Acquisition and Application of the Cellular Automaton Urban Growth Model

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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 deltatrons

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”