Understanding Impacts of Desert Urbanization on Climate and Surrounding Environments to Foster Sustainable Cities Using Remote Sensing and Numerical Modeling

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Select 5 Desert Cities

Landsat (if missing IRS or ASTER) for 5 desert cities (1985, 1990, 1995, 2000, 2005, 2010)

MODIS/AVHRR Daytime/Nighttime Thermal Imagery

National Census Data

SEDAC (GRUMP) Population Data

(1) Pre-processing
(2) Subsetting
(3) Reflectance conversion

Sub-pixel (MESMA)

Object-based

Fractions
Bright Impervious
Dark Impervious
Trees
Shrubs/Grass/Agri
Exposed Soil

Classes
Urban
Active Agri
Inactive Agri
Water
Desert Landscape

Regression Model

LUMPS Local Model

WRF Regional Model

Land Change Simulation Model

LCLU Change (1985-90-95-00-05-10)

Desert Urban Growth & Rate of Change of LCLU (1985-90-95-00-05-10)

Desert City LCLU vs. Local Climate

Desert City LCLU vs. Regional Climate

Desert Population Dynamics vs. Climate Change

Desert Cities vs. Regional Environmental/Climate Change

Future Local/Regional Climate (2030)

Future Urban & LCLU (2030)

Spatial Pattern

0	0	0	0	0	0	0
0	1	1	1	1	1	0
0	1	1	1	1	1	0
0	1	1	1	1	1	0
0	1	1	1	1	1	0
0	1	1	1	1	1	0
0	0	0	0	0	0	0

(a) Extremely clustered
Moran's I = 0.5167

1	0	0	0	0	0	1
1	1	0	1	0	1	1
0	0	1	1	1	0	0
0	1	1	1	1	1	0
0	0	1	1	1	0	0
1	1	0	1	0	1	1
1	0	0	0	0	0	1

(b) Systematically arranged
Moran's I = 0.0461

1	0	1	0	1	0	1
0	1	0	0	0	1	0
1	0	1	1	1	0	1
0	1	0	1	0	1	0
1	0	1	1	1	0	1
0	1	0	0	0	1	0
1	0	1	0	1	0	1

(c) Extremely dispersed
Moran's I = -0.7142

Worldview 2 (NGA)   Output
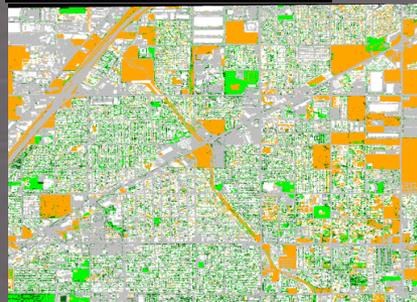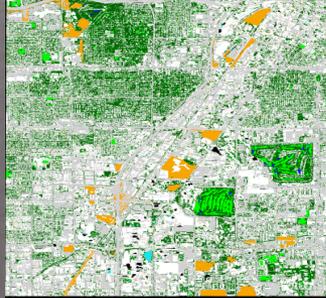
Spatial Pattern of Buildings and Surface Temperatures