

Sustainable Development Planning Tools for MPOs and State DOTs

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Sustainable Development Planning

- Don't harm future generations. Long-range view.
- Objectives:
 - Economic Welfare
 - Social Equity
 - Environmental Quality
- I suggest a Public Policy Analysis framework: "It is better to be roughly right than exactly wrong" (don't leave things out) = **Long-range comprehensive planning.**
- MPOs and State DOTs now do medium-range planning for narrow objectives. They ignore most impacts.
- No Federal requirements for alternatives analysis, long-range simulations, or comprehensive measures in state or regional transportation planning.

Global and U.S. Progress on Sustainable Development Planning

- Global: Aggregate income up; income disparity worse, more starving people; greenhouse gases worse, fisheries crashing, habitats being destroyed.
- U.S.: Income up; income disparity worse; greenhouse gases worse, AQ better, WQ same or worse, habitats destroyed.
- **So, need emphasis on Social Equity and Environmental Quality in measures and in outcomes.**

Role of MPOs in SD Planning

- National Governments do hard policies on:
population, immigration, religion, debt relief,
war, income taxation, infrastructure, monetary
policy, property rights, women's rights, energy and
pollution pricing, welfare/health care/retirement, etc.
- State Governments do:
rail and freeways, state habitat plans, land use laws, local govt.
authority, local finance, school finance, etc.
- MPOs do:
transportation planning and advisory land use planning.

But, transportation systems affect everything. We need a broad accounting of their impacts. So, Transportation Planning, if done well, becomes Sustainable Development Planning.

Imminent Sustainability Problems

- **Climate change may be much larger and faster than we have thought.** The NRC Abrupt Climate Change book (2002) shows temperature changes as large as 30 degrees F. over a few decades, during the last 400,000 years.
 - The ocean thermohaline conveyor belts are probably the triggers for such large changes. Arctic ice melt is now reducing the salt concentration in the N. Atlantic...
 - A scenario report for DOD (Schwartz and Randall, 2003) describes a middle climate scenario and the political outcomes include continental food & water shortages and wars.
- Oil prices are likely to rise soon, due to increased demand. More oil wars likely. More retaliation in U.S.

Policies for SD Transport Planning

- Clean, high-mpg vehicles. Engineering cost models are available. Can account for higher purchase and operation costs with travel models and urban models. Will affect travel and land use.
- Low-cost urban systems (walk, bike, transit; higher densities; mixed land uses). Urban models recently available.
- Economically efficient urban systems (pricing of travel and parking). Ditto.
- Equitable transport and land use systems (transit, inclusionary housing). Ditto.
- U.K. studies of least-emission urban forms found that coordinated land use & transport policies are necessary. Need urban models.
- I have done studies of various transportation and land use policies, using travel models and urban models. We used economic efficiency and equity measures.

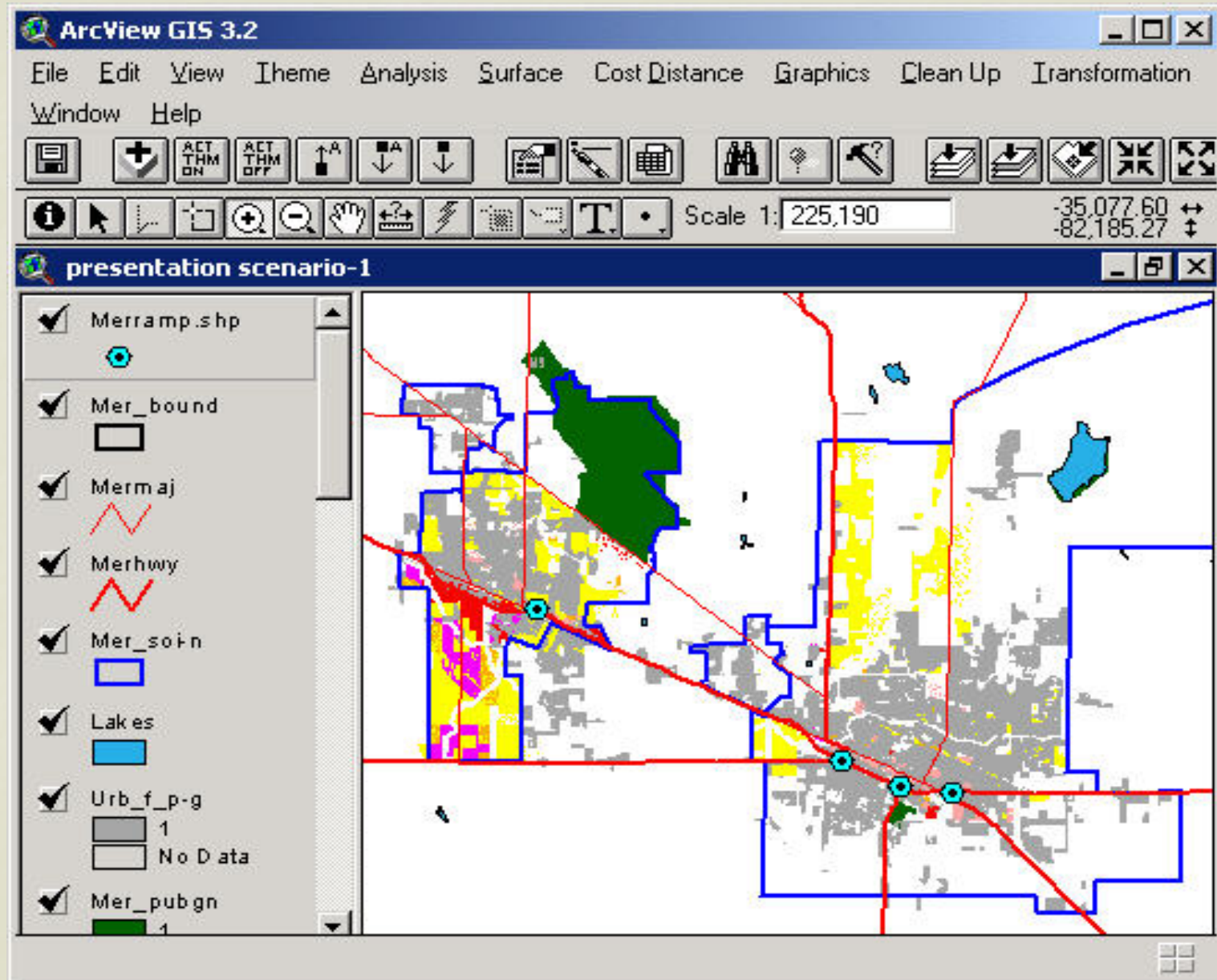
Calif. Demonstrations: Small MPO

- **Merced Co. Assoc. of Govts.**
- 211,000 pop. in 2000. San Joaquin Valley. Severe AQ nonattainment (Ozone and PM). Worsening. High population growth rate.
- USEPA and FHWA Partnership for Integrated Planning demonstration. Calif. DOT supports and funds.
- All Fed., St., and local agencies together, doing RTP using land use and travel models.
- Selected UPlan, my simple GIS land use allocation model, iterated with their 3-step travel model. Land uses are allocated in 50m cells.

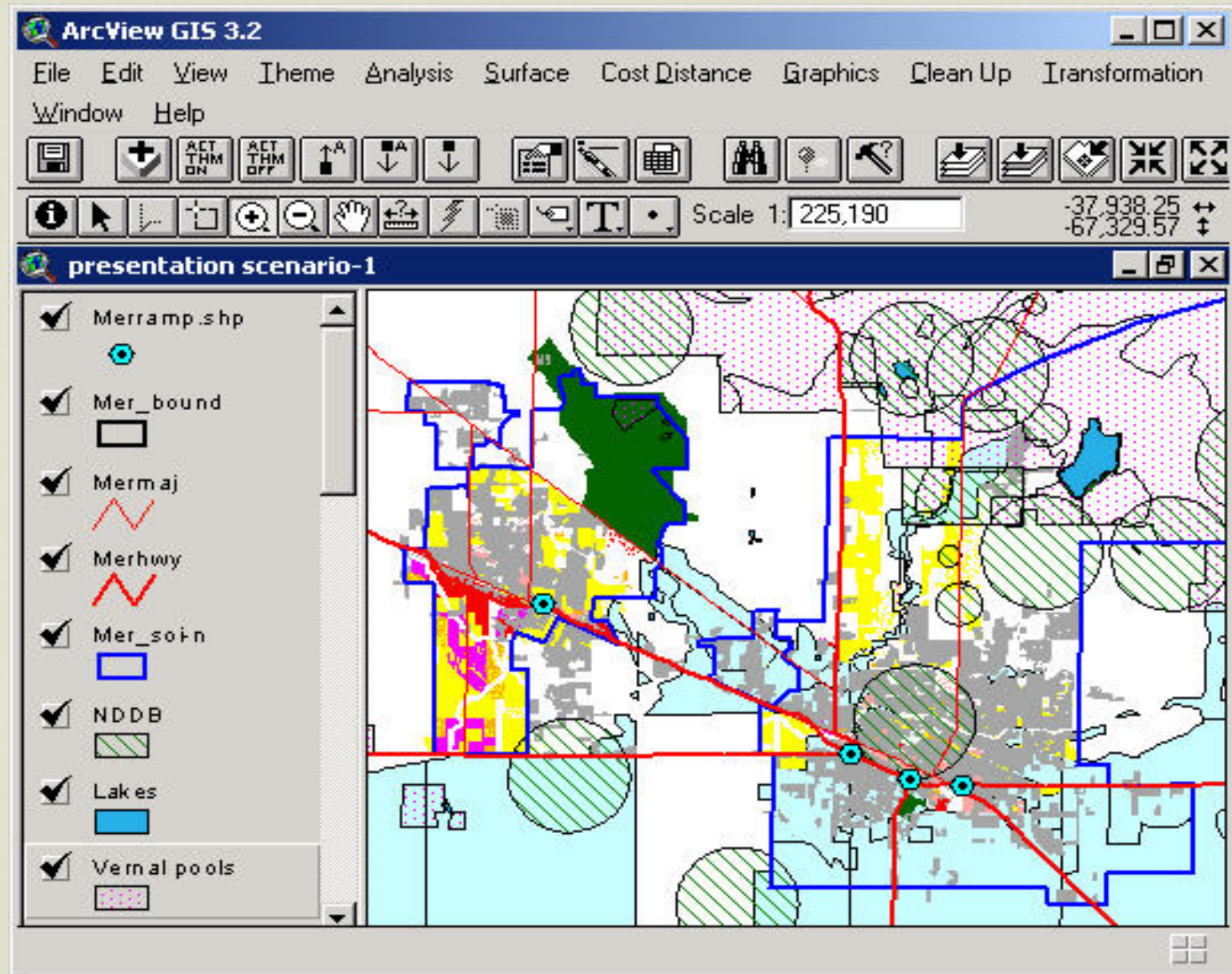
Merced Co., cont'd

- Attention to effects of urban growth on habitats and ag. lands. UPlan can also link to models that forecast erosion and water pollution. Models done in FY 03. Application in FY 04.
- Travel model will give mobile emissions and could give energy use in vehicles.
- Will add mode choice to travel model soon. Then, could get traveler surplus (Small-Rosen) by household income class. Partial economic welfare & social equity measures.
- Fed. and St. agencies finding Env. Planning hard to do. Used to regulating. Ex: How much habitat is enough?
- **So, getting some of the SD Planning measures. Also, doing scenarios to examine tradeoffs. Not long range, though.**

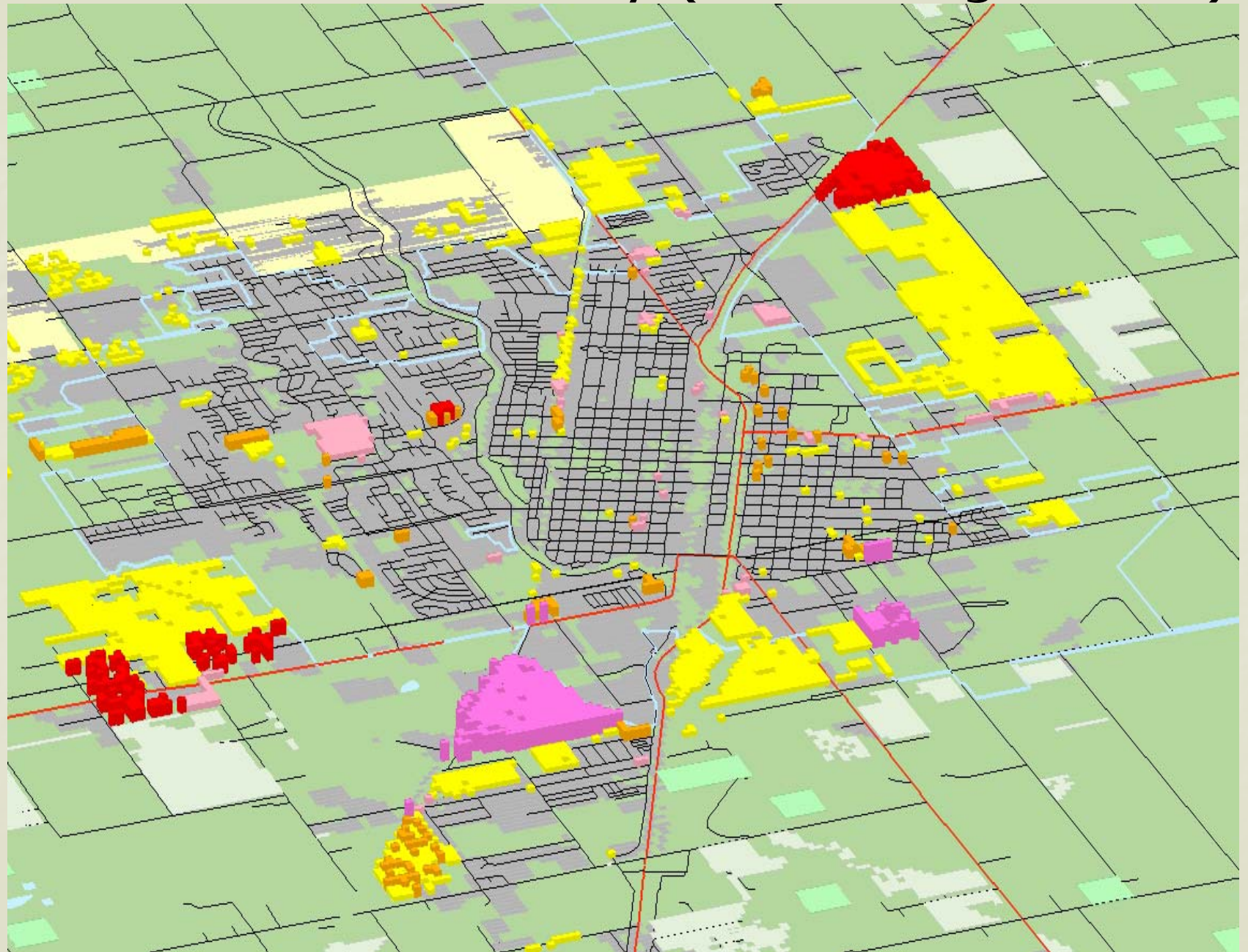
Merced Co. Trend Projection for 2025: Merced and Atwater



Merced Co. Potential Conflicts of Growth with Vernal Pools and NDDB



3D View of Merced City (extruded grid cells)



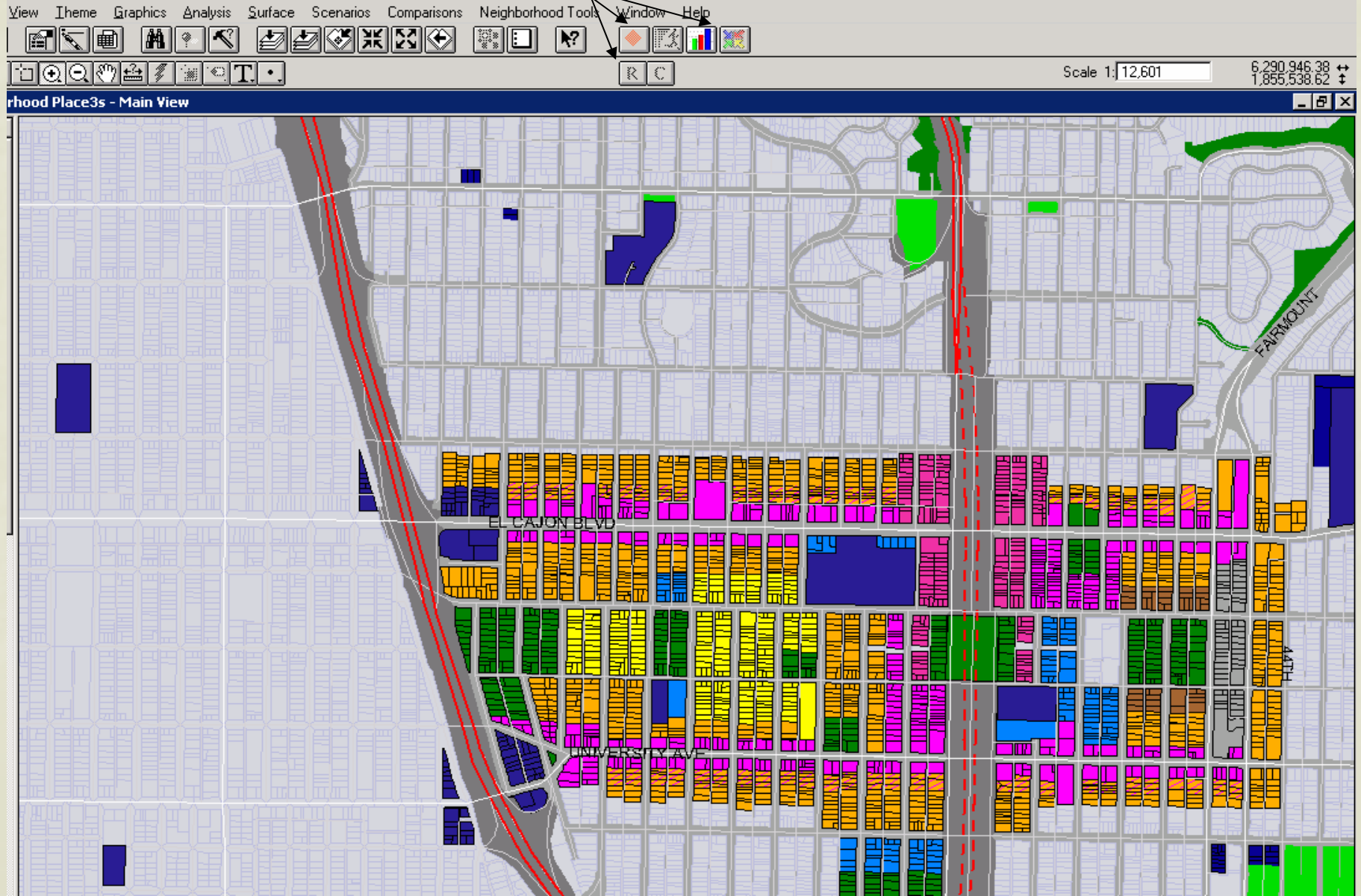
Why Use a GIS LU Alloc'n Model?

- **Cheap. Fast to apply.** Most MPOs have GIS now.
- Maps easy to understand.
- UPlan is transparent to users (rule-based proximity model). Other GIS models are not (logit choice, fuzzy logic, etc.). WhatIf? is a similar proprietary model.
- **Gets MPO started on urban modeling.** Also, admitting that changes in accessibility affect land development. Systems thinking.
- Can move to more complex models, later. Always need GIS for data input and output.

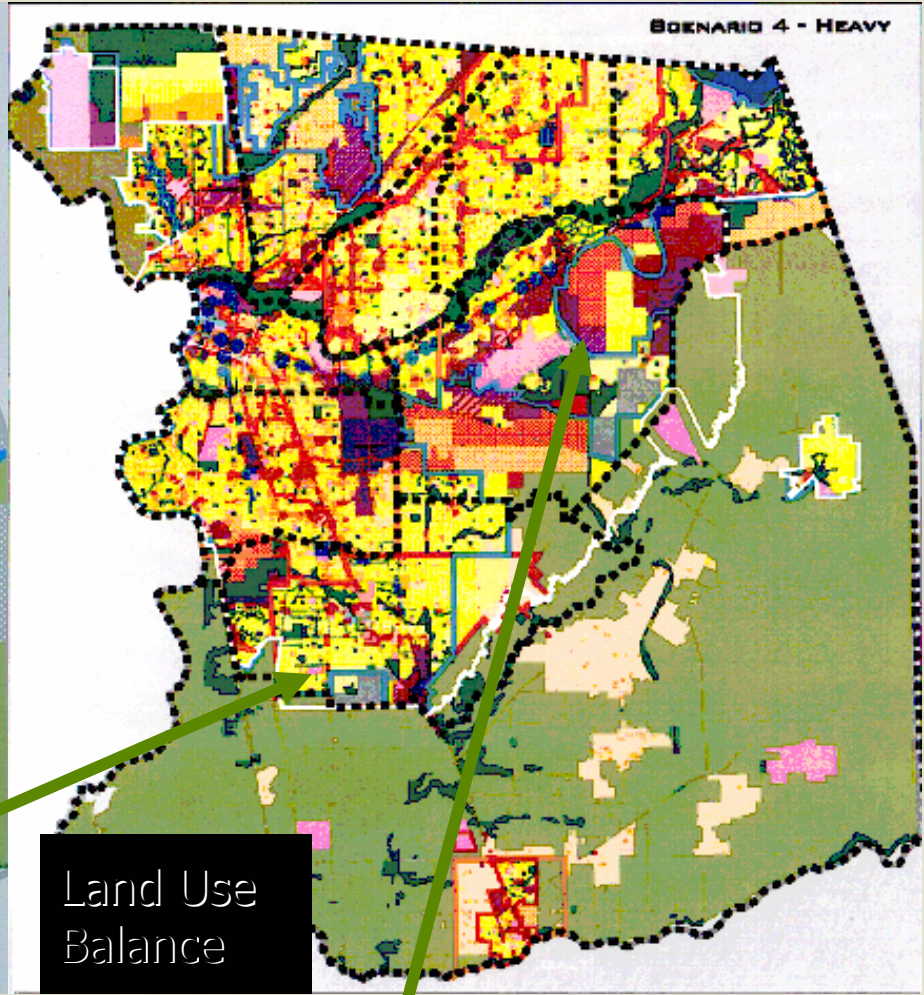
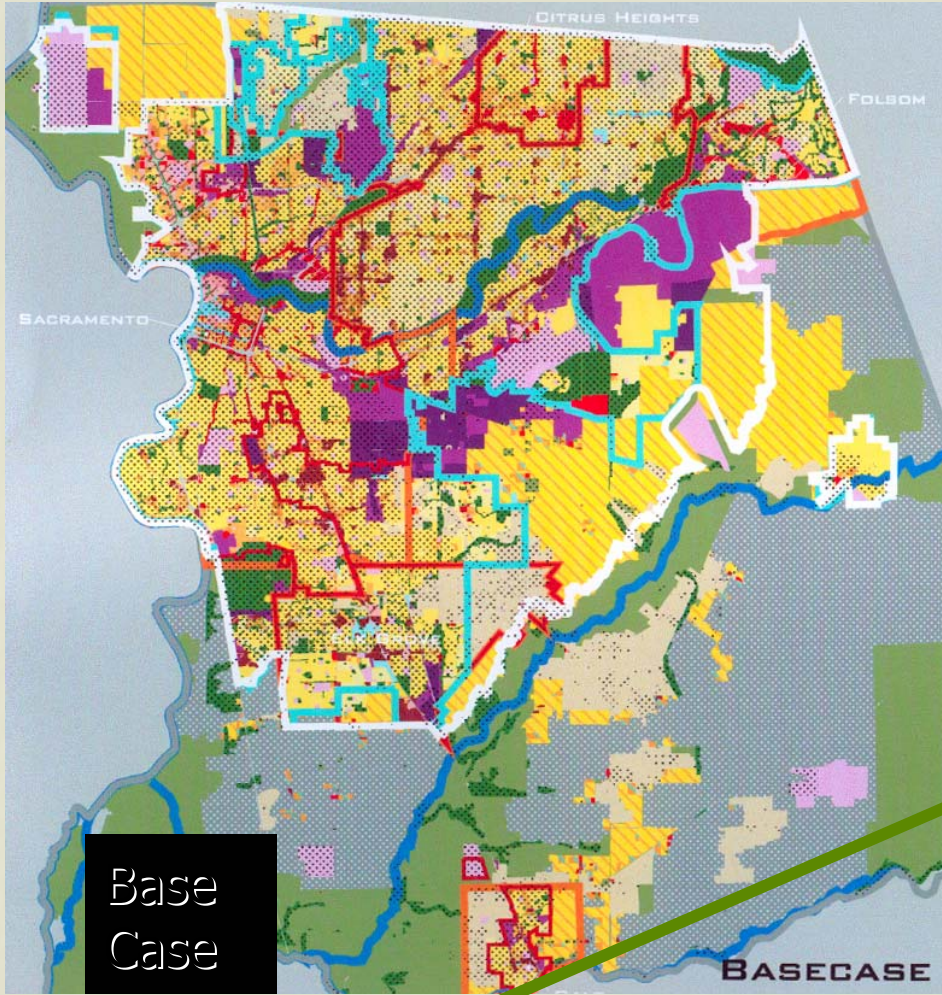
Calif. Demonstrations: Large MPO

- **Sacramento MPO (SACOG).** 1.9 M pop. 2000.
- May not show AQ conformity in next MTP round, due to new State emissions model (SUVs, speed curves).
- Three new freeways in MTP. Will induce sprawl onto ag. lands and habitats. Lawsuits.
- Advanced 5-step travel model. LRT with infill. The central county has a UGB, but sprawl in outer counties.
- Did long-range public scenarios in 2003-04. On SACOG Web site. Used PLACES to redesignate land uses.
- Successful, due to detailed (parcel) data. Started at the neighborhood level, then county, then region.
- Will model regional scenarios with MEPLAN and PECAS.

Place³s Toolbar Additions



Base Case vs. Land Use Balance



Base Case

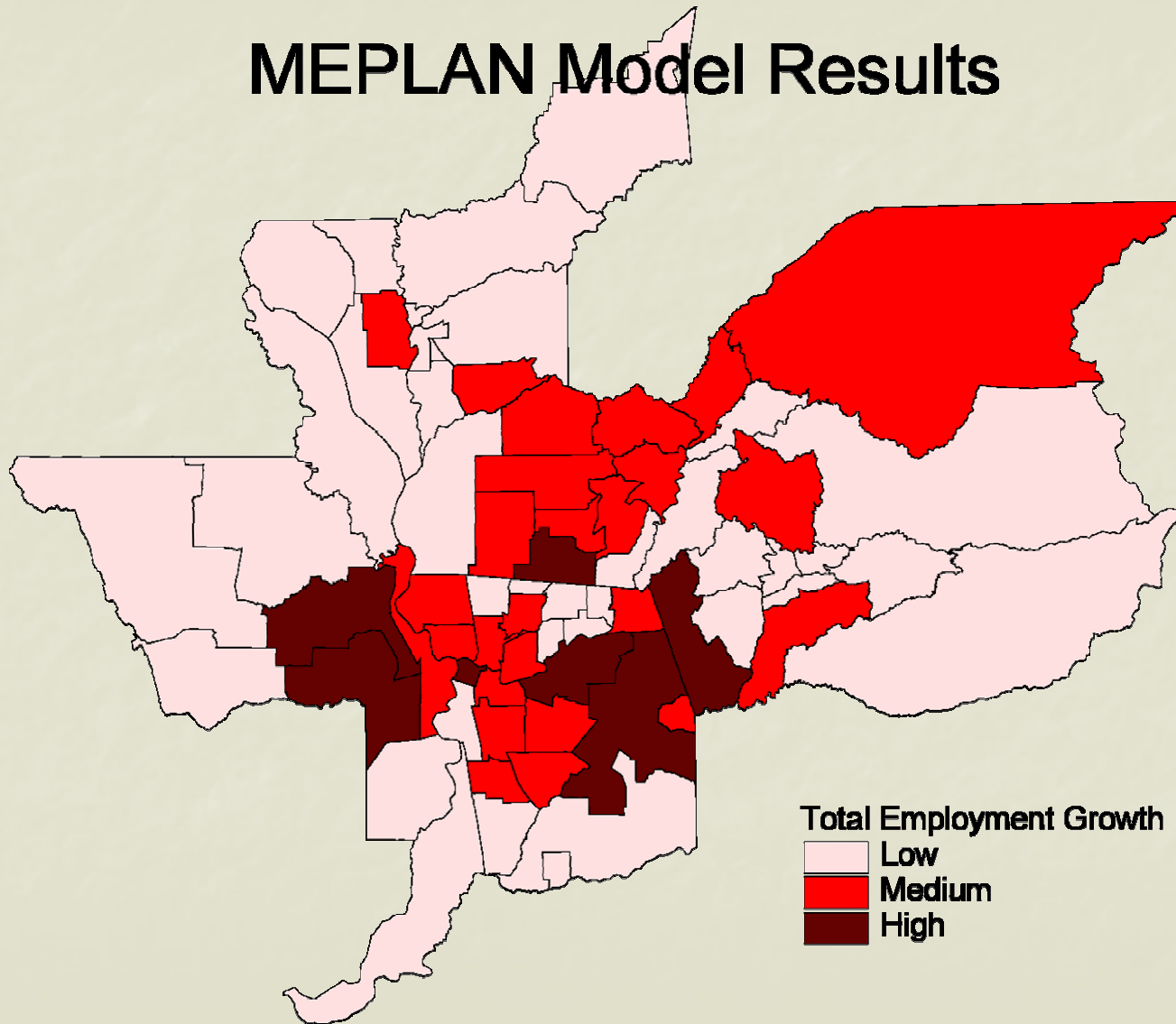
Land Use Balance

Jobs added to housing-rich Elk Grove

Housing added to job-rich Rancho Cordova

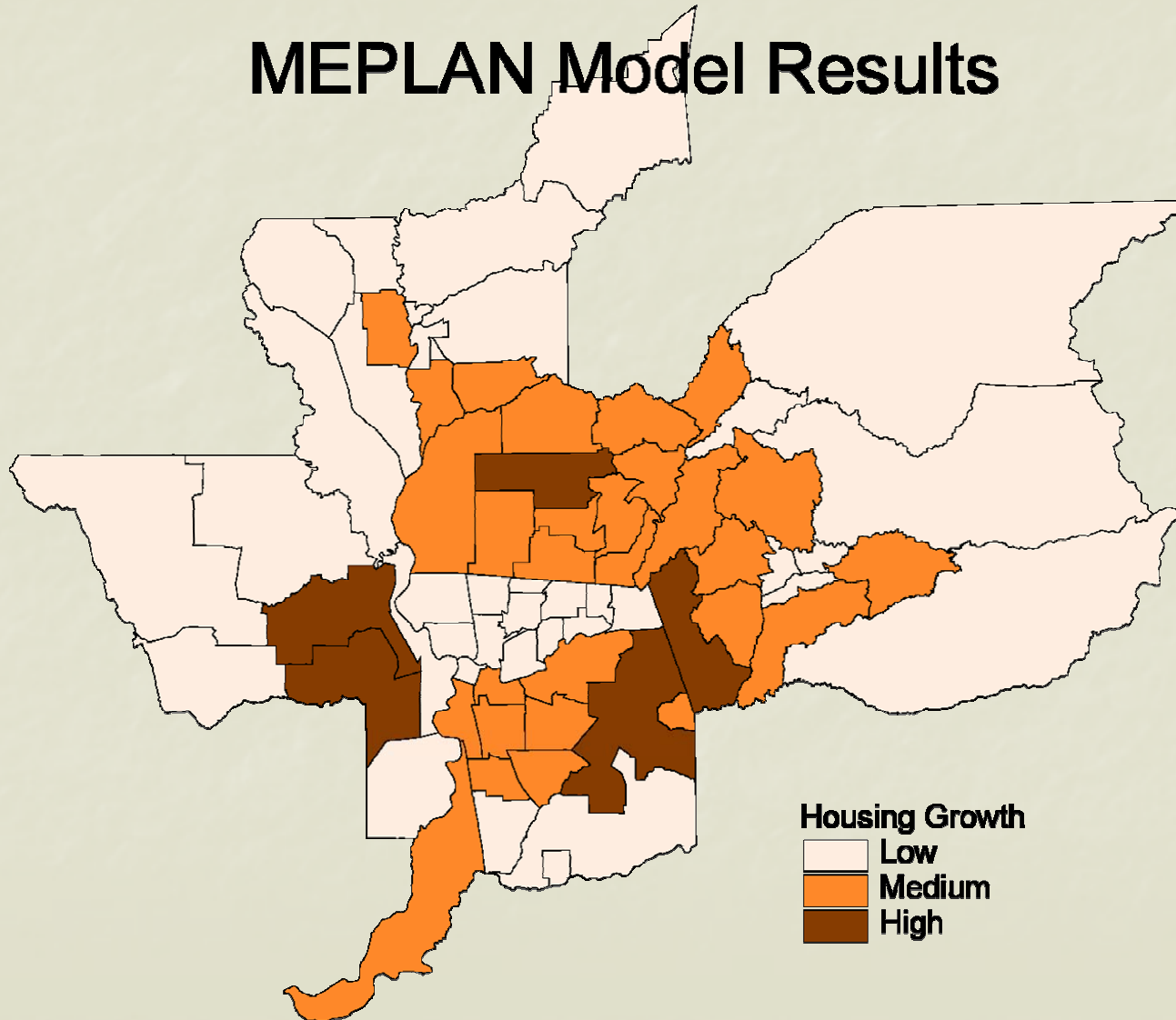
Trend Projection 2050 - Jobs

MEPLAN Model Results

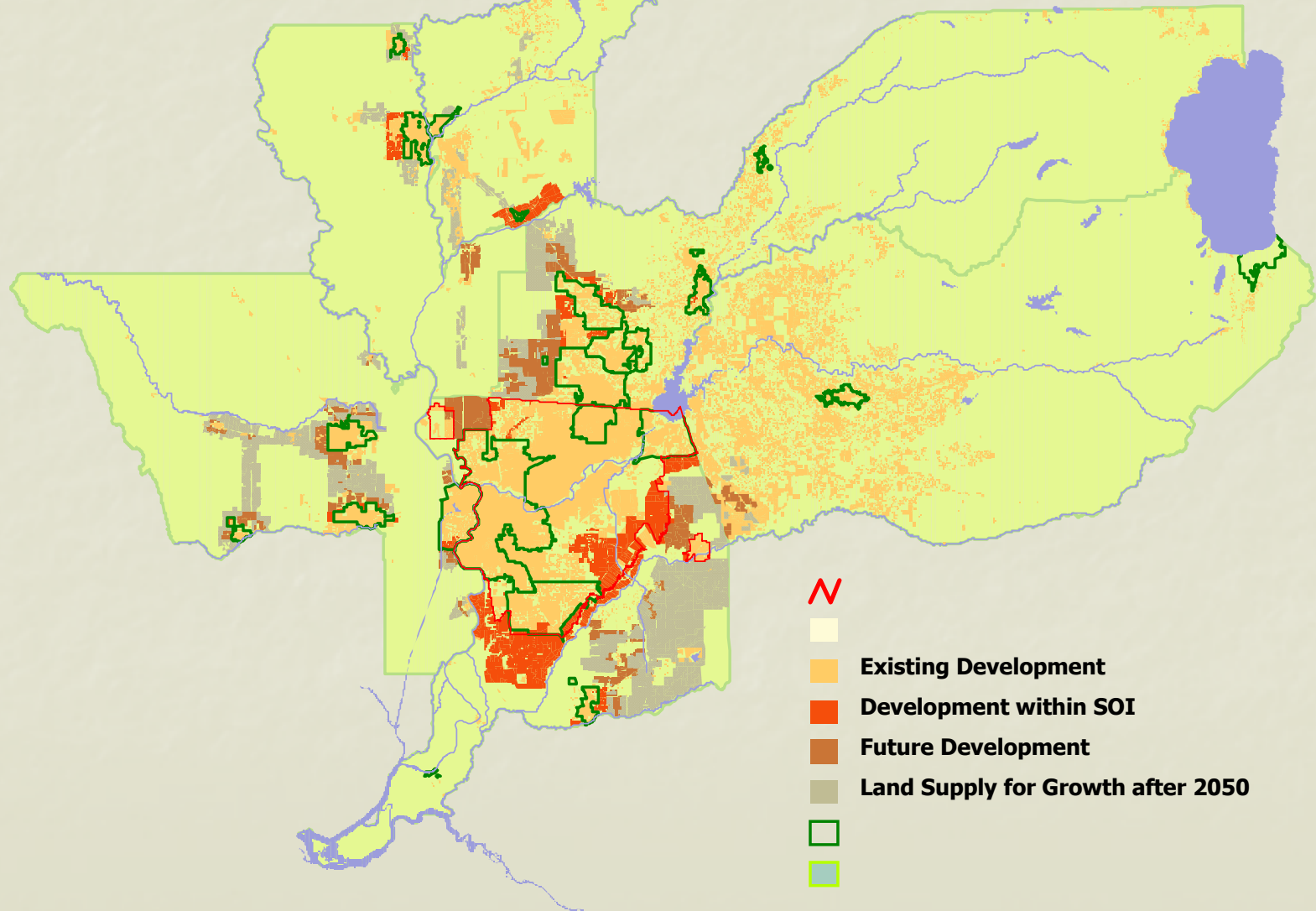


Trend Projection 2050 – Housing

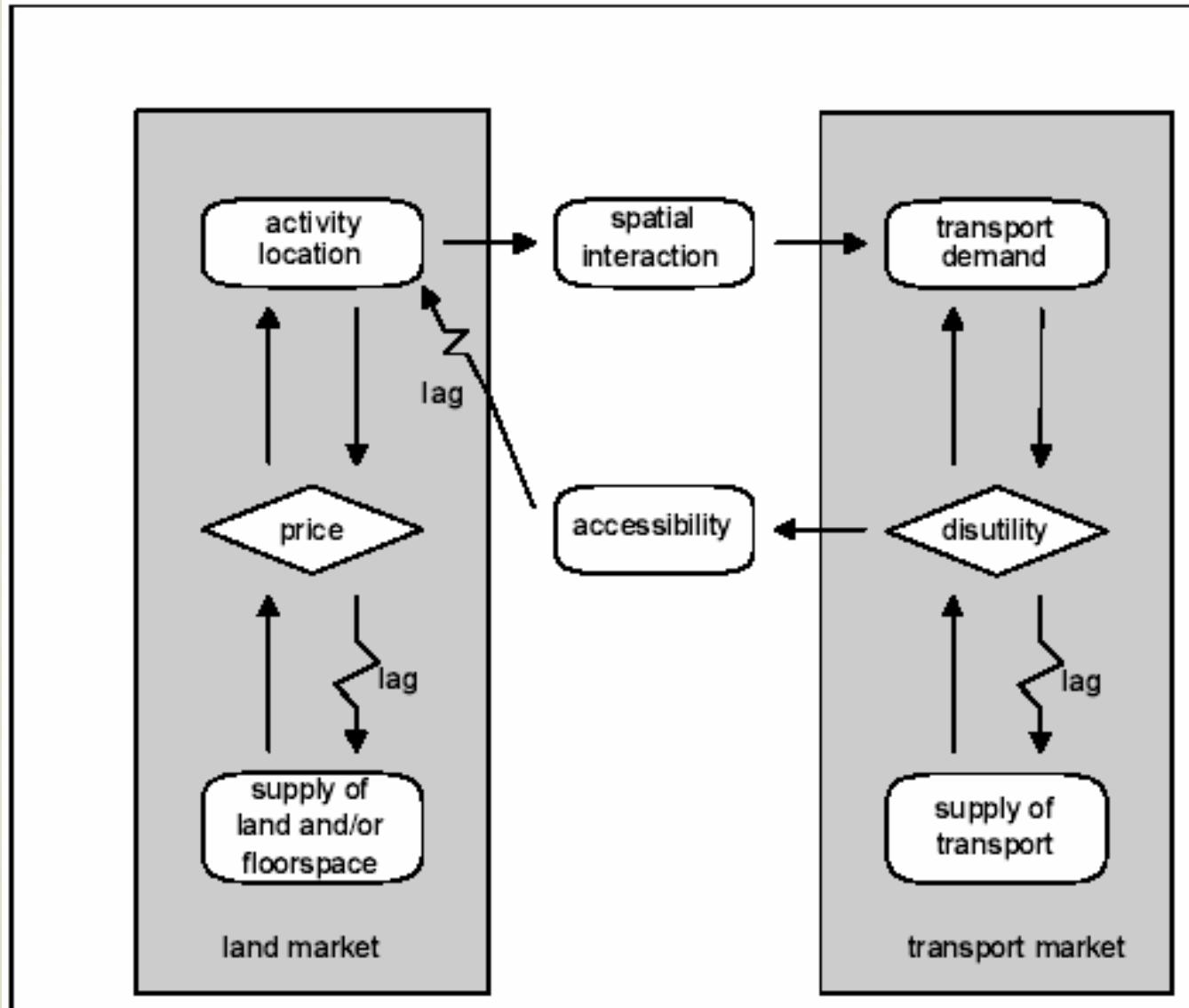
MEPLAN Model Results



Preliminary 2050 Growth Projections, Using MEPLAN and PLACES



Complex Models: Markets in Land and Transport Are the Basis of MEPLAN



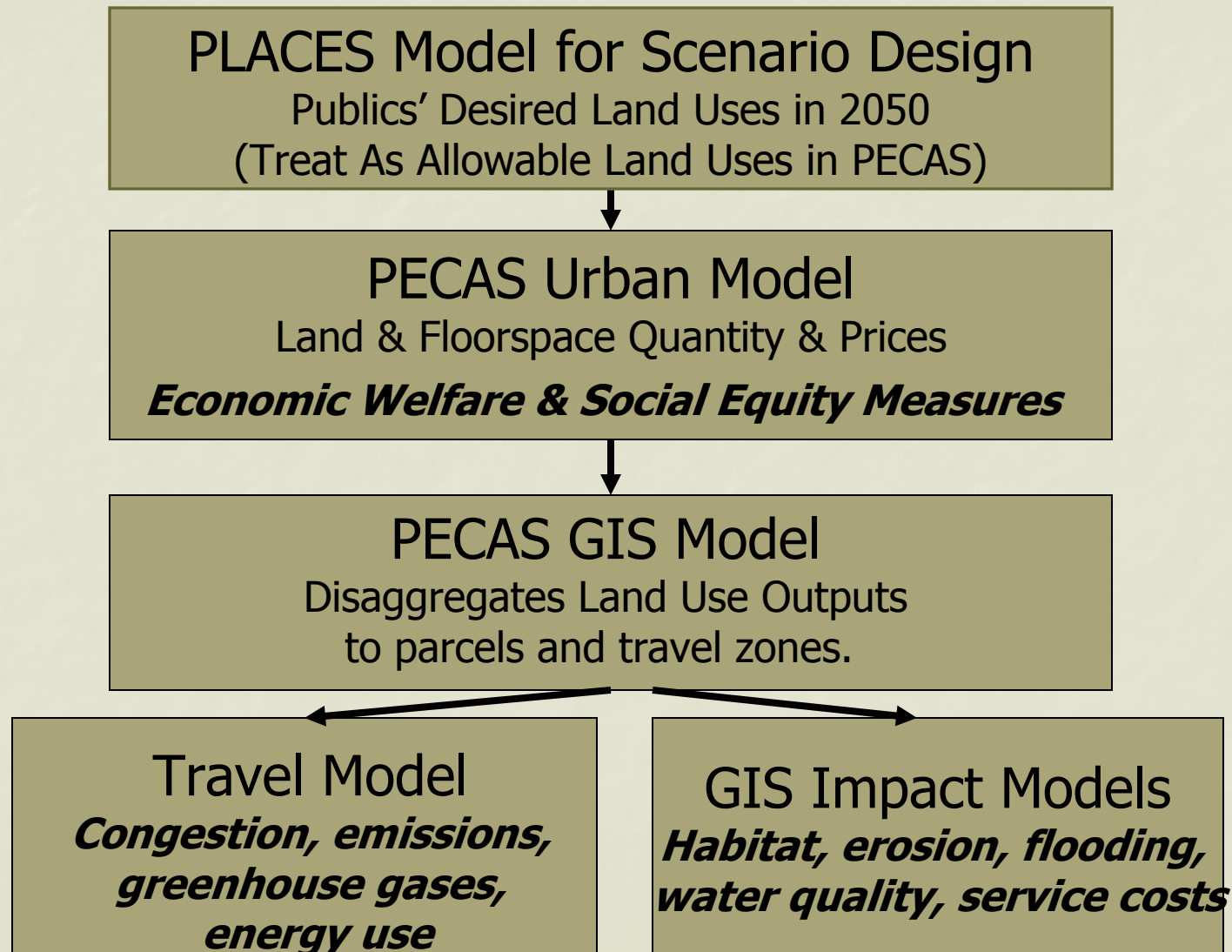
SACOG's 2050 Blueprint Study

- Trend 2050 Scenario Problems:
 - Per capita increases in daily VMT (33%) and travel time (85%).
 - Loss of 43% of wetlands and oak woodlands! FESA problem.
 - Loss of 10% of farmlands. Unpopular.
- Have a MEPLAN model running now (zonal aggregate logit models for locators and travelers).
 - Uses full travel model networks. I am using it for broad policy analysis for local citizens groups. 2050 scenarios.
- Will have PECAS running in late 2004 (parcels and disaggregate logit models).
 - Uses the SACOG zonal travel model, but intend to develop disaggregate travel model.
 - Better economic welfare measure. I'll do testing with it.

Short-Term Improvements, cont'd

- SACOG's travel model will be upgraded to include tours, in 15-minute time periods in FY 05.
- PECAS has full sample enumeration for locators and so generates households for use in the travel model. So, can do household activity simulation. Individual traveler characteristics allows detailed economic and equity analysis. FY 06. Need funding.
- PECAS outputs at the parcel level. So, SACOG can then grid these data and run **GIS impact models** for:
 - habitat damage, erosion, WQ, loss of ag. lands
 - local service costs, costs from flooding, costs from wildfires, etc.
- Travel model will give emissions, greenhouse gases, and energy use. Can get energy use in buildings from PECAS floorspace and building age.

Modeling for Sust. Dev. Planning



SNAKES & LADDERS		Travel Models						
Land Use Models		Trip-Based Models			Tour		Activity	
		Standard	Enhanced	Complex	Aggregate	Simulation	Aggregate	Simulation
Stand Alone	Factored							
	Judgement	Fresno San Joaquin			Boise New Hampshire			San Francisco County
	Policy+Trends Allocation		SACOG Travel Model 1996	Edmonton				
Conn- ected	Rule-Based Allocation		SACOG Trav. Mod + PLACES 2004					
	Equilibrium Allocation (e.g. DRAM)	San Diego Puget Sound	San Francisco Bay Area Atlanta	Santiago Portland (now)				
	Market-Based Allocation							Portland
Integ- rated	Aggregate Economic (Input/Output)		SACOG MEPLAN 2004	London	SACOG PECAS 2005			Oregon Statewide 2004
	Disaggregate Economic Microsim- ulation							SACOG PECAS 2006

Conclusions

- SD Planning requires models that can measure **Economic Welfare, Social Equity, and Env. Quality.**
- With the **PECAS** model, we can now do the first two. (Oregon, Ohio, Calgary, & Edmonton are also doing PECAS models.)
- **UrbanSim** also gives econ. welfare and equity measures (Eugene/Springfield, Oregon; Honolulu; and Salt Lk. region models done. Seattle region model coming soon.)
- Other urban models being developed in the NYC and Chicago regions will also give economic welfare and equity measures. Several in Europe being tested.
- **GIS** and other conventional models can measure various aspects of Environmental Quality, local service costs, etc.

Conclusions, cont'd

- **So, we can now do 50-year scenarios and look at the big tradeoffs.**
 - Urban Growth Boundaries v. housing costs. Freeways and sprawl v. jobs for the poor.
- Also, test future energy scenarios, such as \$5 gasoline.
- We can get our **regional plans balanced**, by looking at all the major issues.
- Comprehensive modeling will bring **all the interest groups** to the table, as their issues are represented.

Conclusions, cont'd

- The models are available and in use.
- GIS models are inexpensive (~\$100K), but not comprehensive. Spatial economic models are expensive (~\$1 mill.) and require staff training. Comprehensive.
- Small MPOs can do GIS models and larger ones can start with GIS models and then go on to economic models.
- MPOs should see model development as ongoing.
- USDOT needs an urban modeling staff and needs to coordinate with the PROPOLIS project in the EC.

What's Next?

- Make the process **relevant** to the public with maps, birdseye oblique drawings or 3-D GIS, and narratives.
- Develop **model feedbacks** from Env. Quality to Economic Welfare. Ex: open space increases property values.
- Develop **model feedbacks** from Social Equity to Economic Welfare. Ex: high income disparity seems to cause low regional growth rates.
- The EU countries are doing the same kind of comprehensive modeling and SD Planning. See the PROPOLIS project on the Web. Spatial economic models plus GIS, for MPOs.
- For the states and the U.S., we need to use econometric models such as the REMI model. Can get welfare and equity measures. Crudely spatial (counties).

What's Next, cont'd

- Validate models carefully with historical forecasts, sensitivity testing, and heuristic use.
- Get academic units to also run models, advise MPOs, and train students.
- **Need USDOT to require alternatives in MTPs.** Need state DOTs to fund MPOs to do these alternatives analyses. 20-25 years.
- **Need USDOT to require long-range scenario exercises (40-50 years)** every three rounds of planning. Need USEPA and USDOT to fund these integrated planning exercises.
- MPOs (NARC?) need to update the Deakin & Harvey study of travel models to include urban models.
- USDOT should adopt advice on models, with NARC.