

*Acquisition and Application of
the Cellular Automaton Urban
Growth Model*

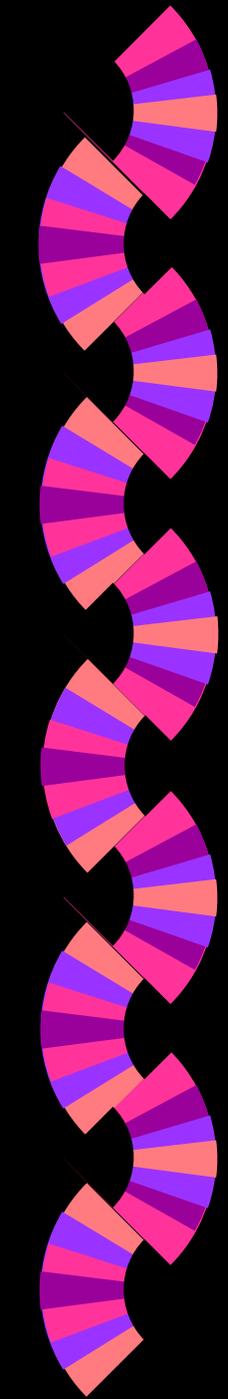
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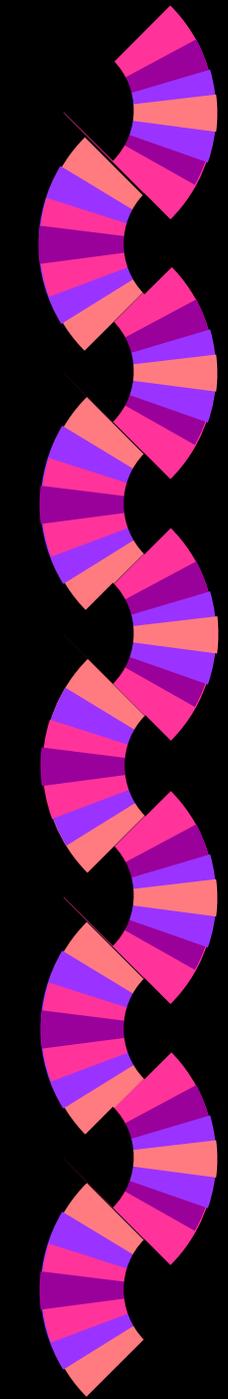
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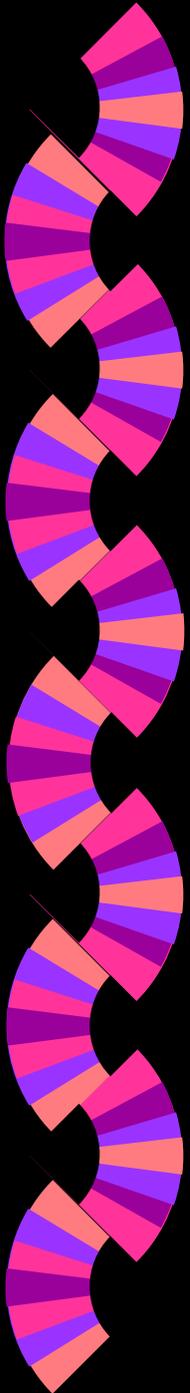
Cellular urban modeling

- Clarke cellular automaton urban growth model (UGM)
- Multiple applications (e.g. San Francisco, Washington/Baltimore) Project Gigalopolis
- New applications under way: Chicago, New York, Portland, Philadelphia, MAIA, Mexico City, Santa Barbara
- 1998/9 funding has made model portable and web-based (USGS: EROS Data Center, EPA Collaboration)
- 1999-01 work will extend and integrate model with other efforts (LANL and USGS collaboration, NSF Urban Research Initiative)



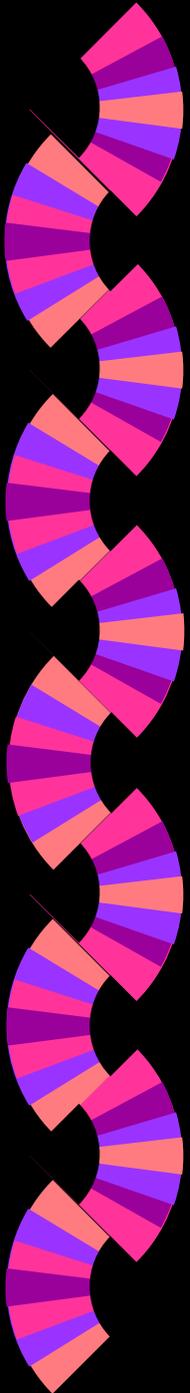
Model now handles land use

- ▶ So far works at crudest level (Anderson Level 1)
- ▶ Calibration under way in MAIA and Lower 48 States (GIRAS, MRLC, Loveland)
- ▶ Needs two LULC layers
- ▶ Based on the concept of deltatrans



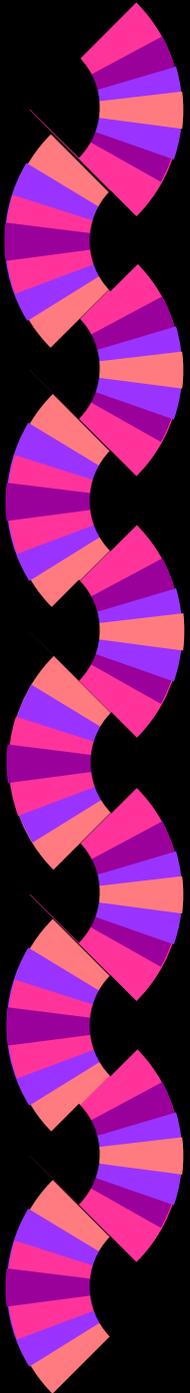
Project Web Site

- ◆ Set of background materials, e.g. publications
- ◆ Documentation as web pages in HTML
- ◆ Source Code for model in C
- ◆ Uses utilities and GD GIF libraries
- ◆ Set of sample calibration data Demo_City
- ◆ <http://www.ncgia.ucsb.edu/projects/gig/ncgia.html>



Implementations to date

- ▶ DEC
- ▶ Silicon Graphics (Indy 10000 and O2)
- ▶ Silicon Graphics (Materials Res. Science and Engineering Center: NSF-funded)
Origin 2000 cluster 32 processors: 2GB RAM
- ▶ Cray Supercomputer (EPA: N. Carolina)



The Urban History of Demo_City

- Small but rapidly growing hypothetical city
- Founders determined that city would conveniently fit into 200 x 200 square grid
- Calibration uses scale independence of key control parameters
- City has no social problems, only residents are bits
- Conveniently isolated from external forces
- Has proven difficult to model!



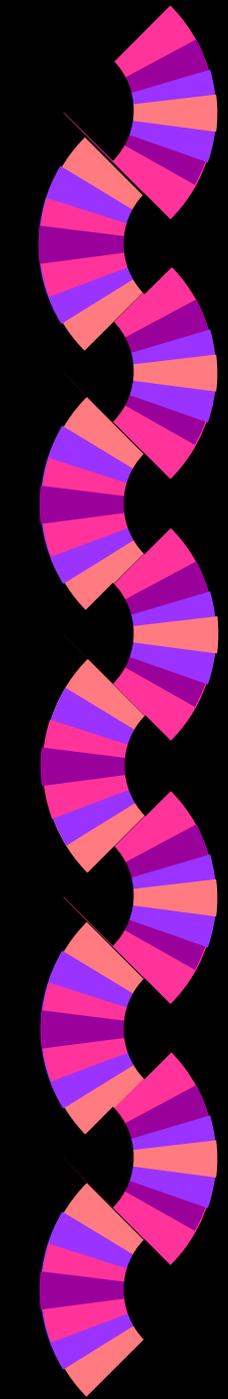
Model output

- ▶ Data layers for import into GIS
- ▶ Animation sequences for visualization
- ▶ Statistics
- ▶ Historical data base



Cellular land transition models

- ▶ Increasingly important methods
- ▶ Many different models
- ▶ Transition probability based
- ▶ Deltatron changes weighted methods by forcing autocorrelation in change space
- ▶ Allow modeling, visualization and experiments



Model refinements

- ▶ Higher attribute resolution
- ▶ Alternative drivers
- ▶ Temporal sensitivity
- ▶ Density linkage
- ▶ Coupling (loose vs. tight)
- ▶ Growth management “Smart growth”