

Sustainable Bioenergy: Role of Geospatial Science and Technology



Budhendra Bhaduri

Presented at

Biomass 2009

March 17, 2009

GIS: Definitions and Perceptions



- **“GI” = Geographic(al) or Geospatial Information**
- **“S” = System and Service and Science**
- **Geographic Information System (and Service)**
 - a collection of computer hardware, software, geographic data designed to efficiently capture, store, update, manipulate, analyze, visualize, and disseminate all forms of geographically referenced information
- **Geographic Information Science**
 - “a multidisciplinary research enterprise that addresses the nature of geographic information and the application of geospatial technologies to basic scientific questions” (Goodchild, 1992)
- **But GISystem is not GIScience**
 - “the science behind or underlying geographic information systems technologies and their applications” (DeBiase et al., 2007)

Four Pillars of Geospatial Technology



- **Global Positioning Systems (GPS)**
 - Accurate geolocation; Location Based Services
- **Remote Sensing (RS)**
 - Space, air, and ground based sensors providing accurate, high resolution, current, and affordable 'data' commodity
 - Image Processing Software (ERDAS Imagine, ENVI, etc)
- **Geographic Exploration Systems (GES)**
 - Platform for visualization; Retail outlets for data;
 - Google Earth, MS Virtual Earth, NASA World Wind
- **Geographic Information Systems (GIS)**
 - Platform for spatial analysis
 - GIS Software (ESRI ArcGIS, GE Smallworld, Intergraph, etc)

What We Realize Today



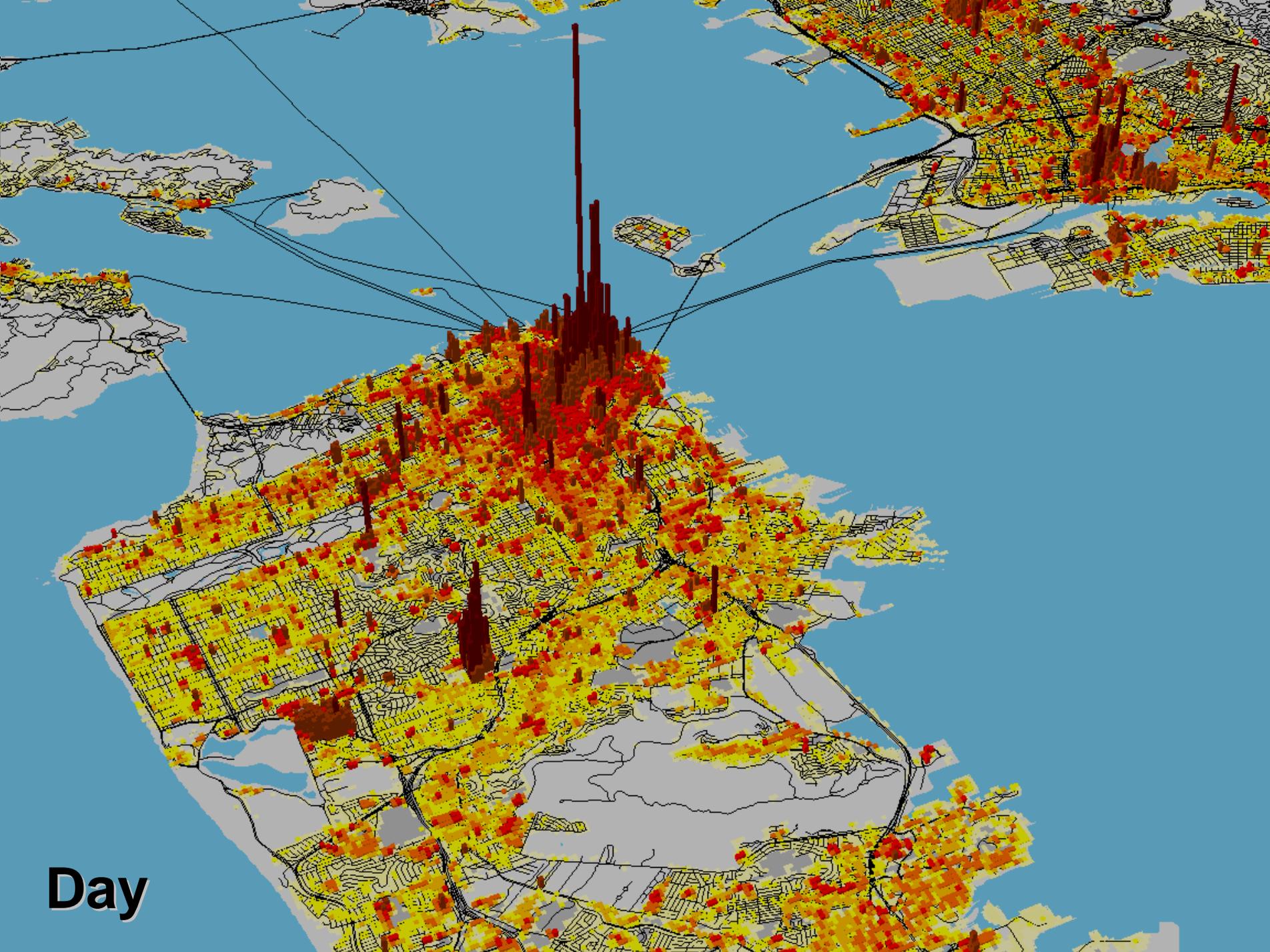
- **Geospatial data are harbinger of massive data explosion (Terascale to Petascale to Exascale)**
 - **Earth Observation**
 - Satellite sensors, Airborne sensors, Ground-based sensors
 - Human sensors (VGI: **V**oluntary **G**eographic **I**nformation)
 - **Earth Simulation**
 - Climate, Astronomy, Hydrology, Biology, Chemistry, Nanotechnology
- **Data volume and complexity present critical challenge**
 - Search, Analyze, and Visualize
- **Geospatial Technology will dominate scientific advancements along with Biotechnology and Nanotechnology**
 - Multi billion dollar industry
- **Road to scientific advancement and discovery**
 - Efficient data management, analysis, creation, and visualization of meaningful information within useful timeframe

Significance of Geospatial S&T

Geographic Information Science and Technology



- **Effectively combines data from physical, engineering, and social systems**
- **Geospatial integration, analysis, and visualization**
 - Aid scientific understanding of earth system models
 - Advance interdisciplinary critical infrastructure models
 - Enhance decision support systems for time-critical missions
- **Integral to decision making process in planning, policy, and operational missions from local to global scales**



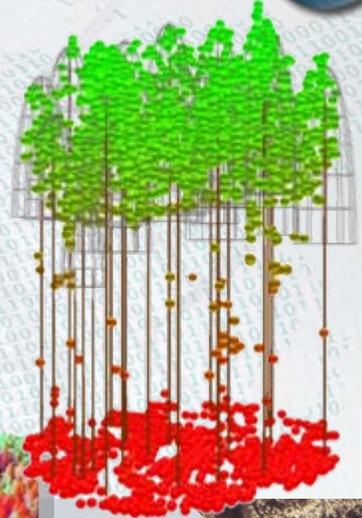
Day

Biomass Sustainability

Geographic Information Science and Technology



- **Accurate spatiotemporal assessment of biomass resources with 3D data**
- **Assessment of land cover and land use change**
- **Photorealistic visualization for ecological response models**
 - Land use change
 - Water quality impacts



Climate Change and Infrastructure

Geographic Information Science and Technology



- Feedback among climate, land use, and population distribution
- Climate induced hazards and infrastructure impacts
- Spatiotemporal translation of regional climate impacts on local decisions

