Spatial Analysis and Decision Assistance (SADA) Version 5
Overview

Midwestern States Risk Assessment Symposium
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SADA General Information

Windows--based freeware designed to integrate scientific models with decision and cost analysis frameworks in a seamless, easy to use environment.

- Visualization/GIS
- Statistical Analysis
- Geospatial Interpolation
- Geospatial Uncertainty Analysis
- Human Health Risk Assessment
- Ecological Risk Assessment
- Custom Analysis
- MARSSIM Module
- Area of Concern Frameworks
- Cost Benefit Analysis
- Sampling Designs
- Export to Arcview/Earthvision

SADA has been supported by DOE, EPA, and the NRC. SADA Version 4.0/4.1 has had 15000+. Version 5.0 has been out since January, 2009. Support is provided through Yahoo groups, training courses, and a 600 page user guide.
Where and who....

http://www.tiem.utk.edu/~sada/documentation.shtml

A list of sites, uses, and documents use or refer to SADA:

DOD
USACE
Wiley InterScience - cookie error
Innovative Technology Advocate, USACE - Triad Mechanics
US Army Corps of Engineers - Elements of Successful Project Planning Initiatives

Navy
Navy Guidance for Conducting Ecological Risk Assessments
Naval Installation Restoration Information Solution

DOE
RESRAD Connection for Facilitating MARSSIM Analysis
Oak Ridge Associated Universities - listed SADA as one of industry’s most useful resources
Brookhaven National Laboratory evaluation of SADA
The Life Cycle Analysis Toolbox - U.S. Department of Energy
Oak Ridge National Laboratory - Human Health Assessment

EPA
Human Health and Ecological Risk Assessment with SADA
Data Exploration

Data Plot/GIS Overlays

Spatial Data Screens

Statistics

Polygon Selection/Cutaways
Statistics

- Numerous univariate statistics
- Non-parametric hypothesis testing
- Power curve based sample sizes
- Histogram and cdf
Spatial Analysis

Spatial Uncertainty

Spatial Estimation
Human Health and Ecological Risk

- SADA implements EPA methods for conducting ecological and human health risk assessments
- Calculation of site-specific preliminary remediation goals
- Benchmark database for contaminant effects on ecological receptors
- Exposure modeling for humans and over 20 other terrestrial species
- Contains IRIS/HEAST toxicity databases for calculating risk from exposure
- Contains EPA default exposure parameters for the risk models
- Tabular screening and risk results
- Point screens
- Risk and dose mapping
Human Health Risk Calculations

- For each media:
  - Soil, Sediment, Surface Water, Groundwater

- Exposure Scenarios:
  - Residential, Industrial, Agricultural, Excavation

- Exposure Pathways:
  - Ingestion, Inhalation, Dermal Contact, Food Chain (Beef, Milk, and Vegetable Ingestion)

- IRIS and HEAST Toxicity Databases for Carcinogenic and Noncarcinogenic Effects

- Physical Parameters for Modeling
  - Bioaccumulation Factors
  - Volatilization, Particulate Emission Factors
  - Permeability Constants, Absorption Factors
  - Saturation Coefficients, Radionuclide Half-Lives
Human Health Risk

- PRG Calculation
- PRG Screens
- Human Health Risk
Human Health Spatial Risk Maps

- SADA calculates risk for each sampling point or spatial estimate based on contaminant and exposure scenario
- Legend scale changes to risk
Ecological Risk Benchmark Screening

Ecological Risk Benchmarks

- Suitable for screening ERAs
- Compilation of ecological benchmarks for surface water, soil, and sediment
- Benchmarks a function of environmental variables where appropriate
Ecological Dose Exposures

- SADA calculates dose (mg/kg BW d) from food ingestion, soil ingestion, dermal contact, and inhalation for terrestrial exposures
- SSL, Female, Male, or Juvenile
- Over 20 different species
Custom Criteria

- View or Edit Criteria
- Data Screens

![Custom Analysis Example]

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Decision Analysis

- Spatial Screens
- Sampling Strategies

- Spatial Risk
- Area of Concern
- Cost Benefit

Cost Vs Risk Reduction
3D Visualization

True 3d Views: Points, Blocks, and Isosurfaces
Sample Designs

SADA has a number of sample design strategies in Version 4.0. These strategies include initial and secondary designs. Some are based on data alone while others are based on modeling results. With the exception of a couple of exclusively 2d designs all are available in 3d dimensions.

**Initial Sample Designs**
- Judgmental
- Simple Random
- Simple Grid
- Simple Unaligned Grid
- Standard Grid
- Standard Unaligned Grid
- MARSSIM Design
- 2d and 3d Hot Spot search designs

**Secondary Sample Designs**
- Threshold Radial
- Adaptive Fill
- High Value
  - (soft, simulated & unsimulated)
- High Variance
  - (soft, simulated & unsimulated)
- Extreme Value
  - (soft, simulated & unsimulated)
- Area of Concern Boundary Design
  - (soft, simulated & unsimulated)
- Minimize/Maximize Area of Concern
- LISA Designs
  - (Ripley’s K, Moran’s I, Geary’s C)
Some Example Initial Designs

Judgmental Grids

Random Grids

Unaligned Grids

3d hotspot search
Some Example Secondary Designs

Threshold Radial

High Value Design

AOC Boundary Design

Adaptive Fill
SADA Overview: Autodocumentation

• Provides transparency in the modeling process and facilitates reproducibility of results.

• SADA automatically analyzes any current result and determines what the “ingredients” of that result are. These ingredients are presented to the user, who can choose the level of documentation to create.

• Self-documentation of all parameters, models, and other relevant information.
  – Exposure concentrations
  – Risk models
  – Exposure variables
  – Geospatial parameters
  – Toxicity data
  – Images as bitmaps

• HTML format, can be exported to popular word processors
SADA Overview: Autodocumentation

- Area of concern map
- Based on HH Risk
- Utilized inverse distance as geospatial model
- Block based area of concern framework.
Resources/Support

- Help file
- 500+ page user guide
- User group
- Web page
- Classes
- EPA Clue-in classes

An Introduction to Spatial Analysis & Decision Assistance (SADA)

Environmental Applications for Version 5
User Guide
First Edition

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www.tiem.utk.edu/~sada/index.shtml

SADA – Spatial Analysis and Decision Assistance

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QUESTIONS

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