

Supporting the San Marcos Comprehensive Planning Process

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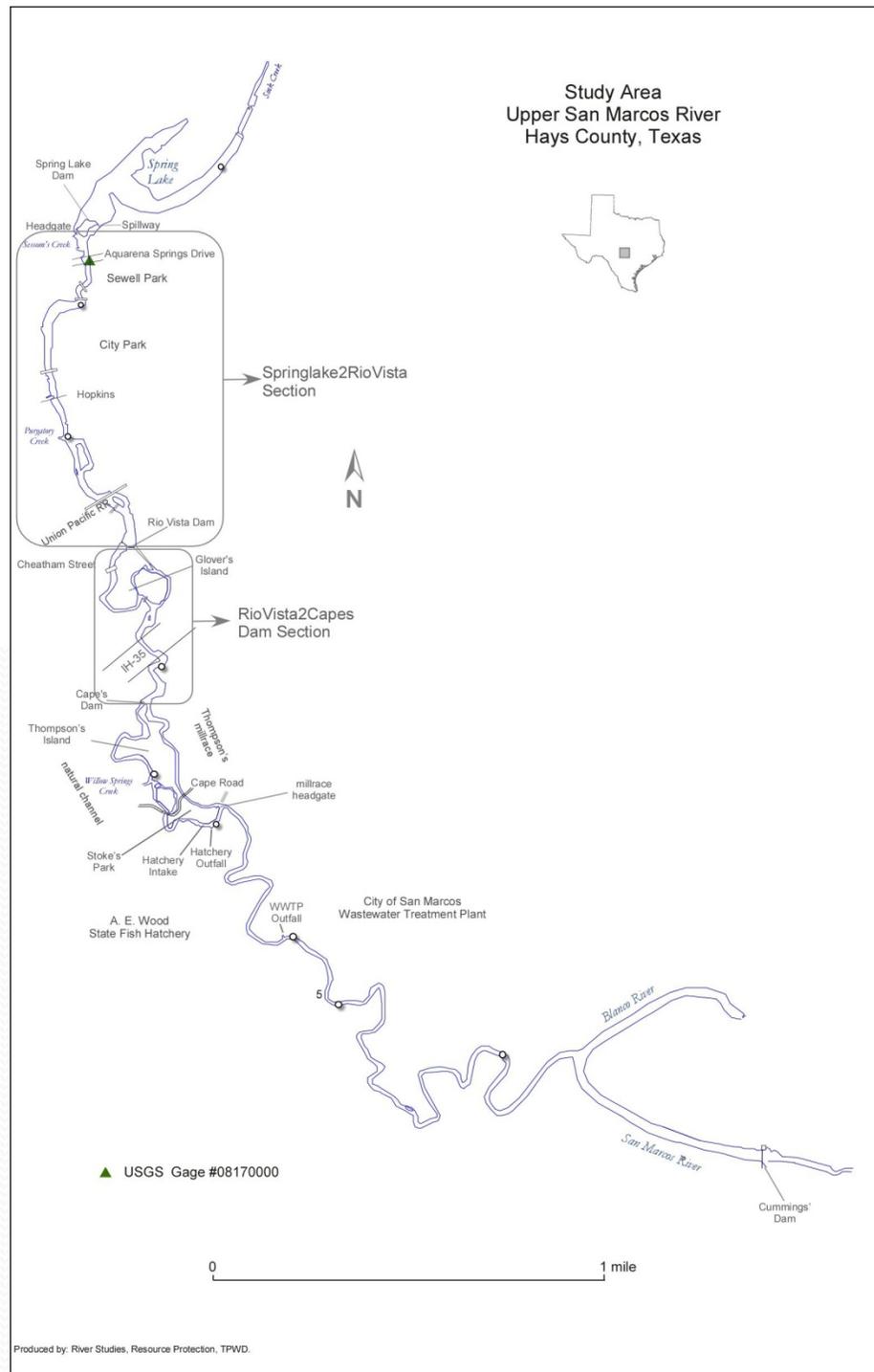
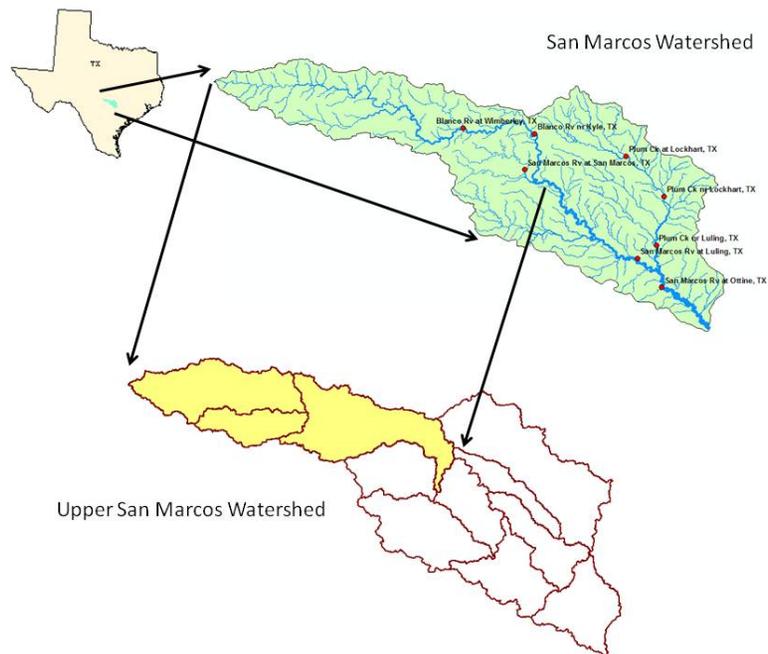
- Stewardship of Spring Lake – Texas State University Lake Management Plan
- San Marcos Observing System
- San Marcos River Texas Wild Rice State Scientific Area - Collaboration with Texas Parks and Wildlife Department, the City of San Marcos and Texas State University
- Edwards Aquifer Authority Habitat Conservation Plan
- Upper San Marcos Watershed Protection Plan
- City of San Marcos Comprehensive Planning Process

Primary Role is Research and Technical Support

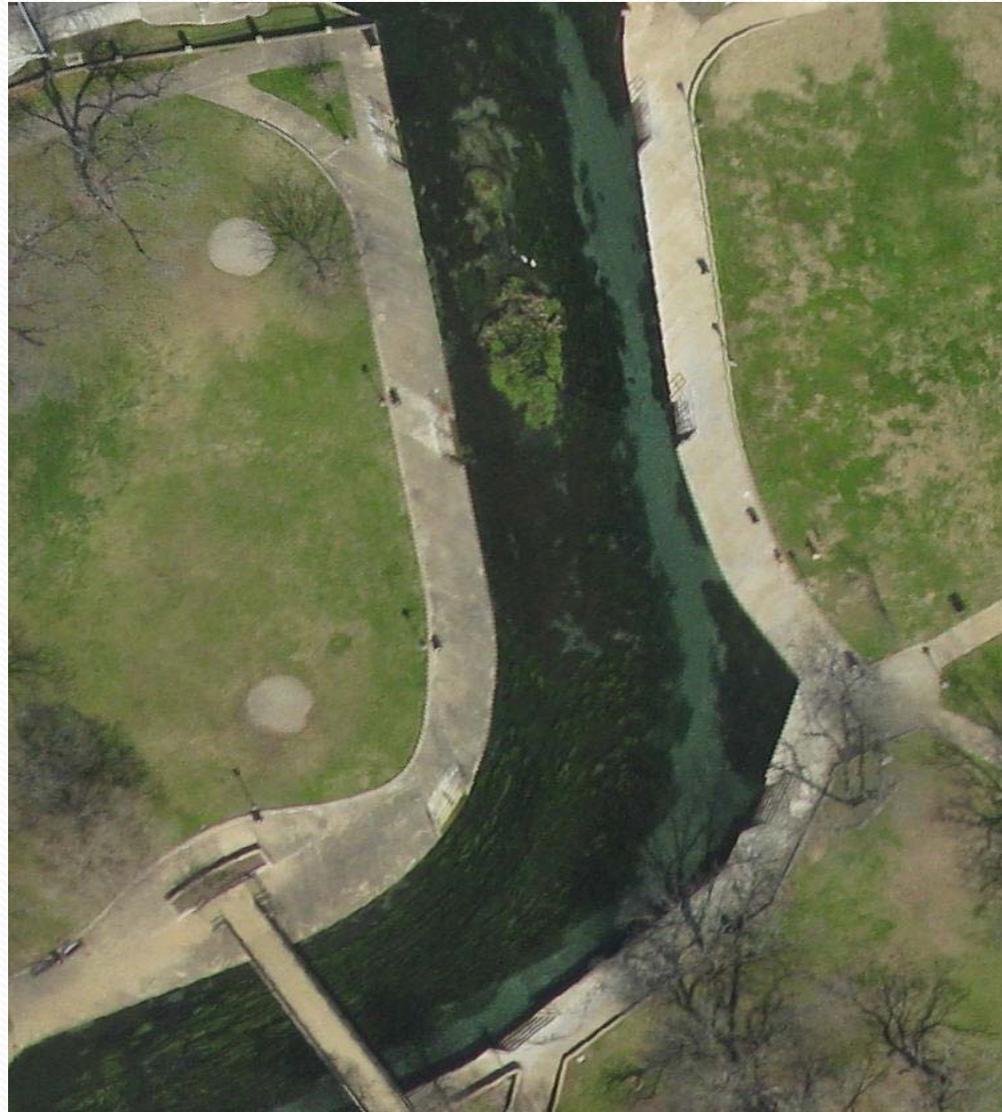
- Characterization of the Watershed in terms:
 - Trends in Land Use and Land Cover changes
 - Discharge
 - Water Quality
 - Ecological Status
- In terms of the Comprehensive Planning Process:
 - Evaluation of Existing Non-point Sources of Water Quality Constituents
 - Implications of Future Changes in LU/LC on Water Quality due to population growth and projected changes in Land Use and Land Cover
 - Evaluation of Best Management Practices and Low Impact Development under existing or future development scenarios

Support is Both Data Driven and Based on Quantitative Modeling

- High resolution characterization of the physical, chemical and biological status of the San Marcos River
 - Three dimensional topography of the San Marcos River from Spring Lake to Cummings Dams
 - Complete aquatic vegetation mapping at 1 meter resolution
 - Hydraulic modeling at 0.25 meter resolution
 - Hourly water temperature modeling
 - Biological models of flow dependant characteristics of habitat for Texas wild rice and fountain darters

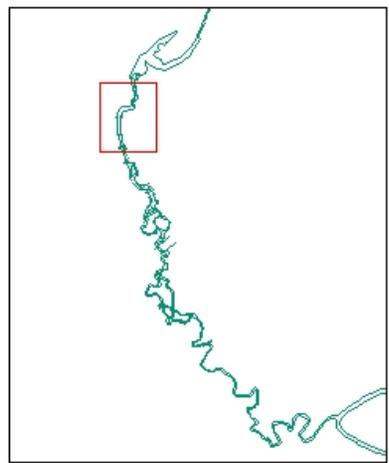
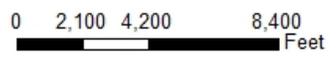
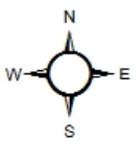
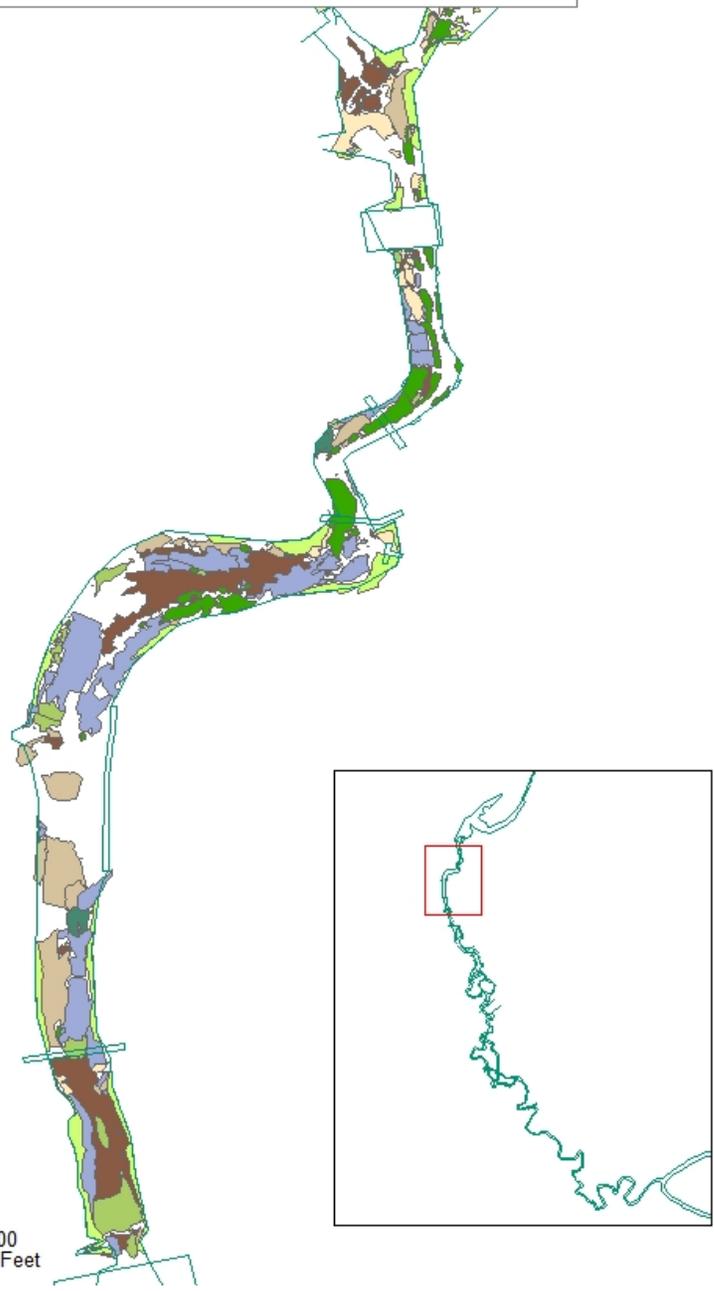


25 cm resolution color photography for San Marcos River



San Marcos Aquatic Vegetation Clear Springs to Hopkins St

- Rivers Edge
- Aquatic Vegetation**
- Other Species
- Fanwort
- Elephant ear
- Hydrilla
- Hygrophila
- Myriophyllum
- Nuphar advena
- Potamogeton
- Arrowhead
- Texas wild rice



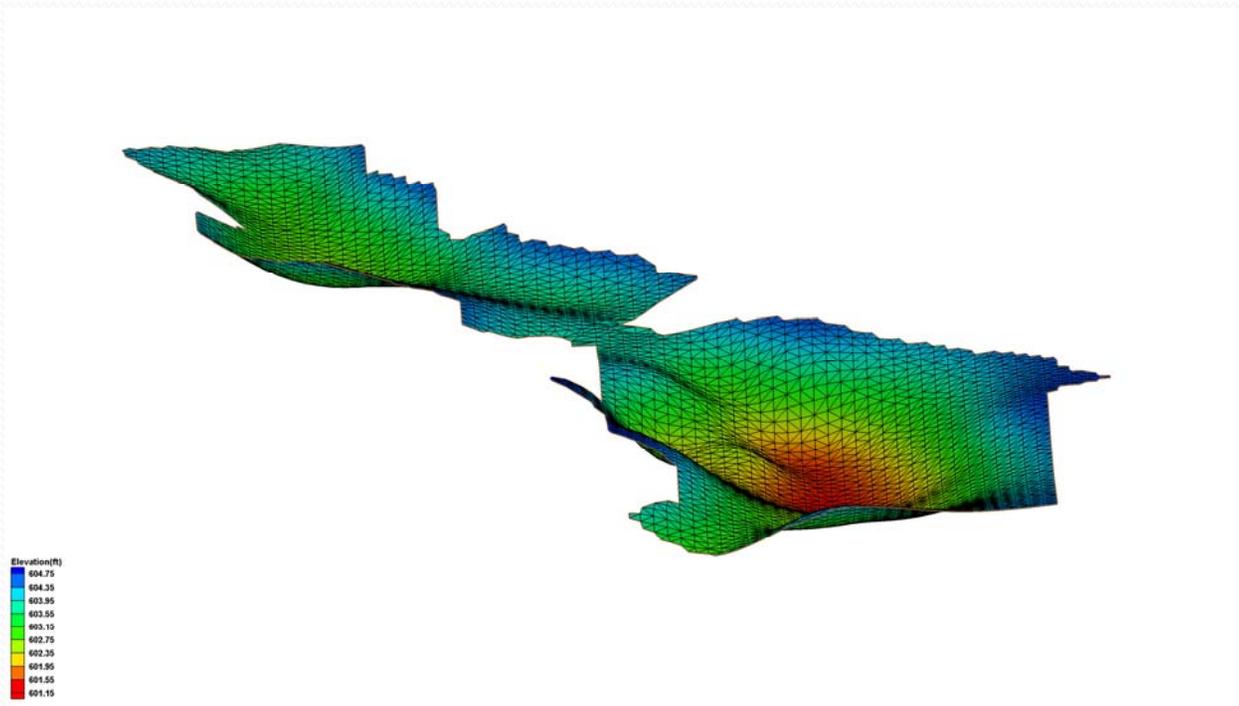
Explicit mapping of in-channel river topography



Integration of LIDAR for above river channel topography, canopy height and stream shading



In channel 3-dimensional topography is integrated with aquatic vegetation polygons to calibrate 2-dimensional hydraulic models





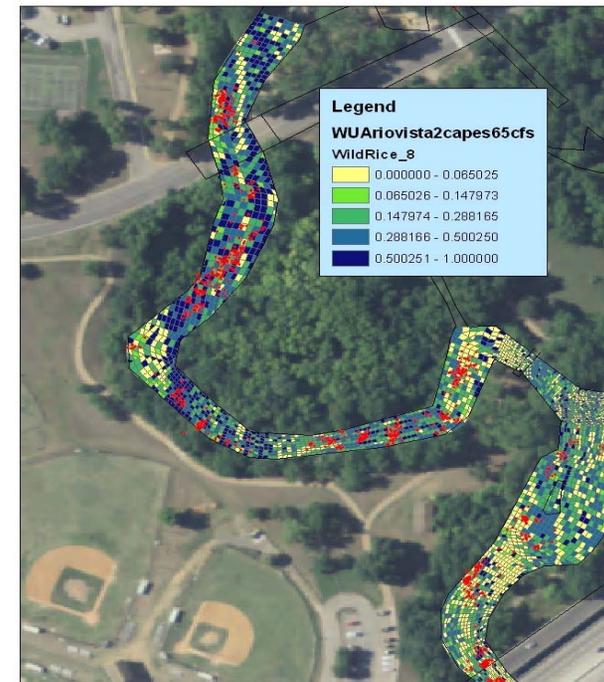
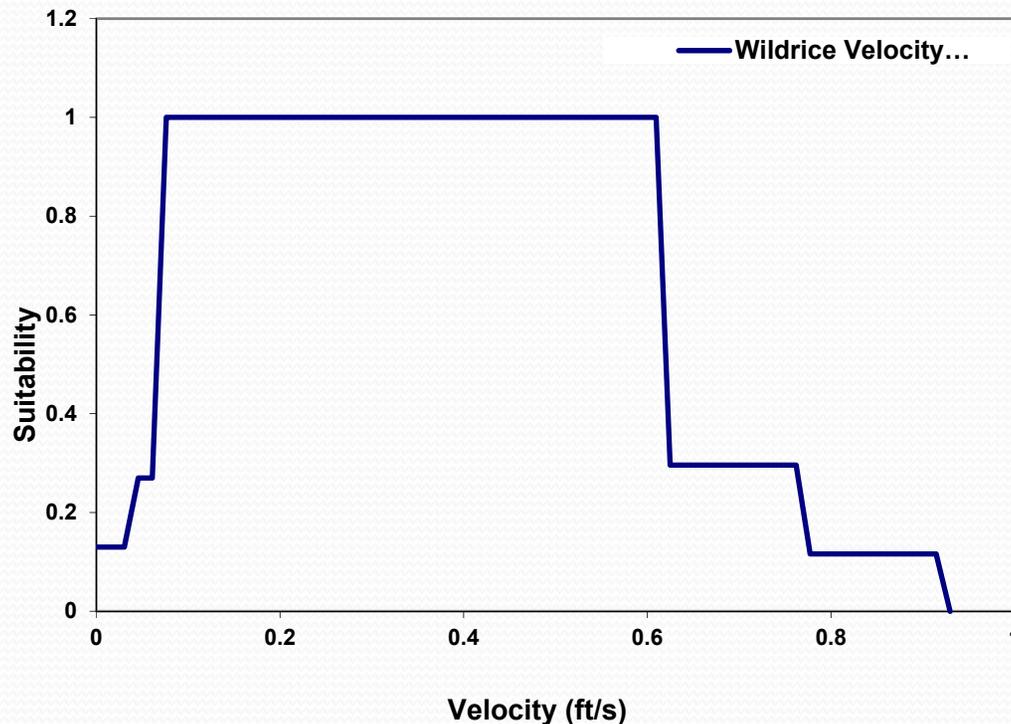
Fountain Darter Habitat Modeling

- 1-Dimensional Water Quality Model Extends from Spring Lake to the confluence with the Blanco River
- Simulated conditions at flow rates between 30 and 250 cfs
- Temperature simulations are integrated with the 2-dimensional hydraulic model to estimate suitable fountain darter habitat as a function of flow rate

Texas Wild Rice Habitat Modeling

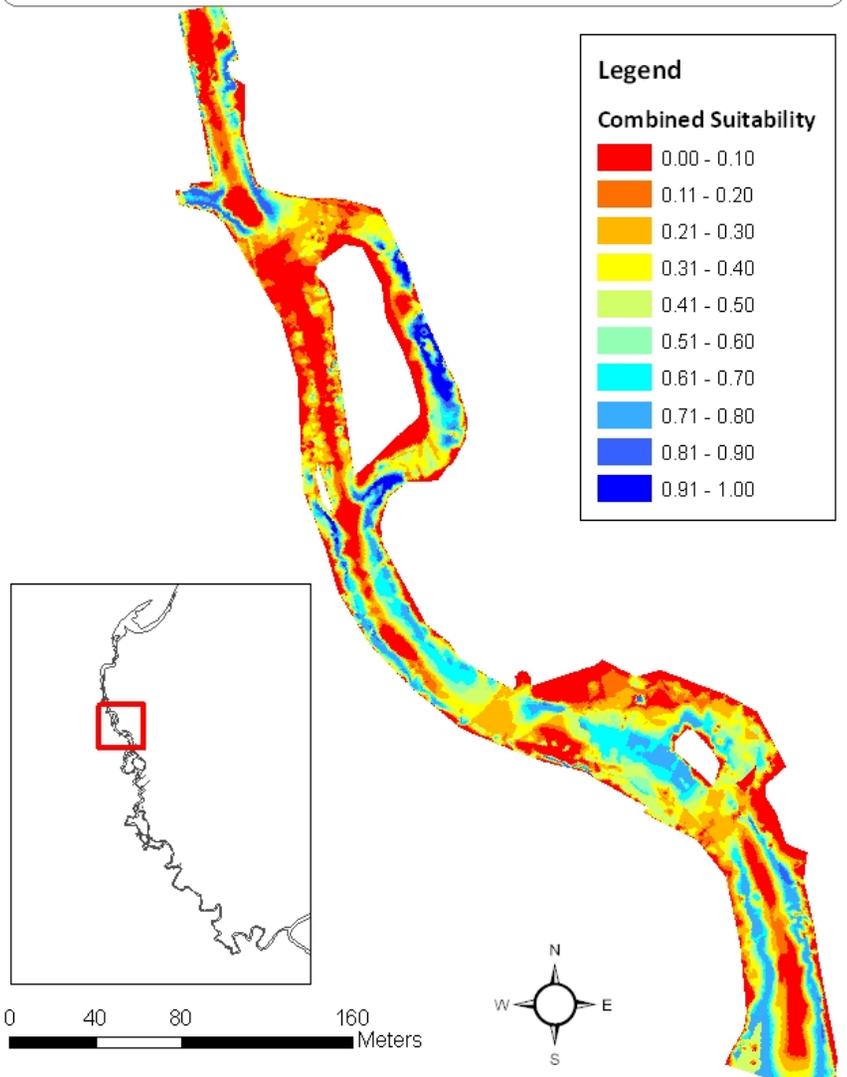
- Integrates 2-dimensional hydraulic model and species preference for depth and velocity

Wildrice Velocity Suitability



Fountain darter habitat modeling

Combined Suitability for Fountain Darters at 90cfs from Snake Island to Rio Vista Park



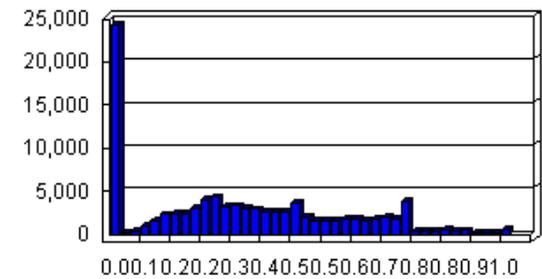
Statistics of Snk2RV_90cfs_FD_SI

Field: FD_SI

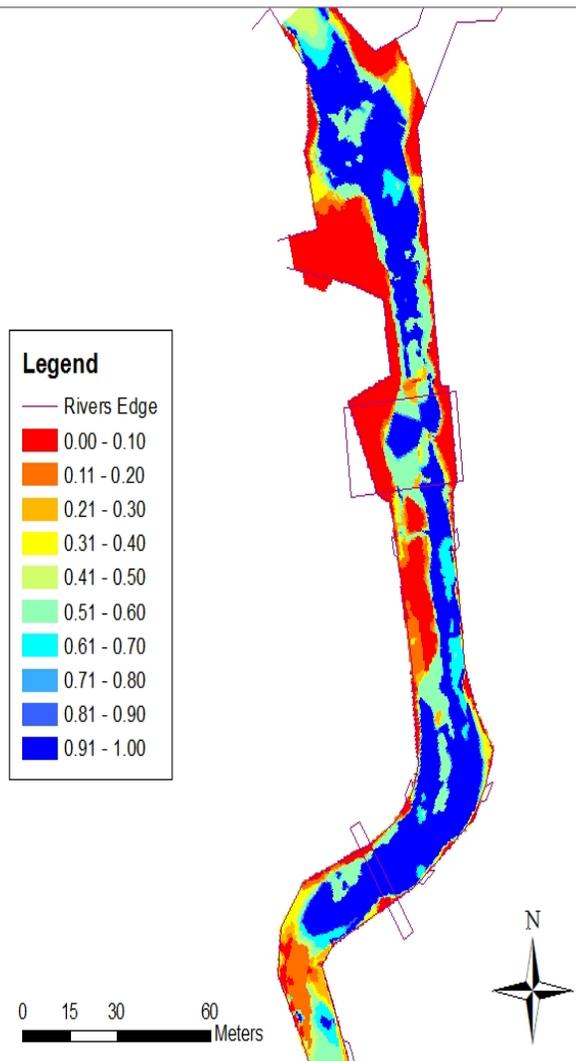
Statistics:

Count: 95170
Minimum: 0
Maximum: 0.982021
Sum: 29921.193909
Mean: 0.314397
Standard Deviation: 0.258636

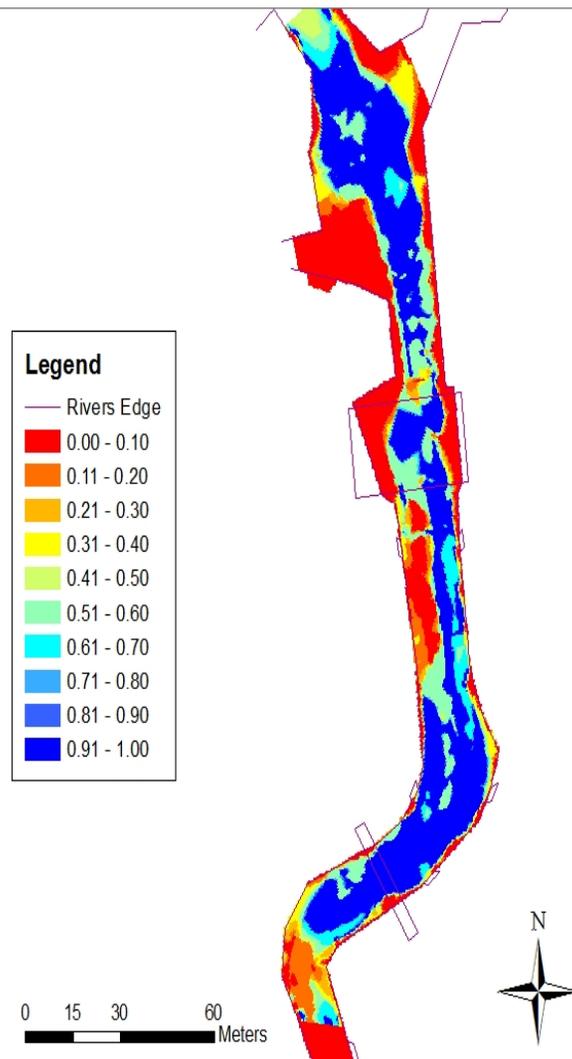
Frequency Distribution



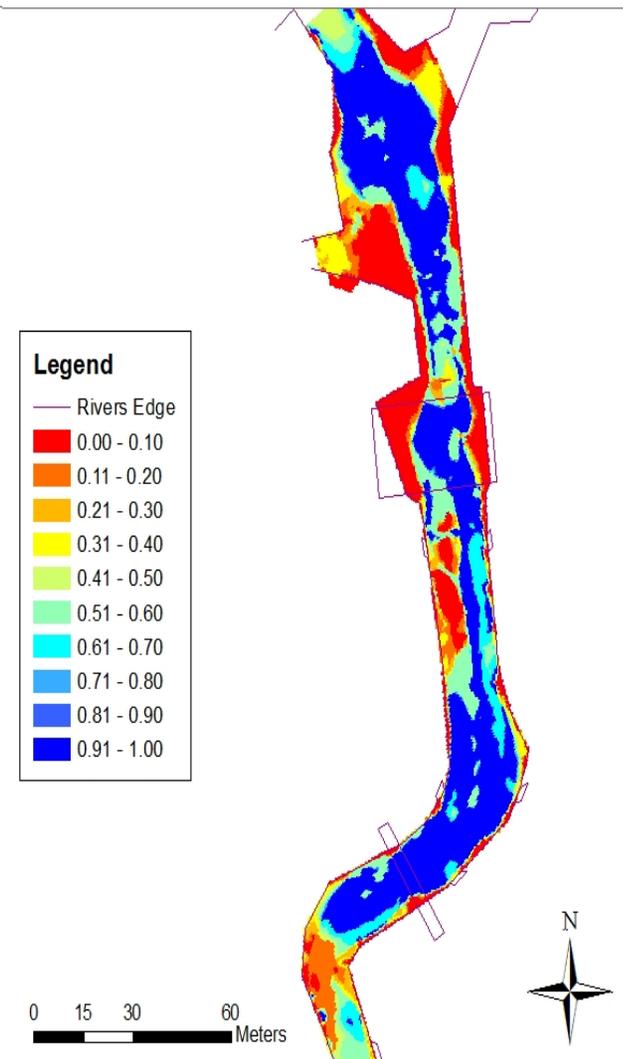
San Marcos River from Spring Lake Dam to Sewell Park
Wild Rice Combined Suitability at 55 cfs



San Marcos River from Spring Lake Dam to Sewell Park
Wild Rice Combined Suitability at 60 cfs



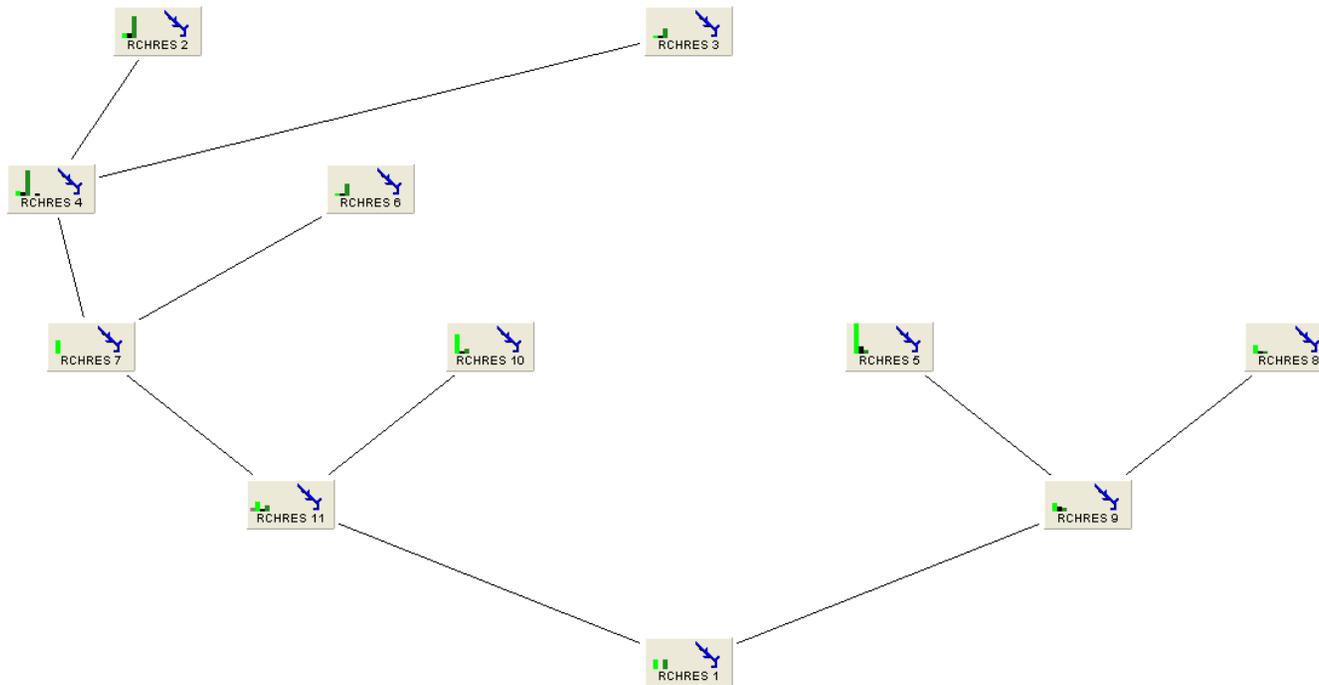
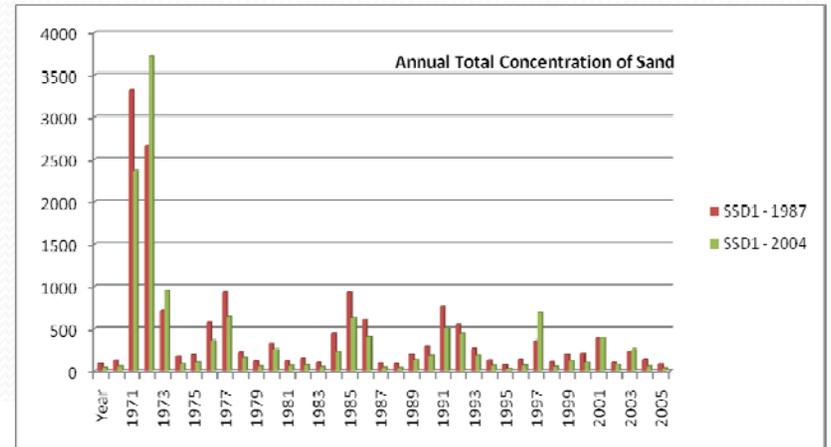
San Marcos River from Spring Lake Dam to Sewell Park
Wild Rice Combined SI at 70 cfs

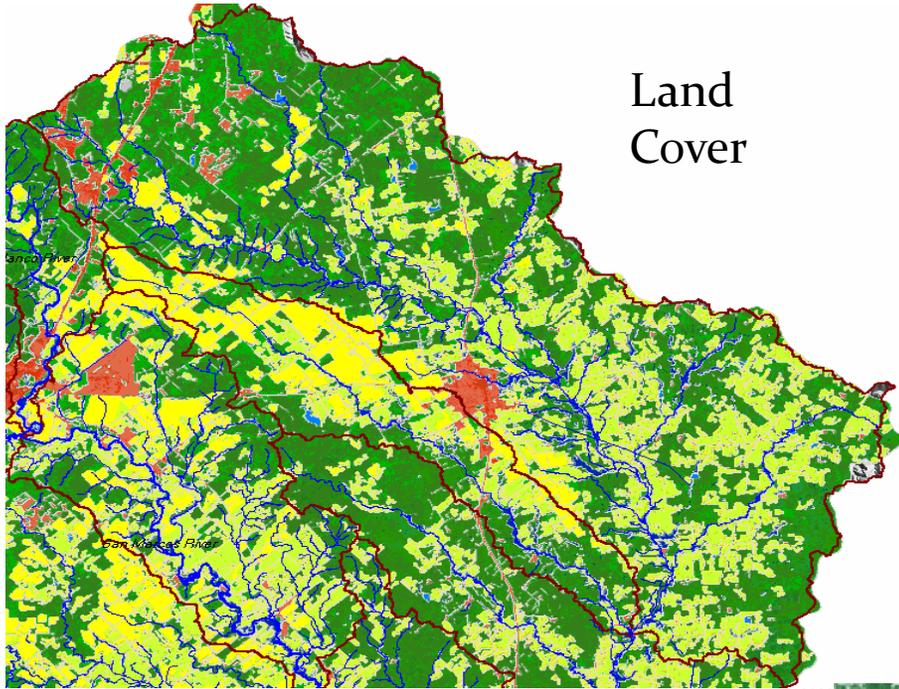


Linkages to the Comprehensive Planning Process

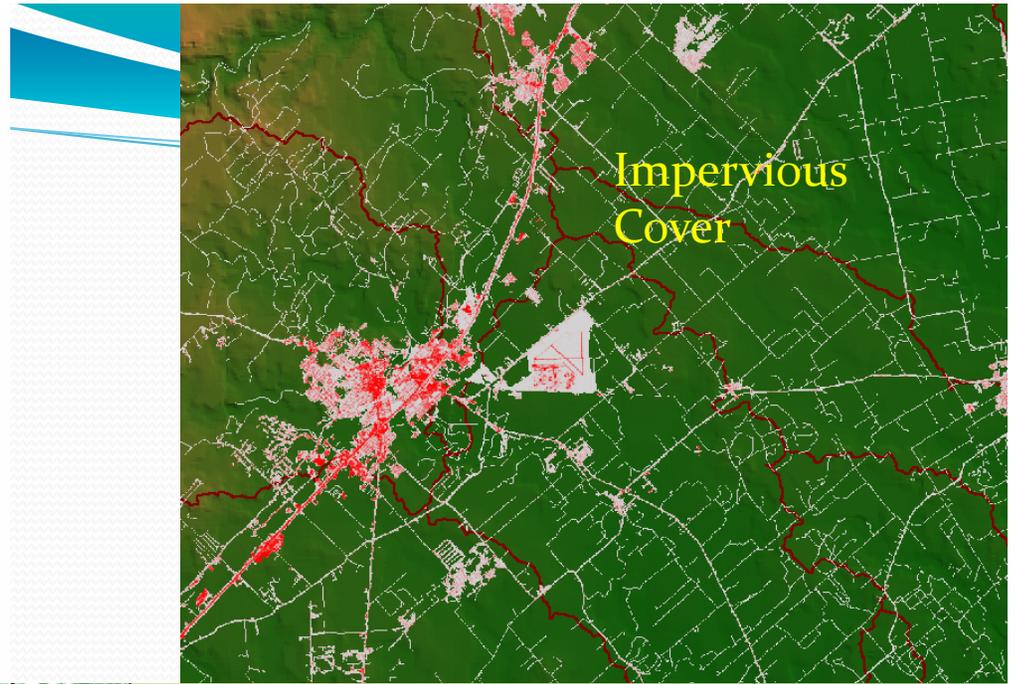
- Land Use and Land Cover
- Sub-watershed boundaries
- Drainage network
- Soils
- Water quality sampling
- Discharge
- Meteorology

HSPF – Distributed Watershed Rainfall-Runoff Model

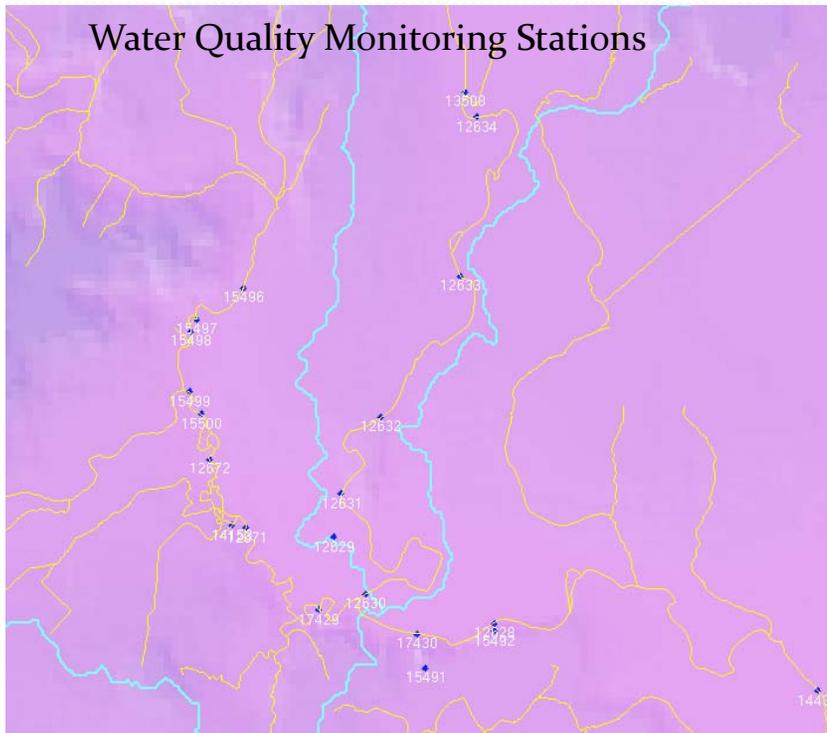




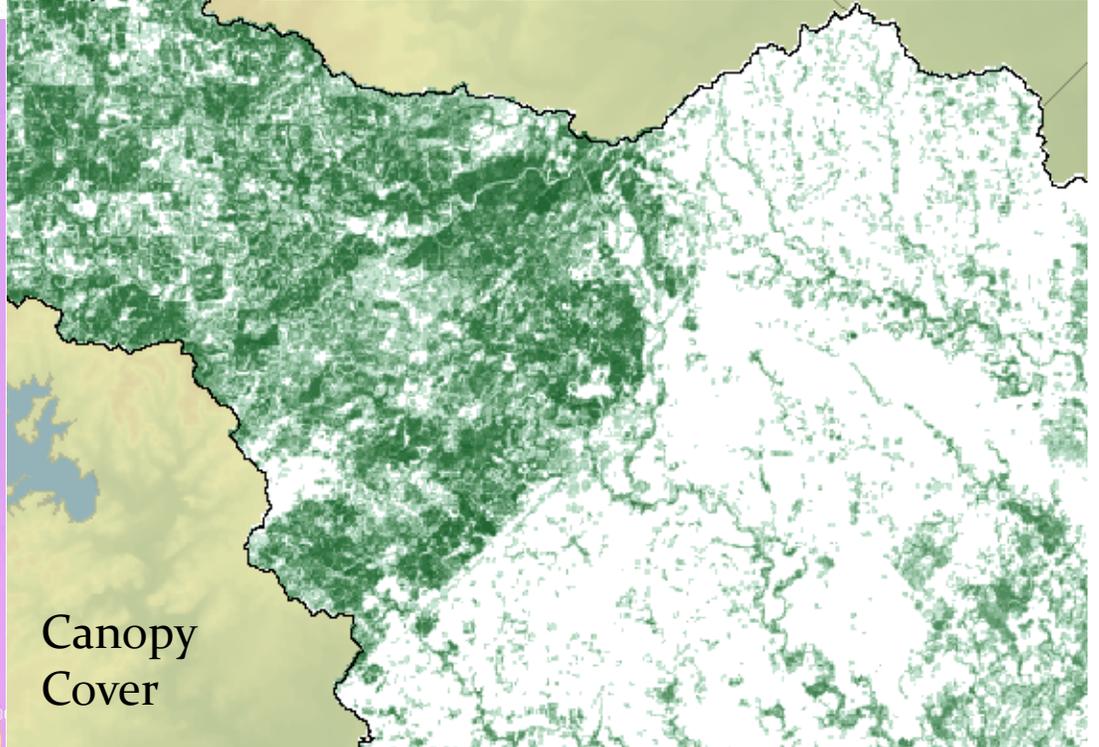
Land
Cover



Impervious
Cover

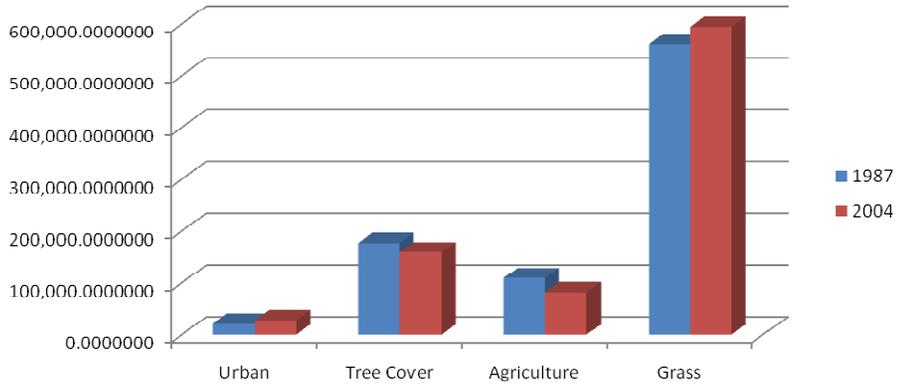
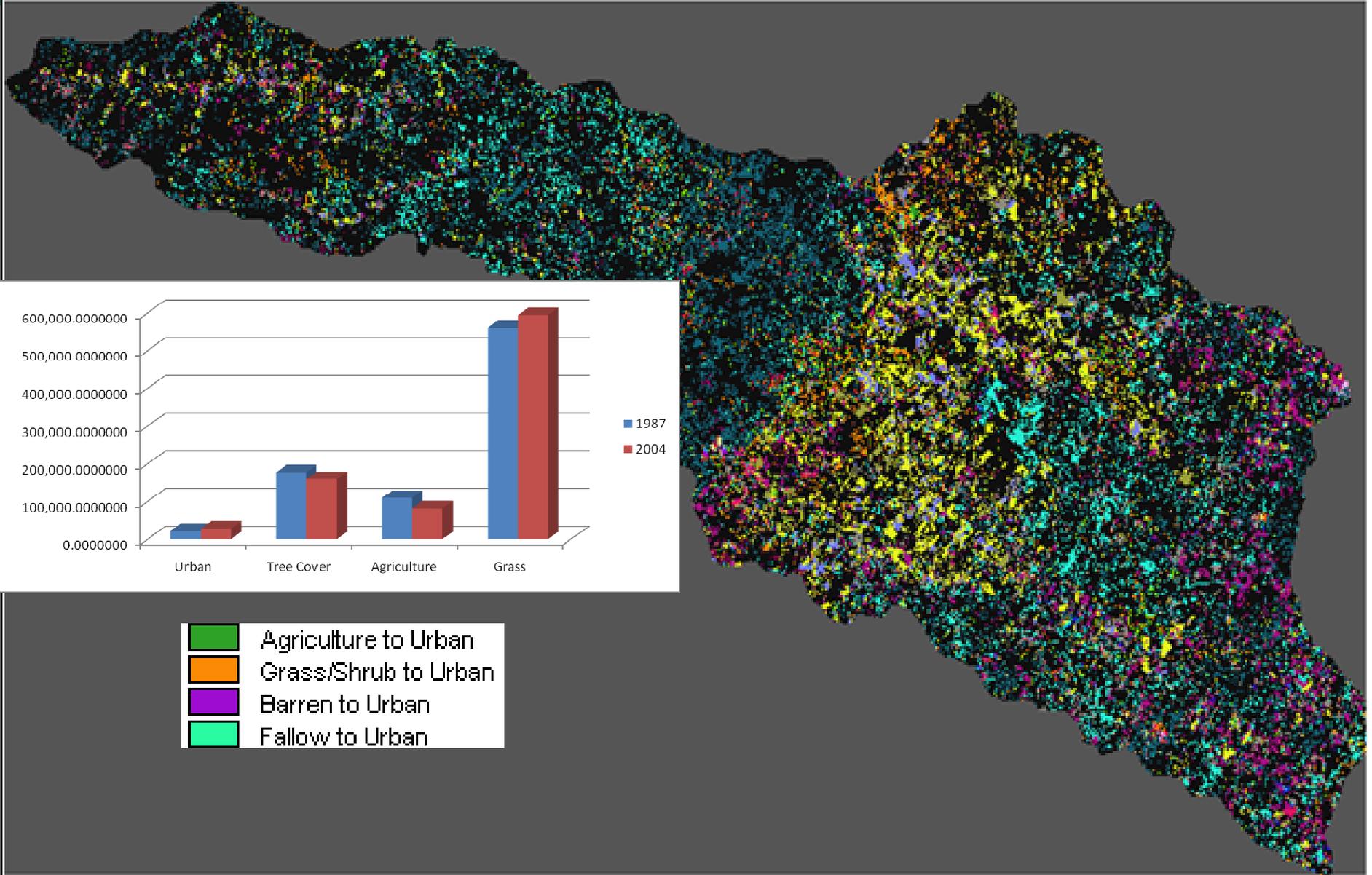


Water Quality Monitoring Stations

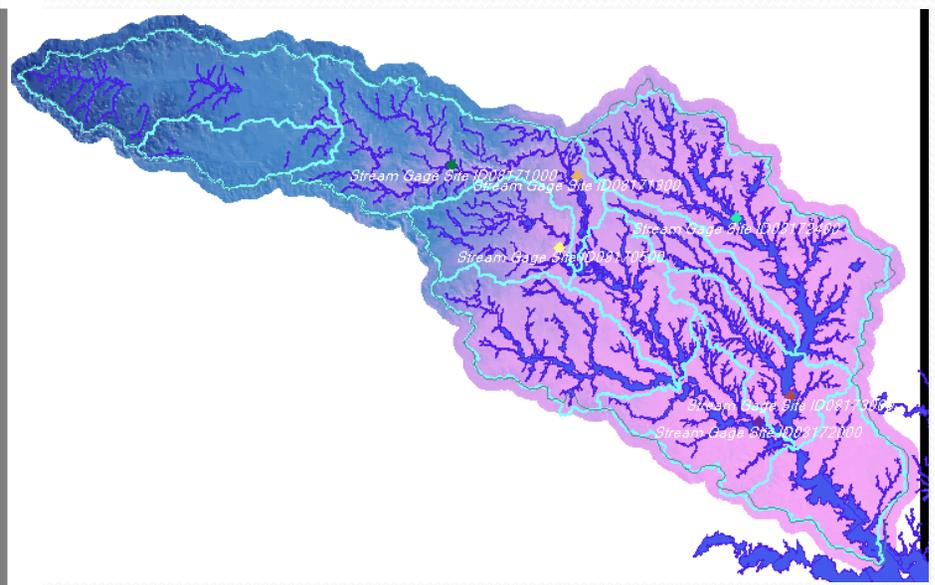
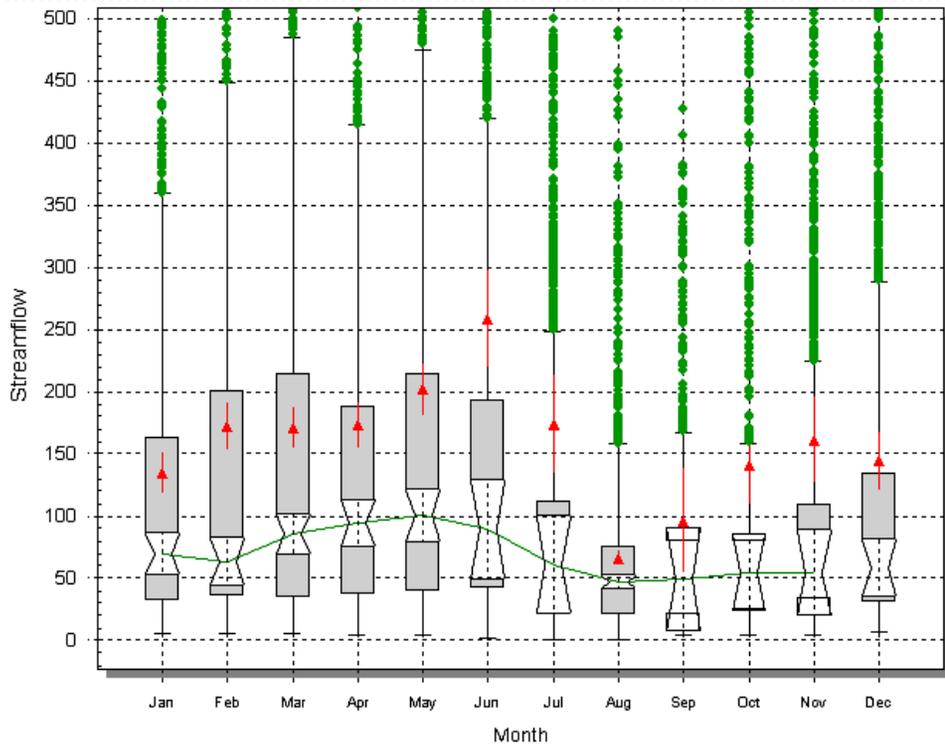
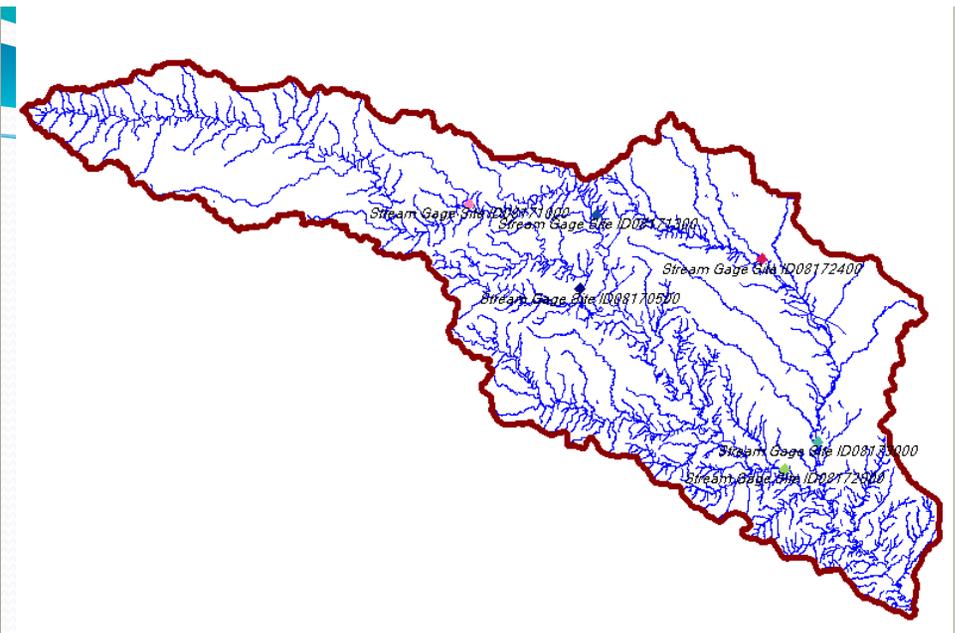
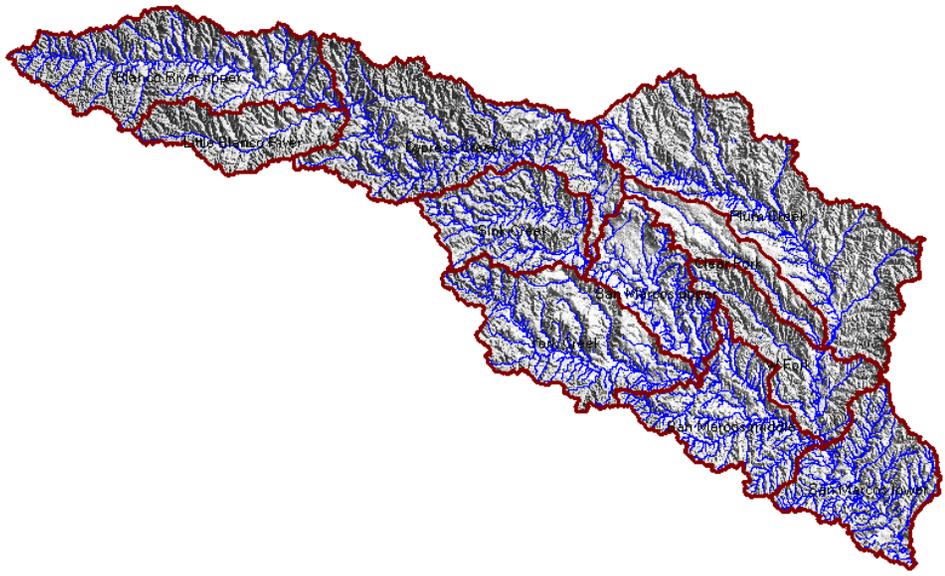


Canopy
Cover

Change from 1987 to 2004



-  Agriculture to Urban
-  Grass/Shrub to Urban
-  Barren to Urban
-  Fallow to Urban





Next Steps

- Updating the HSPF model to the most recent Land Use and Land Cover Data
- Identification of critical watershed areas in terms of water quality protection under Existing Conditions
- Evaluation of Future Conditions incorporating Build Out Scenario(s)
- Evaluation of Low Impact Development and Best Management Practices on addressing existing or potential water quality issues



Conclusion

Researchers have already cast much doubt on the subject and if they continue their studies we shall soon know nothing at all.

Mark Twain