What the GIS Analysis Certificate offers:

This certificate trains students to become qualified GIS analysts in their specific specialty fields or disciplines. Students pursuing this certificate should expect to gain development and confidence in GIS by learning:

1. How problems in "*my*" field are interpreted, or, how "*I*" should understand these problems, in GIS.
2. How to model scientifically the geospatial world and its components using GIS in a space-time-scale-theme framework.
3. Not only how to use GIS tools, but also how to use them correctly.
4. How others solve space-related problems in "*my*" field of GIS applications, and accordingly, how "*I*" can do it as well.
5. How to design and implement a GIS project in "*my*" field.
6. How to make high-quality maps and use maps wisely for GIS story-telling.

Specifically, students will gain GIS expertise from all three perspectives of GIS learning: theoretical understanding, skill development, and real-world problems solving. The following is a list of elements contained within these three perspectives that will be covered by this certificate

1. Skill set
    a. Spatial problem translation (into GIS) skills;
    b. GPS field survey methods;
    c. Remote sensing and image processing methods;
    d. GIS data handling (e.g. conversion and transformation), common data sets/sources, data pre-processing (e.g. cleaning or selection), and data processing (e.g. resampling) skills;
    e. GIS spatial analysis methods;
    f. Quantitative analysis skills;
    g. Advanced GIS modeling skills: model uses and model development;
    h. GIS software skills: not only skills in common GIS software packages (e.g. ArcGIS, IDRISI, ERDAS, etc.), but also skills needed to identify and tackle new software (including scripts) tools that may be encountered in the future;
    i. Map-making skills;
    j. Basic GIS scripting/programing skills (e.g. Python).

2. Theory set

    a. GIS conceptualization and conceptual models;
    b. GIS data models;
    c. GIS data availability and data production;
    d. GIS data quality, data assessment, data limitations, and data improvements;
    e. Density fields in GIS and surface modeling;
    f. Dynamic modeling and temporal prediction in GIS;
    g. Geostatistical analysis, spatial statistical analysis, and fuzzy mapping methods;
    h. Spatial interpolation approaches;
    i. Network analysis;
    j. Spatial sampling theory and methods;
    k. GIS modeling of the society and related issues;
    l. Environmental modeling and environmental analysis using GIS;
    m. GIS algorithm issues;
    n. GIS scale issues;
    o. GIS uncertainty issues;
    p. Space-time-scale integration in GIS.

3. Application set (incomplete, with examples)

    The GIS application focus of this certificate is oriented more towards general GIS analysis theories and techniques, with applications in social and environmental disciplines. The ecological GIS focus of this certificate addresses issues specifically related to biological/ecological applications of GIS.

Application fields involved in the program	**Example applications and analyses**
Socioeconomic applications	
Emergency management	Evacuation routes and siren audibility mapping
Health sciences	Cancer-demography/environment analysis
Law and crimes	Crime hotspots and crime-population relations
Population mapping	Dasymetric population density mapping
Precision agriculture	Spatial sampling effect and yield-

	input/environment relations
Sociology	Neighborhood delineation and poverty analysis
Transportation	Network analysis and service accessibility
Urban planning	(Dynamic) modeling of urban sprawl
Environmental applications	
Climatology	Tornado density and probability mapping, PRISM
Environmental sciences	Non-point source pollution modeling, dispersal
Geology	Geostatistical pattern analysis, kriging
Hydrology	Hydrological modeling in GIS
Landscapes	LULC change modeling methods
Natural resources	Floodplain/wetland mapping, windfarm siting
Soil erosion	RUSLE and terrain-based modeling
Soil mapping	Fuzzy soil classification and soil property interpolation
Biological/ecological applications	
Landscape-based habitat (patch) delineation	
Predictive vegetation mapping	
Pest/disease dispersal modeling	
Animal migration route choice (e.g. agent-based modeling)	

An application example (map created by an instructor of the certificate): 3-D views of tornado density maps created for the eastern U. S. using different density computation algorithms and parameters.