



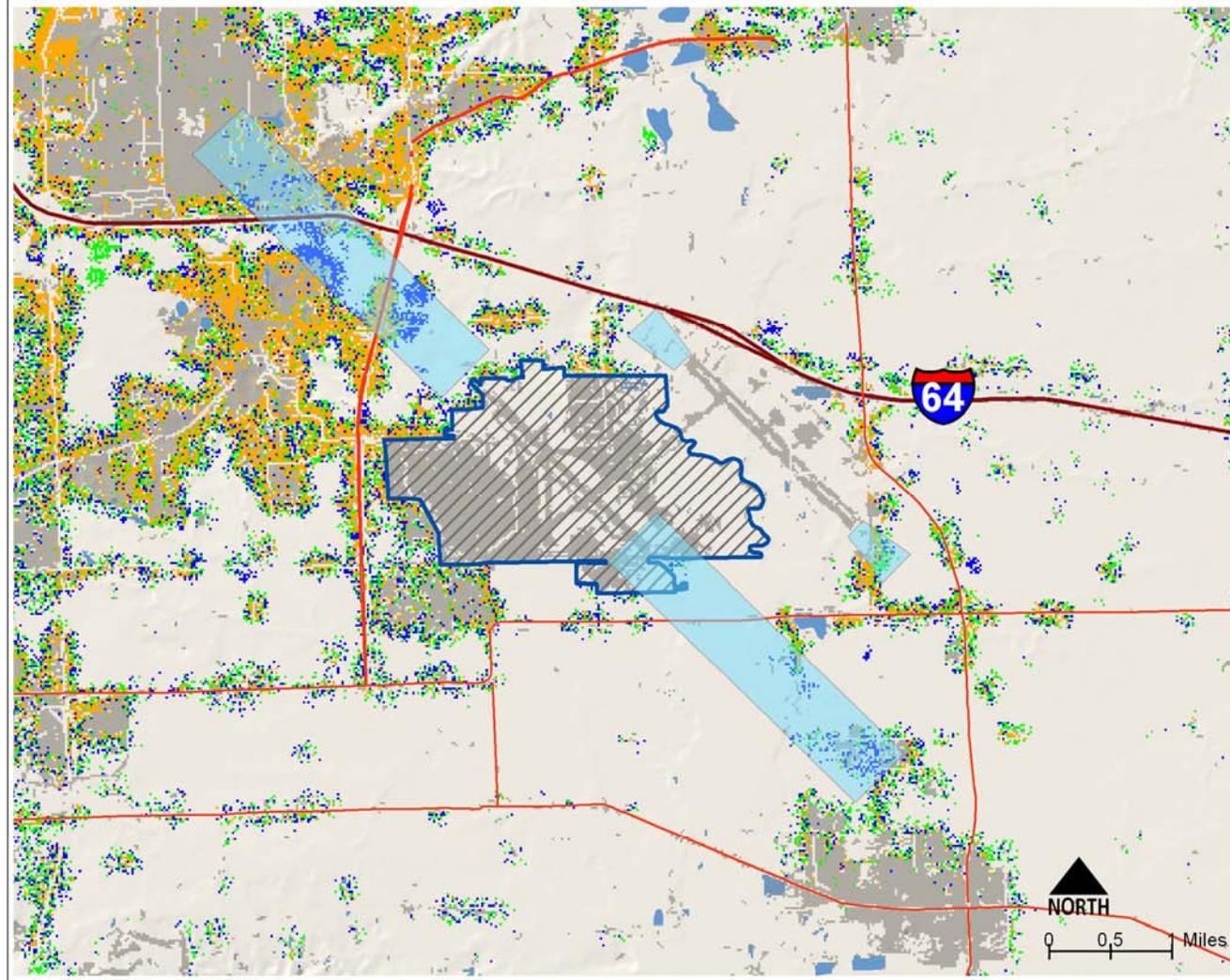
Implications of Landscape Evolution

Dealing With Future Landscapes

Dr Brian Deal
Dr Varkki Pallathucheril
University of Illinois

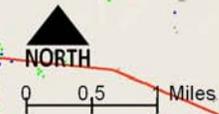
- What happens to Scott AFB if Mid America Airport (a neighboring community based airport) realizes some of its economic development projections?

MidAmerican Expansion/Base Landuse Change/AICUZ Restrictions



Immediate Scott AFB Region
Landuse Change Comparison MidAmerica Expansion and No Growth in AICUZ w/ Business as Usual

- Interstate
- US route
- State route
- State Line
- County Boundary
- Scott AFB
- Adjusted AICUZ
- Expansion & No Growth
- Business as Usual
- Common
- Developed
- Water

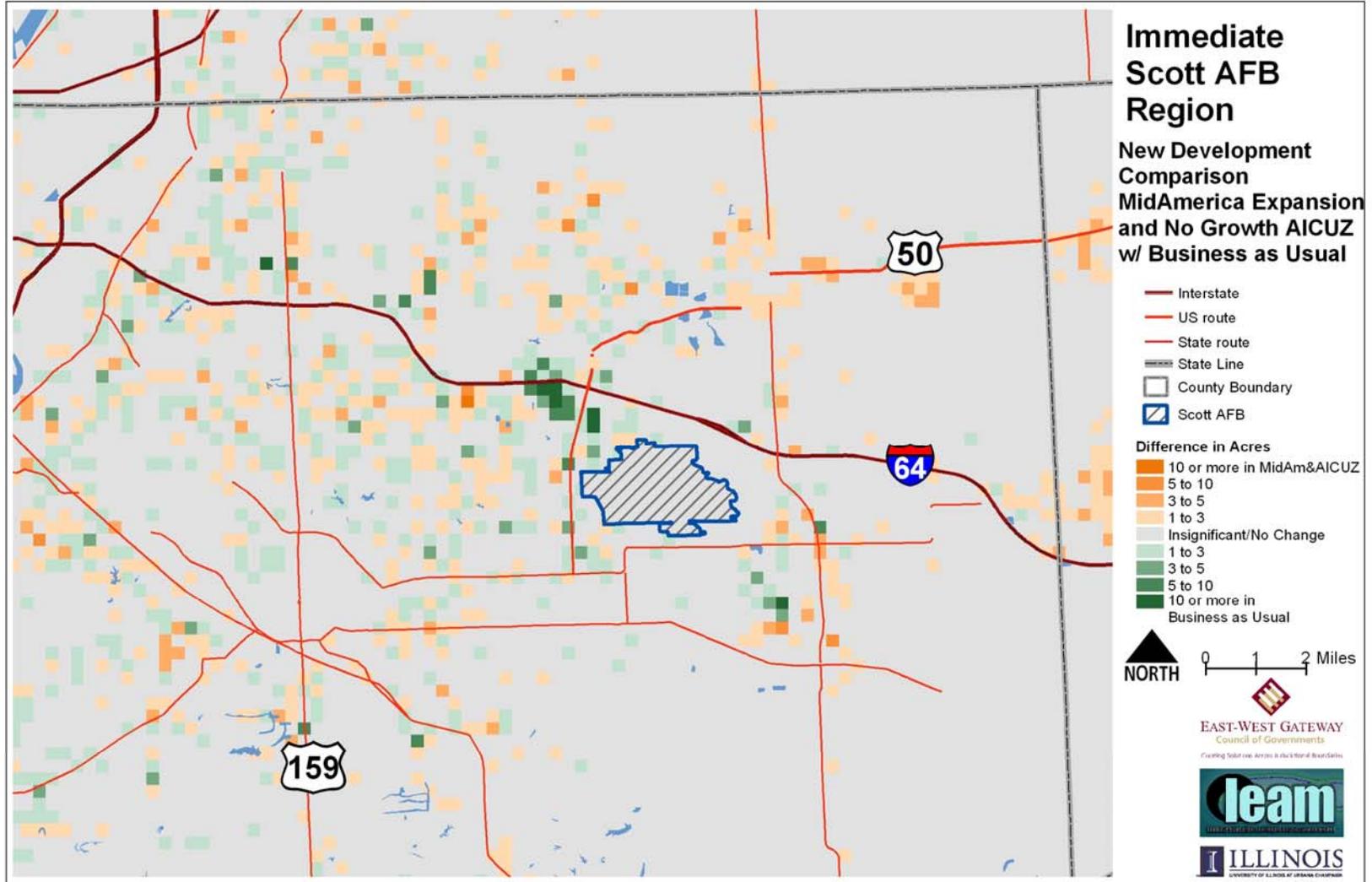



EAST-WEST GATEWAY
 Council of Governments
Creating Solid New Areas & New Rural Boundaries


Team
East-West Gateway Council of Governments


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MidAmerican Expansion/Base Aggregate Change/AICUZ Restrictions



Overview

- The problem?
 - Understanding and dealing with the future
- Future landscapes
 - Tools
 - Implications
- Applications
- Conclusions

Dealing with the Future

- We have good tools for analyzing historic and current conditions
- Our tools for dealing with the future are, at best, crude
 - Wishful thinking is not very useful
 - Community Visioning processes
 - We have a poor grasp of future consequences of different actions and future changes

What Does the Future Hold?

- A trend line can be extrapolated for a single future
 - But what if it does not come about?
 - There is a need for richer descriptions
- Multiple descriptions of the future (scenarios) provide a more substantial basis
 - Can frame probable futures
 - Can deal with complex issues
 - Economic, social, and environmental forces
 - Public policies and investment decisions

Modeling Landscape Evolution

- Simulate multiple ways in which a regional landscape evolves
- These provide a basis for constructing rich descriptions of the future
 - Land consumption
 - Social, economic, and environmental consequences

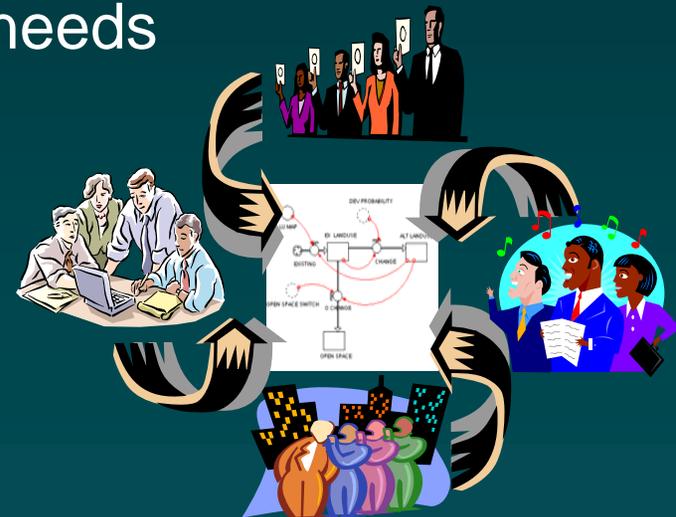
The Landuse Evolution and Impact Assessment Model

LEIAM

A Scenario Modeling Tool
to help Plan for the future

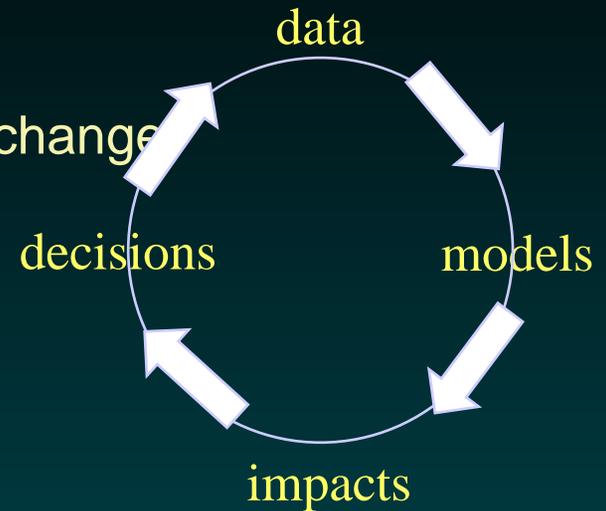
Understanding Development Pressure

- What factors cause change and how?
 - Translate this into mathematical equations
- Computers simulate changes over space and time
 - Alter equations to play out different scenarios
 - Helps articulate the future
 - Can assist in determining future needs

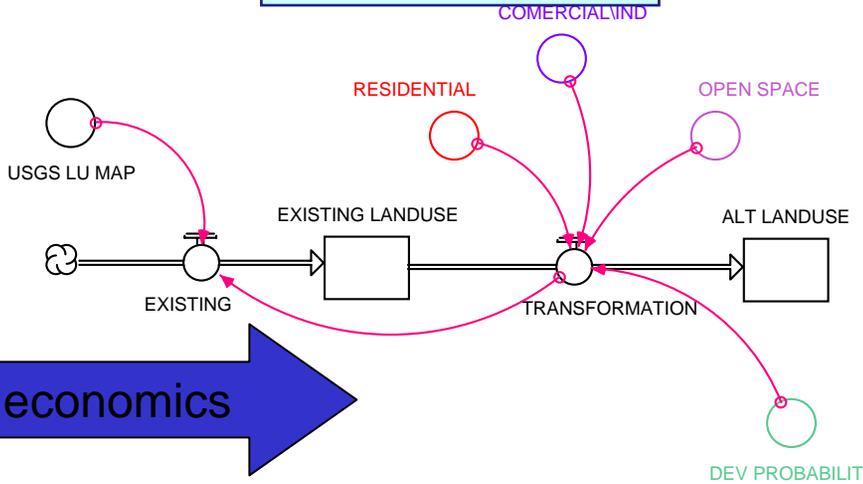


LEAM Approach

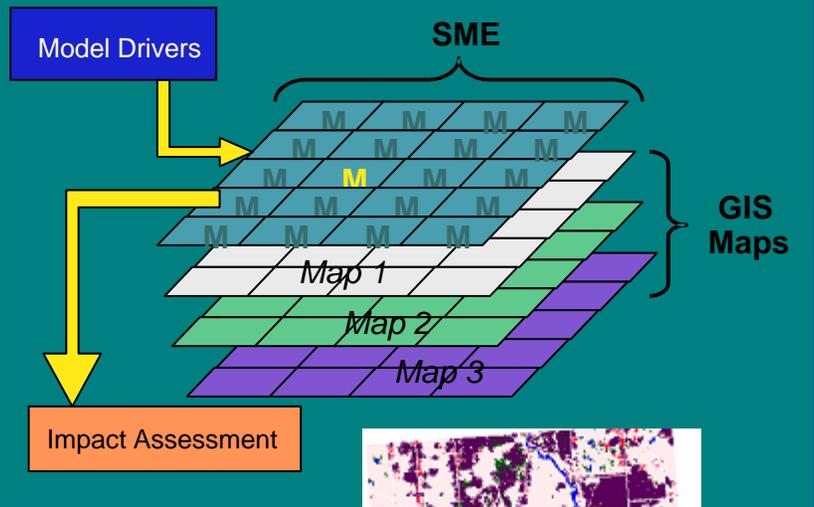
- Captures causal mechanisms of land-use change
 - What if?
 - Environmental, Social, Economic
 - Appropriate scales
- Captures dynamics of complex systems
 - Feedbacks
 - Lags
- Captures impacts of land use change - So What?
 - Causal relationships
 - Environmental, Social, Economic
- Incorporates calibration and validation
 - Quantify uncertainty
- A hybrid approach
 - Cellular automata (agents - landowners)
 - On a non-uniform (probability) surface



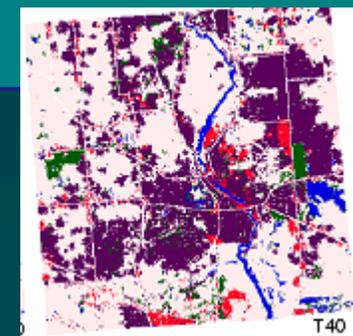
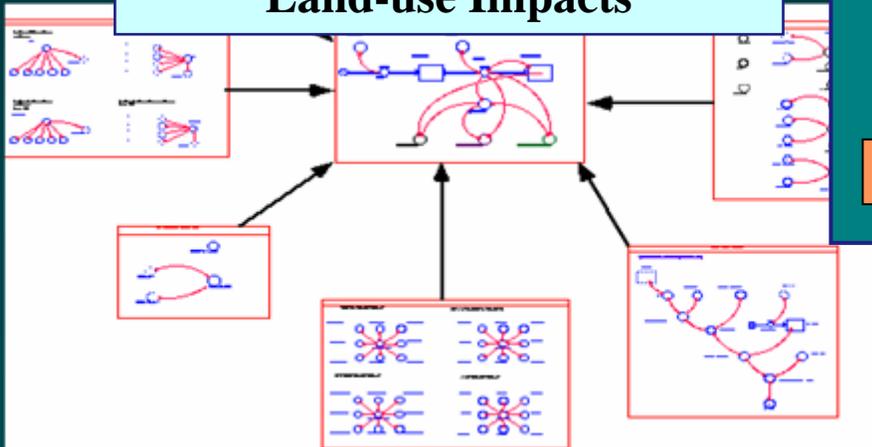
Land-use Drivers



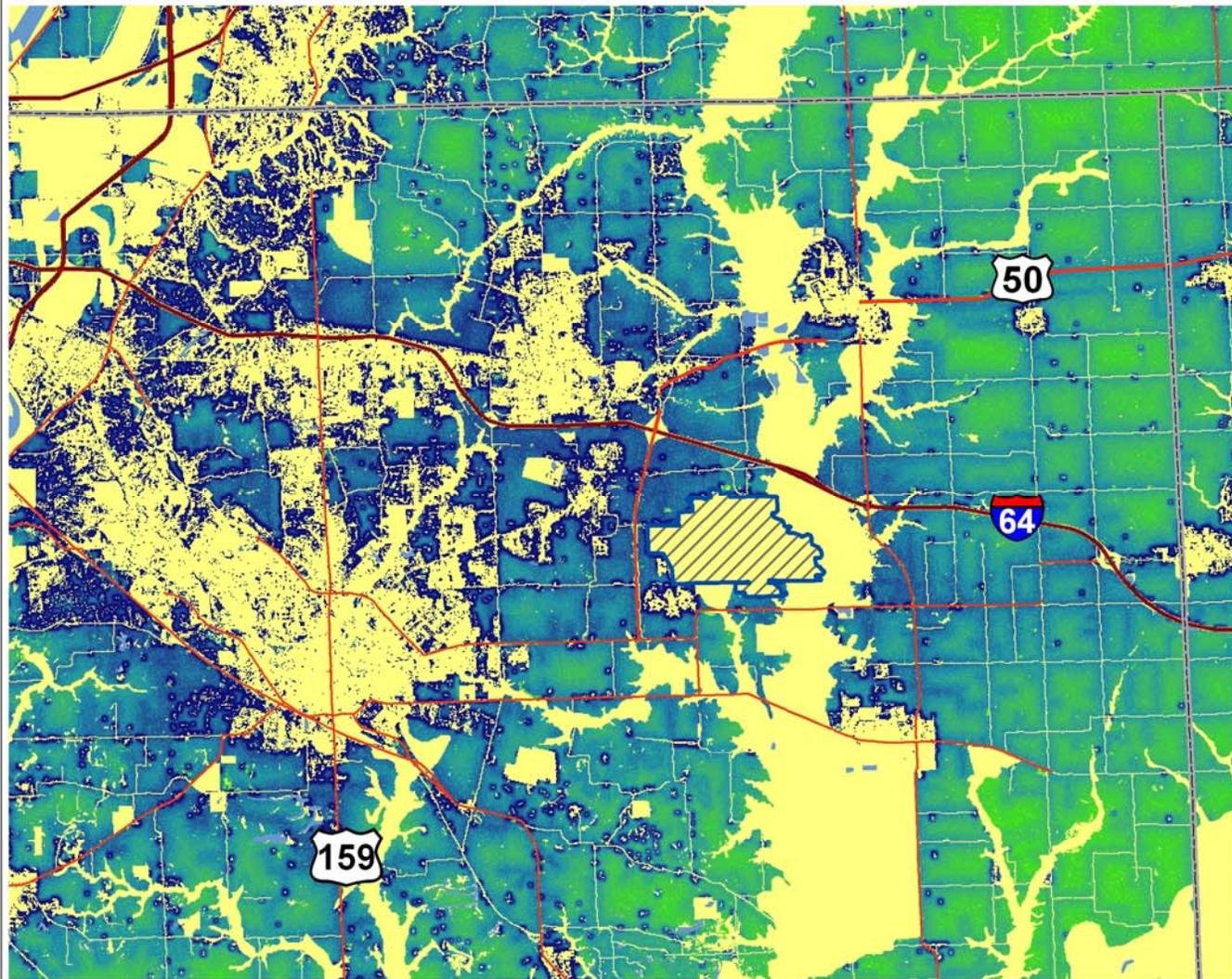
Land-use Change



Land-use Impacts



Development Probability Surface

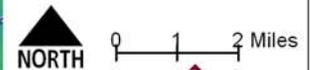


Immediate Scott AFB Region

Development Probability Initial

- Interstate
- US route
- State route
- State Line
- County Boundary
- Scott AFB
- Water

Probability

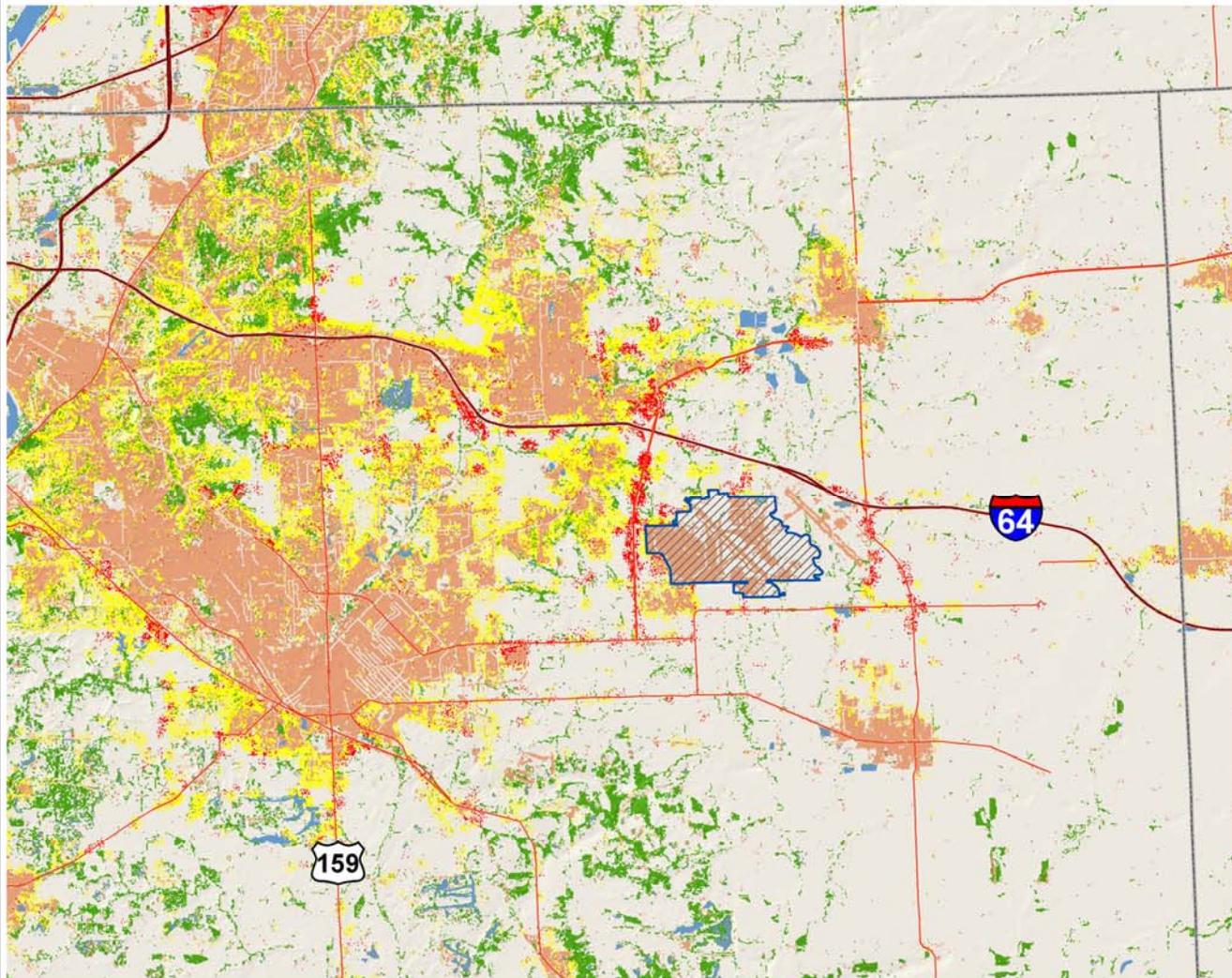


EAST-WEST GATEWAY
Council of Governments
Preserving today's air, water & recreational resources



Immediate Scott AFB Region

2030 Landuse Change Business as Usual



- Interstate
- US route
- State route
- State Line
- County Boundary
- ▨ Scott AFB
- New Residential
- New Commercial
- Developed
- Forest
- Others
- Water



0 0.9 1.8 Miles


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Creating Solutions Across Jurisdictional Boundaries



Implications

Environmental, Social, Economic Implications

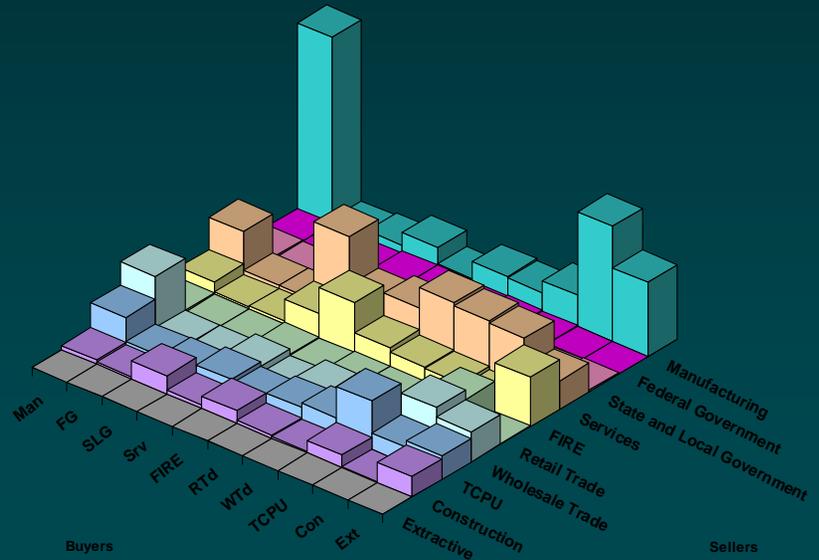
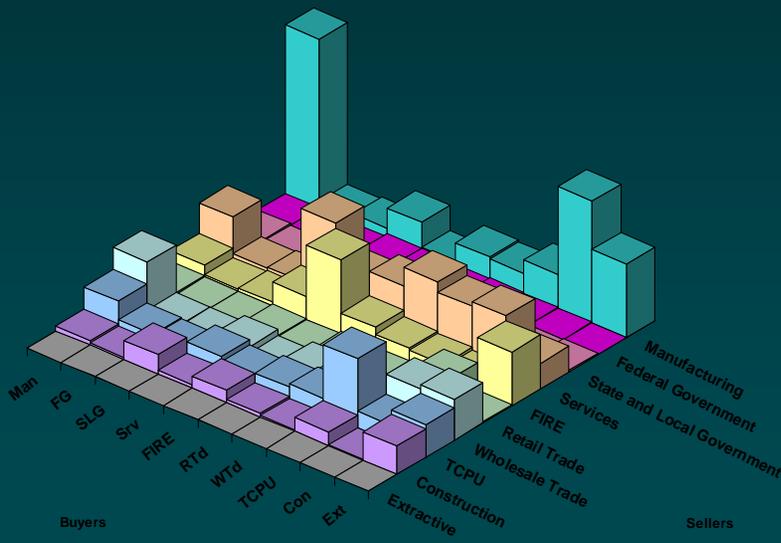
- General Impacts
 - Land use change, impervious surface, loss of key resources
 - Convert developed cells into population/HH, spatialize data by various boundaries (school district, water & sewer area) to estimate infrastructure needs
- Impact models allow for further assessment of the consequences of land-use change
- We have implemented
 - **Traffic volume**
 - Fiscal impacts
 - School costs
 - Water & air quality impacts
 - Economic impacts
 - Habitat fragmentation
 - Stormwater/flooding

Landcover Classification	1993 Landcover	2025 High	2025 Mid	2025 Low
Water	93,781	93,781	93,781	93,781
Residential	183,408	226,230	218,187	213,641
Commercial/Industrial	232,747	241,615	239,717	238,901
Agricultural	1,677,371	1,644,462	1,650,485	1,653,606
Urban Openspace	164,252	181,133	181,539	181,750
Forested	963,332	930,195	933,314	935,110
Grasslands	37,969	36,684	36,828	36,905
Others	142,001	140,262	140,513	140,669
Total	3,494,861	3,494,861	3,494,861	3,494,861

LEAMecon

Regional Economic Modeling

- Regional economy captured in a two-part model
 - a nine-sector input-output model
 - an econometric model

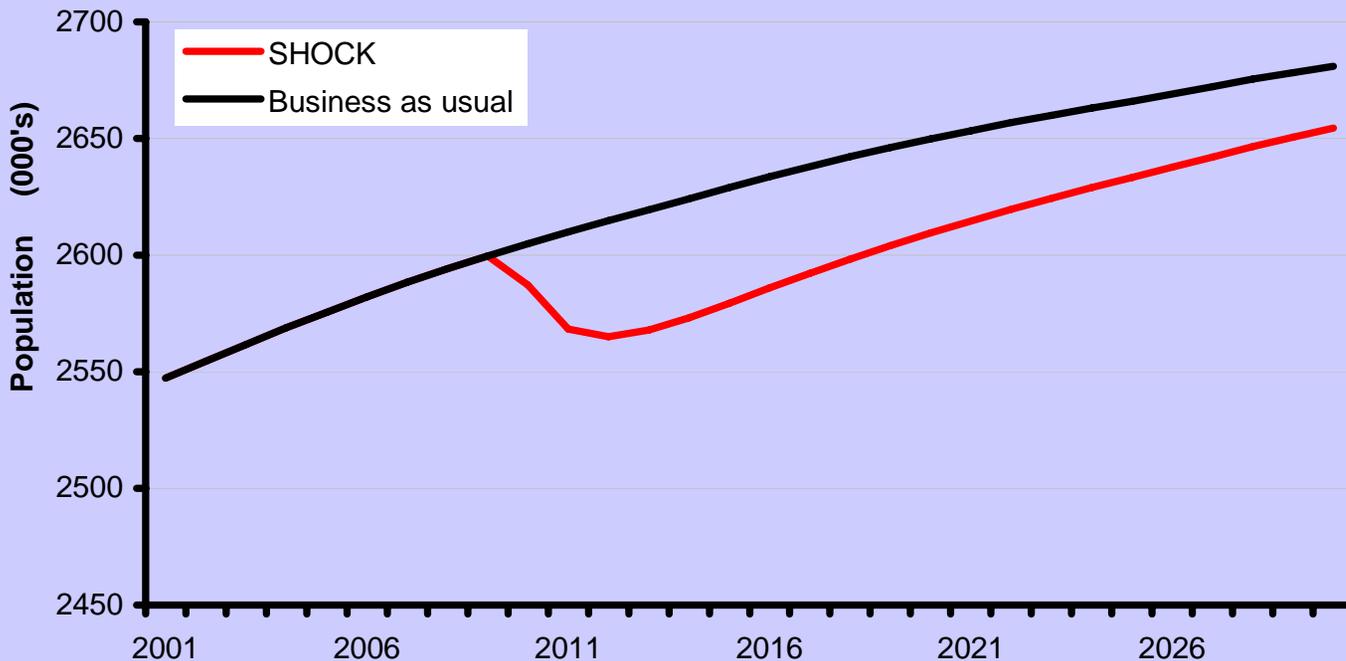


LEAMecon

'What if? Scenario Building

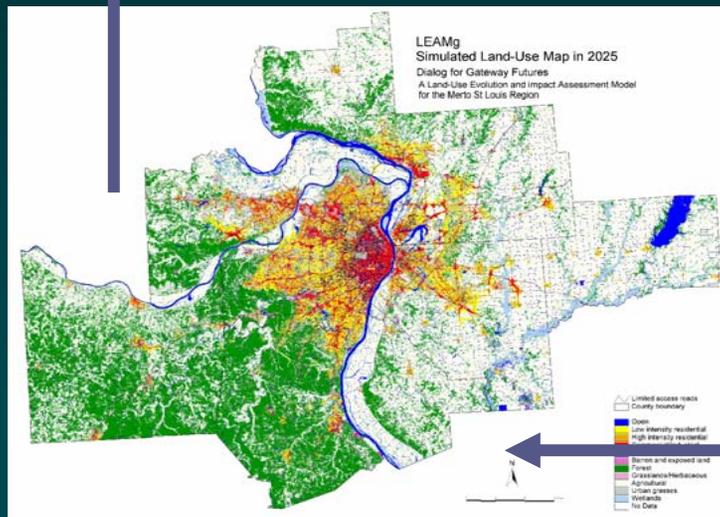
Closing Scott AFB, MO

Total Population

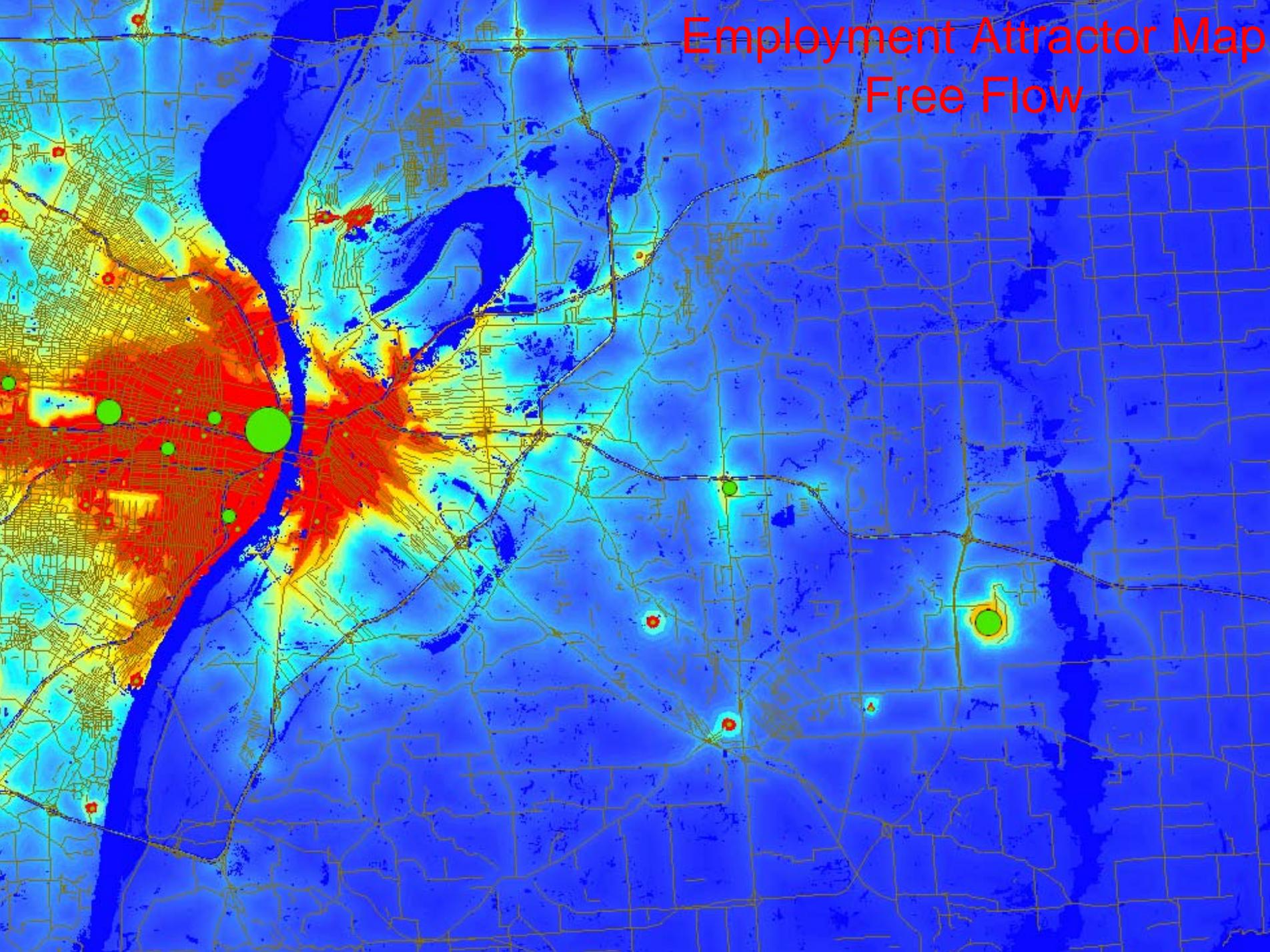


Transportation and Landuse

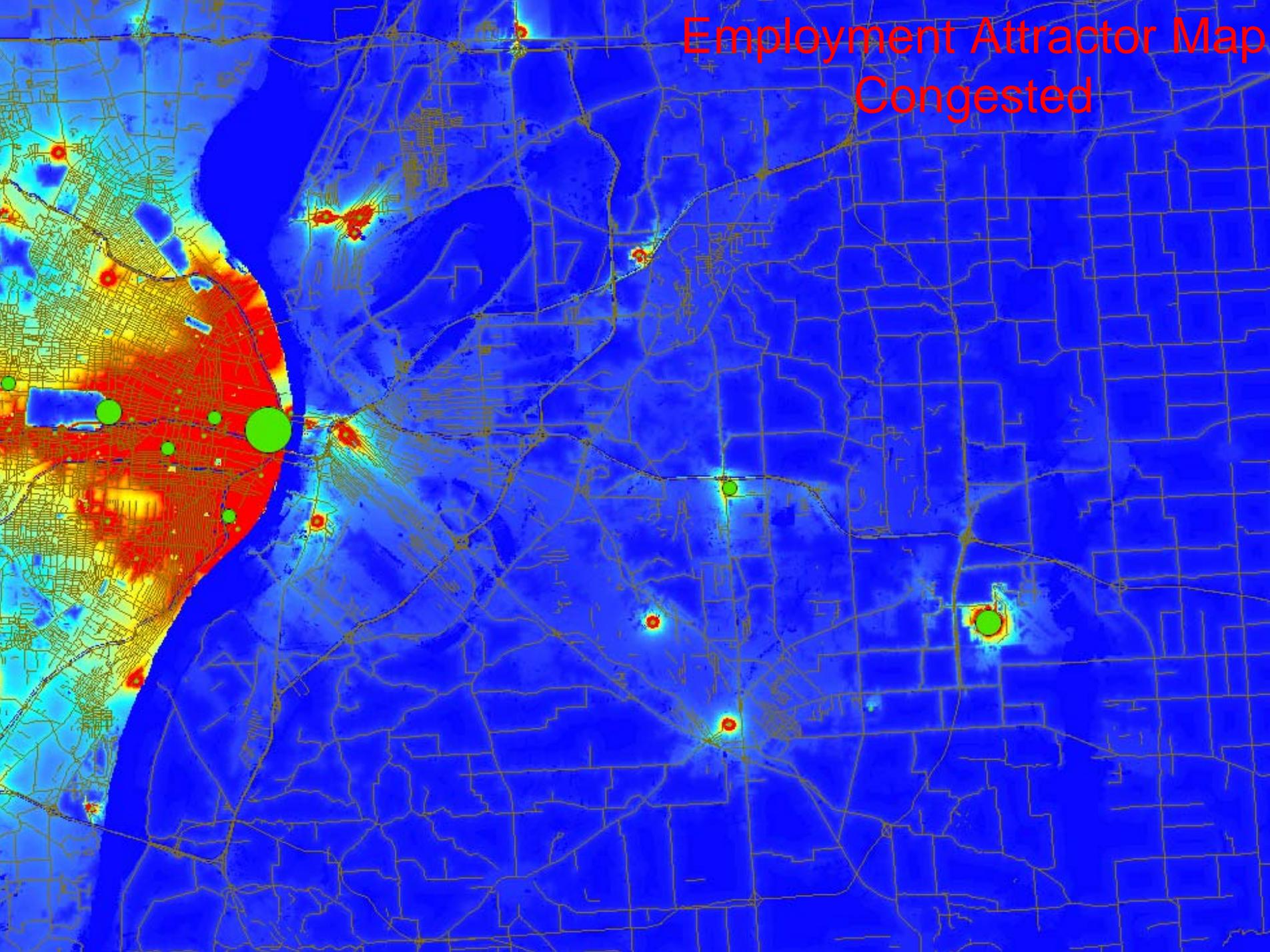
- Inextricable connection
- feedback



Employment Attractor Map Free Flow

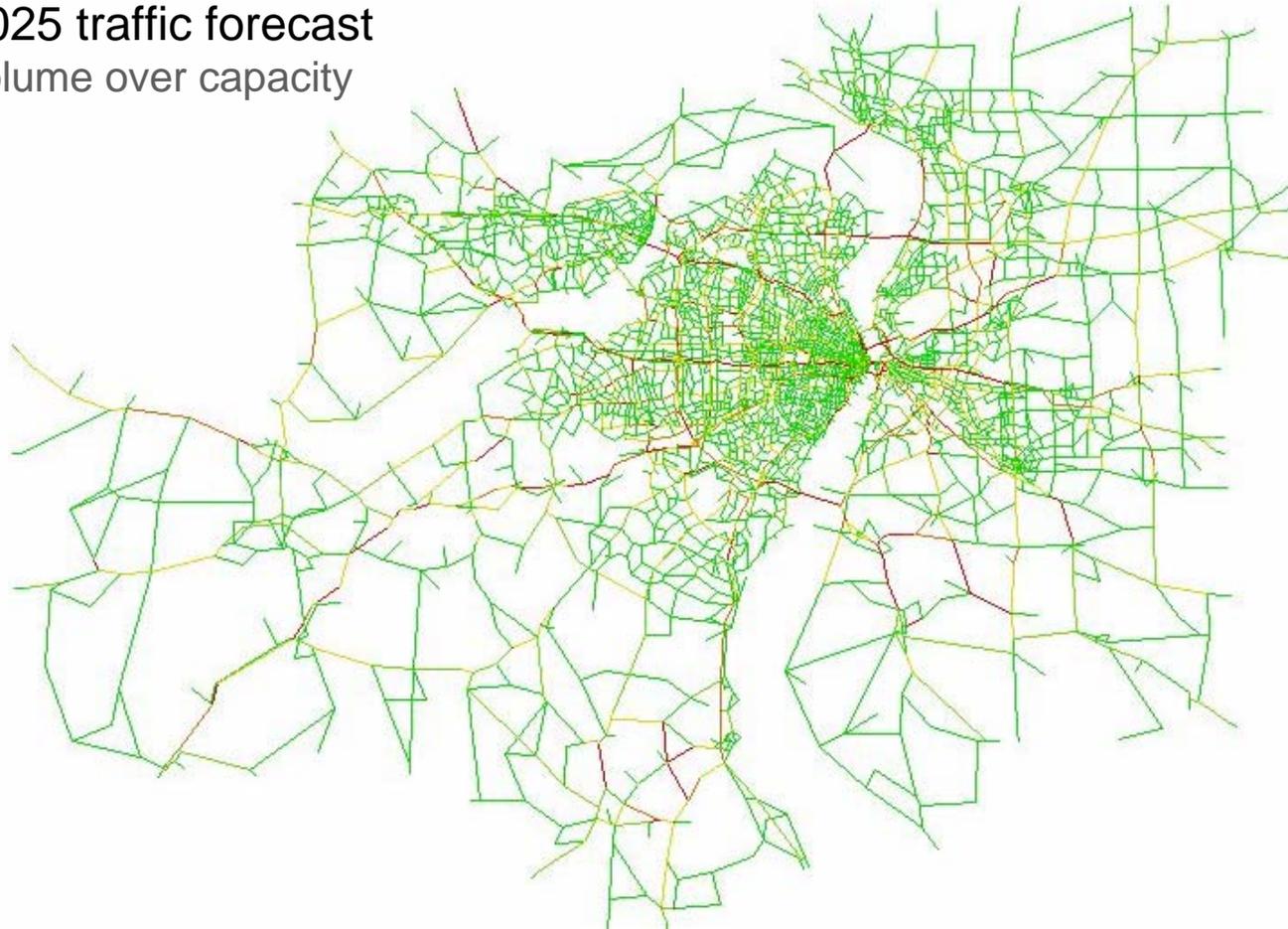


Employment Attractor Map Congested



Transportation Impacts

2025 traffic forecast
volume over capacity

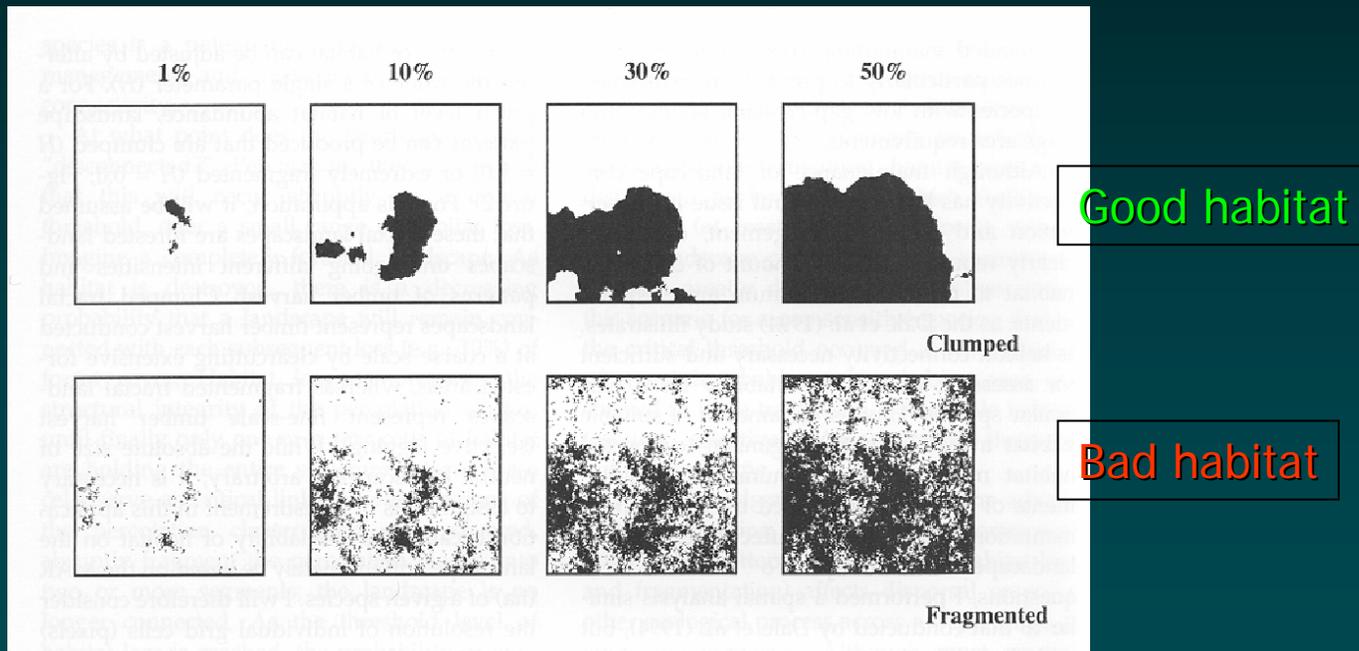


v/c values in percentage

- 0 - 25
- 24 - 50
- 51 - 79
- 80 - 95
- 96 - 183

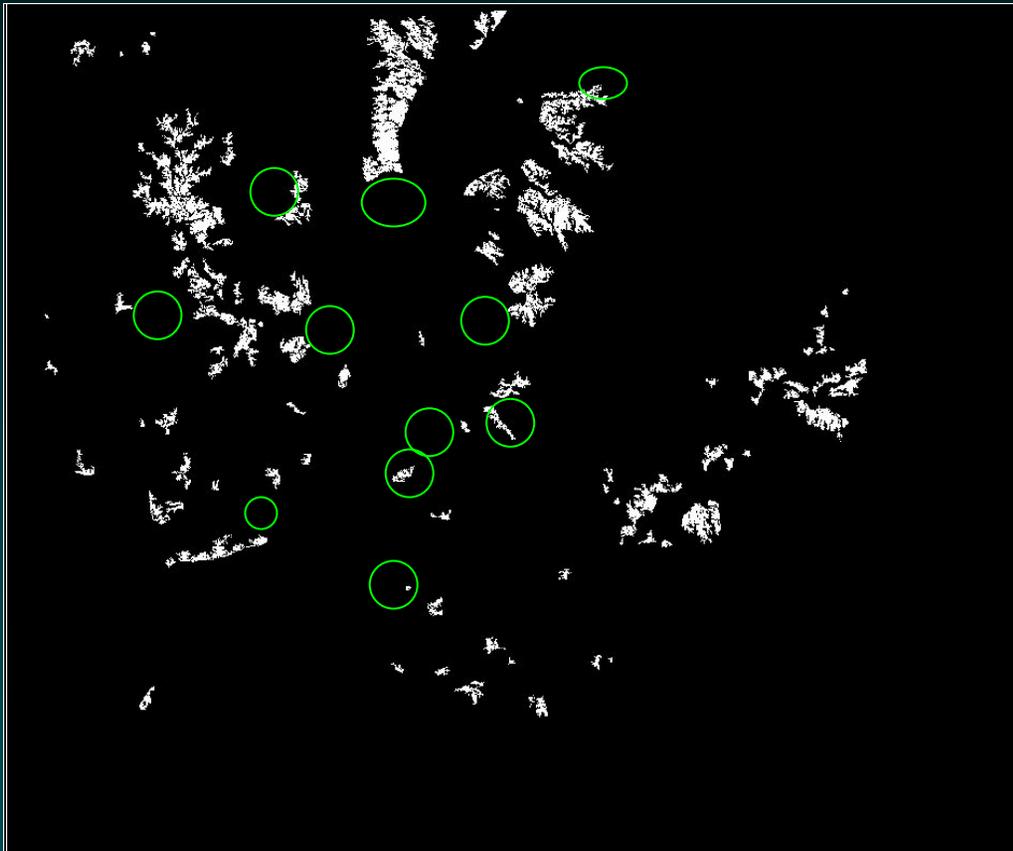
Habitat Fragmentation

- Landscape consideration
 - spatial arrangement of potential habitat is important



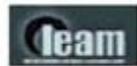
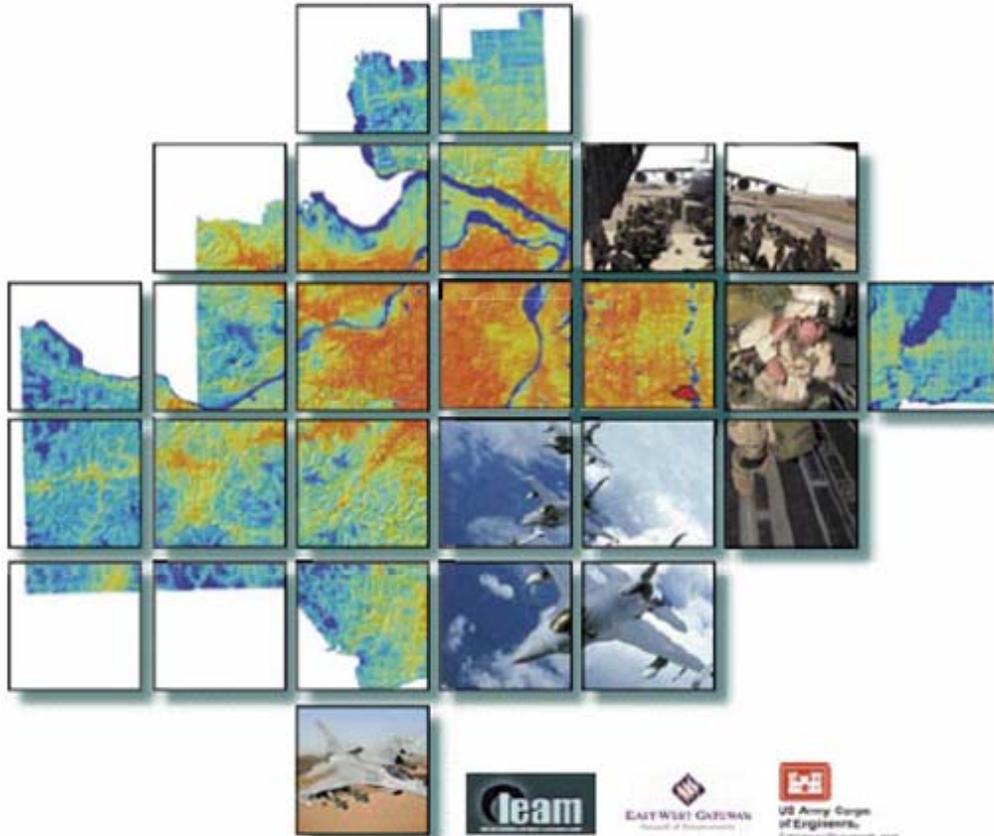
pLEAM Fragmentation

Spatial results



Applications

Scott Air Force Base Regional Planning Workshop



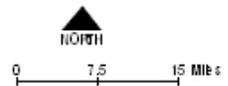
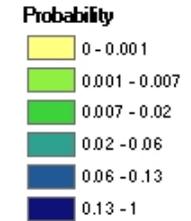
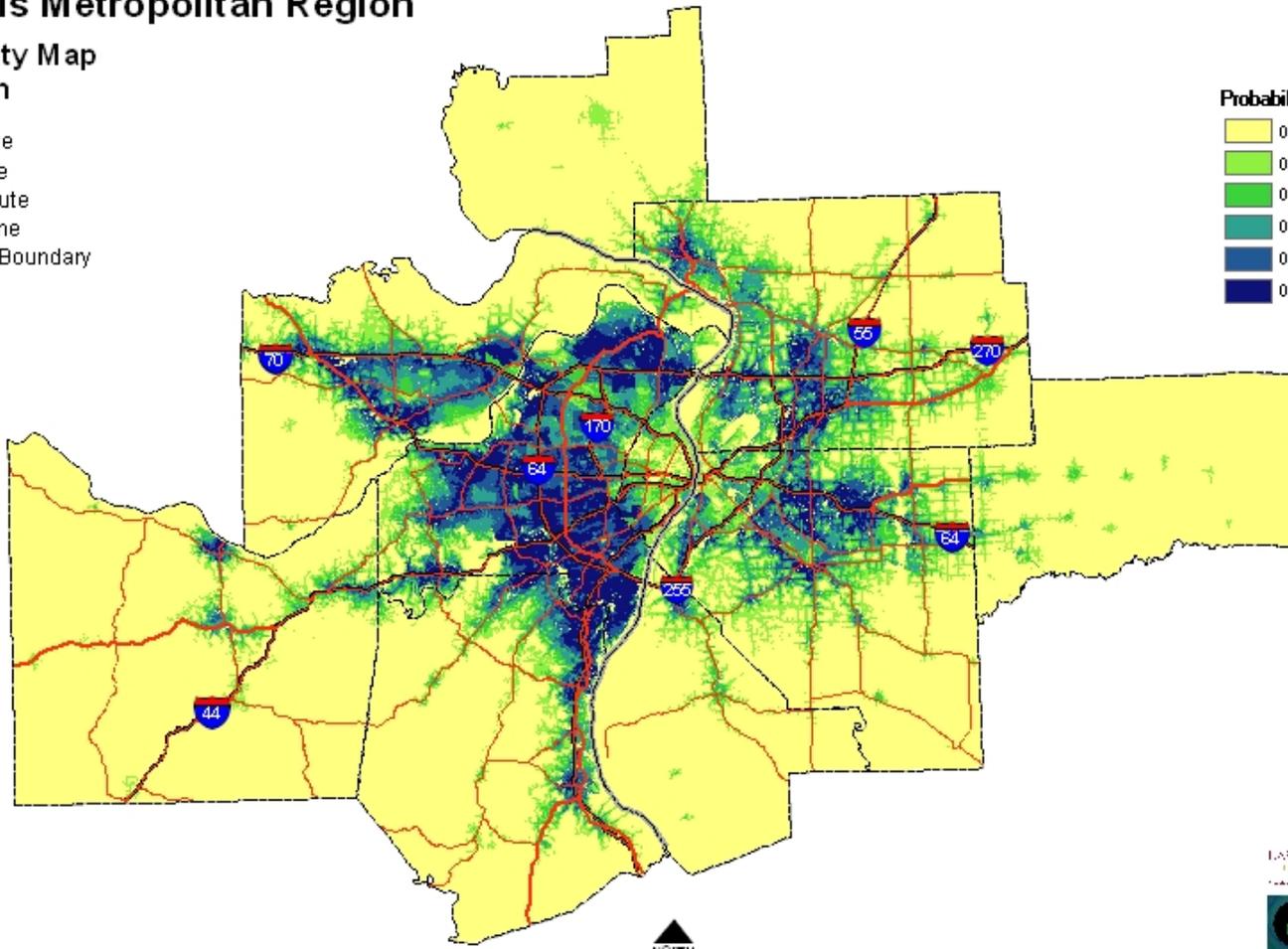
safbLEAM

Probability Surface

St. Louis Metropolitan Region

Probability Map Base Run

- Interstate
- US route
- State route
- State Line
- County Boundary



Regional Landuse Change

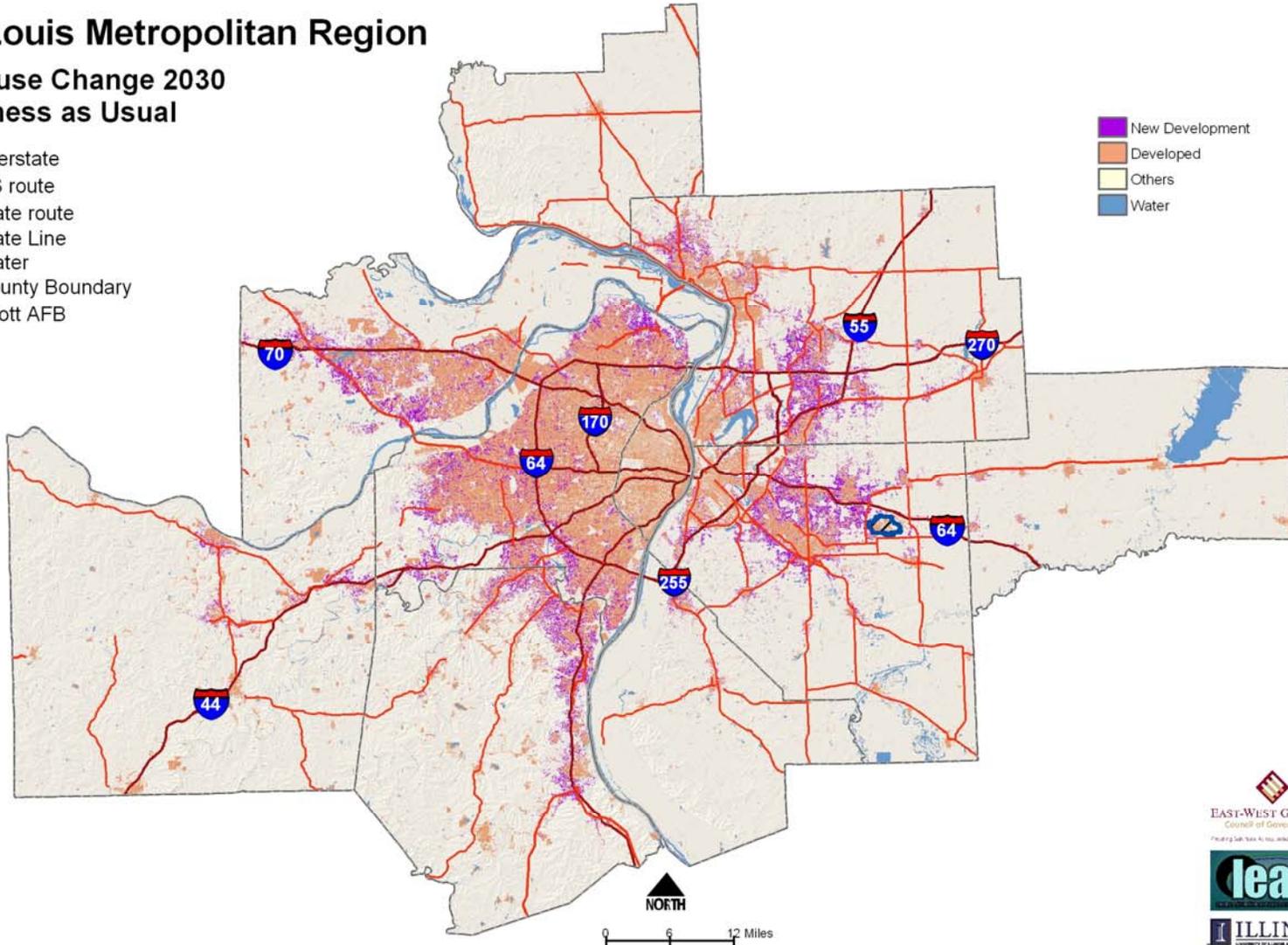
St Louis, MO

St. Louis Metropolitan Region

Landuse Change 2030 Business as Usual

- Interstate
- US route
- State route
- State Line
- Water
- County Boundary
- Scott AFB

- New Development
- Developed
- Others
- Water




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Featuring Sub-Sector Analysis and Growth Patterns


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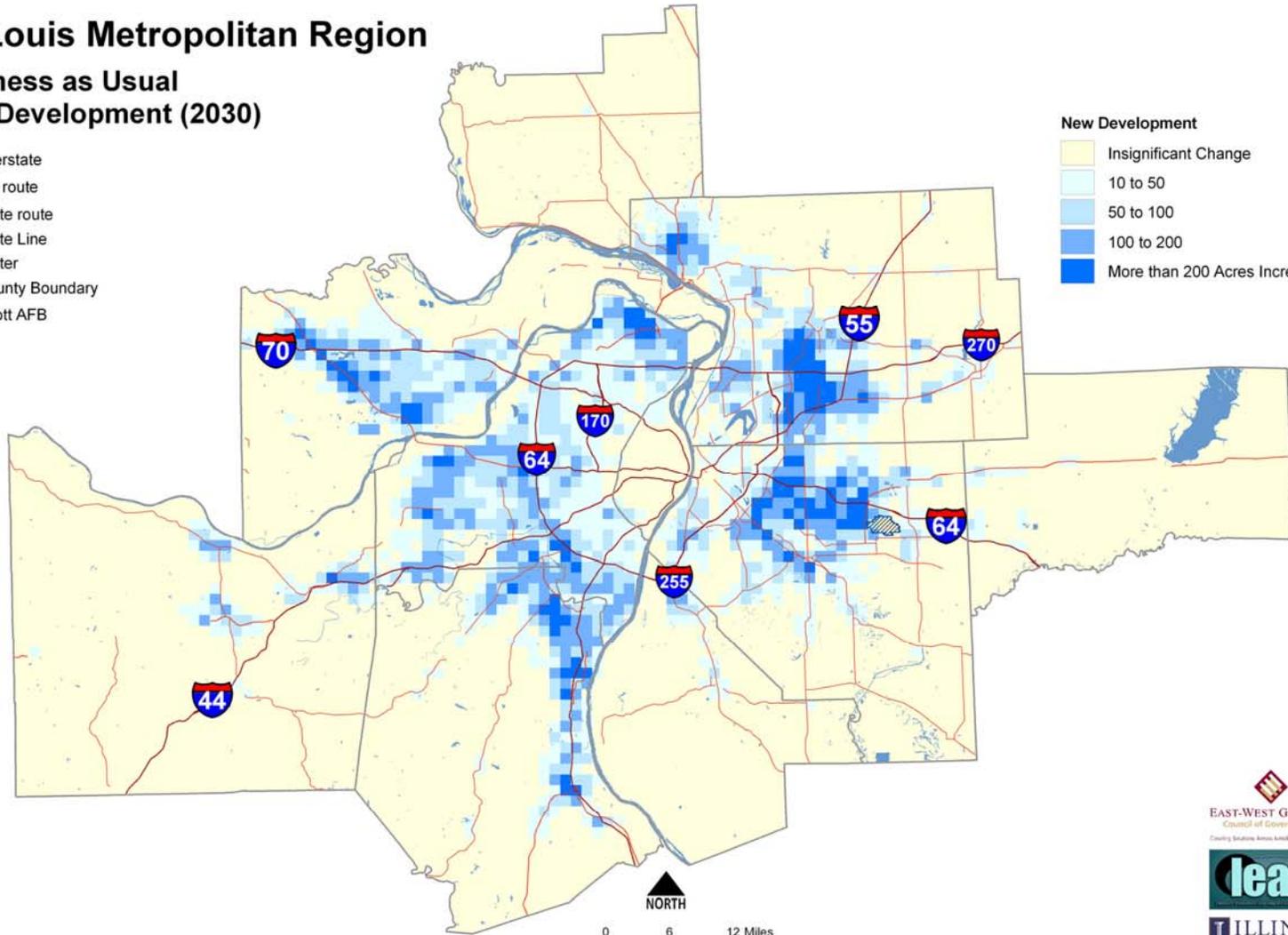
Aggregate Change by section

St. Louis Metropolitan Region

Business as Usual New Development (2030)

- Interstate
- US route
- State route
- State Line
- Water
- County Boundary
- Scott AFB

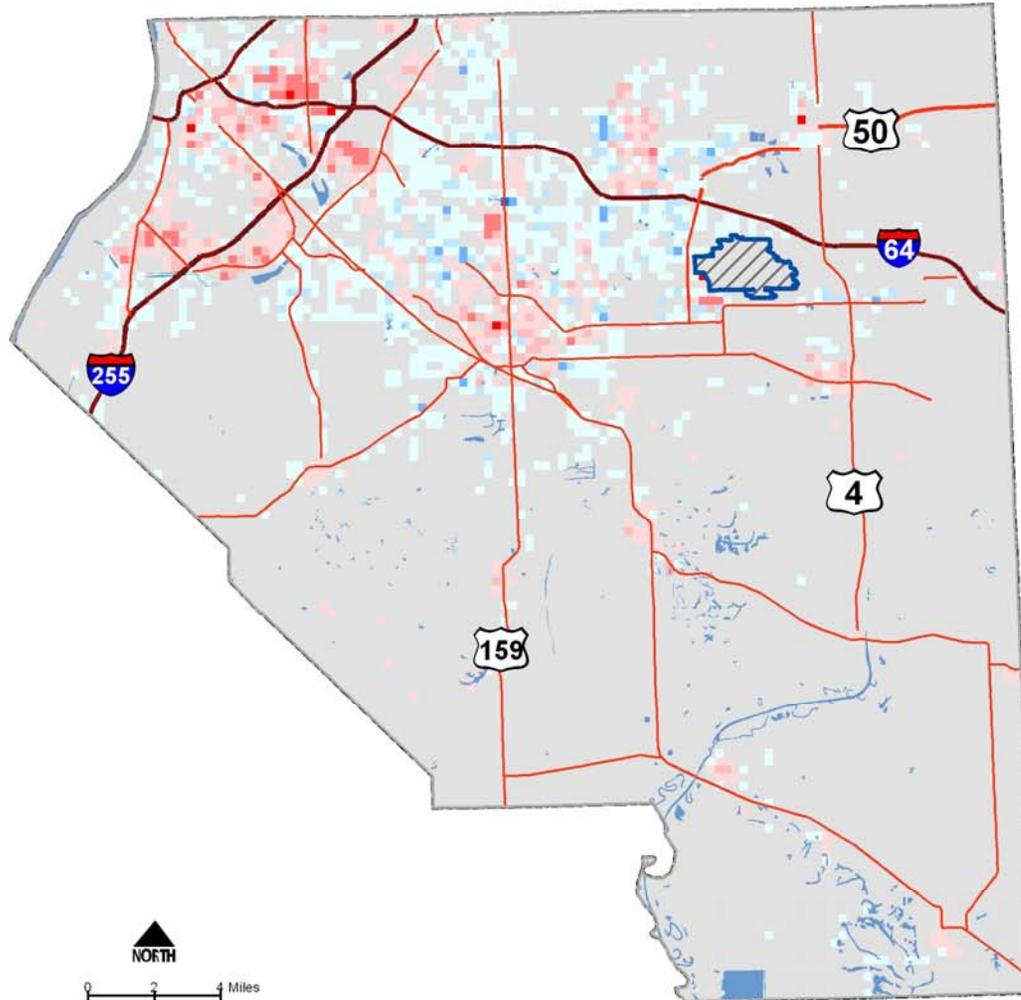
- New Development**
- Insignificant Change
 - 10 to 50
 - 50 to 100
 - 100 to 200
 - More than 200 Acres Increase



St Clair County Landuse Change

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

St. Clair County Population Change



St. Clair County 2000-2030 Population Change by Quartersection Business as Usual

- Interstate
- US route
- State route
- State Line
- Water
- County Boundary
- Scott AFB

Population Change

- 200 or more increase
- 100 to 200
- 50 to 100
- 10 to 50
- Insignificant/No Change
- 10 to -50
- 50 to -100
- 100 to -200
- 200 or more decrease

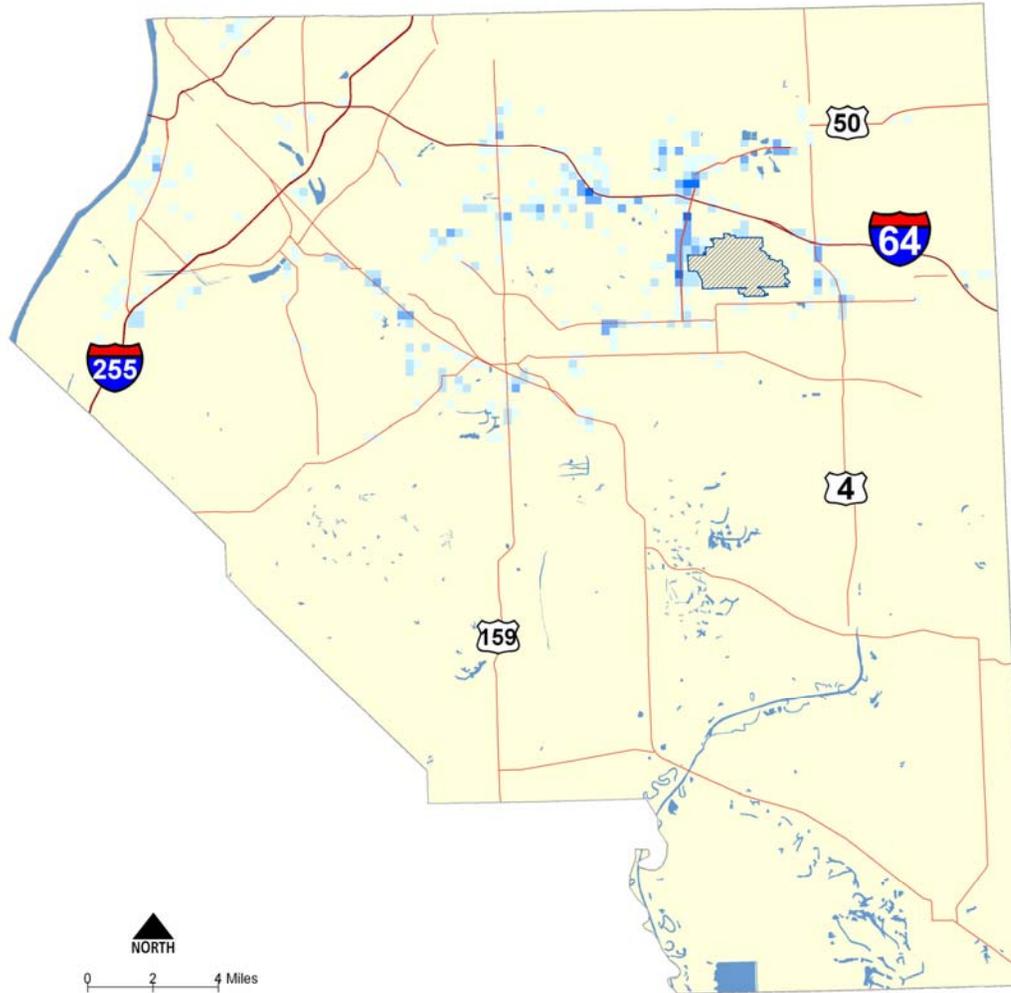


EAST-WEST GATEWAY
Council of Governments

Creating Solutions Across Jurisdictional Boundaries



St. Clair County Commercial Development



St. Clair County

New Commercial Development by Quartersection Business as Usual

- Interstate
- US route
- State route
- State Line
- Water
- County Boundary
- ▨ Scott AFB

New Commercial Development

- Insignificant Change
- 2 to 5
- 5 to 10
- 10 to 20
- More than 20 Acres Increase

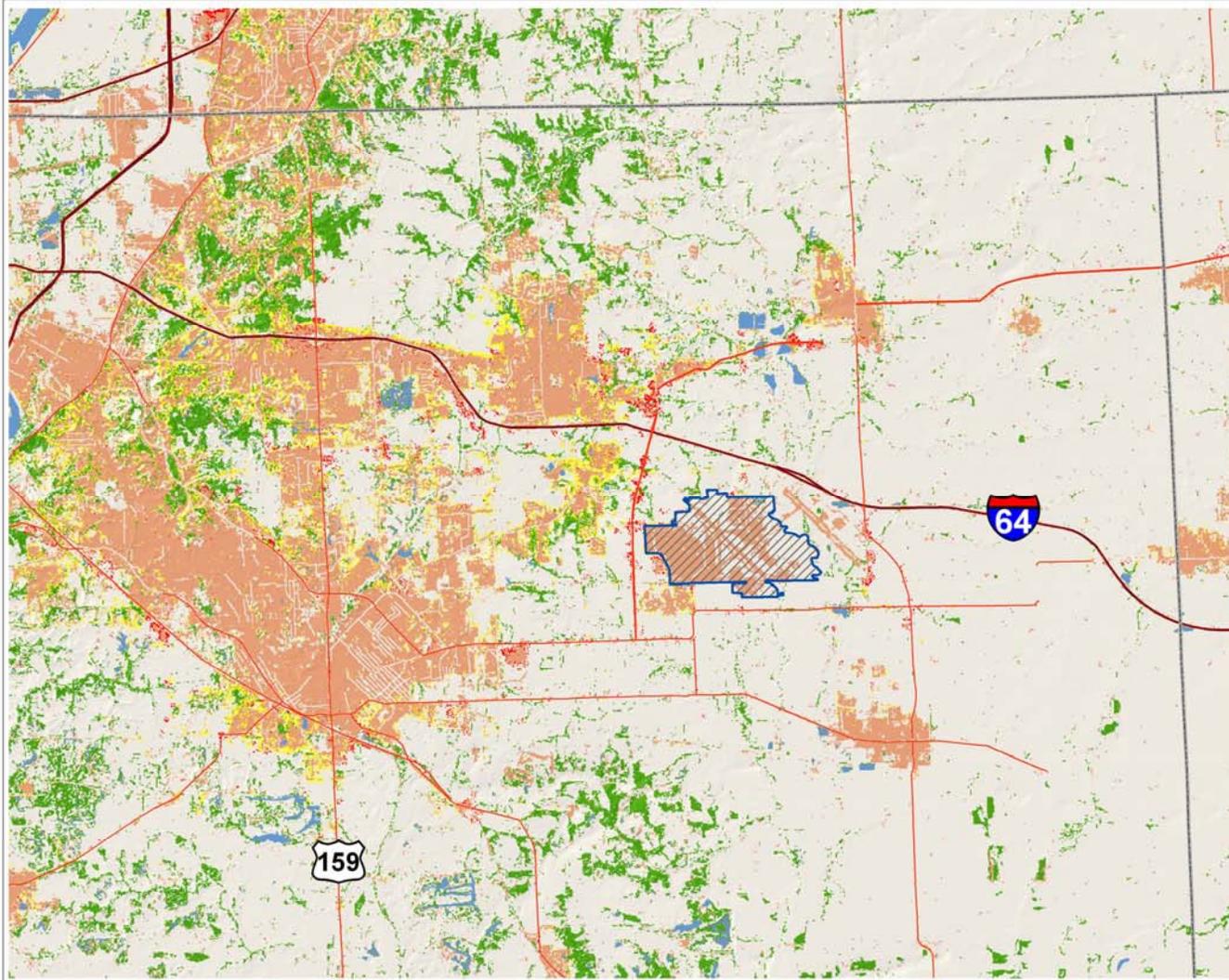


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Creating Solutions Across Jurisdictional Boundaries



Local Landuse Change



Immediate Scott AFB Region

2010 Landuse Change Business as Usual

- Interstate
- US route
- State route
- State Line
- County Boundary
- Scott AFB
- New Residential
- New Commercial
- Developed
- Forest
- Others
- Water



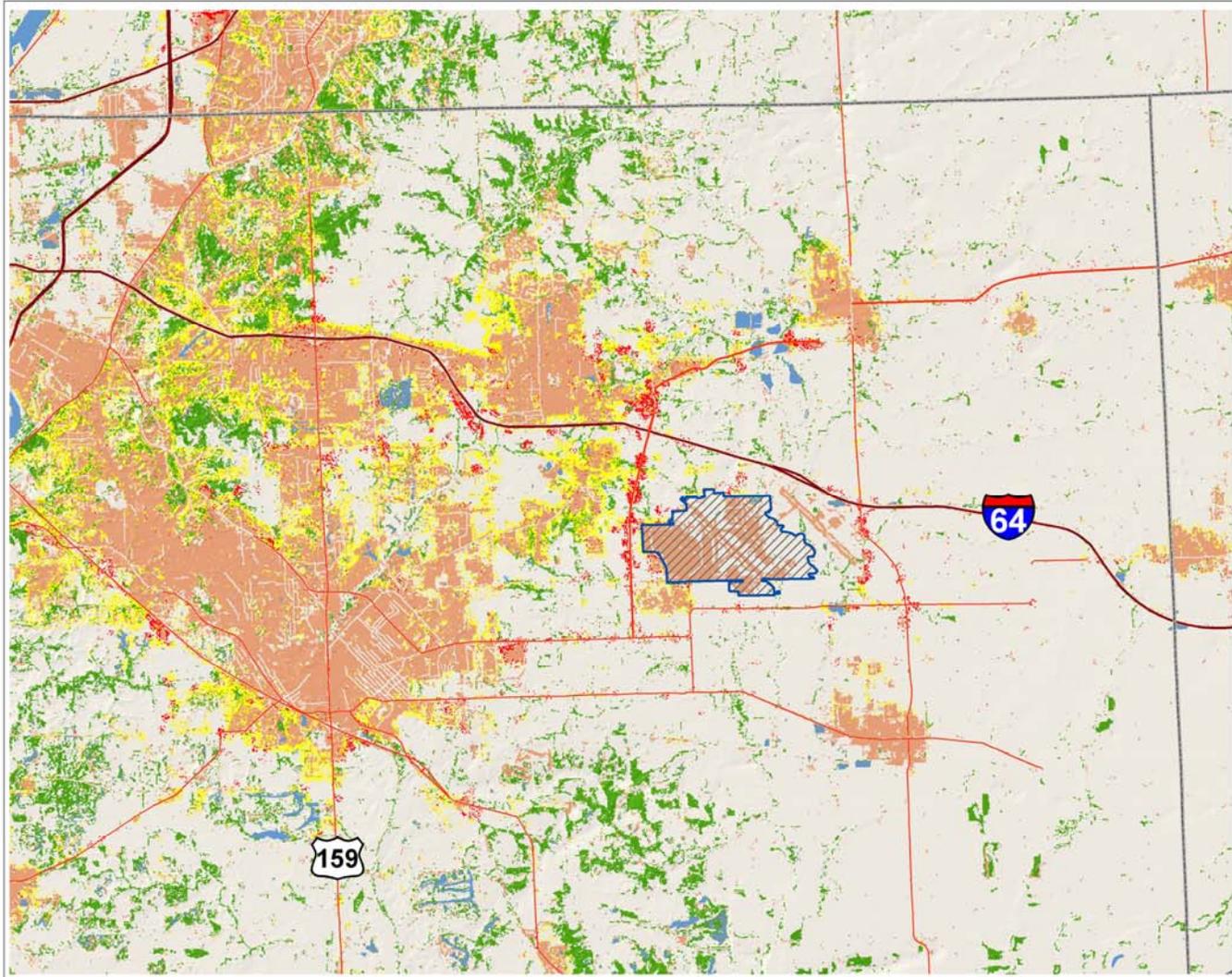
0 0.9 1.8 Miles



EAST-WEST GATEWAY
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Creating Solutions Across Jurisdictional Boundaries





Immediate Scott AFB Region

2020 Landuse Change Business as Usual

- Interstate
- US route
- State route
- State Line
- County Boundary
- Scott AFB
- New Residential
- New Commercial
- Developed
- Forest
- Others
- Water



0 0.9 1.8 Miles

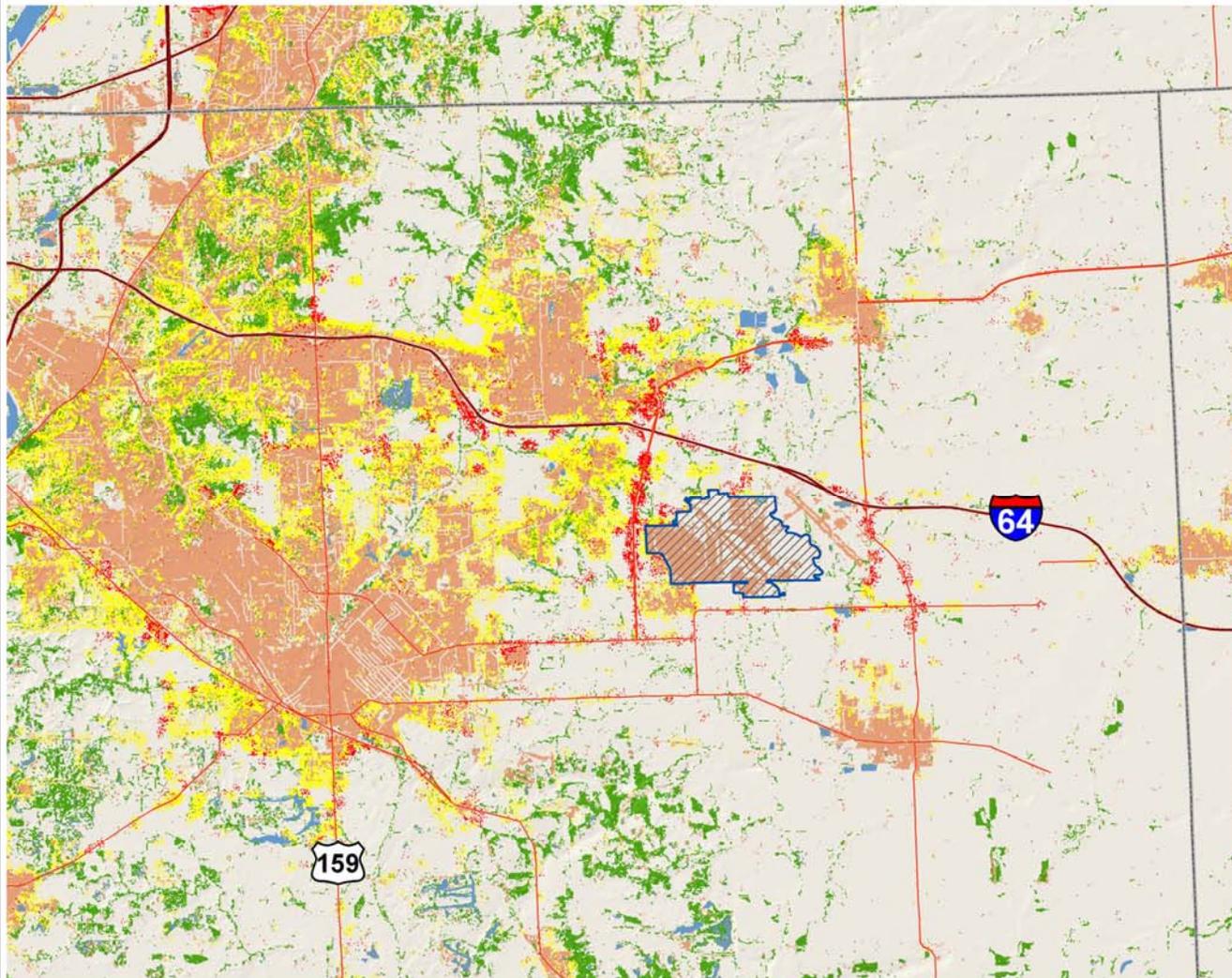

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 Creating Solutions Across Jurisdictional Boundaries


leam
 Center for Land Use and Environmental Assessment

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Immediate Scott AFB Region

2030 Landuse Change Business as Usual



- Interstate
- US route
- State route
- State Line
- County Boundary
- ▨ Scott AFB
- New Residential
- New Commercial
- Developed
- Forest
- Others
- Water

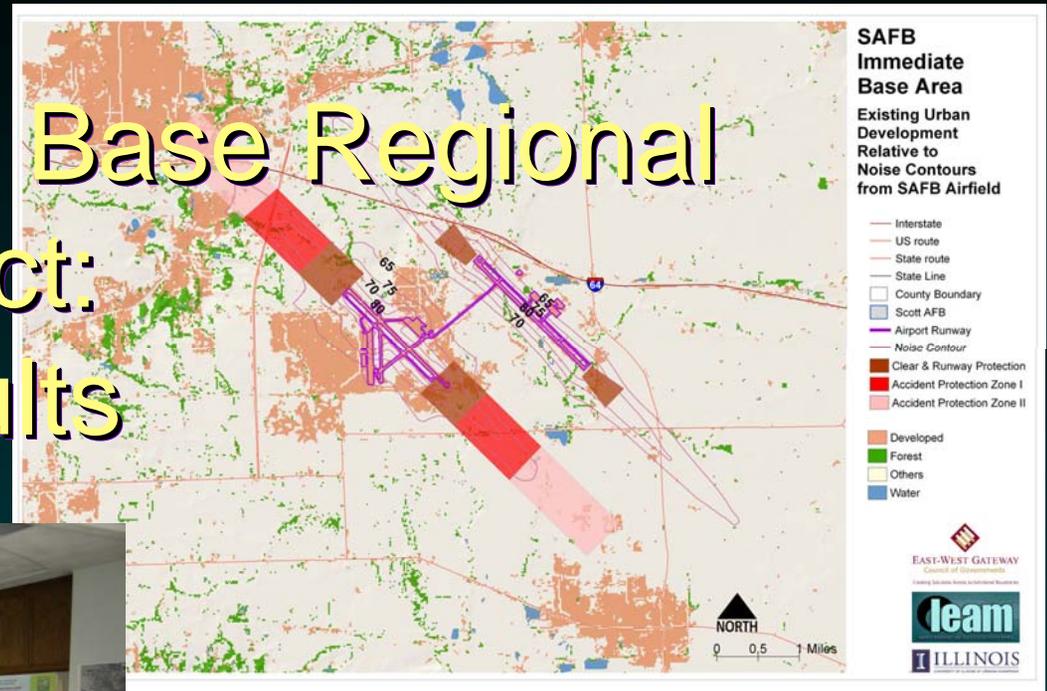


0 0.9 1.8 Miles

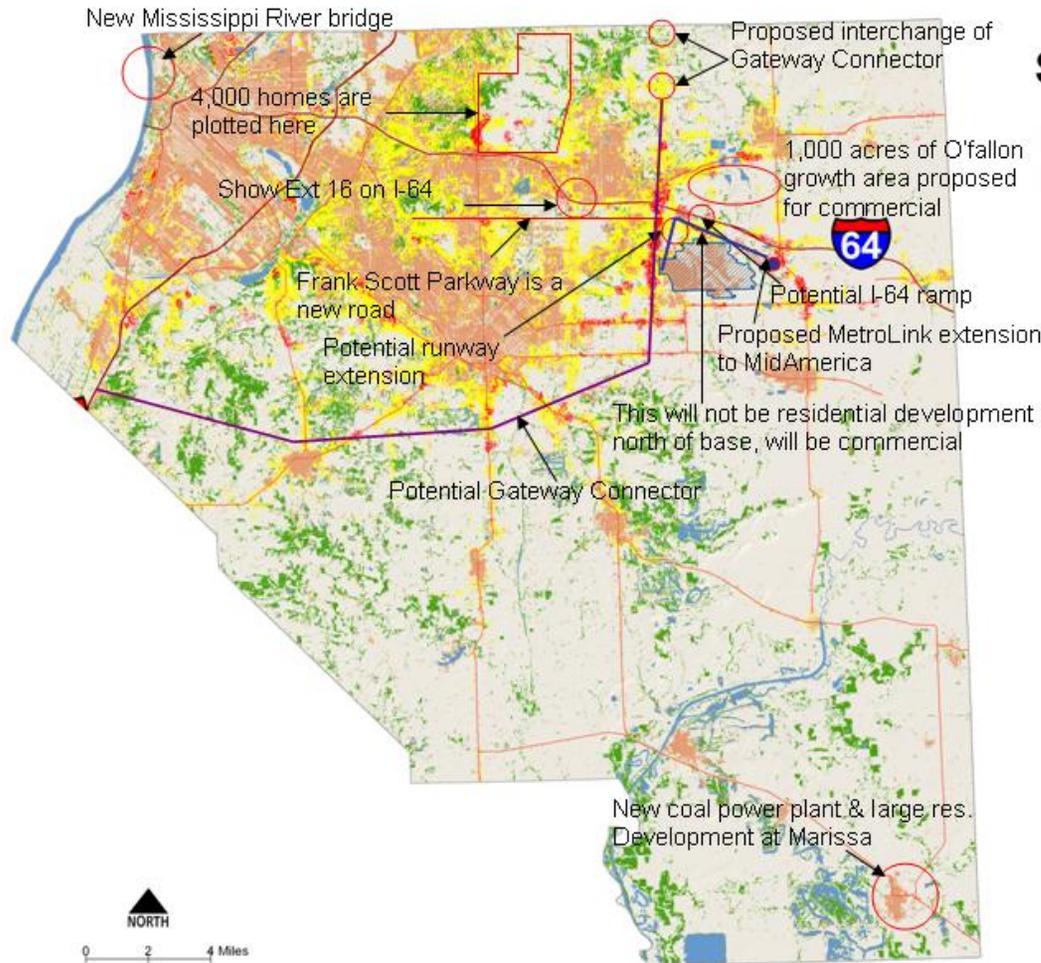

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Creating Solutions Across Jurisdictional Boundaries



Scott Air Force Base Regional Planning Project: Charrette Results



Stakeholder Comments



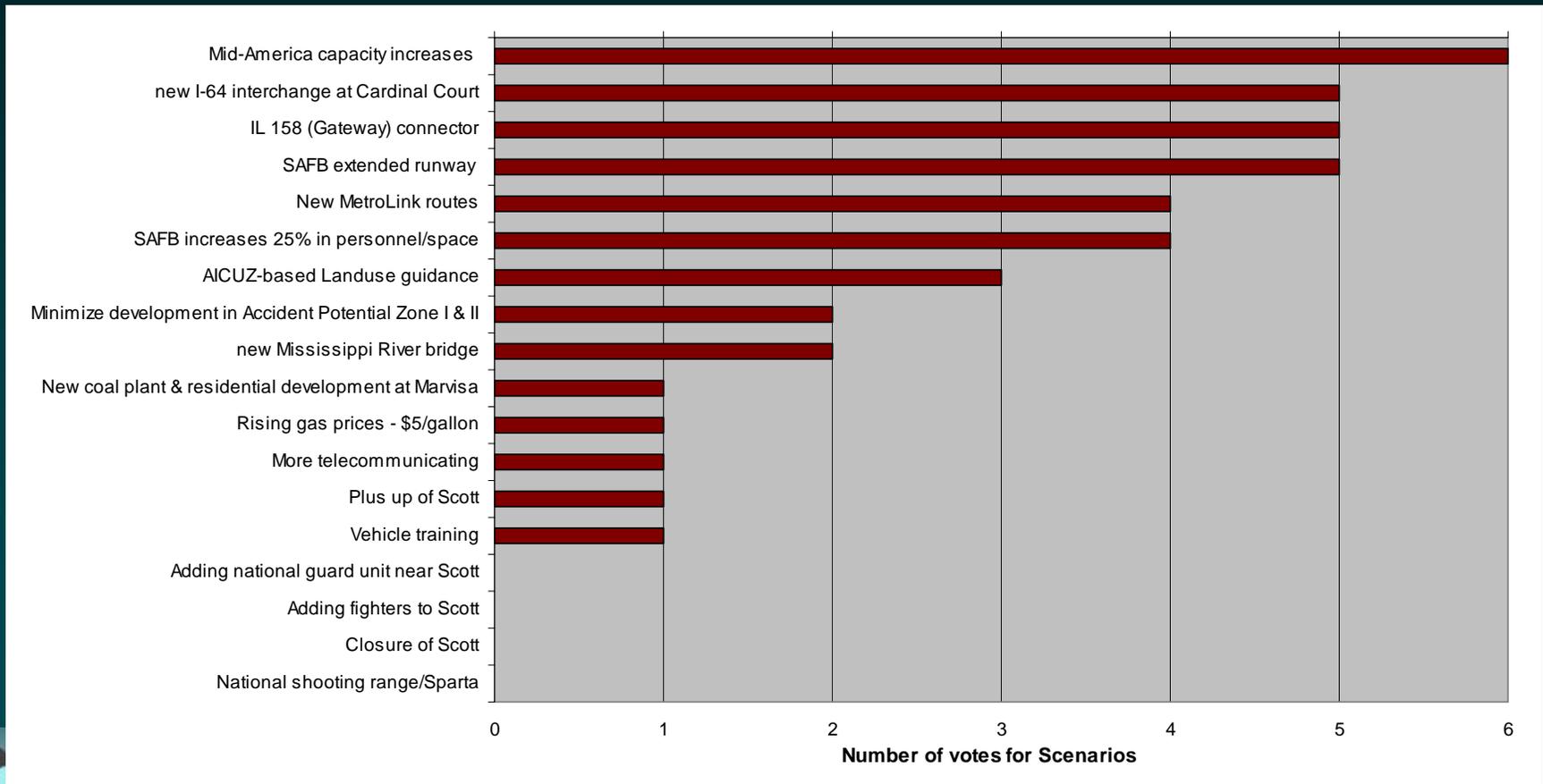
St. Clair County Higher Growth Landuse Change

- Interstate
- US route
- State route
- State Line
- County Boundary
- Scott AFB
- New Residential
- New Commercial
- Developed
- Forest
- Others
- Water

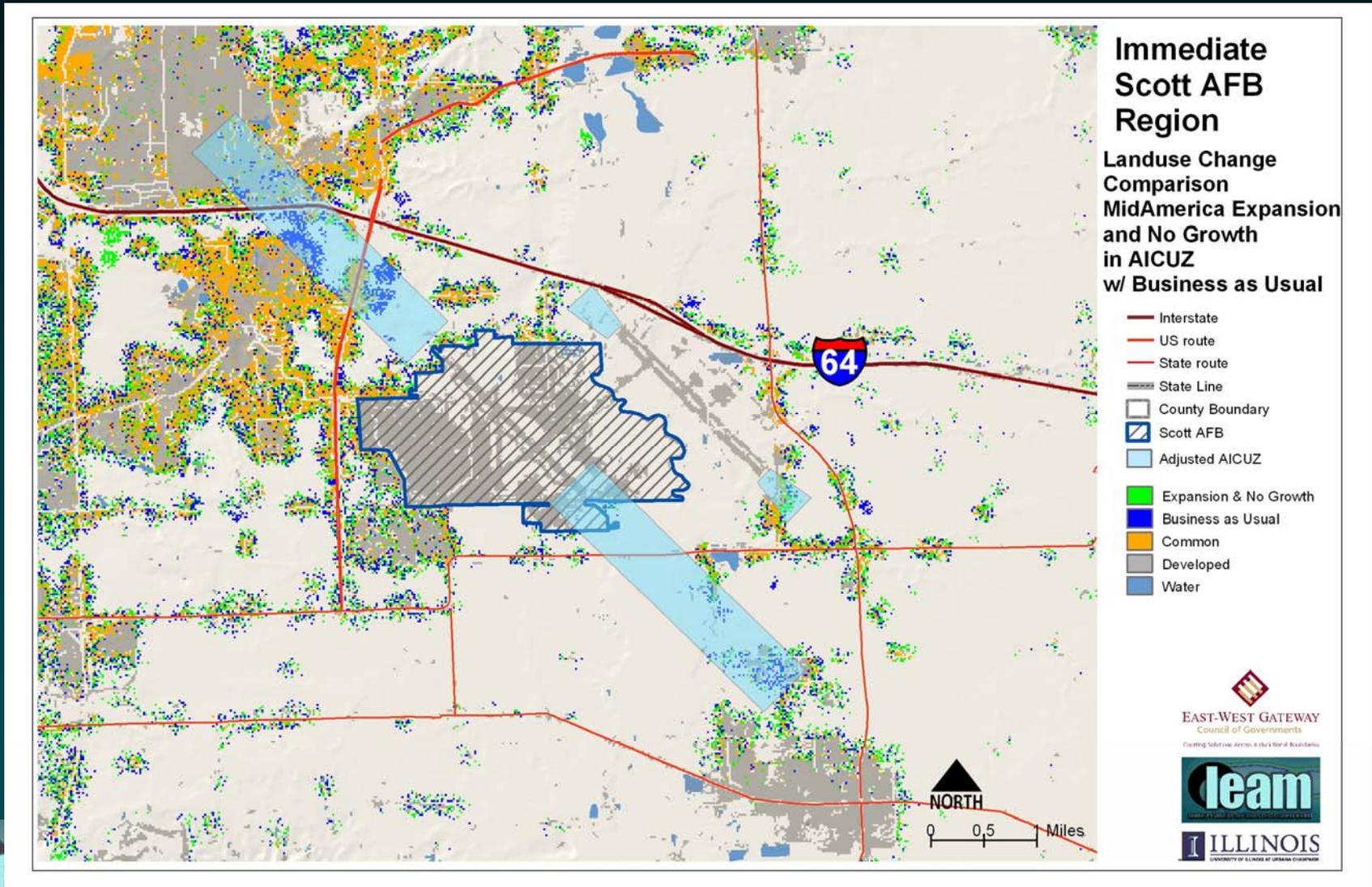


Scenarios and Priorities

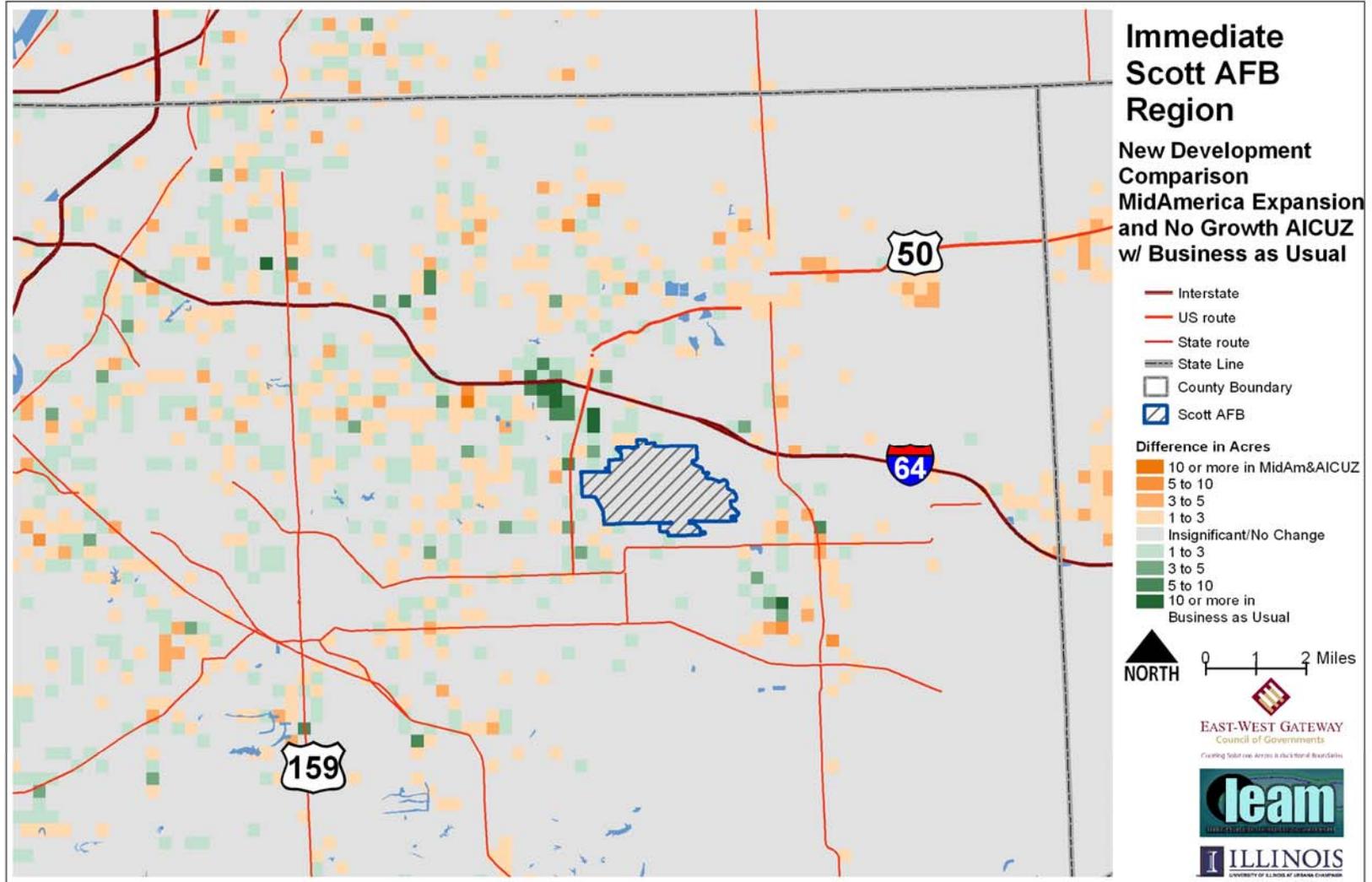
- Eighteen scenario ideas were suggested by participants
- Participants were then asked to vote for their top five scenarios

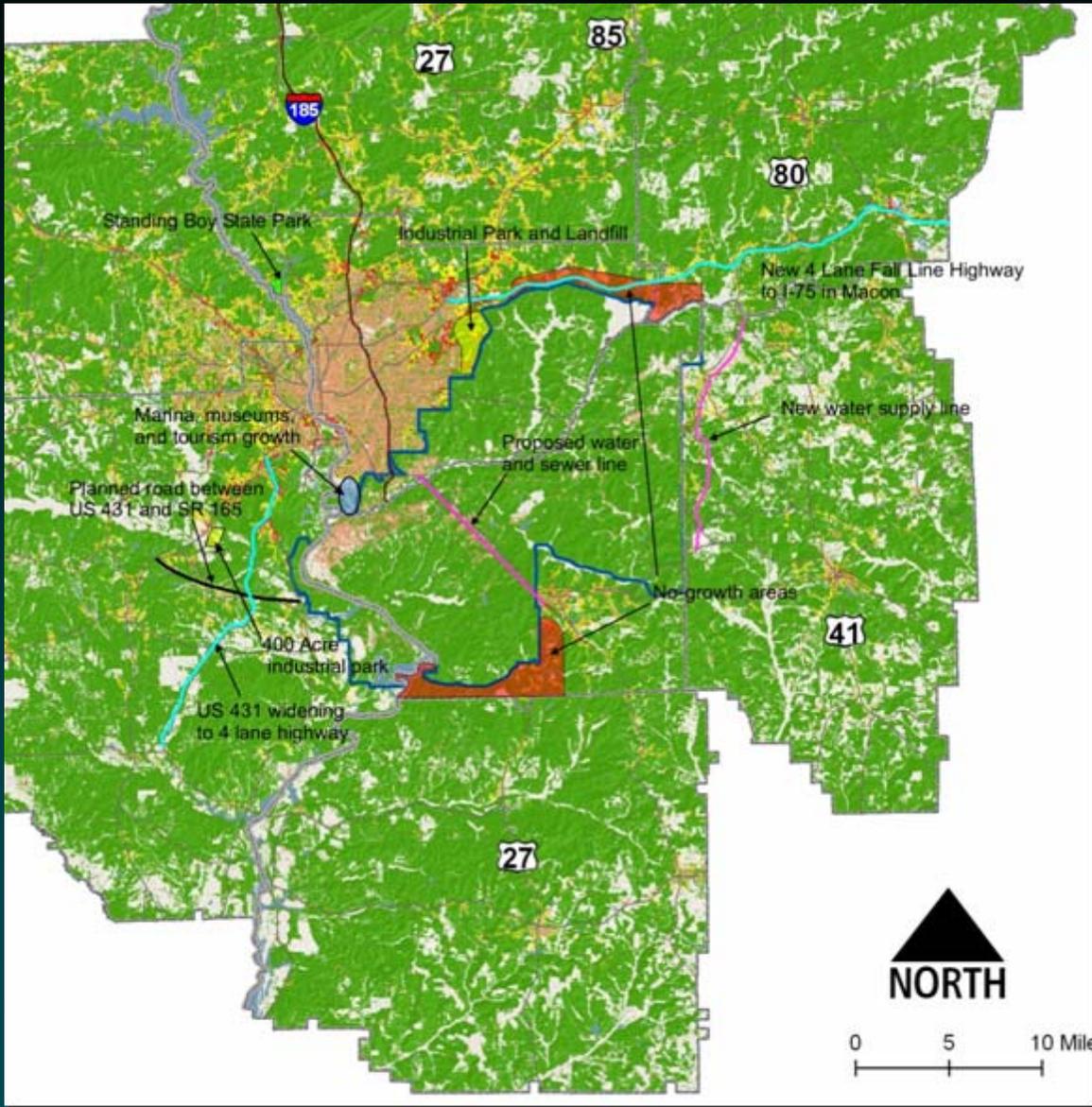


MidAmerican Expansion/Base Landuse Change/AICUZ Restrictions



MidAmerican Expansion/Base Aggregate Change/AICUZ Restrictions



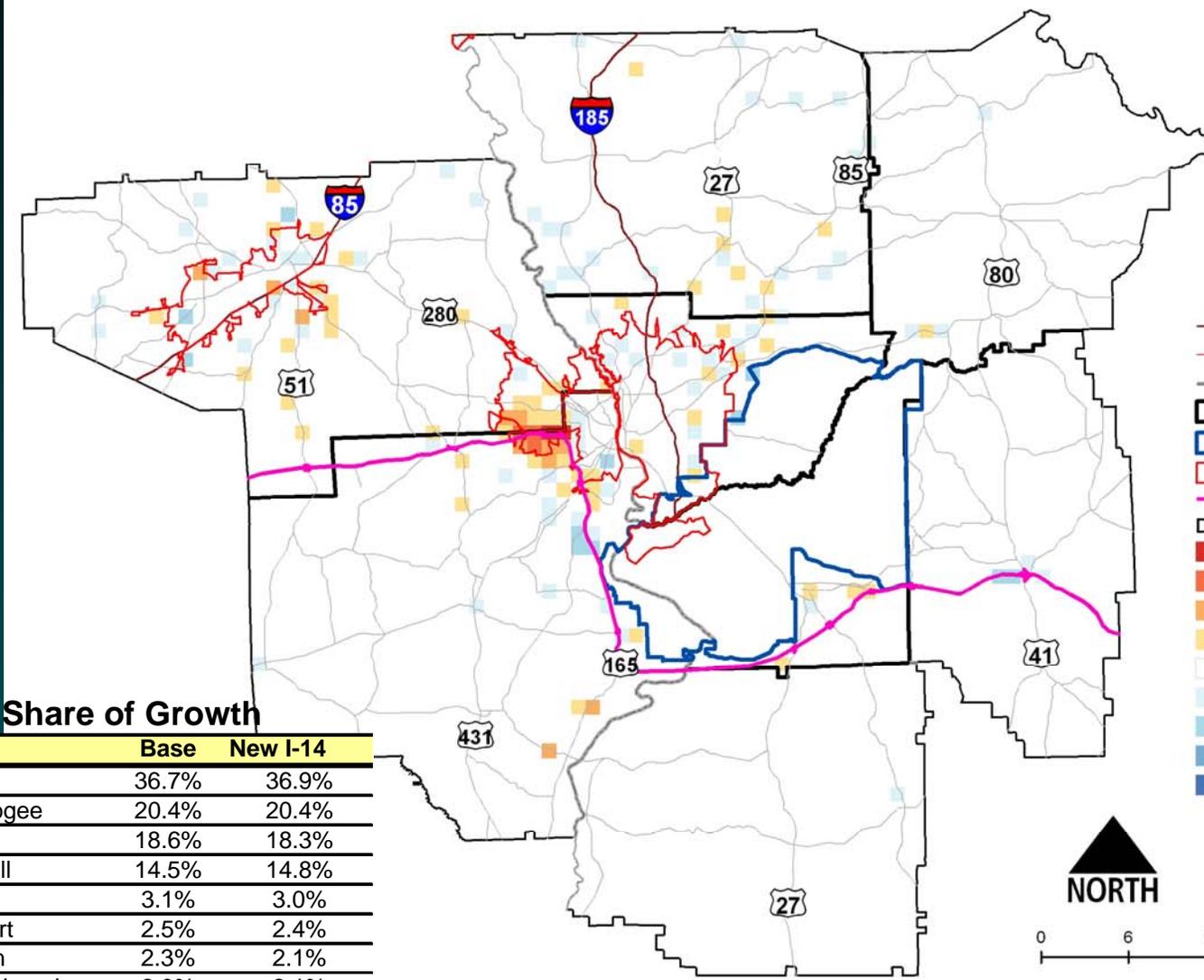


fbLEAM

New Development Comparison: New Interstate 14 with Base

Fort Benning Region

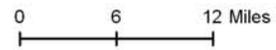
New Development Comparison New Interstate 14 with Base Scenario



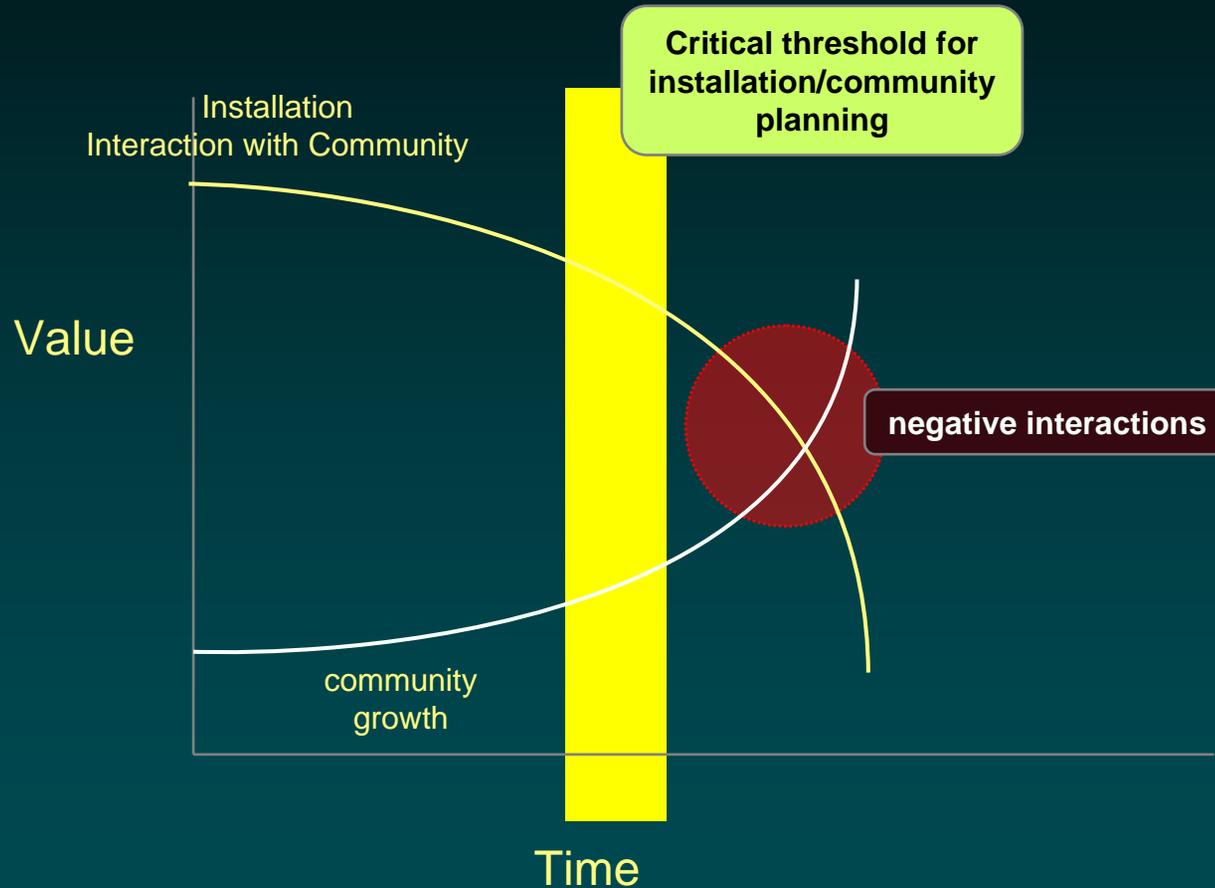
- Interstate
 - Major Roads
 - State Line
 - ▭ County Boundary
 - ▭ Fort Benning
 - ▭ Municipal Boundary
 - New Interstate 14
- Difference in Acres**
- 50 or more in New Interstate 14
 - 30 to 50
 - 10 to 30
 - 5 to 10
 - Insignificant/No Change
 - 5 to 10
 - 10 to 30
 - 30 to 50
 - 50 or more in Base Scenario

Share of Growth

	Base	New I-14
Lee	36.7%	36.9%
Muscogee	20.4%	20.4%
Harris	18.6%	18.3%
Russell	14.5%	14.8%
Talbot	3.1%	3.0%
Stewart	2.5%	2.4%
Marion	2.3%	2.1%
Chattahoochee	2.0%	2.1%

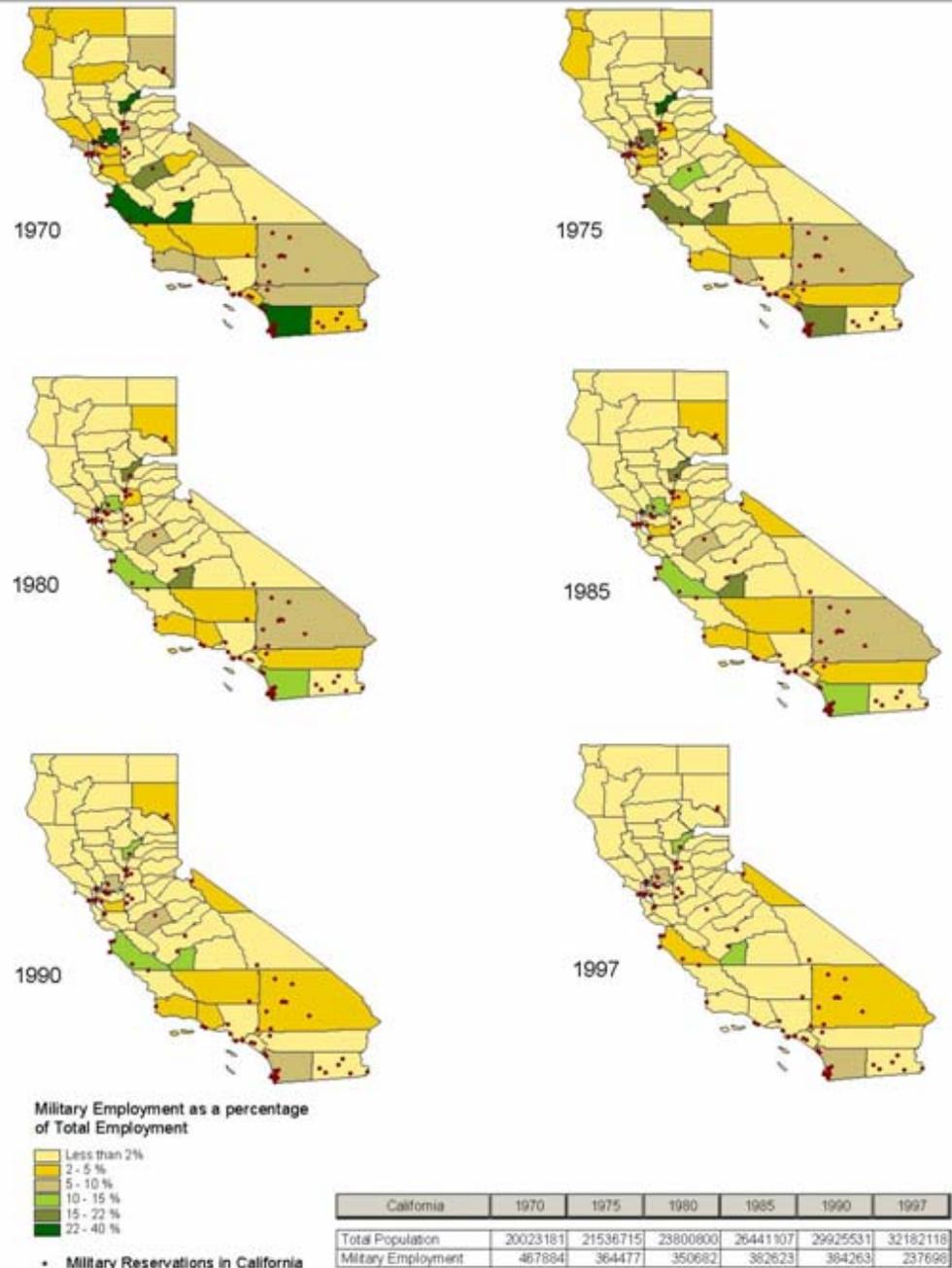


Community Interactions



Military Employment in California

Military employment as a percentage of total employment (by county)



Conclusions

Modeling is Important

- Provides people help in handling uncertainty feedbacks and lags.
- Highlights gaps in the organization's understanding of its process
- Provides a system memory
- Reveals "normal" system performance
- Facilitates experimentation
 - What if?
- Provides a common, analogic frame of reference
- Reveals emergent properties of a system.

Next Steps?

- Dealing with multiple futures
 - Data model, interface
 - Data mining strategies
- Applications?
 - Value added to BRAC/JLUS processes
- Making LEAM more available
 - LEAMgroup

Contact Information

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