Introduction to

N-SPECT

The Nonpoint-Source Pollution and Erosion Comparison Tool

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

Description

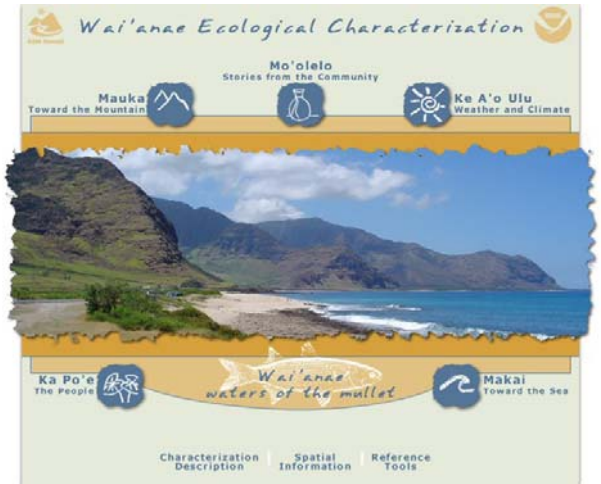
- Water quality screening tool
- Spatially distributed (raster-based) pollutant and sediment yield model
- Compares the effects of different land cover and land use scenarios on total yields
- User friendly graphical interface within ArcGIS

History

- Audience
  - Coastal managers
  - Land-use planners
  - Scientists
  - Teachers
- Development team
  - Dr. David L. Eslinger, Jamie Carter, Margaret VanderWilt, Bev Wilson, Ed Dempsey, Andrew Meredith
- Major contributors
  - Hawaii Coastal Zone Management Program
  - NOAA Coastal Services Center (CSC)
  - National Ocean Service Pacific Services Center
  - Hawaiian management community

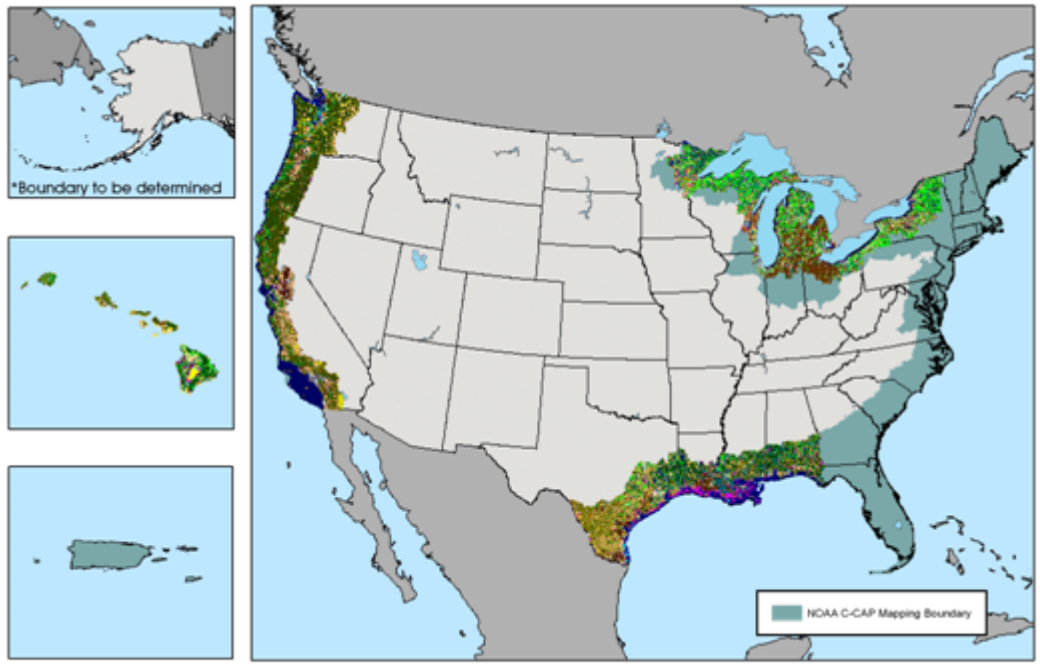
History

- Hawaii managers needed a simple, quick screening tool
- Initially applied in Wai'anae region in Oahu, Hawaii
  - Current pressure from residential development
  - Sensitive coastal habitats
  - Ahupua'a management
- Component of CSC's landscape characterization in Hawaii (Wai'anae Ecological Characterization)



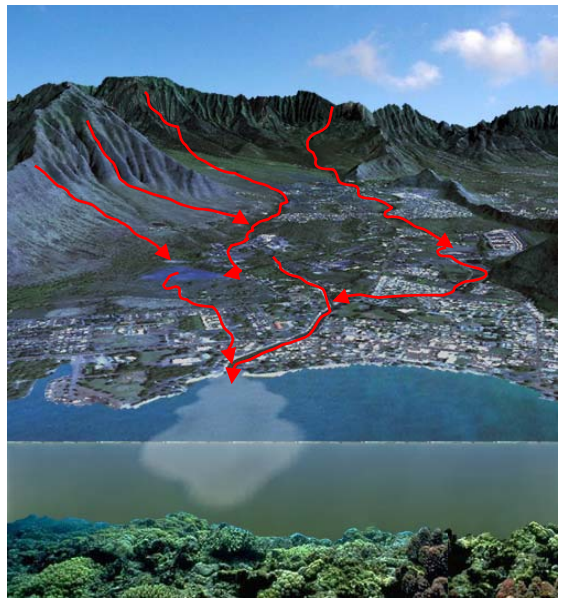
History

- Follow-on to CSC's activities with NEMO (Nonpoint Education for Municipal Officials)
- General tool - useful in other geographies



Functions

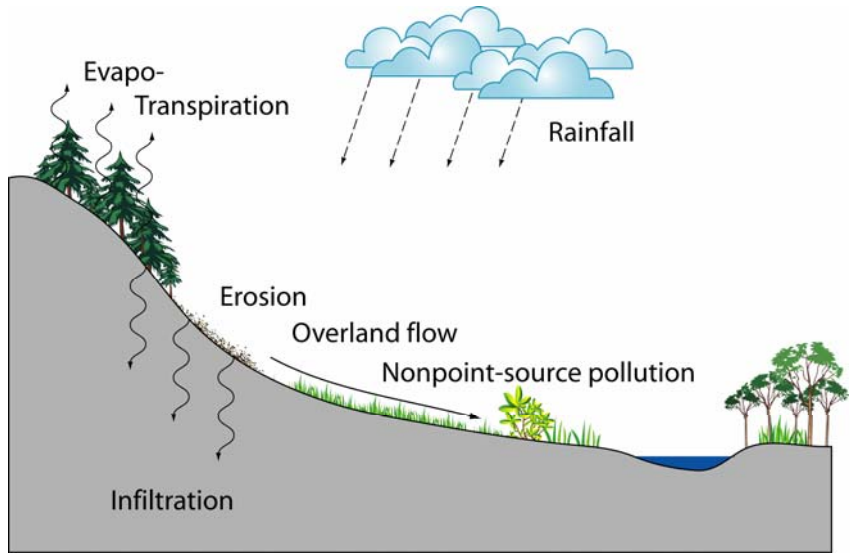
- Rainfall-runoff model
  - Soil Conservation Service (SCS) curve number technique
- Pollutant model
  - Event mean concentration coefficients
- Sediment yield model
  - Universal Soil Loss Equation (USLE)
    - Modified (MUSLE)
    - Revised (RUSLE)



	EVENT	ANNUAL
RUNOFF MODEL	SCS RUNOFF CURVE NUMBER	MODIFIED SCS CURVE NUMBER
EROSION MODEL	MUSLE	RUSLE
NONPOINT-SOURCE MODEL	EVENT MEAN CONCENTRATION	EVENT MEAN CONCENTRATION

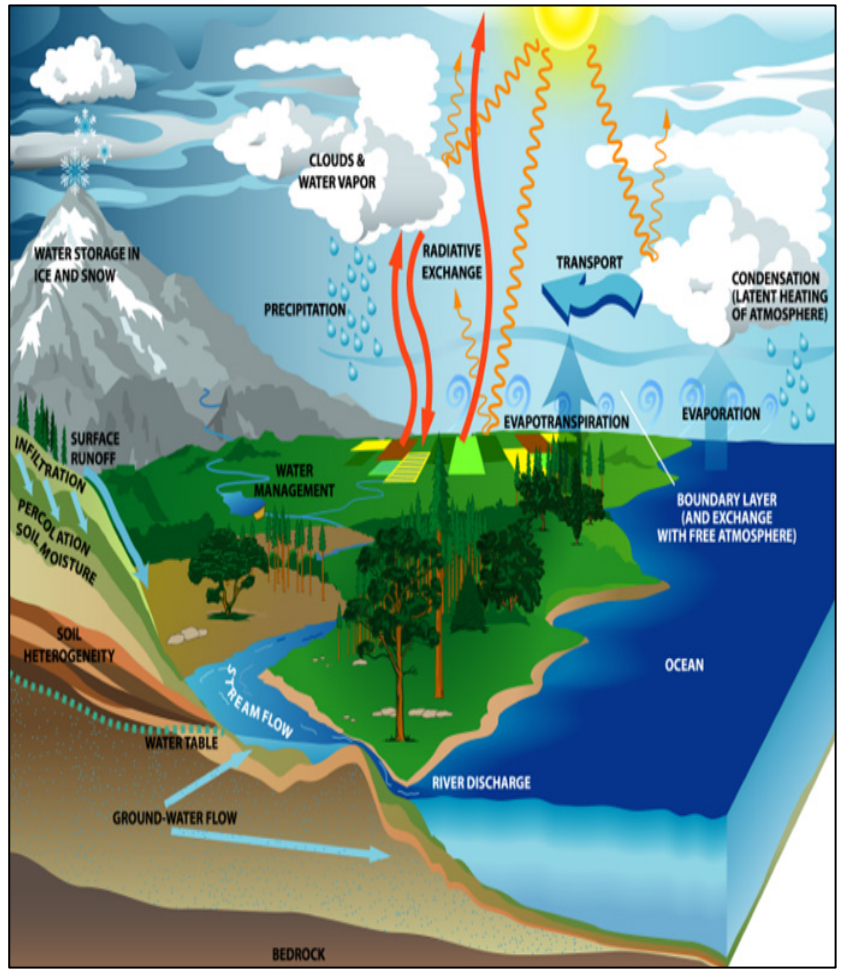
Process

- *Topography* determines flow direction and slope
- *Soil characteristics*, *land cover*, and *precipitation* determine runoff
- *Runoff, land cover,* and *pollutant coefficients* determine pollutant loads
- *Runoff, topography, soil characteristics*, and *land cover* determine sediment loads



Assumptions/Limitations

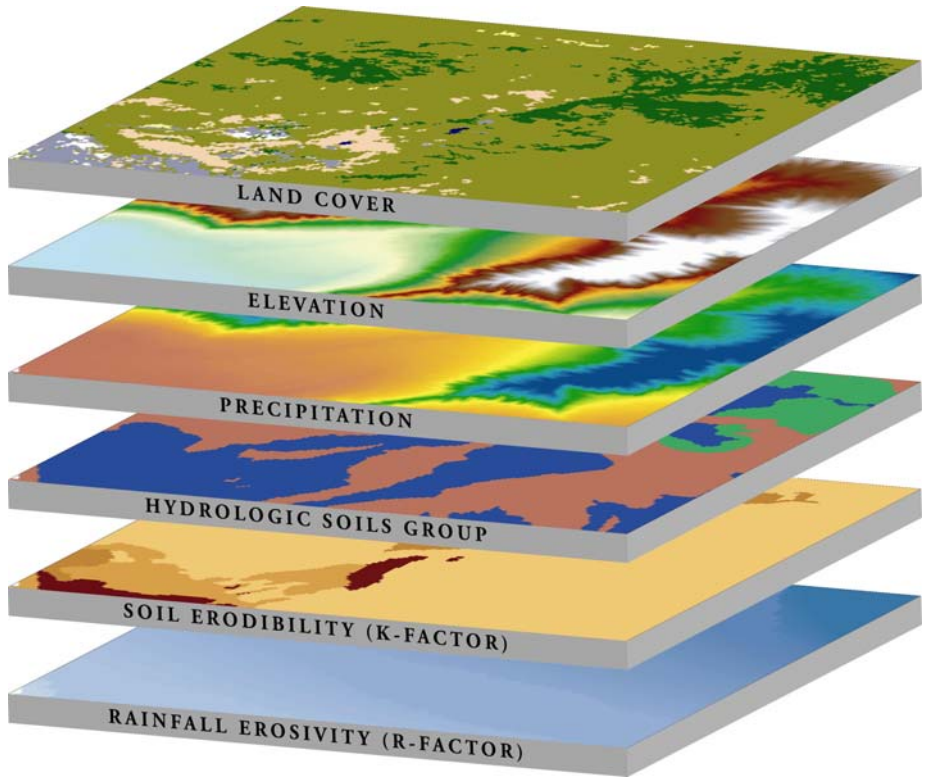
- Omitted processes
  - Atmospheric deposition
  - Groundwater processes
  - Stormwater drainage
  - Stream diversions
  - Snow melt
  - Landslides
- No time dependency on
  - Runoff dynamics
  - Sediment redeposition
  - Pollutant load



Source: NASA Earth Science Enterprise

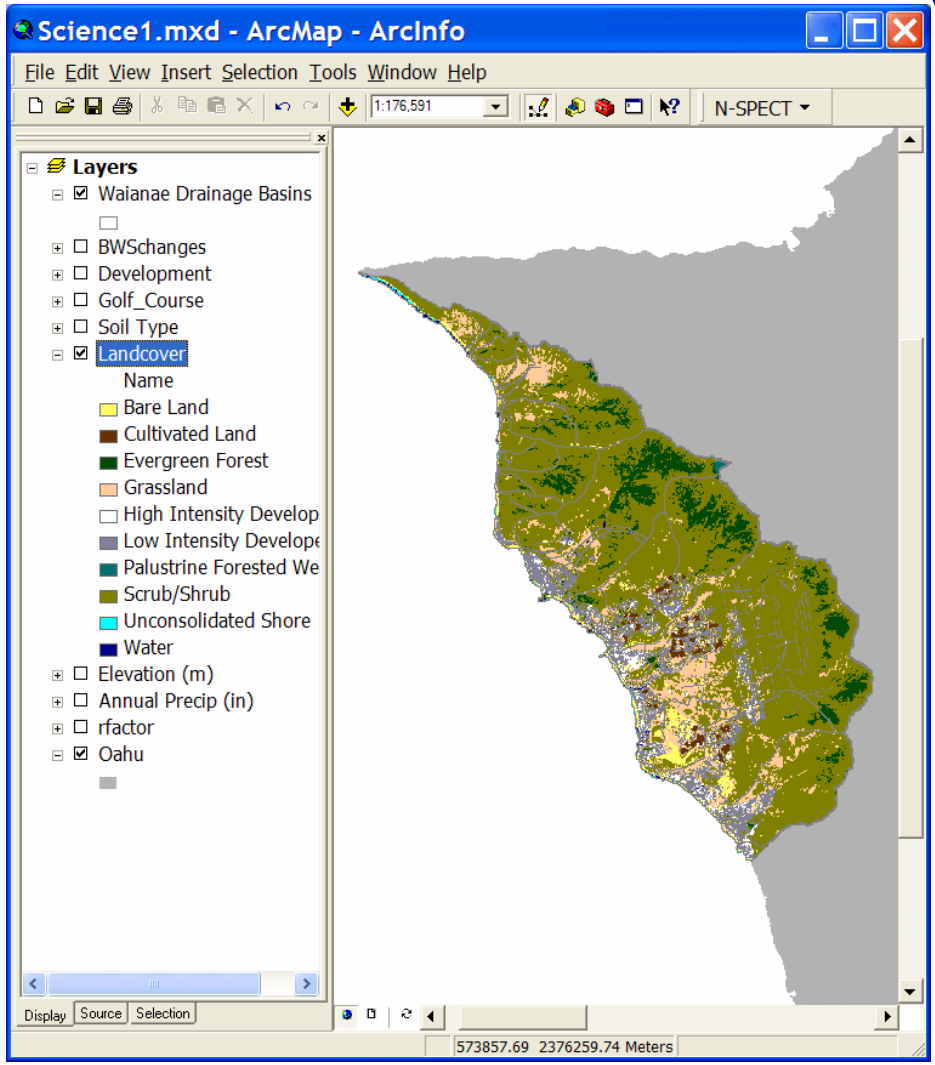
Data Needs

- Nationally derived
  - Land cover data
  - Topography
  - Soils data
- Locally derived
  - Precipitation
  - Rainfall erosivity (R-factor)
  - Pollutant coefficients
  - Water quality standards



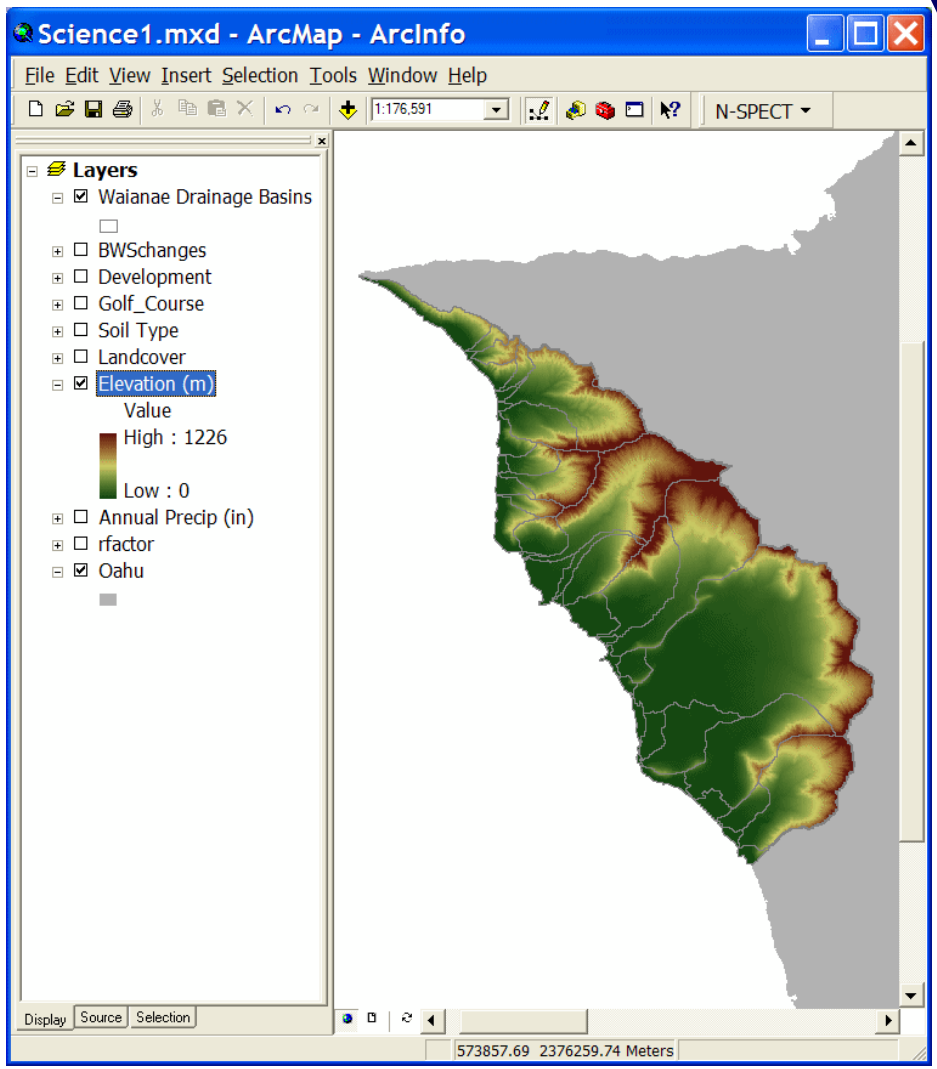
Land Cover

- Foundation for runoff quantity, sediment yield, pollutant yield
- Default
  - Coastal Change Analysis Program (C-CAP)
  - 30 m resolution
- Flexible
  - Can easily substitute any land cover grid



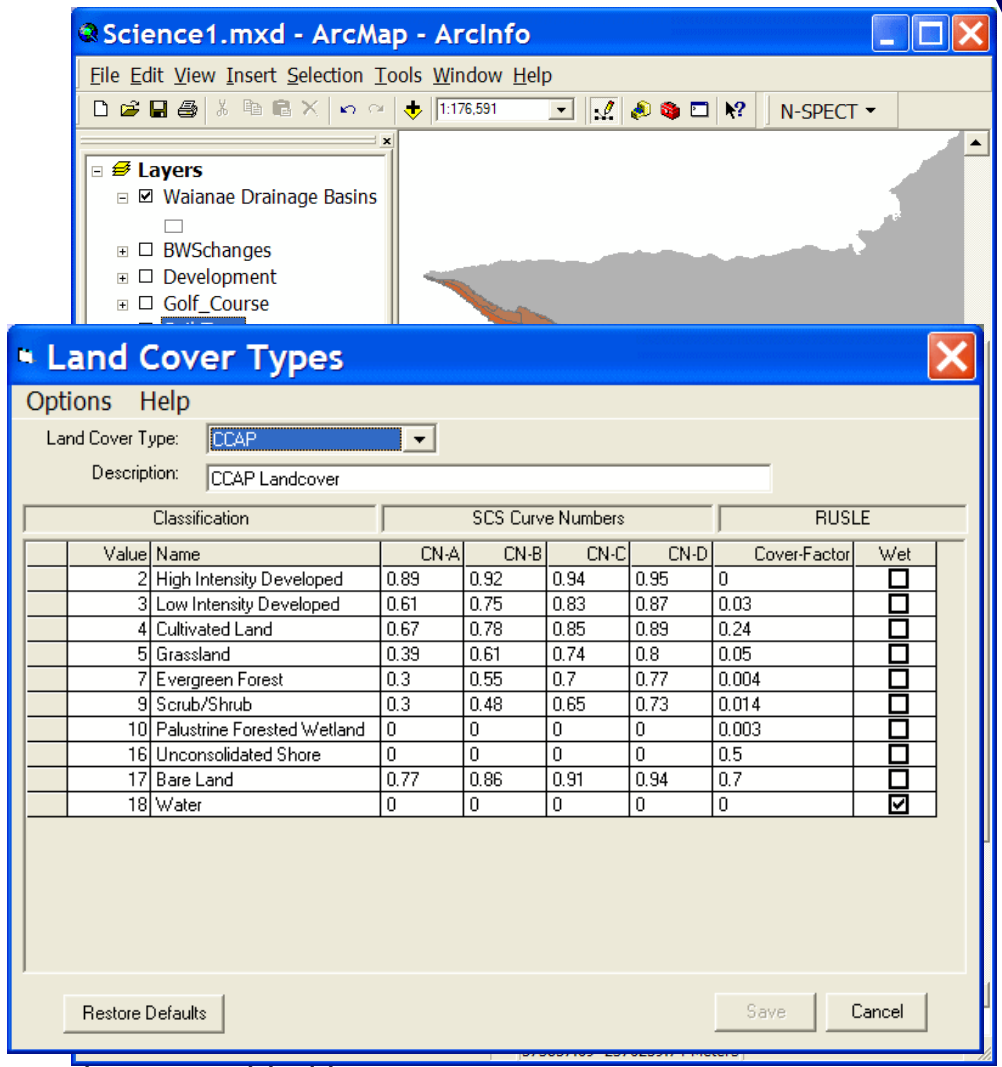
Topography

- Defines flow direction, stream networks, watersheds
- Default
  - U.S. Geological Survey (USGS) 30 m resolution digital elevation model
- Resolution impacts processing speed and file size



Soils

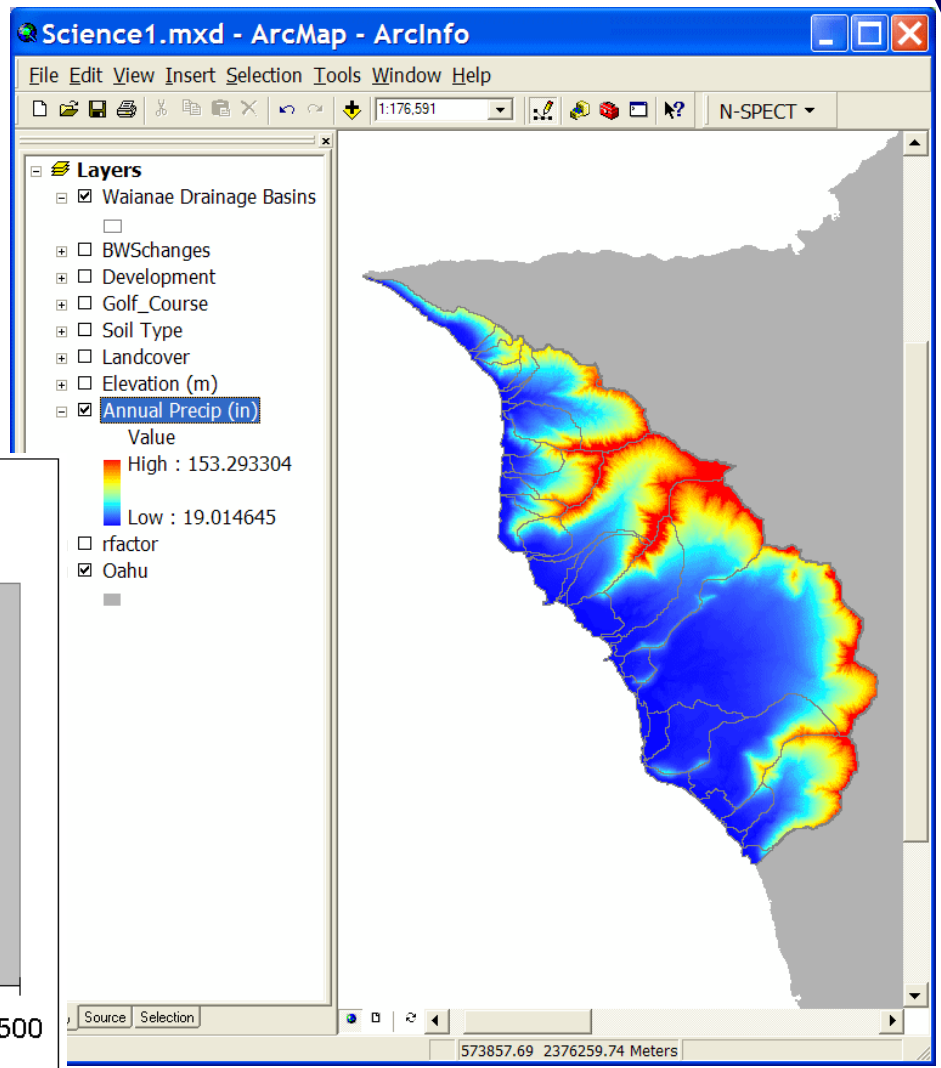
- Runoff and erosion estimates are dependent upon soils and land cover
- Default
  - SSURGO soils†
  - County level resolution
- Hydrologic group
  - Infiltration rate
- K-factor
  - Soil erodibility

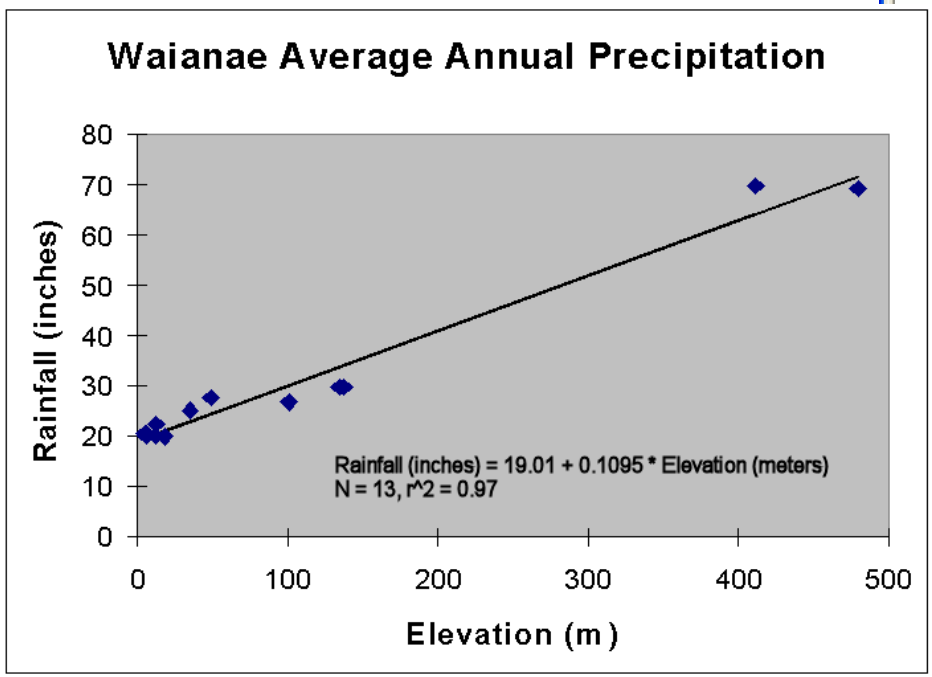


† Soil Survey Geographic Database provided by the Natural Resources Conservation Service

Precipitation

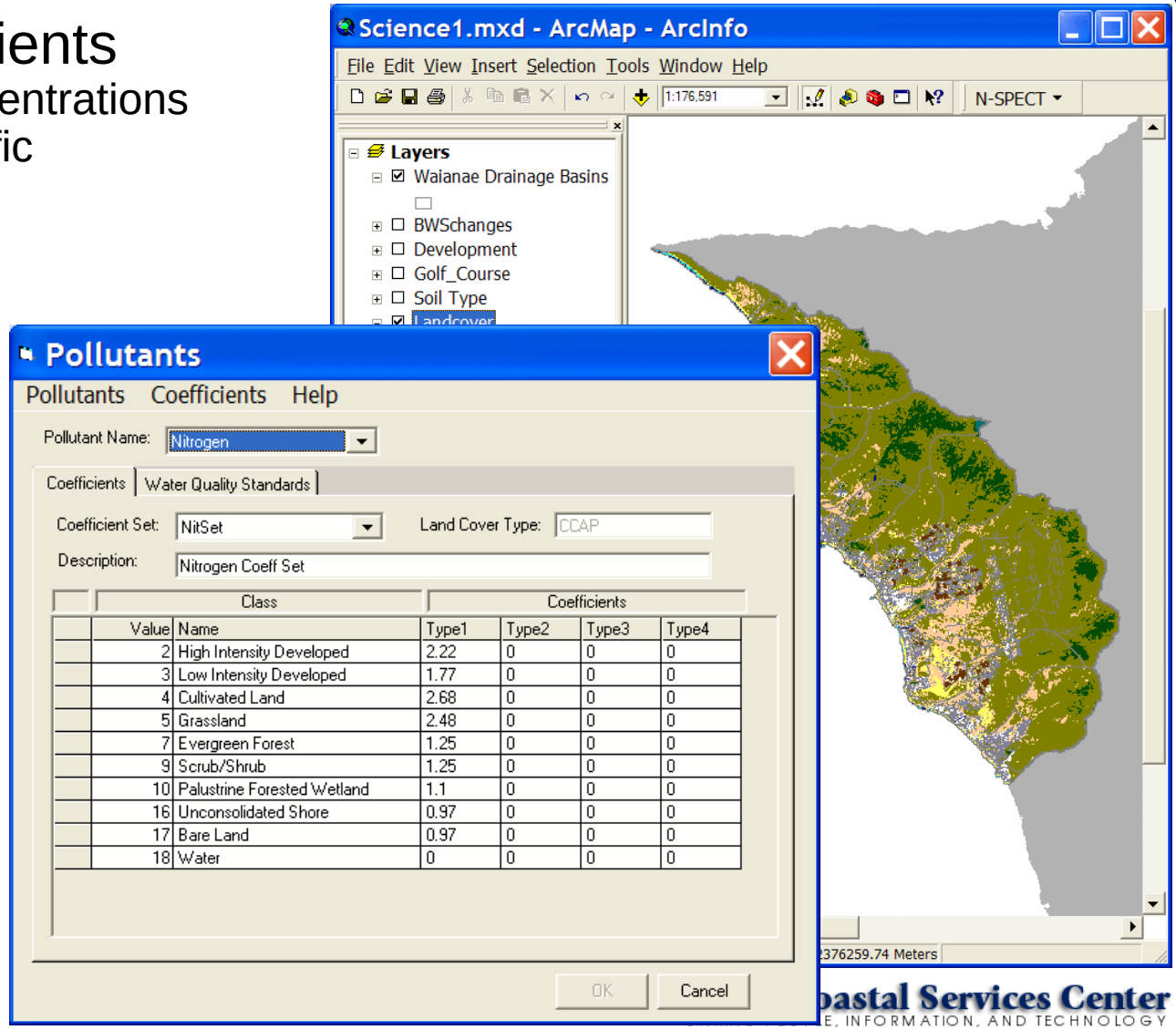
- Derived from point estimates or modeled
- Annual grids
  - Average annual rainfall
- Event grids
  - Event rainfall





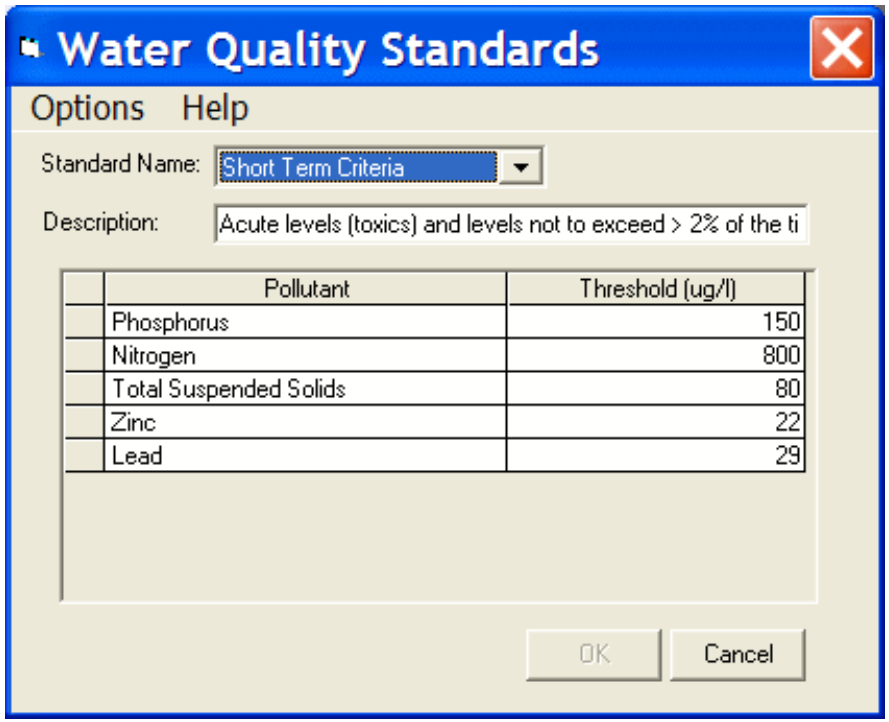
Pollutants

- Pollutant coefficients
  - Event mean concentrations
  - Land cover specific
- Default
  - Nitrogen
  - Phosphorus
  - Lead
  - Zinc
- User–definable
  - Pollutants
  - Coefficients



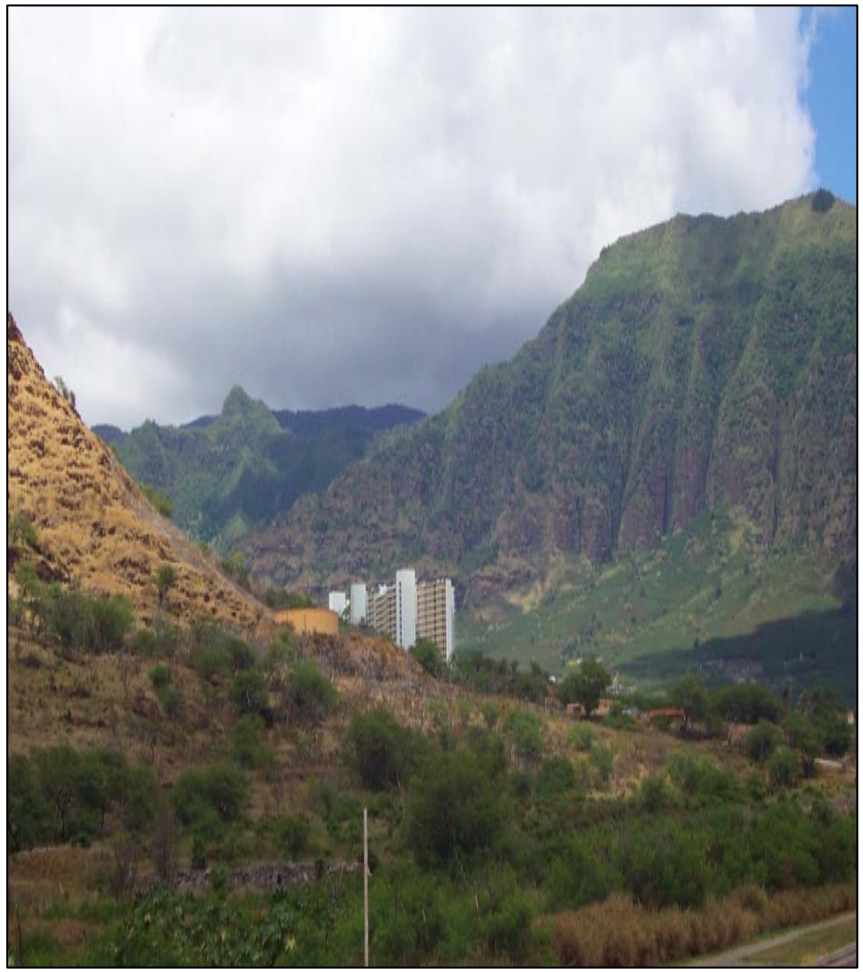
Water Quality Standards

- User-defined standards
  - Annual or event-specific
  - Regulatory or target
- Final pollutant loads are compared with standards to assess water quality



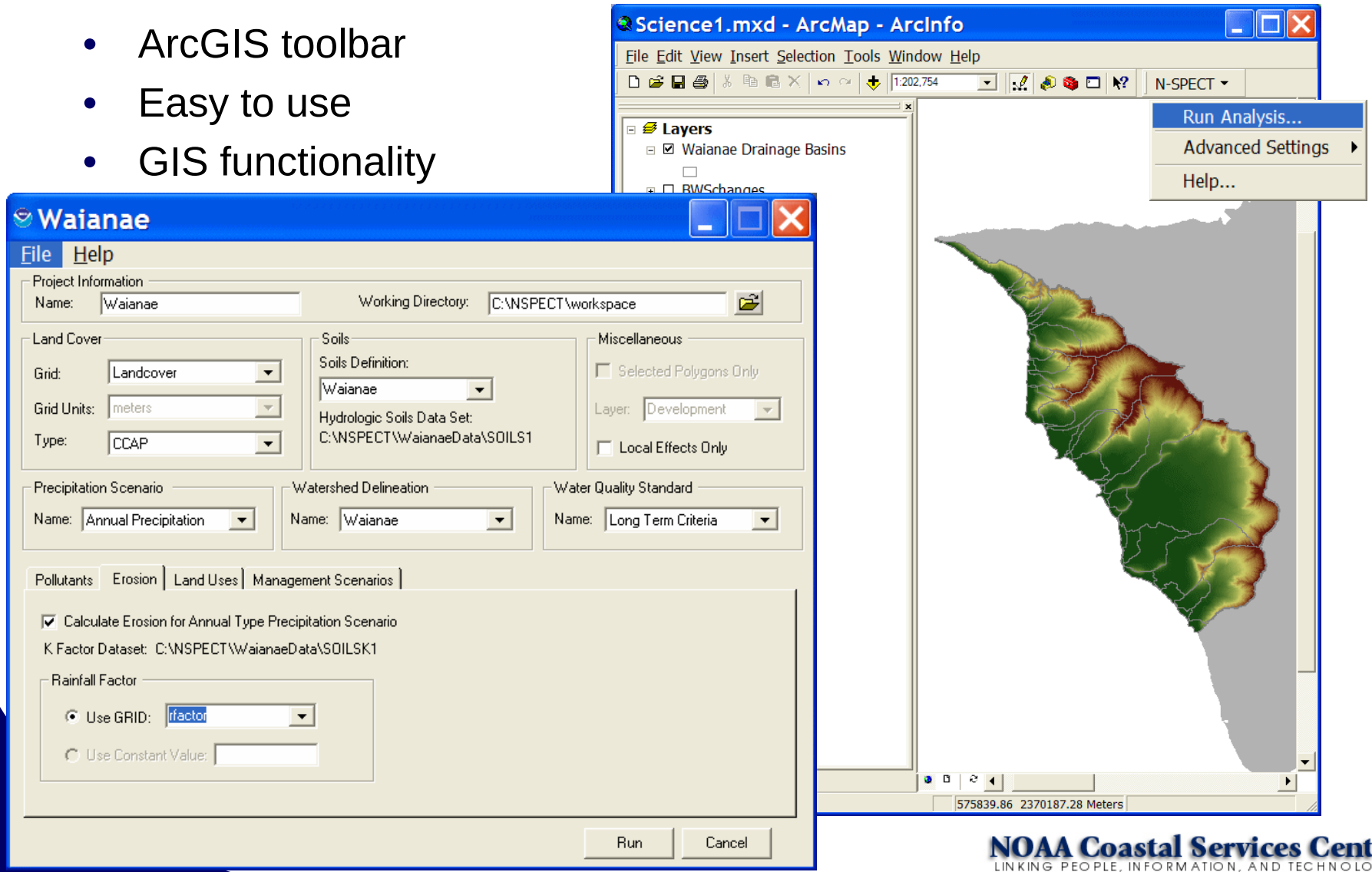
Example Application

- Makaha Valley, Oahu, Hawaii
- Annual time scale
- "What-if" scenario
  1. Baseline
  2. Land cover change
     - New residential development
  3. Comparison



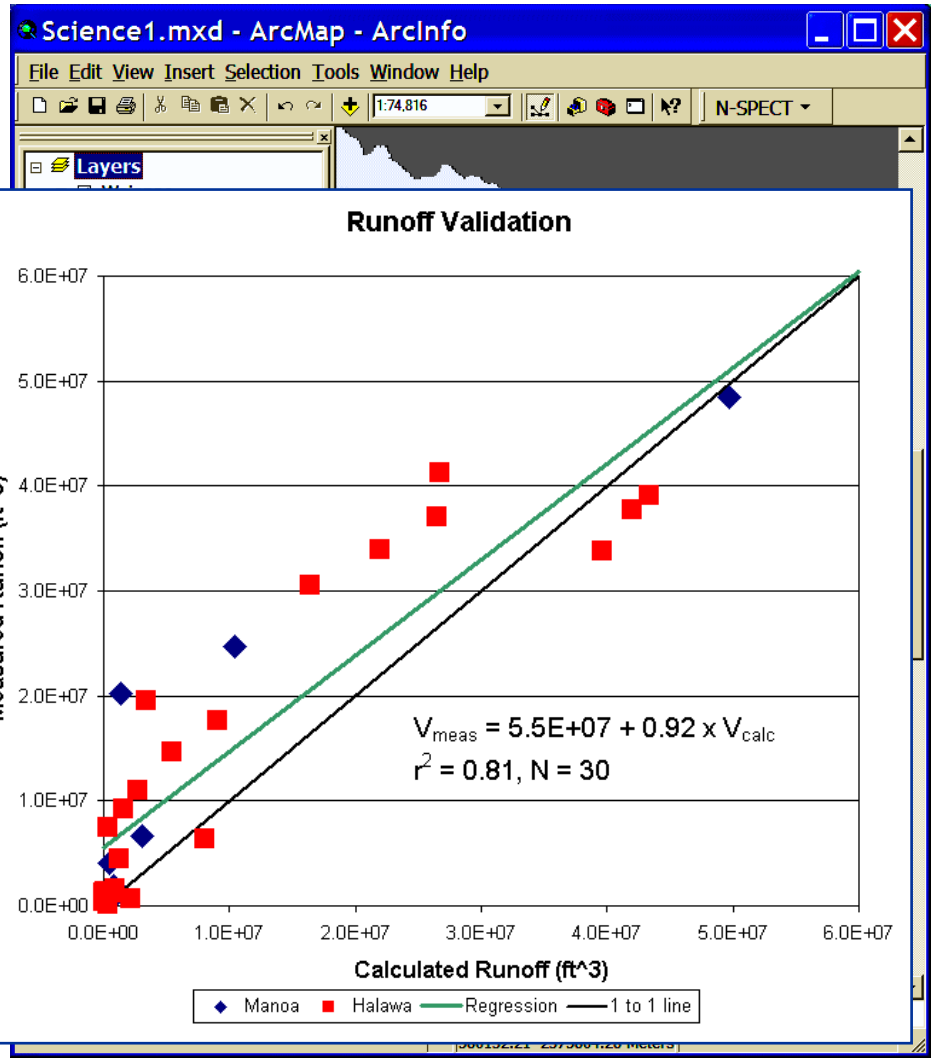
Interface

- ArcGIS toolbar
- Easy to use
- GIS functionality



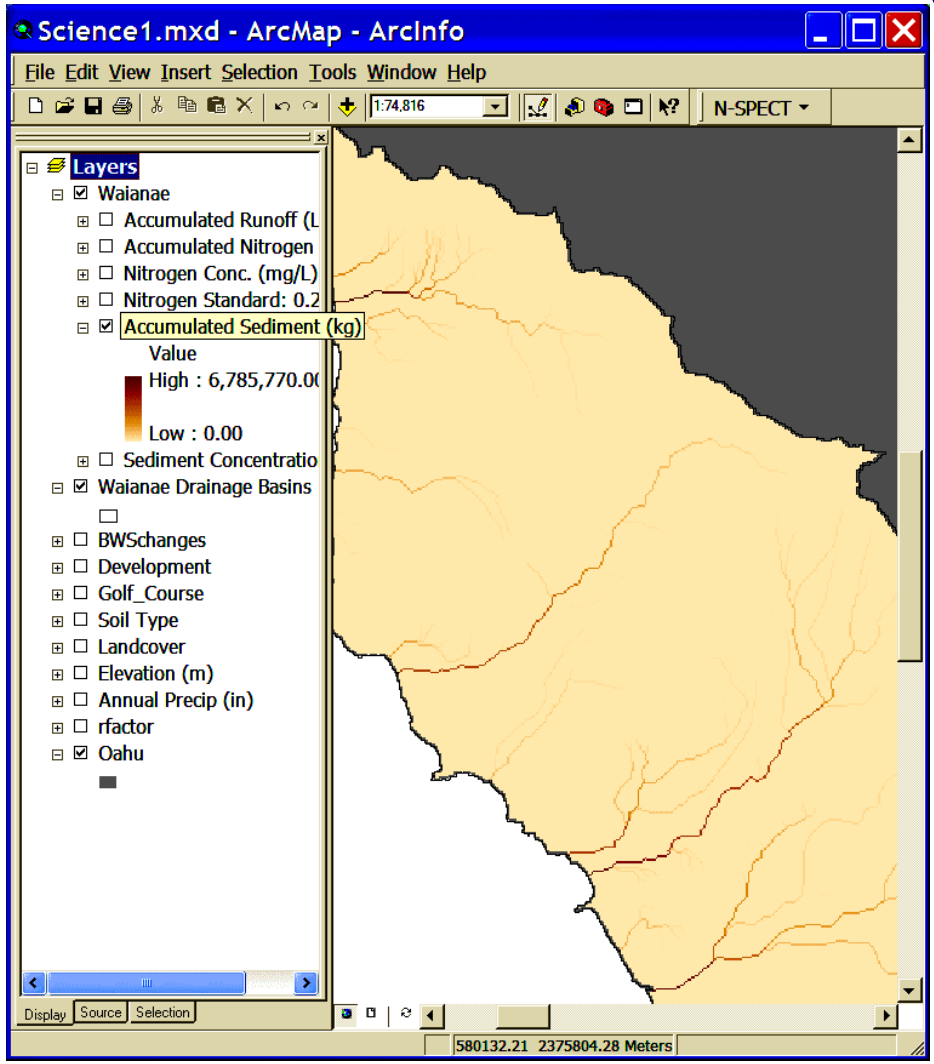
Baseline Runoff

- Flow directions derived from topography
- Precipitation grid provides amount of rainfall
- Uses soils and land cover data to estimate volume of runoff
- Validated



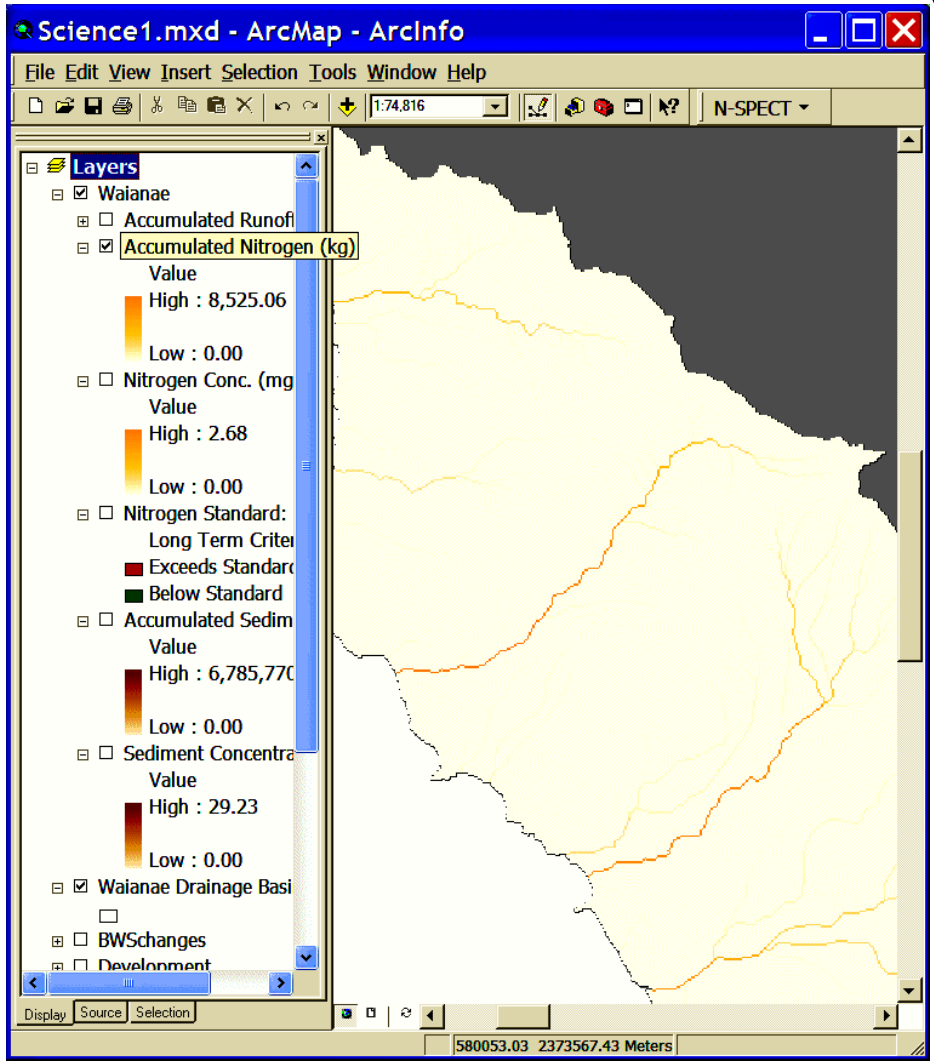
Baseline Erosion

- Estimates total annual sediment load delivered to coast
- Provides a conservative estimate
  - A “worst-case” scenario



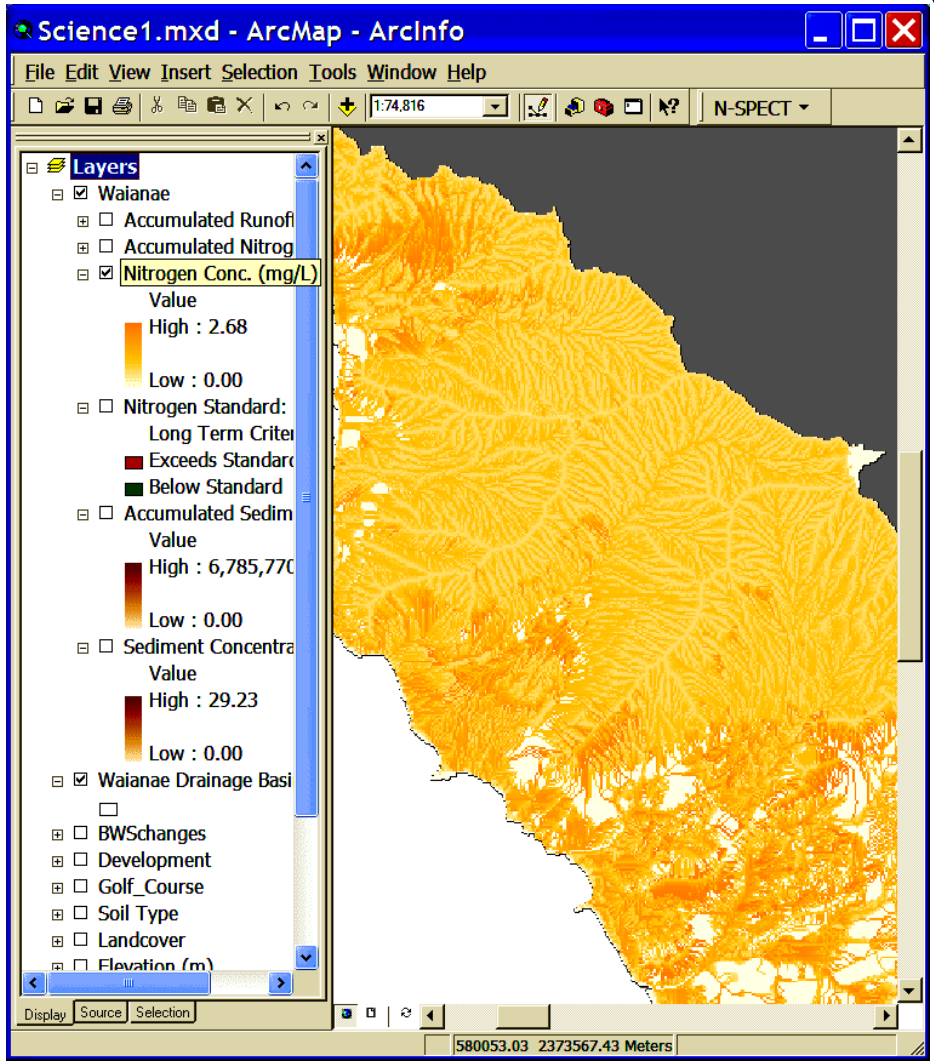
Baseline Nitrogen

- Estimates total annual pollutant load delivered to coast
- Includes sum of contributions to any particular point



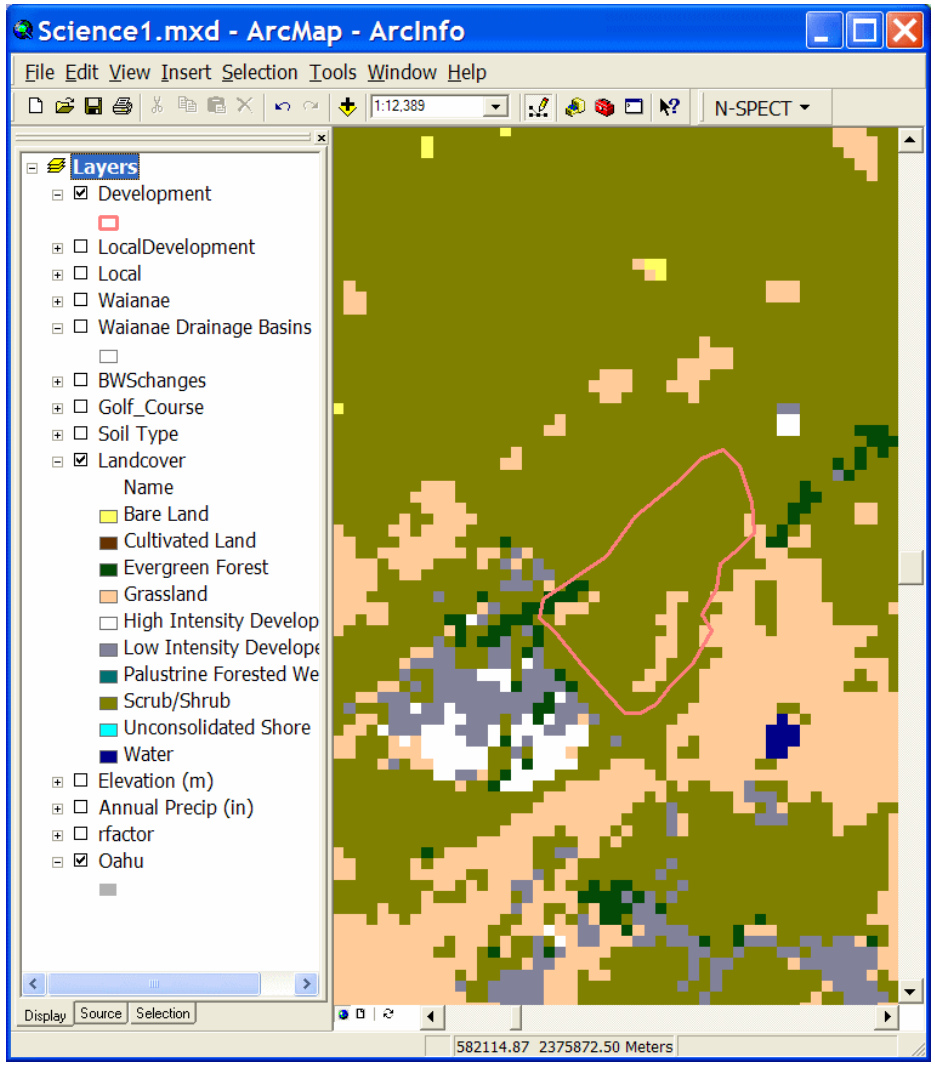
Baseline Nitrogen

- Estimates total annual pollutant concentration
- Focuses attention on source areas



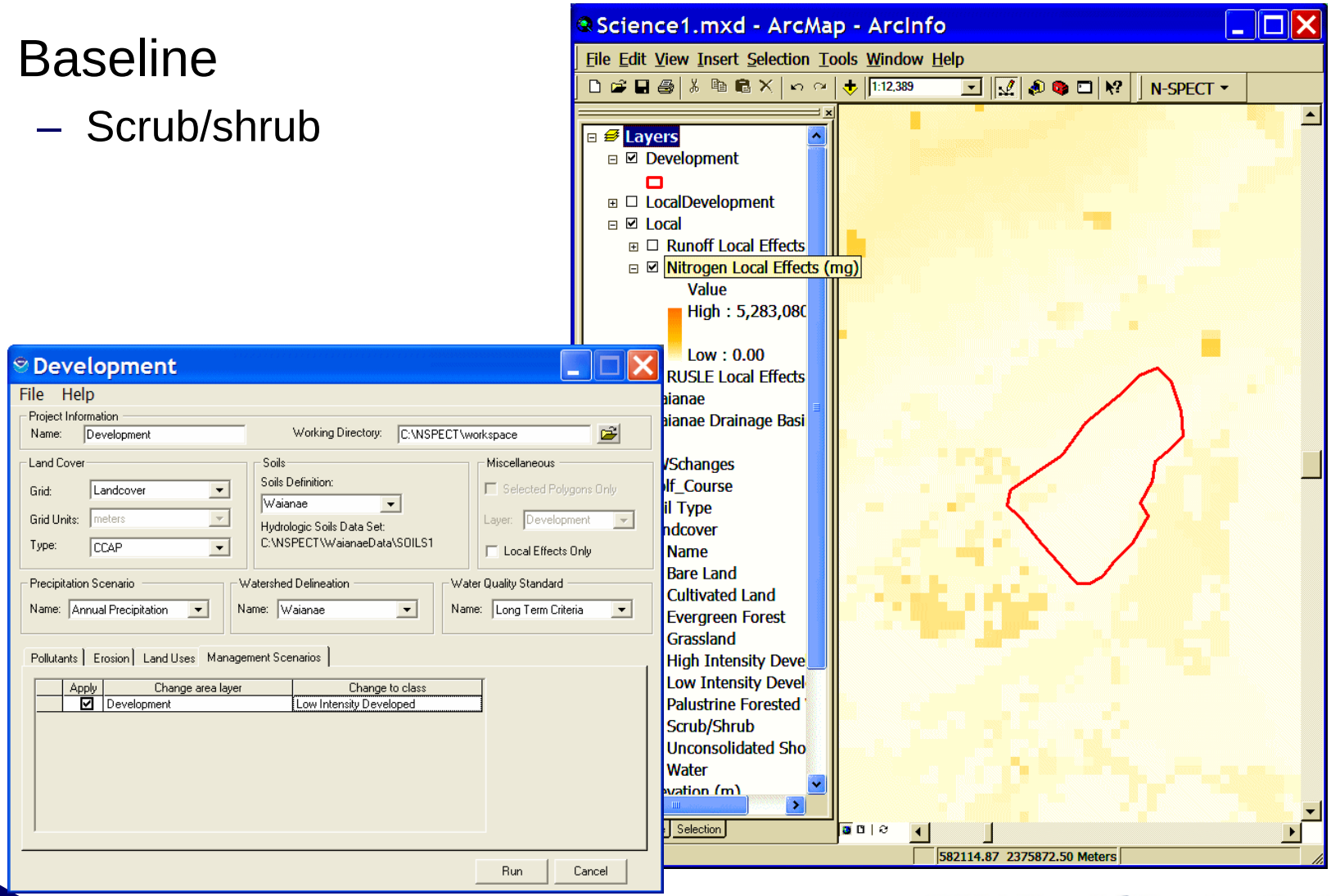
Land Cover Change Scenario

- Develop a subdivision
- Change scrub/shrub vegetation to low intensity development



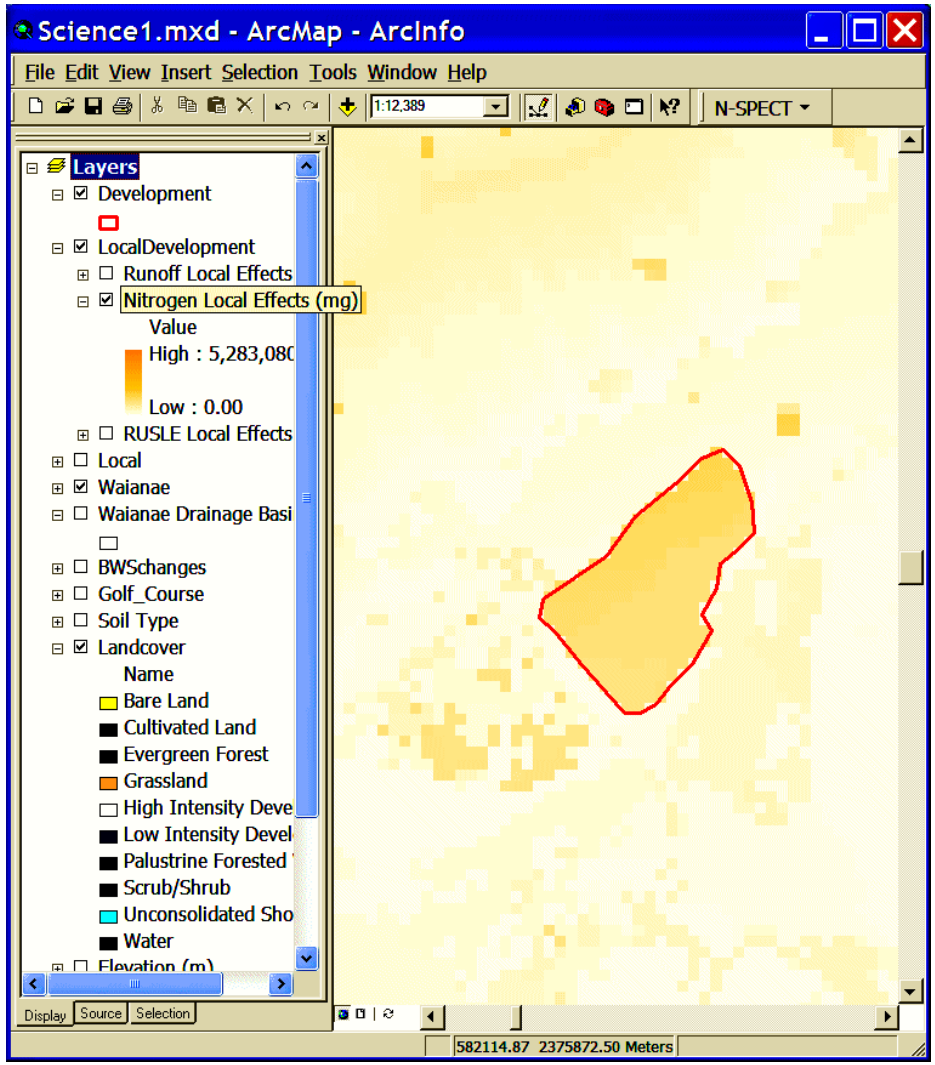
Nitrogen (Pre-Change)

- Baseline
  - Scrub/shrub



Nitrogen (Post-Change)

- Land cover change
  - Low intensity residential
- Compare baseline estimate to the estimated load after a change in land cover
- Estimated 138 percent increase in nitrogen load from this area



Resources

- N-SPECT help files
- User manual
- Technical guide
- Tutorial
- Advanced applications

- Web site
  - *www.csc.noaa.gov/nspect*
- List server
  - *n-spect@csc.noaa.gov*
- Technical Support
  - Jamie Carter
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