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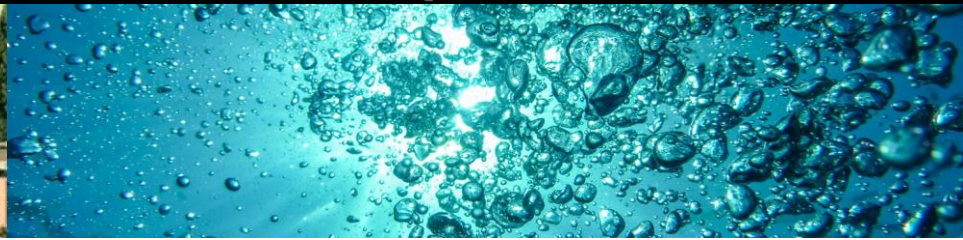


Water Use Impacted by the Shape of Our Cities

Forecasting Urbanization and Future Water Demand

Georgina M. Sanchez

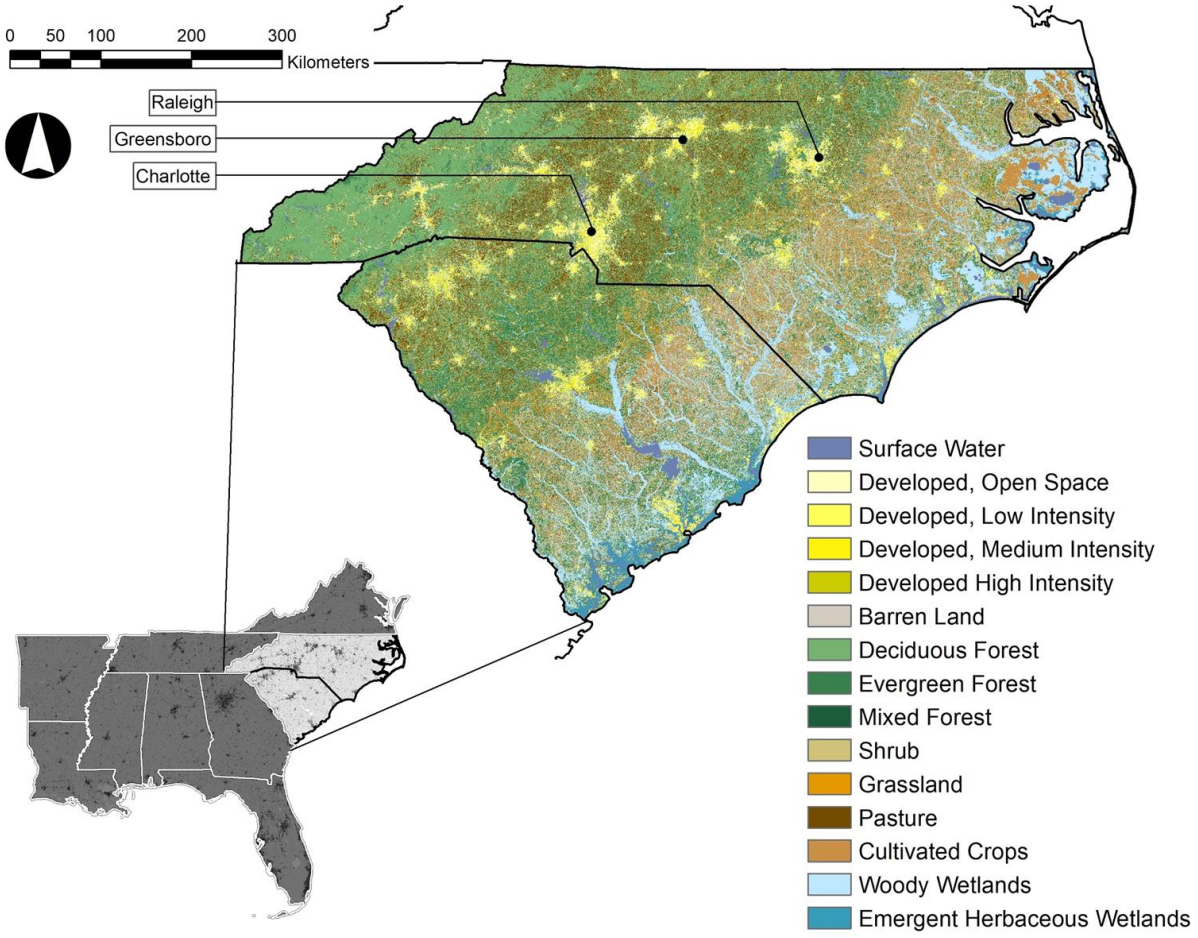
SOUTHEAST Climate Adaptation Science Center

USGS science for a changing world

Effects of the spatial patterns of development on human and environmental well-being

Study system

- Rapidly growing region.
- Characterized by highly heterogeneous landscapes.

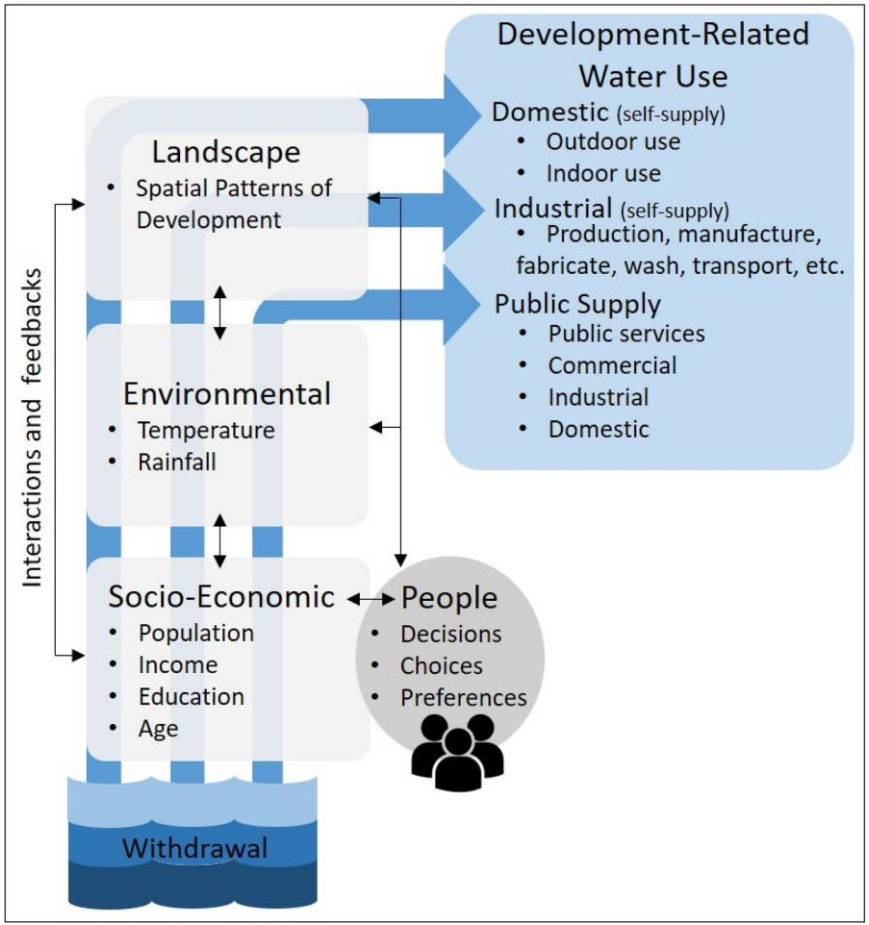


Conceptual framework

We developed an integrated land- and water-use modeling approach to inform more water-efficient development patterns.

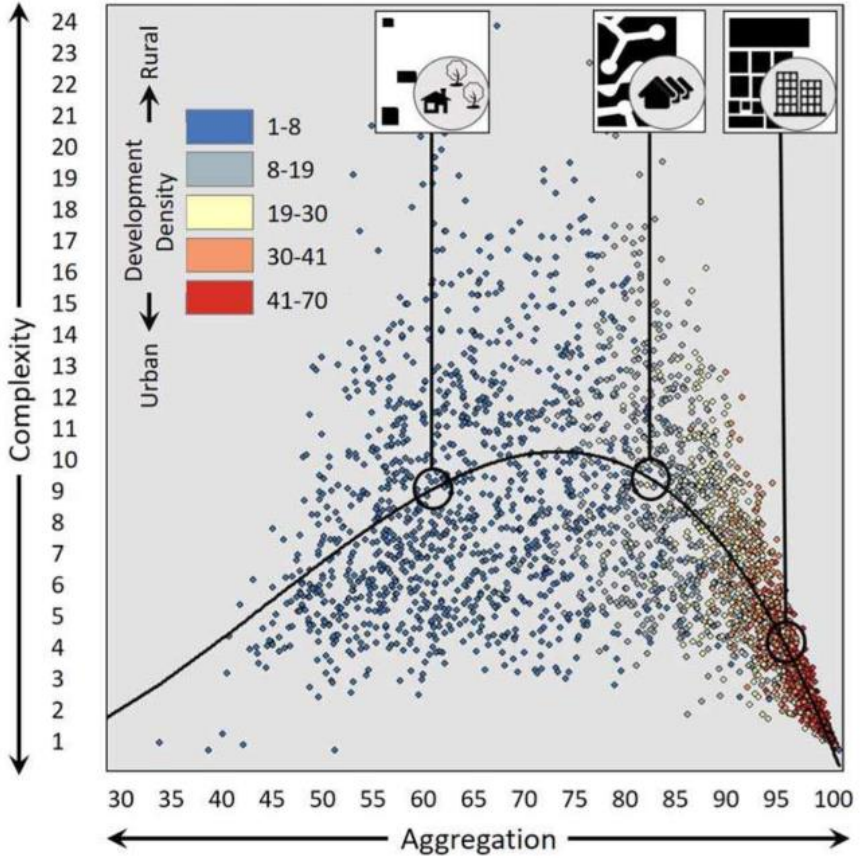
People make de facto water decisions when they make land use decisions.

Sanchez et al., 2018
(Water Resources Research)

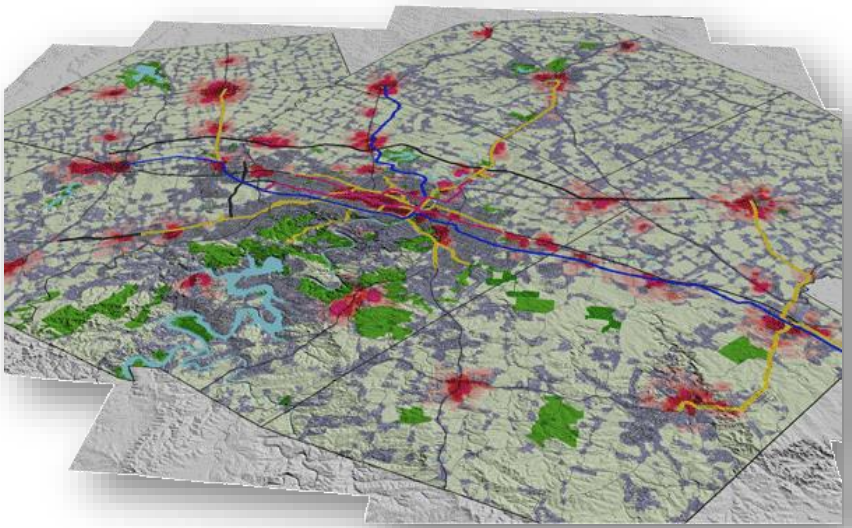


Sanchez et al. (2018) highlights

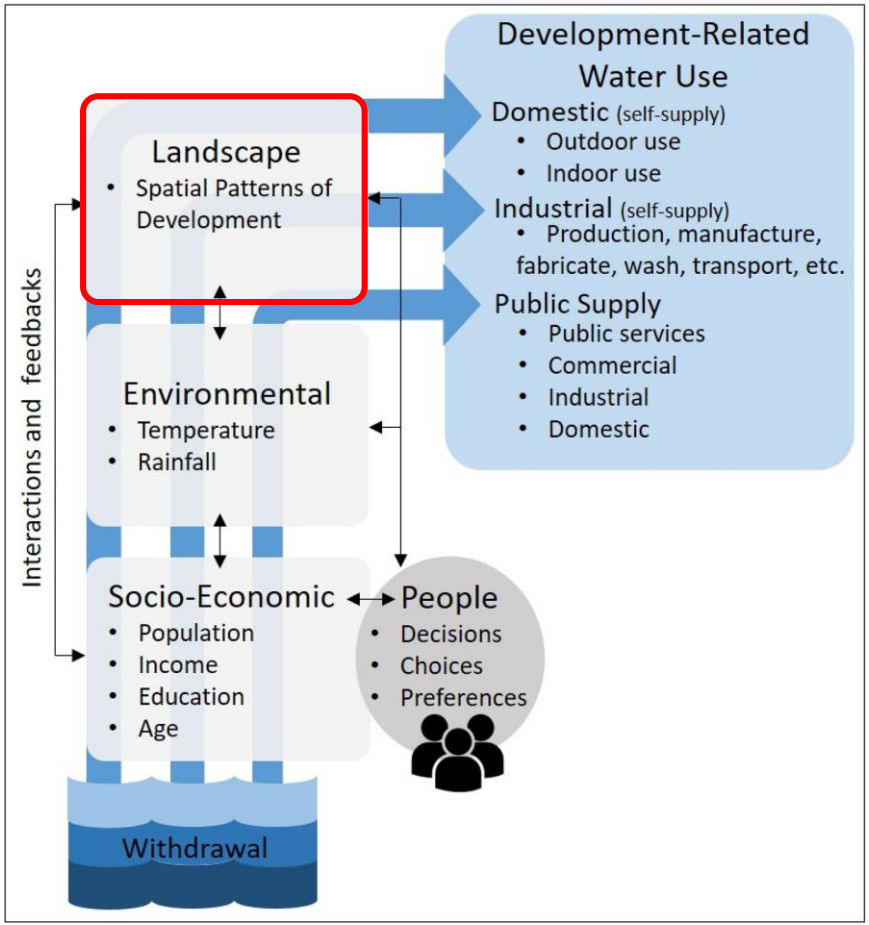
- Spatial patterns of development explained more variability in water use than socio-economic and environmental variables.
- Developed landscapes that promote simple, compact patterns show potential for more efficient use of water.



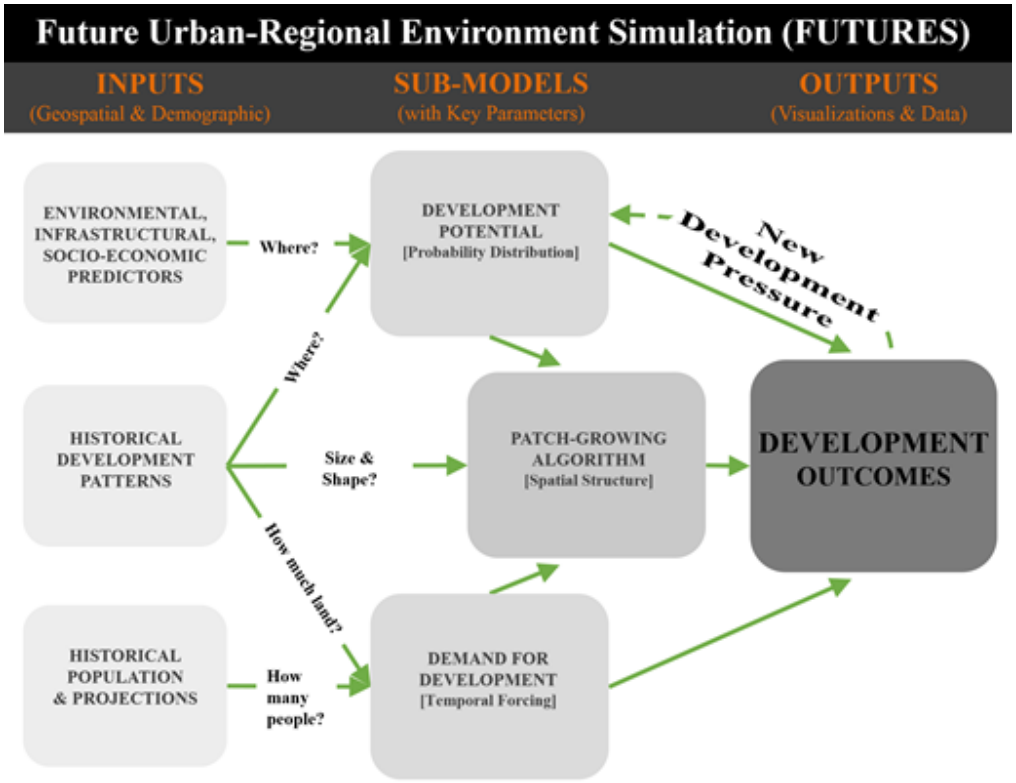
Land change simulations



Land change model: FUTure Urban-Regional Environment Simulation (FUTURES; Meentemeyer et al., 2013).



Land change model: FUTURES

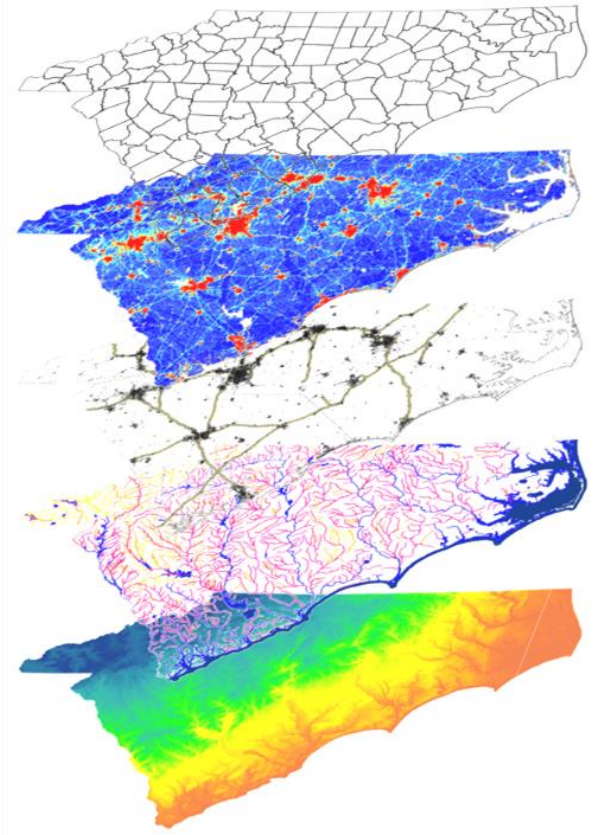


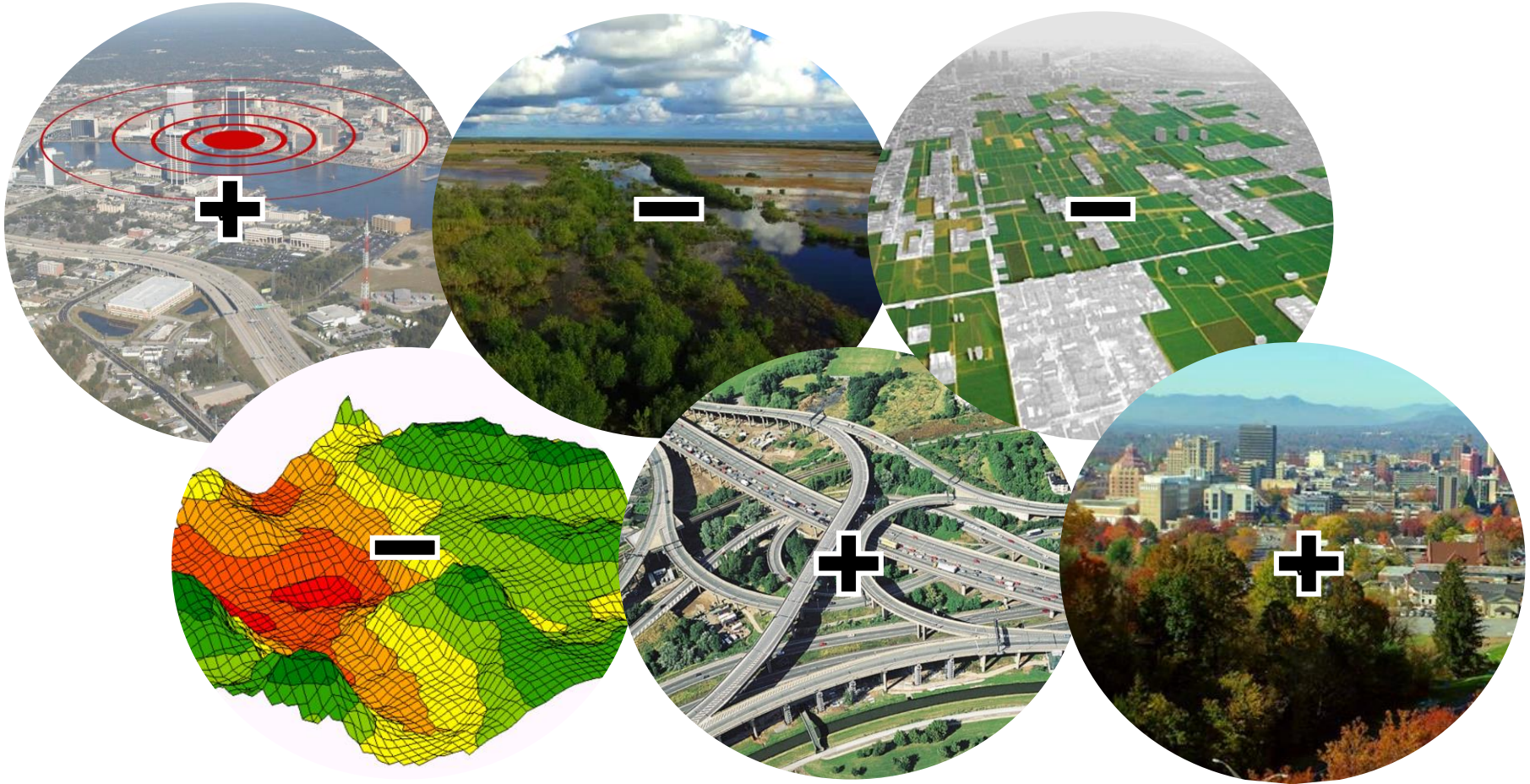
[Meentemeyer et al., 2013]

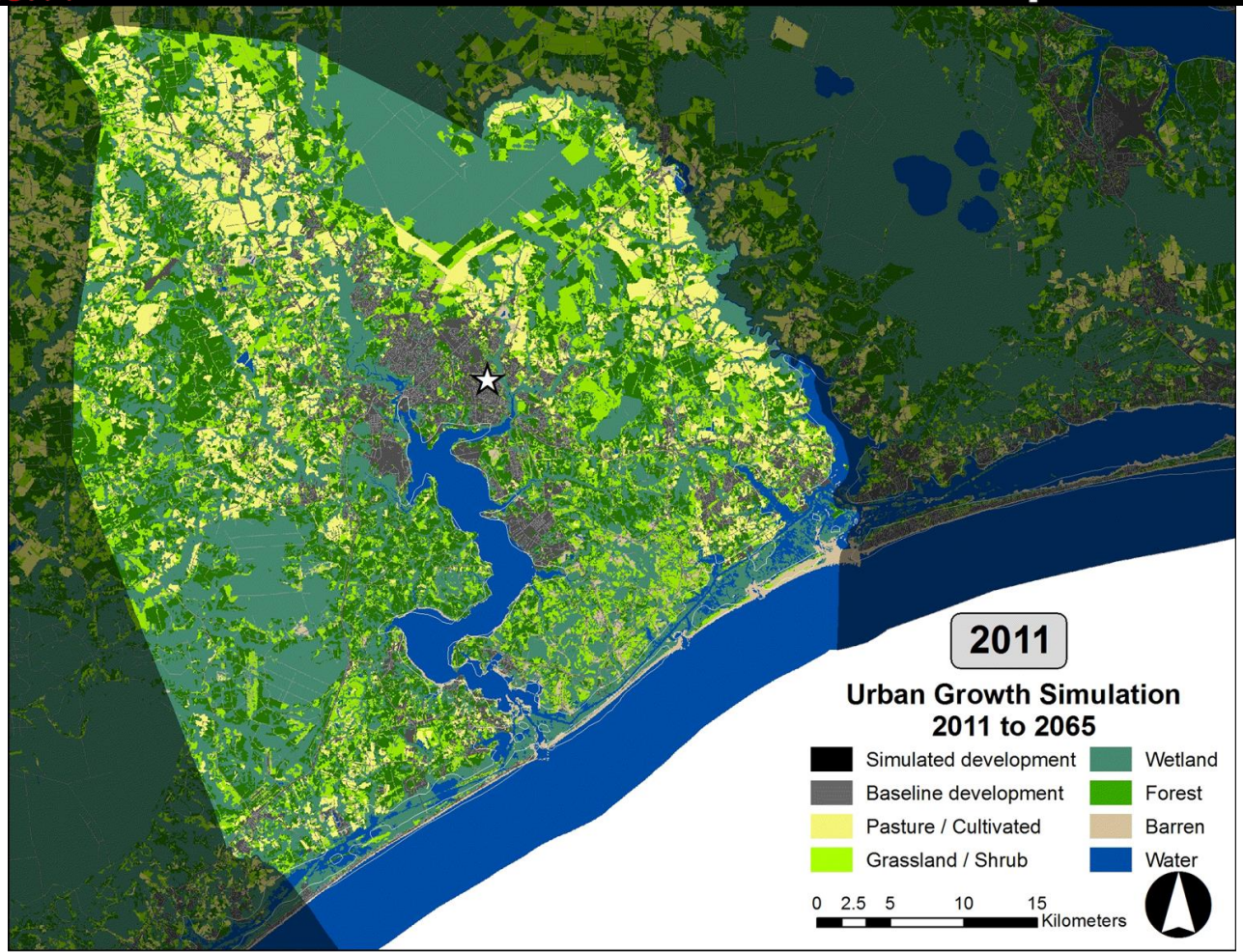
- Simulates spatial patterns of land-use change driven by urbanization.
- Population demand and development suitability interact to simulate urban growth.
- Realistics patches of growth.

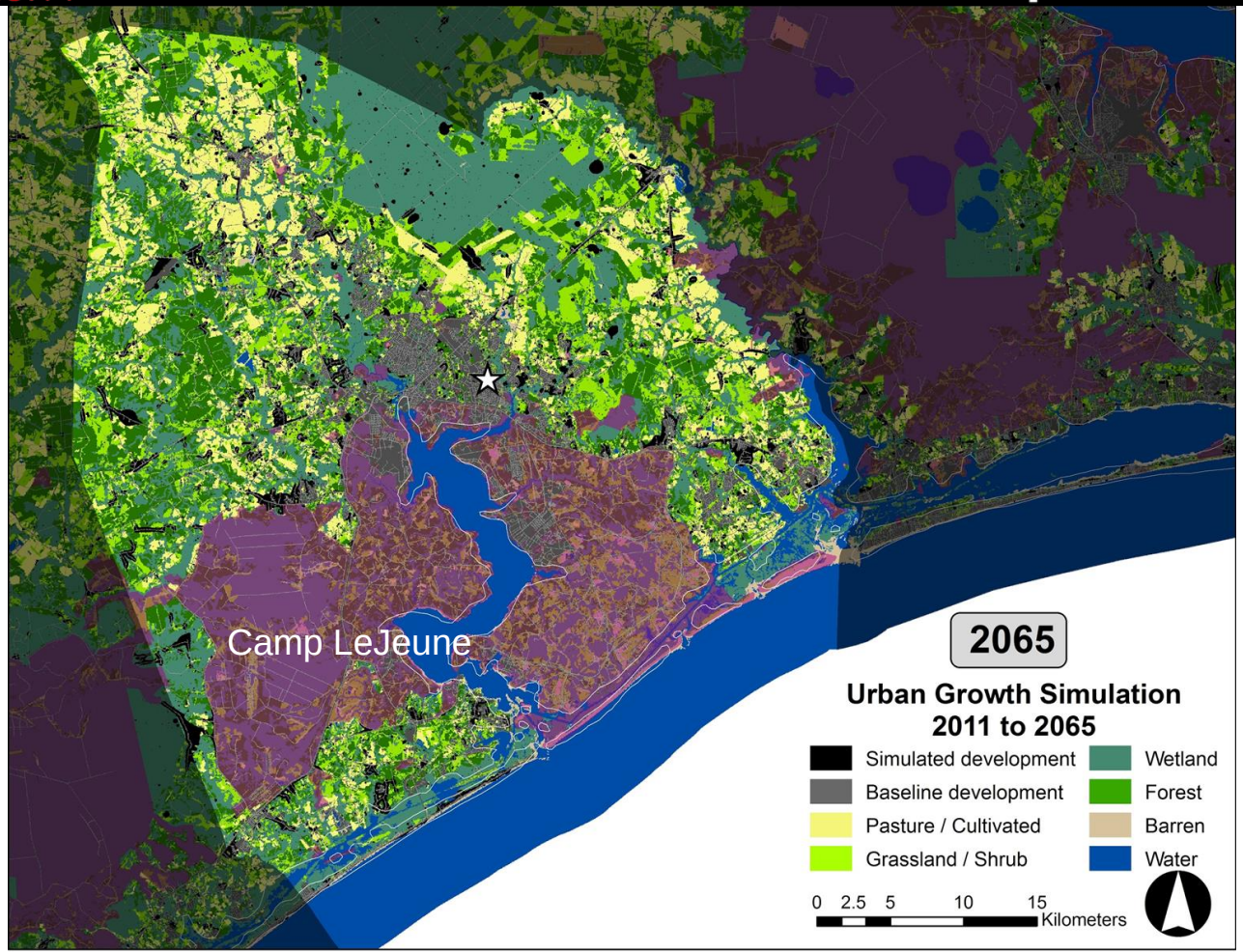
Land change model: FUTURES

- Projections are based on historical patterns of grow and their relationship to socio-economic, infrastructural and environmental predictors.






2011
Urban Growth Simulation
2011 to 2065
Simulated development
Baseline development
Pasture / Cultivated
Grassland / Shrub
Wetland
Forest
Barren
Water
0 2.5 5 10 15
Kilometers


Camp LeJeune
2065
Urban Growth Simulation
2011 to 2065
Simulated development
Baseline development
Pasture / Cultivated
Grassland / Shrub
Wetland
Forest
Barren
Water
0 2.5 5 10 15
Kilometers

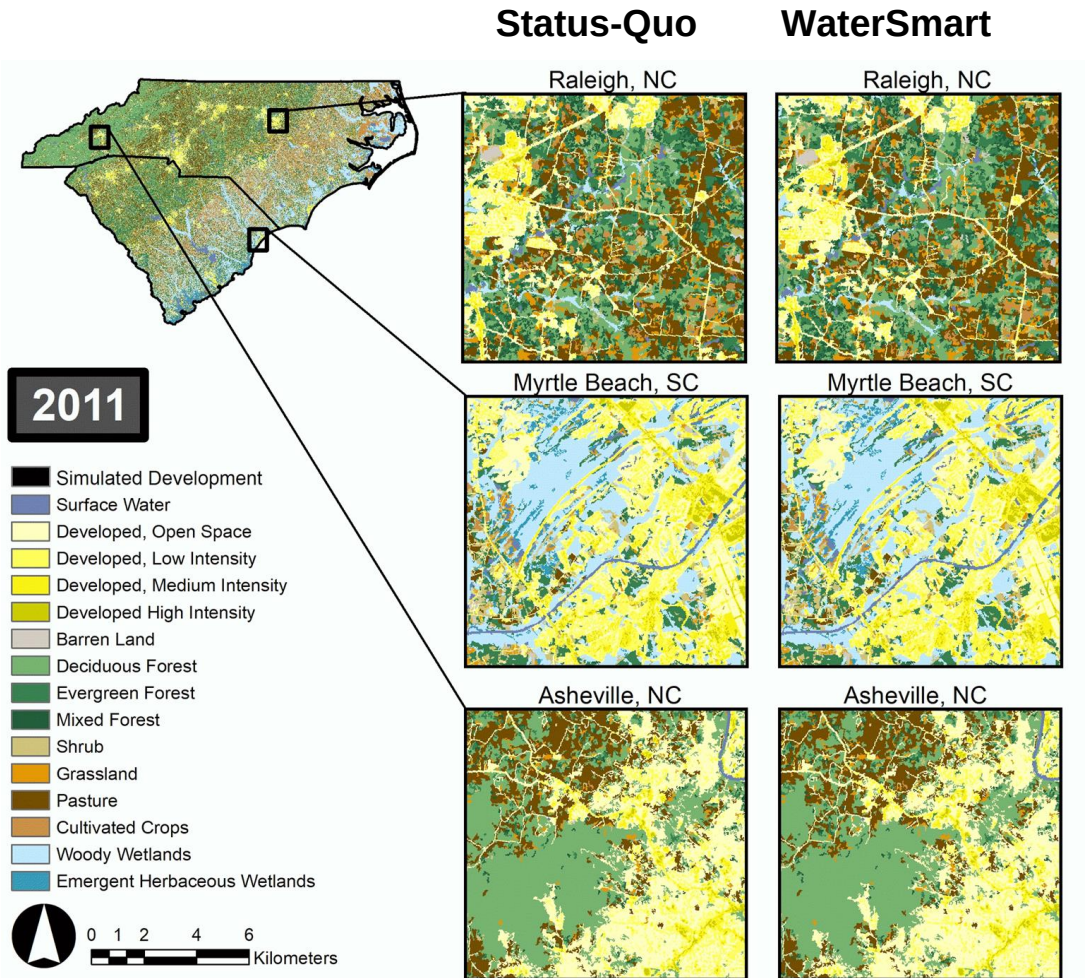
Two urbanization scenarios

Status-Quo

Population	24 M
Per capita land consumption	2.5 people/unit
Spatial patterns of development	historical pattern of growth
Additional conservation measures	N/A

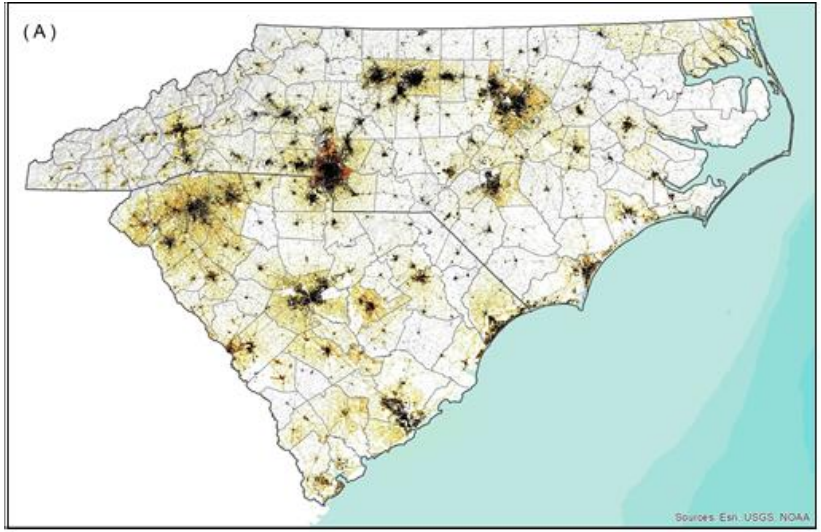
WaterSmart

Population	24 M
Per capita land consumption	3 people/unit
Spatial patterns of development	infill (simple, compact patches)
Additional conservation measures	riparian buffers, wetlands

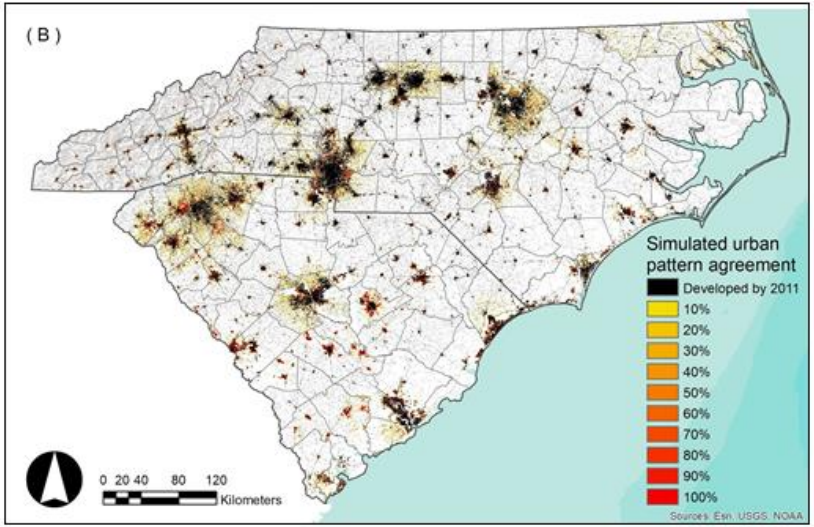

Status-Quo
WaterSmart
Raleigh, NC
Raleigh, NC
Myrtle Beach, SC
Myrtle Beach, SC
Asheville, NC
Asheville, NC
2011
Simulated Development
Surface Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub
Grassland
Pasture
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
0 1 2 4 6
Kilometers

Urbanization probability by 2065

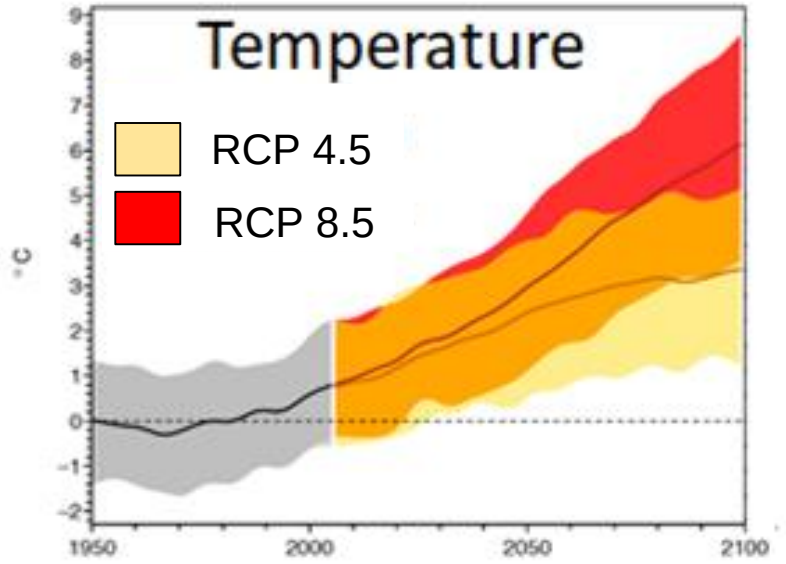
Status-Quo

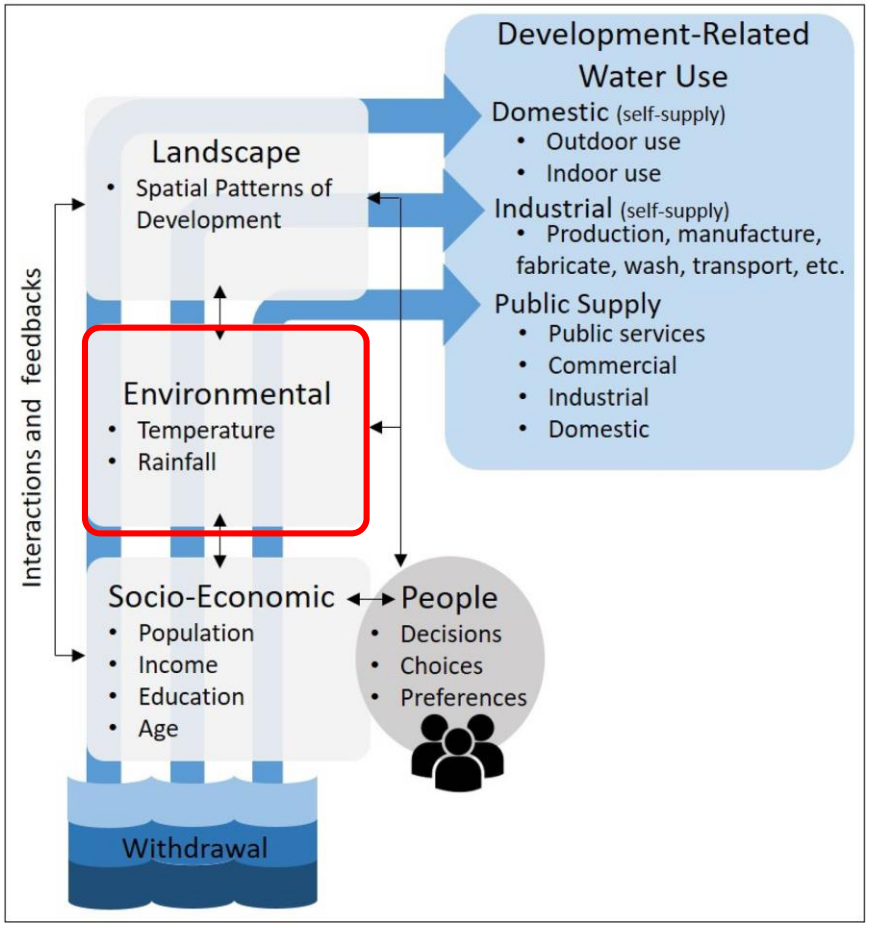


WaterSmart

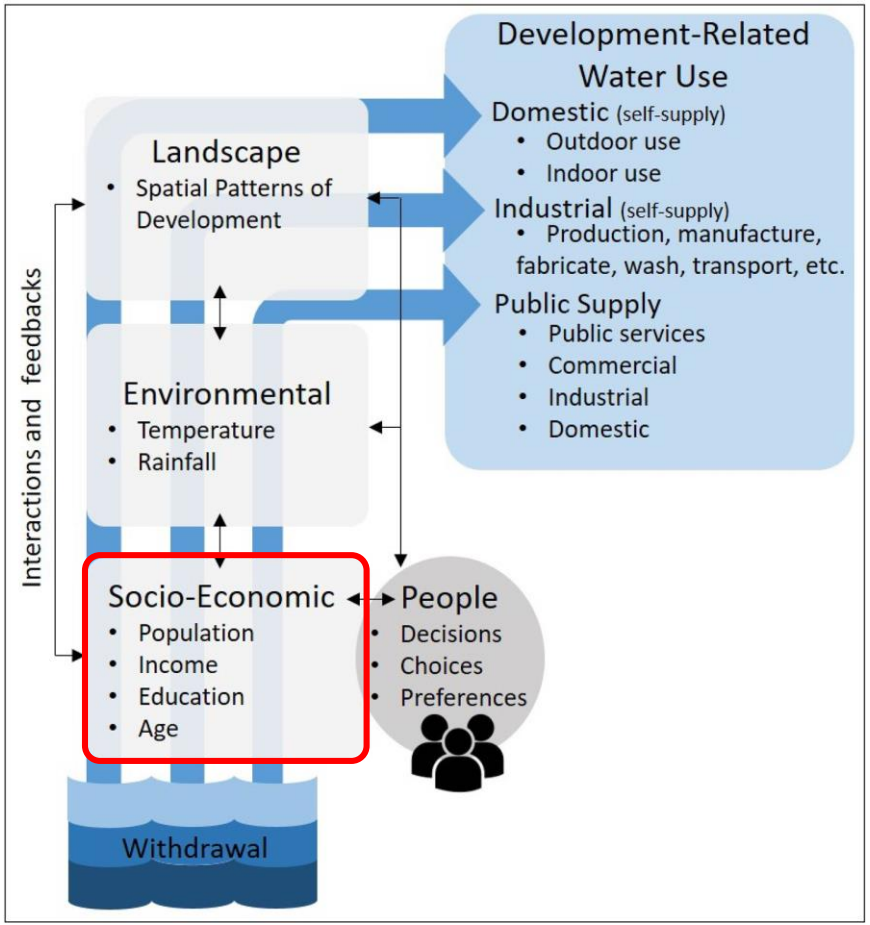


Climate scenarios

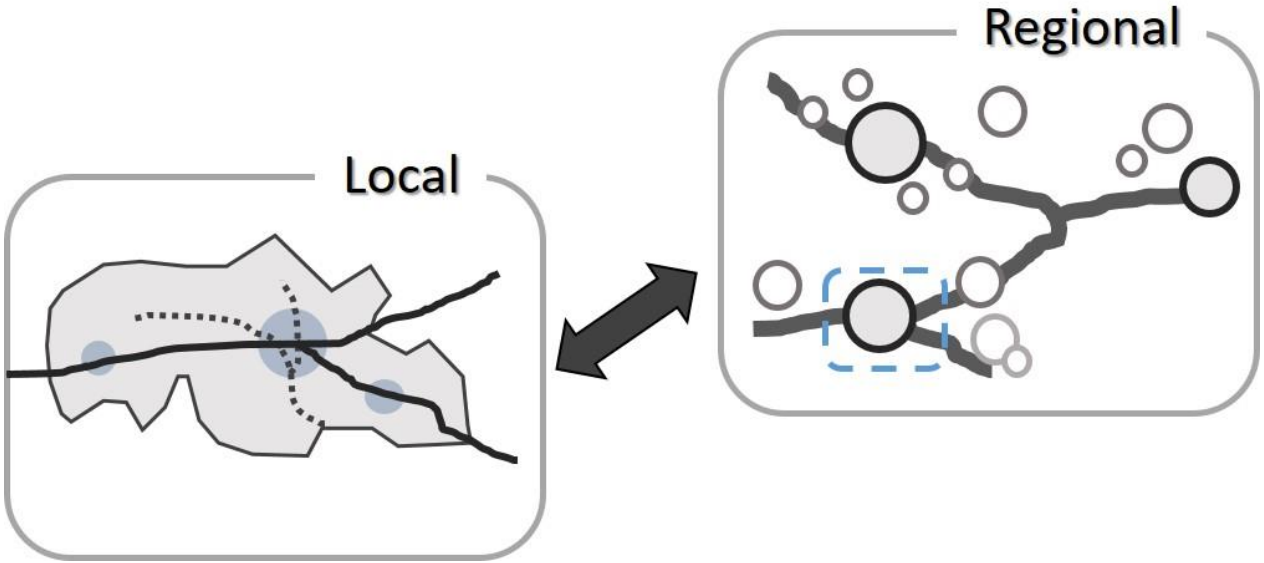




Population growth



Scalability and replicability

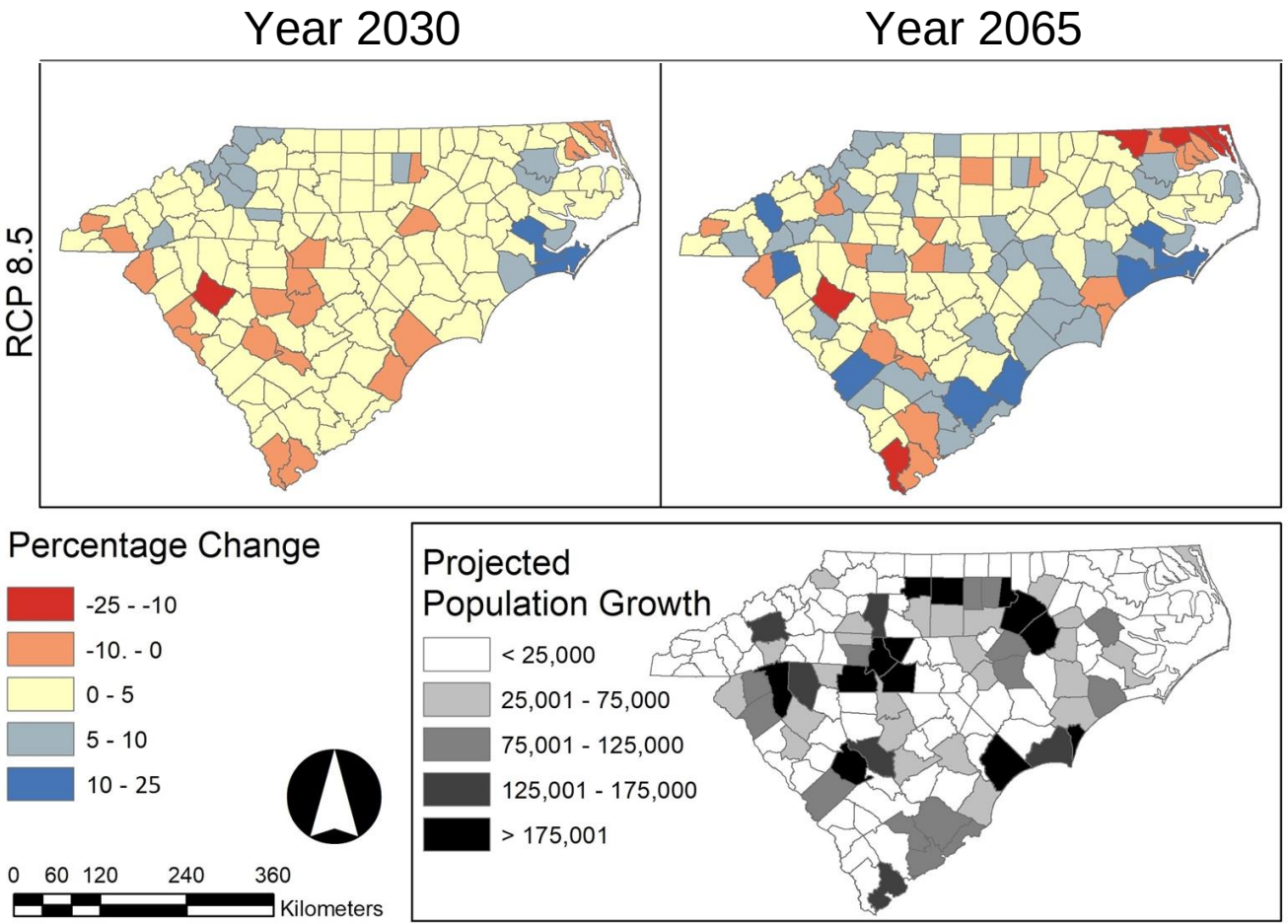


Water saving potential of land use policies by 2065

- In average, the WaterSmart scenario projected 360 MGD less than the Status-Quo.
- The water saving potential associated to the WaterSmart scenario represents 13% of the region's water use by 2010

Urbanization scenario comparison

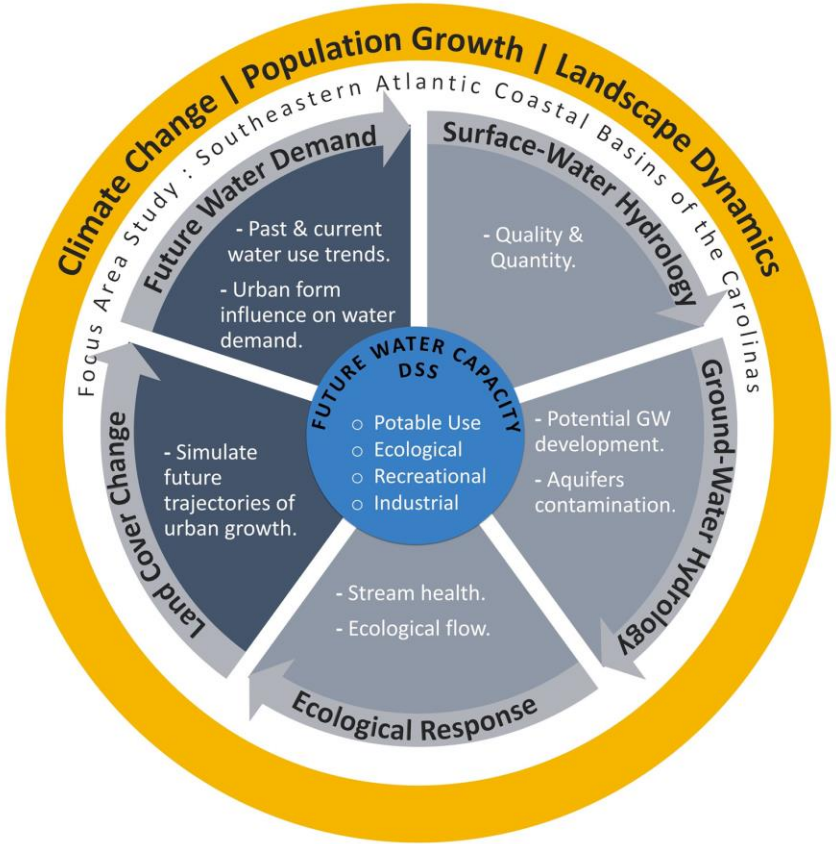
Percentage difference between the WaterSmart and the Status-Quo projected demand.



Integrated land- and water-use planning

Our framework can help local and regional entities to better understand the implications that their planning and development choices have on future water demand.

Integrated Land Use Planning: An Example from Land and Water Use



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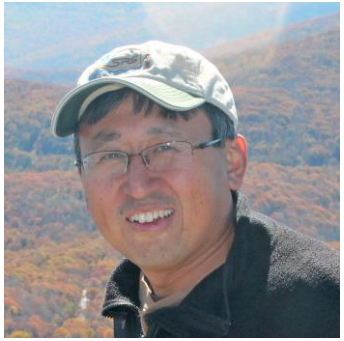

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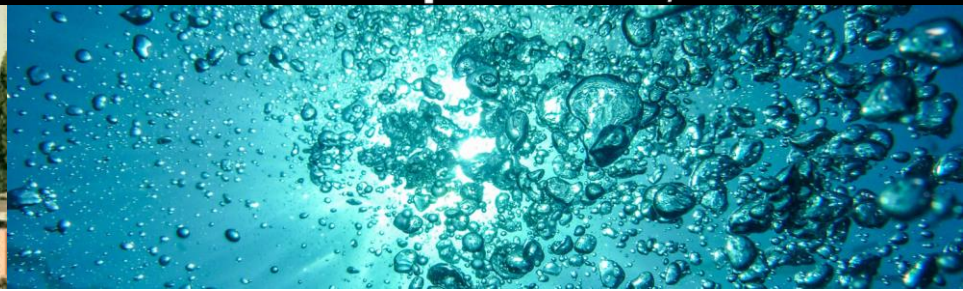

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Regional projected change in water demand