

L-THIA 2.0 -- A practical GIS model for regional and local water resource management

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WHAT IS L-THIA?

- Land use development plan screening tool
- Decision support tool for estimating the effect of land use change on surface runoff and Non-Point Source pollution (NPS)



- Features
 - Based on Curve Number (CN)
 - For decision makers
 - Simple model & Easy to use
 - Minimum data input

HOW DOES L-THIA WORK?

Step Four

Runoff and Nonpoint Source Pollutant Results

Based on the information provided (see Summary of Scenarios), L-THIA estimates the following rates of runoff volume, runoff depth, and nonpoint source pollutants. Results can also be viewed in comparative bar graphs and pie charts by using the pull-down menus located at the top-left of each table.

Go to: SCENARIOS PRINT Results Download Results

SUMMARY OF SCENARIOS View as: Select

State: Indiana
County: Tippecanoe

Land Use	Hydrologic Soil Group	Current	Scenario 1	Scenario 2
Grass/Pasture	A	100	0	0
Low Density Residential	B	0	30	20
Commercial	B	0	30	75

Avg. Annual Runoff Volume (acre-ft) View as: Select

Land Use	Current	Scenario 1	Scenario 2
Grass/Pasture	0.00	0	0
Low Density Residential	0	7.41	3.75
Commercial	0	10.30	21.00
Total Annual Volume (acre-ft)	0.00	17.71	24.75

Also view [Annual Loadings](#) and [Percentages of Coverage](#)

Avg. Annual Runoff Depth (in) View as: Select

Current	Scenario 1	Scenario 2
0.00	0.20	0.40

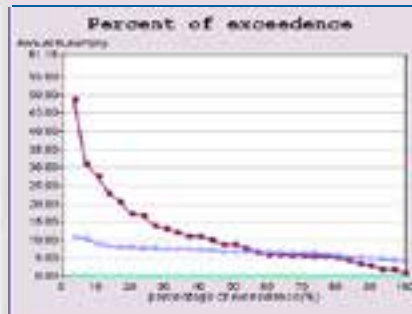
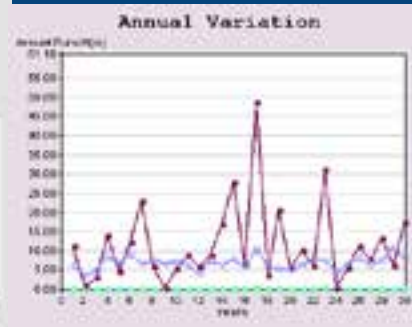
Avg. Runoff Depth by Landuse View as: Select

Land Use	Hydrologic Soil Group	Curve Number	Runoff Depth (in)
Grass/Pasture	A	30	0.00
Low Density Residential	B	10	1.00
Commercial	B	30	10.00
Average Annual Runoff Depth (in)			00.07

NONPOINT SOURCE POLLUTANT RESULTS

Nitrogen (lbs) View as: Select

Land Use	Current	Scenario 1	Scenario 2
Grass/Pasture	1	0	0
Low Density Residential	0	37	10
Commercial	0	140	215
Total	1	177	225



Output: Average Annual Runoff and NPS loadings

WHY L-THIA 2.0?

- No reflect critiques and updates of CN method

Rainfall-Runoff equation, parameters e.g., CNs/ARC, focus on local watersheds

- Lengthy calibration process

Manually local data processing, technically intensive

- Only one platform

Purdue L-THIA website <https://engineering.purdue.edu/~lthia/>

- Not use new datasets available

Remote Sensing and Ground-based observations



EXPERIMENT (CNs)

- Asymptotic Method

Match return period of rainfall and runoff data

- Least Squares Method (LSM)

Minimize the different between calculated and observed runoff

- NEH630 Statistical Method

CNs as random variable with upper and lower limits

- Current L-THIA lookup table

Currently used in L-THIA

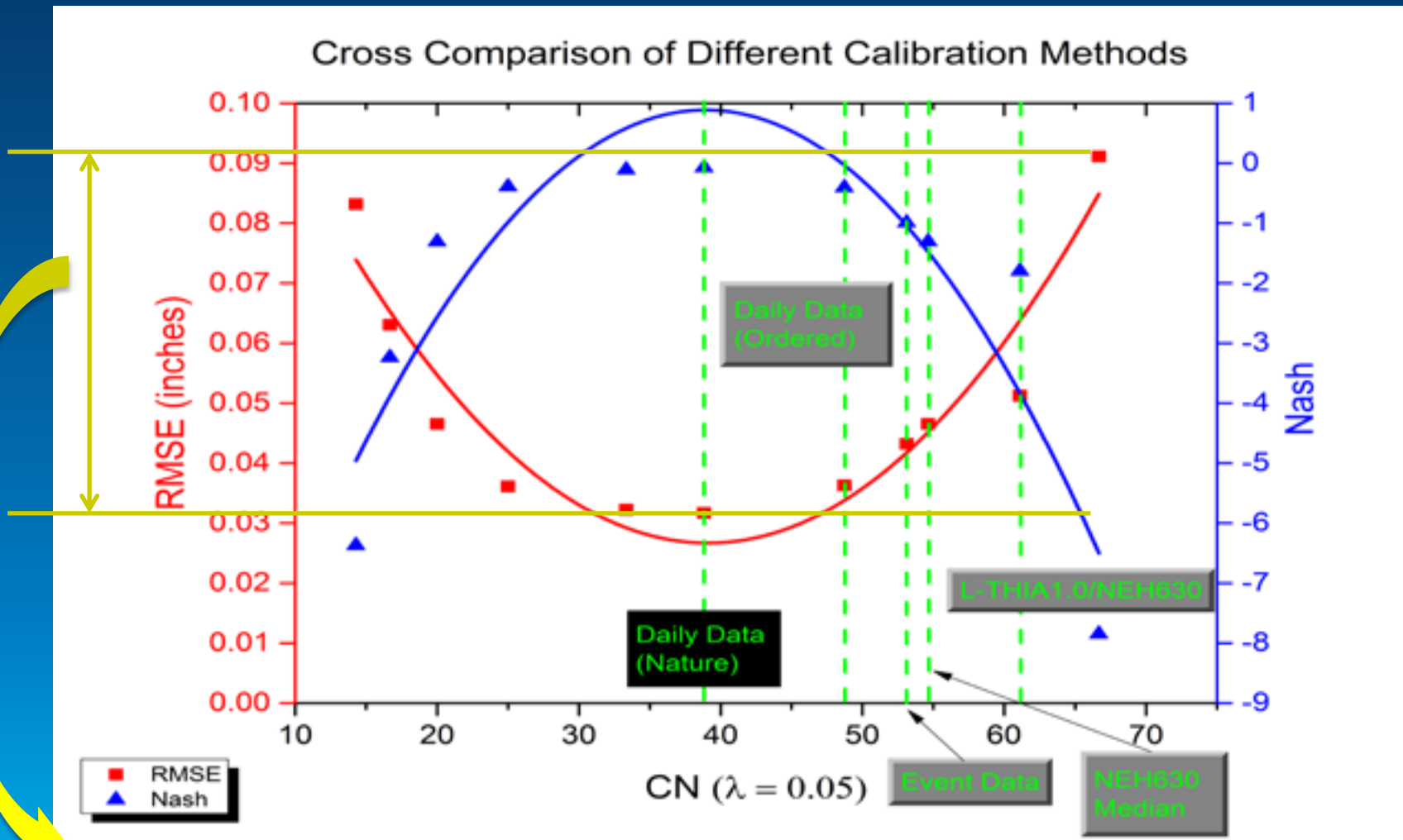
- Lookup table in NEH630

Originally derived from some watersheds as the reference

Test Data: USDA-ARS Walnut Gulch Experimental Watershed, AZ



CURRENT RESULT



Note: Actual average annual runoff range from 0.003 – 0.08, so the RMSE covers almost 78% of the range!

DESIGN FRAMEWORK

- 1st Priority: **Automatic Calibration!**
- Dynamic, end-user oriented solution for L-THIA 2.0



USDA
 USGS
 EPA
 NOAA
 NASA
 US Army Corps

Unification of
 different hydro
 Data

Model Revision,
 Parameter
 Calibration and
 Update

 Data Visualization

 GIS Services

Compatible with
 Multi-platforms

 Integrate into
 other decision
 support toolsets

Result Report

 Suggests/Rec.

 Table/Graph

USER INTERFACE DESIGN DEMO

- Homepage

Long Term Hydrologic Impact Analysis (L-THIA) 2.0 Beta

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Documentation
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Home

Data

Calibration

Result/LID

About Us

Welcome to the L-THIA 2.0!

Latest News

L-THIA 2.0 Beta Testing
Initiated!

Special Offers

*LTHIA
2.0
Premier* Premier
Subscription
Discount!

Traffic 000000000001

- Data Acquisition/Visualization

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Location



[State]

[County]

Watershed Delineation



Search Variables



[Enter Keyword]

Start 01/01/1950

End 01/01/2014

Select Data Sources



Request Data Update



Download to Local



Data Graphing



Time Series

Probability

Histogram

Grid View

Script Tool

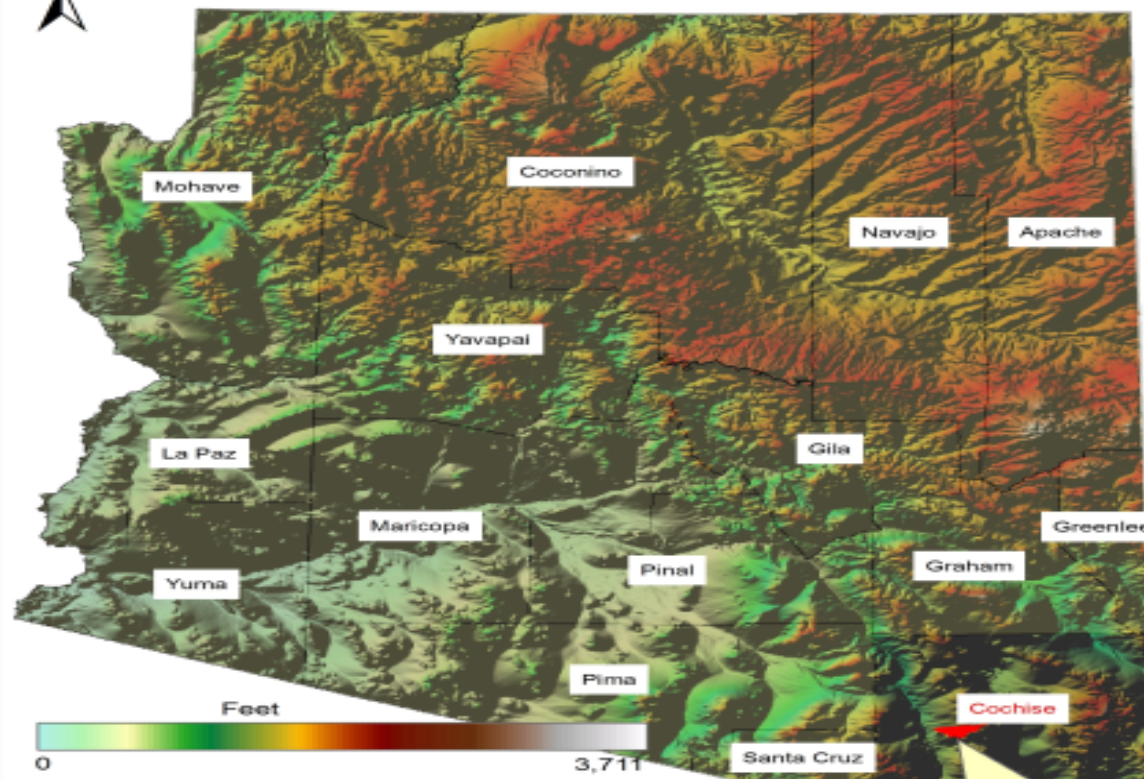


External Internal Local

Mapview

Graphic View

Table View



Layers

DEM

Landuse

Soil

Moisture

Ave P

Ave Q



- Calibration

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External Internal Local

Step 1: Parameters

$\lambda =$ 0.05 0.2 Other, please specify:

Variables

- CN Only -- Observational Data
- CN Only -- RS Soil Moisture
- CN and λ
- Comprehensive (Revised CN Method)

Step 2: Graph

- Rainfall -- Runoff
- Watershed Behavior
- RMSE -- Nash -- CN

Step 3: Method

Daily

- Natural
- Ordered
- NEH630 Median

Event

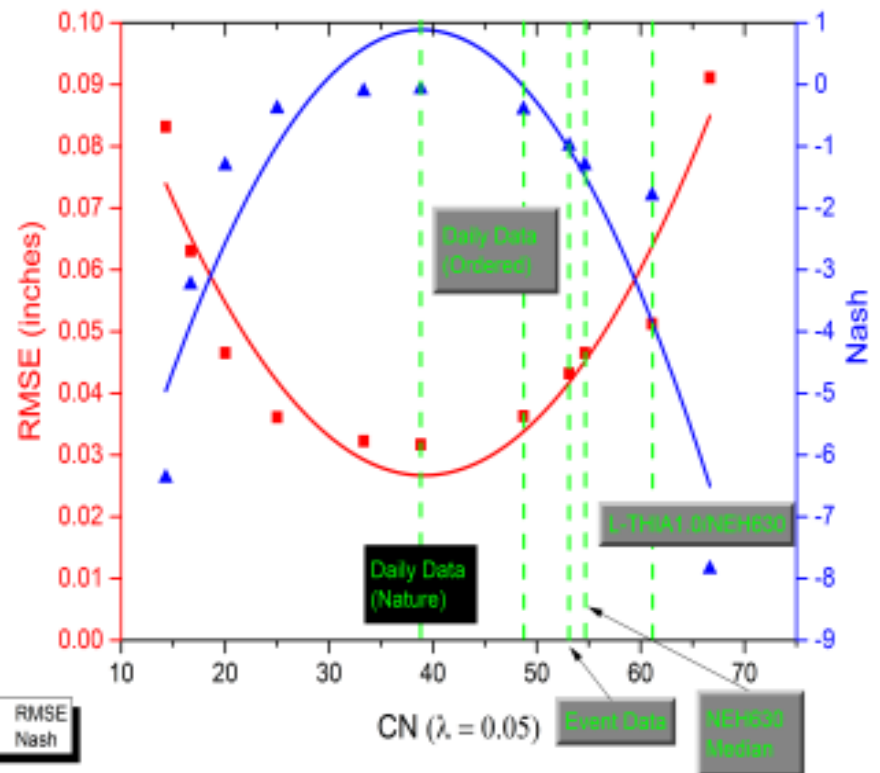
- Asymptotic

No Calibration

- L-THIA 1.0 Value
- NEH Lookup Table

Graph

Cross Comparison of Different Calibration Methods



- Results and Rec.

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Calibration

Simulation/LID

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Step 1: LID Implementation

- Bioretention
 Green Roof
 Rain Haversting
 Porous
 Grass Swale
 Rain Gadern

Step 2: Assessment Method

Opt 1 Goal Setting

Runoff Volume Reduce (Acre-ft)

NPS Loading Reduce (lbs)

Opt2 Landuse Change Scenarios

Pre-development Landuse (Optional)

Lot Size (Acres, optional)

Post-development Landuse

Lot Size (Acres)

Post-development Area with LID

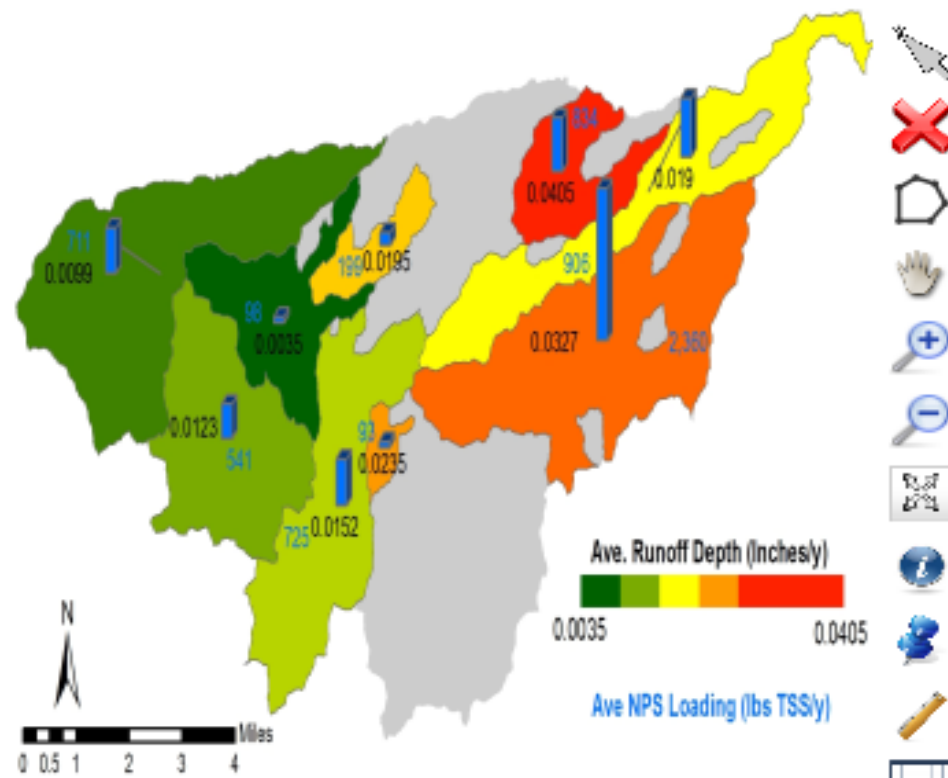
Step 3: View Result

Step 3: Report Download

Map

Table

Graph



Spatial Visulization of Runoff and NPS loading

Thank you for your attention!