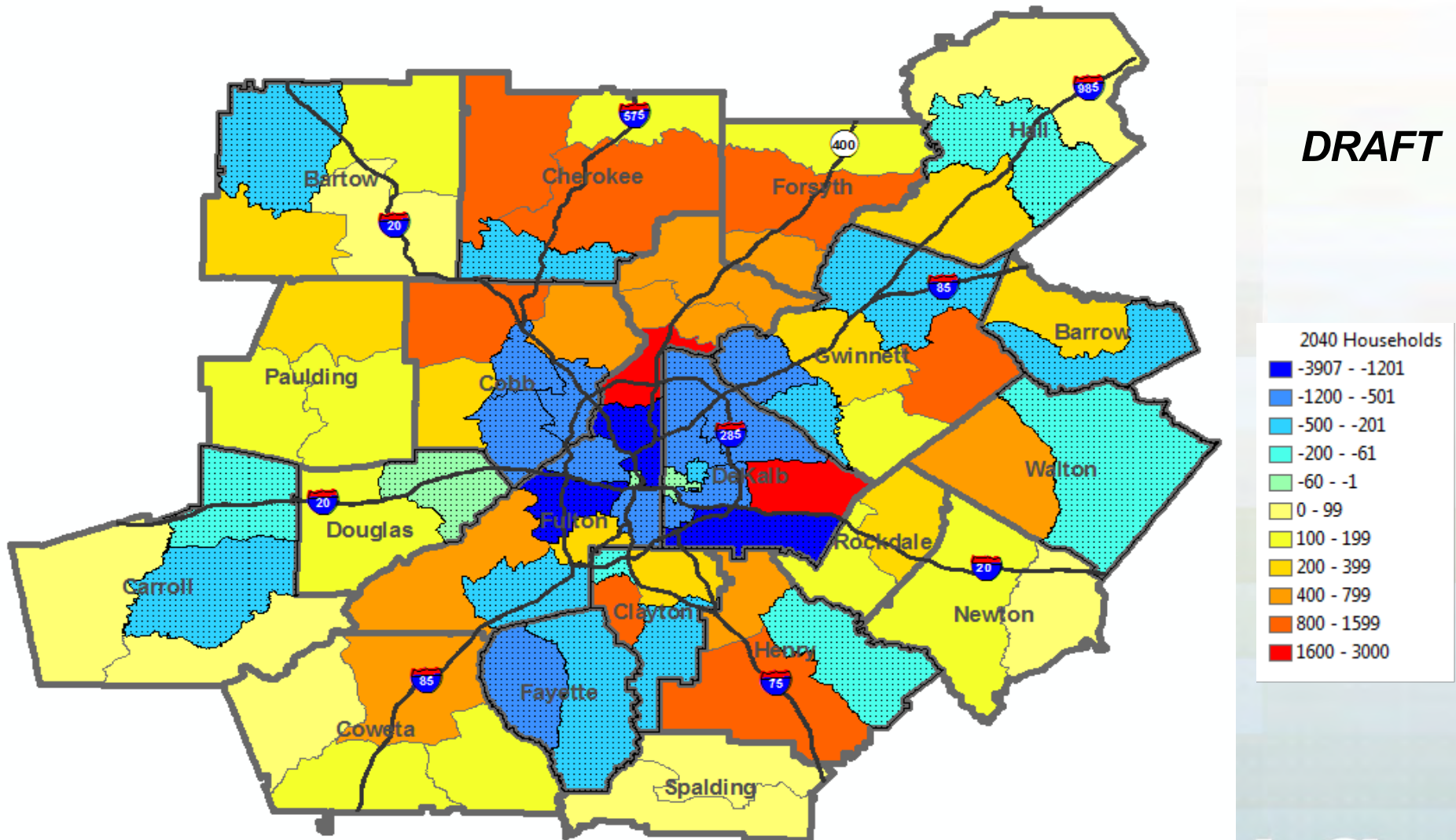
regional impact + local relevance

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Change in Single Family detached residential space between I01f and NB01 in 2035

each blue dot is 35400.0, each red dot is -35400.0
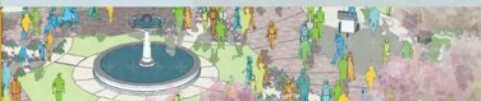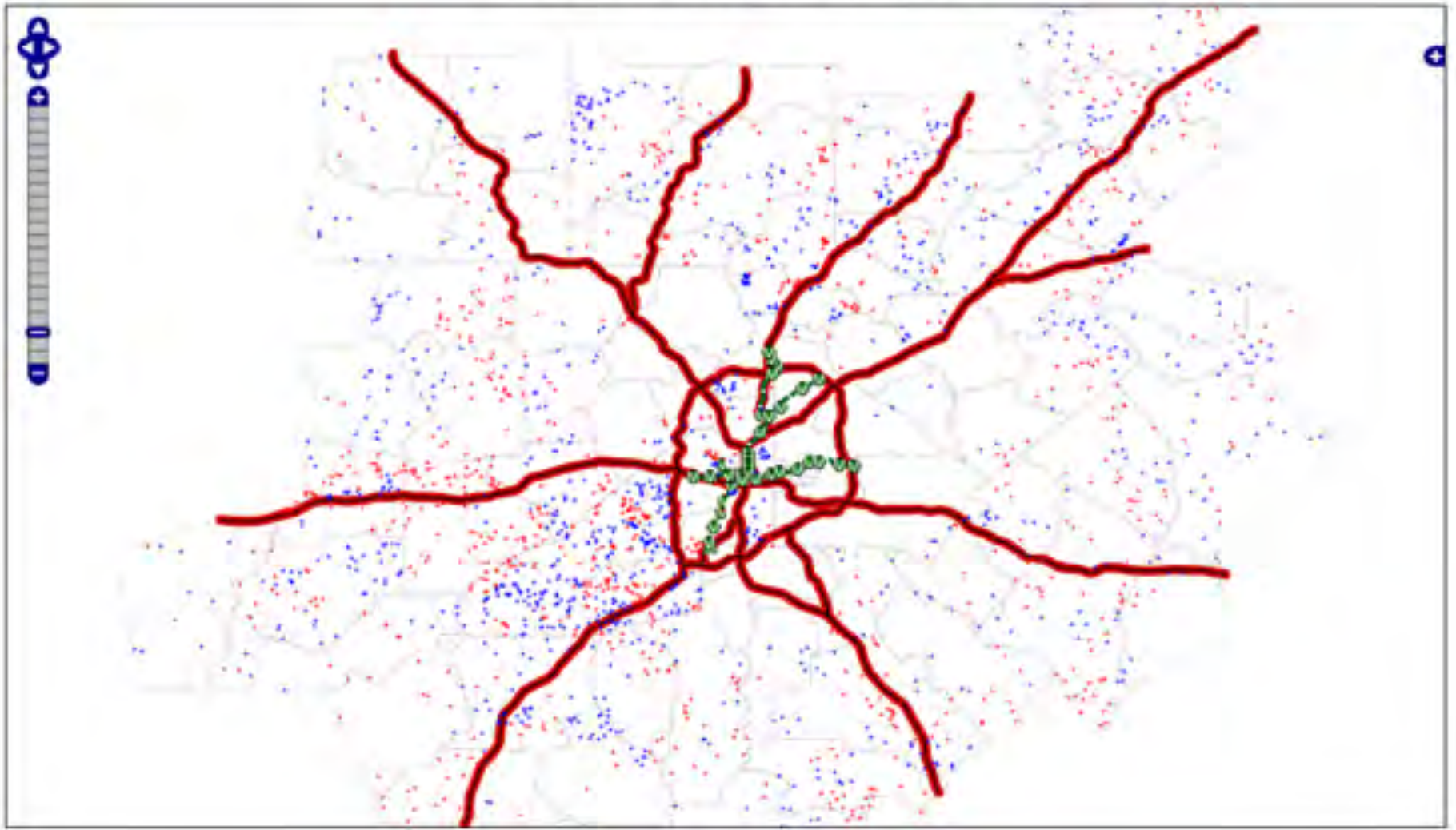
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Change in **Multifamily** residential space between I01f and NB01 in 2035

each blue dot is 38100.0, each red dot is -38100.0
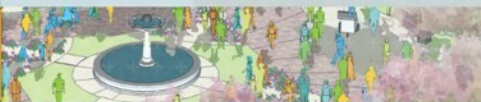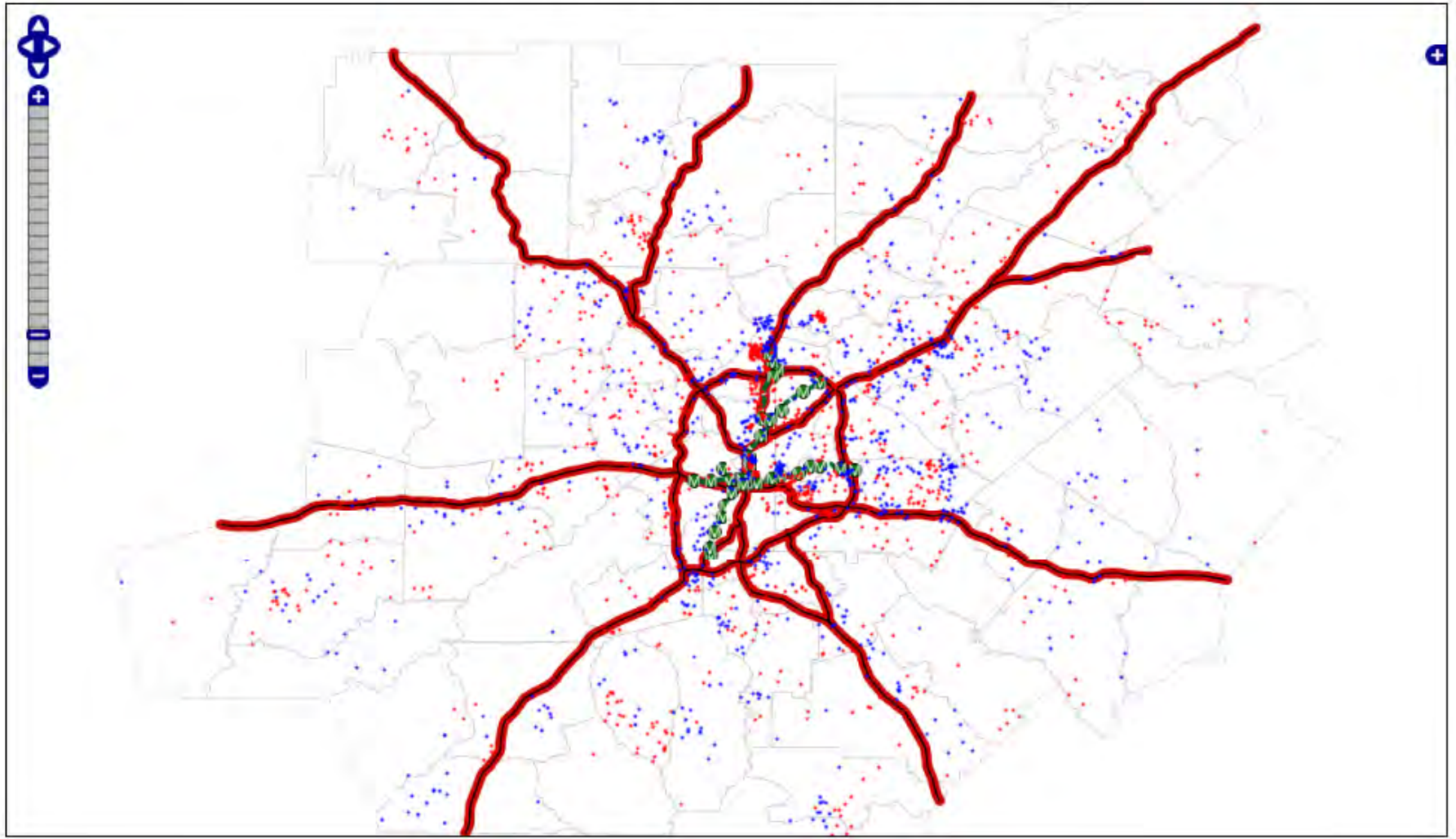
regional impact + local relevance

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Change in Households (left); Labor (right) between I01f and NB01 in 2035

each blue dot is 14.2, each red dot is -14.2
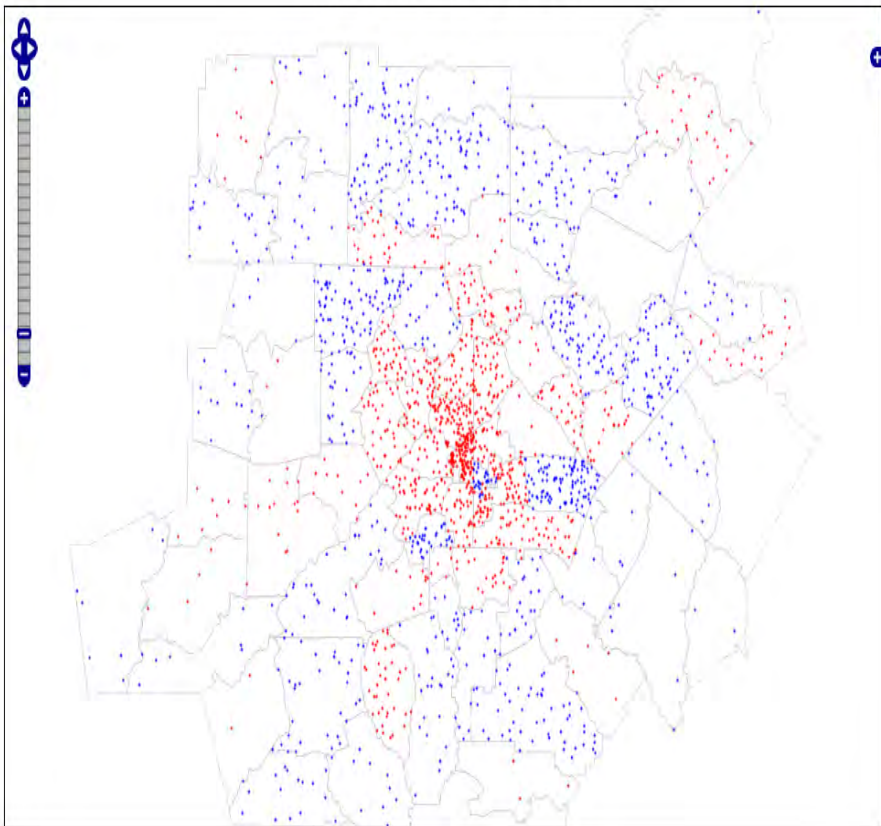
each blue dot is 5180000.0, each red dot is -5180000.0
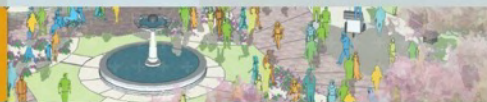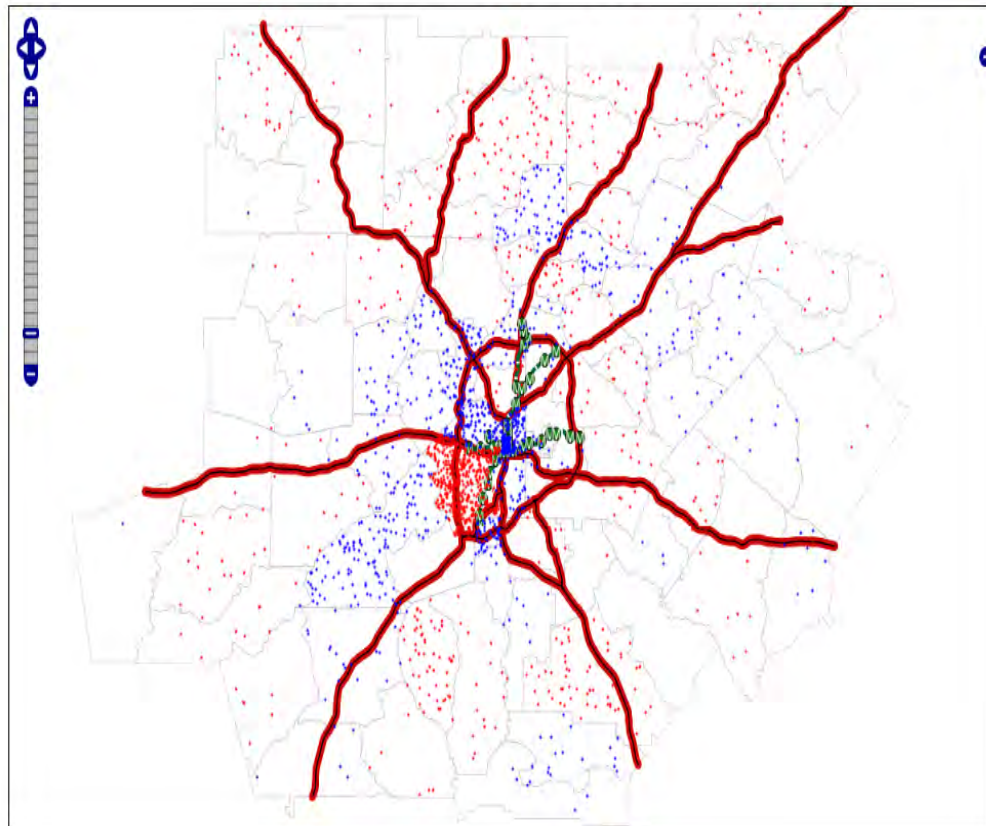
regional impact + local relevance

Change in benefits by activities between I01f and NB01 from 2005 to 2040
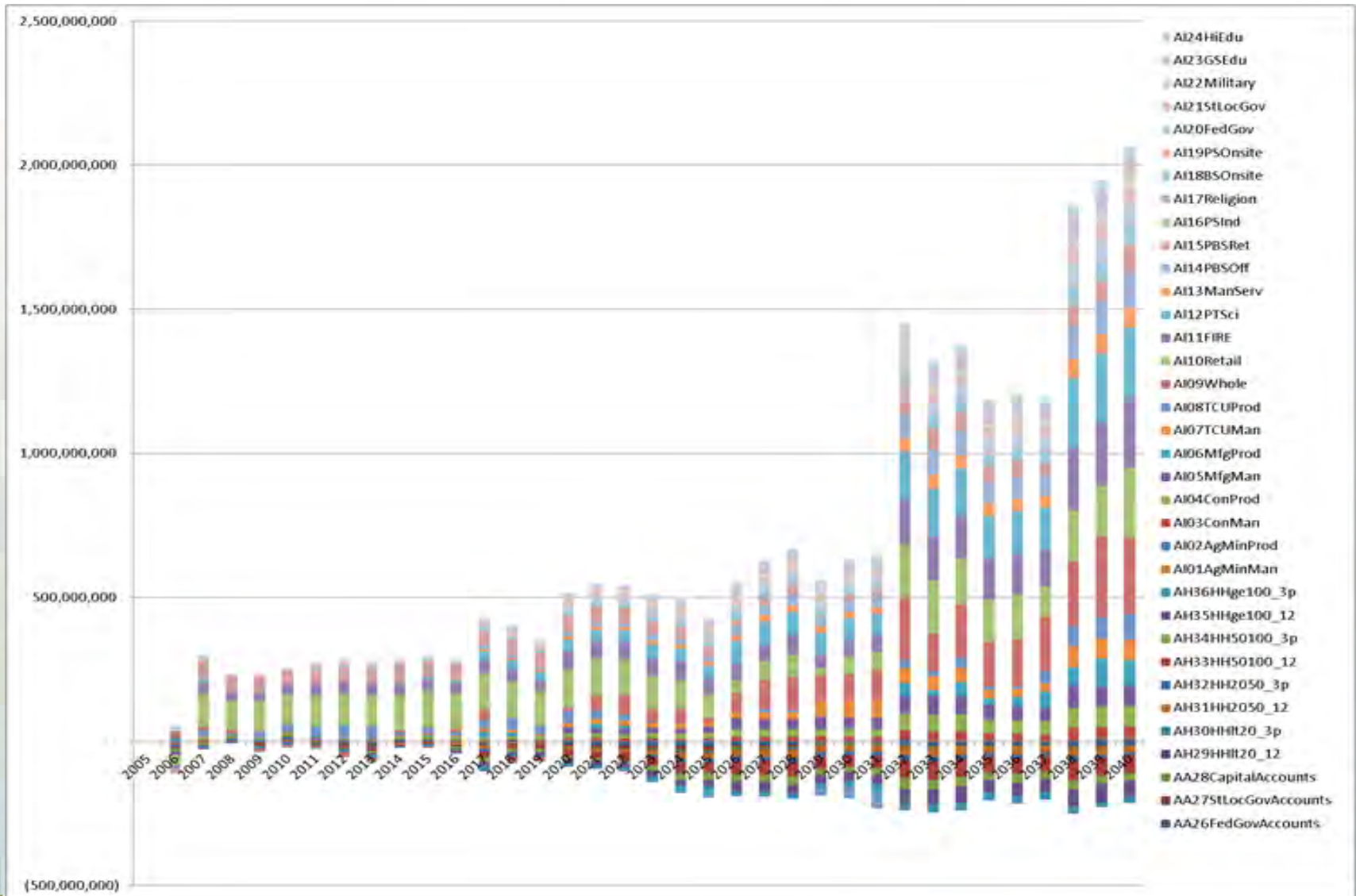
Where We're **No**t At--Overview

- **Challenge of Model Output for Conformity**
  - **Nature of Output**
    - ➤ **HH Matrix Expansion**
    - ➤ **HH to Population**
    - ➤ **Output $ to Jobs**
  - **Too Much "Change" from Expectations**
  - **Little "Real" Ability to Adjust Output**
- **No Full Integration with REMI**
  - **Still Driven at Industry Level by IMPLAN**
- **No Automatic Integration with ABM**
- **Buy-In for Scenario Analysis**

SO, Current and Future Work Program

- **Model Output for Conformity**
  - **Achieve Calibration for Baseline TARP**
  - **Changed Nature of Output (Progress)**
    - ➢ **for TDM**
  - **Tools to Analyze & Modify Output**
    - **Mapit>>WEAVE/ Leaflet**
    - **Zoning**
    - **Adjustment**
- **LATER, full Integration with REMI**
  - **Still Driven at Industry Level by IMPLAN**
- **LATER, Automatic Integration with ABM**
- **Parallel Scenario Work...**
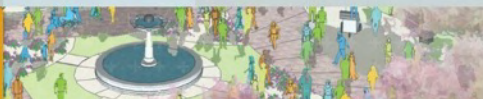
regional impact + local relevance

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Sales Tax Policy Analysis

- **Scenario 1:**
- Forecast the expected land use impacts of improved transit
  - Propensity to redevelop around transit due to:
    - Improved accessibility
    - Higher forecast rents
  - Resulting increases in use.

Sales Tax Policy Analysis

- **Scenario 2:**

- Look for places where zoning is restricting development around transit.

- Increase zoning in the model

- Determine if developers in model use the higher density

Sales Tax Policy Analysis

- **Scenario 3:**
- Add TOD developments to PECAS explicitly
- Let PECAS forecast what other development does NOT occur if control total fixed
- Look at impact on travel model ridership, congestion

Atlanta "Vision" Analysis

- **City of Atlanta Design Studio**
- The Goal of 1.5 Million WITH...
  - Aesthetics
  - Economic Sustainability
  - Equity
- Scenario I: Getting to It with Existing Zoning and Controls
- Scenario II: Test Desired Zoning Changes
- Others: Which Zoning and Incentive Changes "Work"
- Workshop Next Week with HBA and COA Staff

Overall Assessment/ Lessons Learned

- **Terrific Theory with "Genius" Consulting**
- **State of the Art…**
- **Ability to Leverage Work for Others**
- **Complexity**
  - Data Hungry & Synthesis Challenges
  - Elusive Understanding of Structure
  - Never Ever Done
- **Staff (and Consultant) Hungry**
  - Long, Long Lead Time >> Expense
- **CHANGE IS HARD**
  - Expectations of Staff
  - Expectations of Management
  - Appeal of the New and Shiny

Other Resources-I

- ARC (jskinner@atlantaregional.com)
- John Abraham and HBA
- Contacts for/in Other Areas

Other Resources--II