State of Surface Water Quality Modeling in New Mexico

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Overview

- TMDL program
- Temperature modeling
- Recovery Potential Screening Tool
- Modeling needs

Ballooning
Bad
ABQ
Nm

New Mexico TMDL Program

- New Mexico averages 20-30 TMDLs per FY and completed the Consent Decree requirements in 2006.
- There are 208 Category 5 waters on the 2012-2014 303(d)/305(b) List.
- The most frequent impairments in New Mexico are:

Temperature	Dissolved oxygen
Sedimentation	Specific conductance
Turbidity	Nutrients
Aluminum	

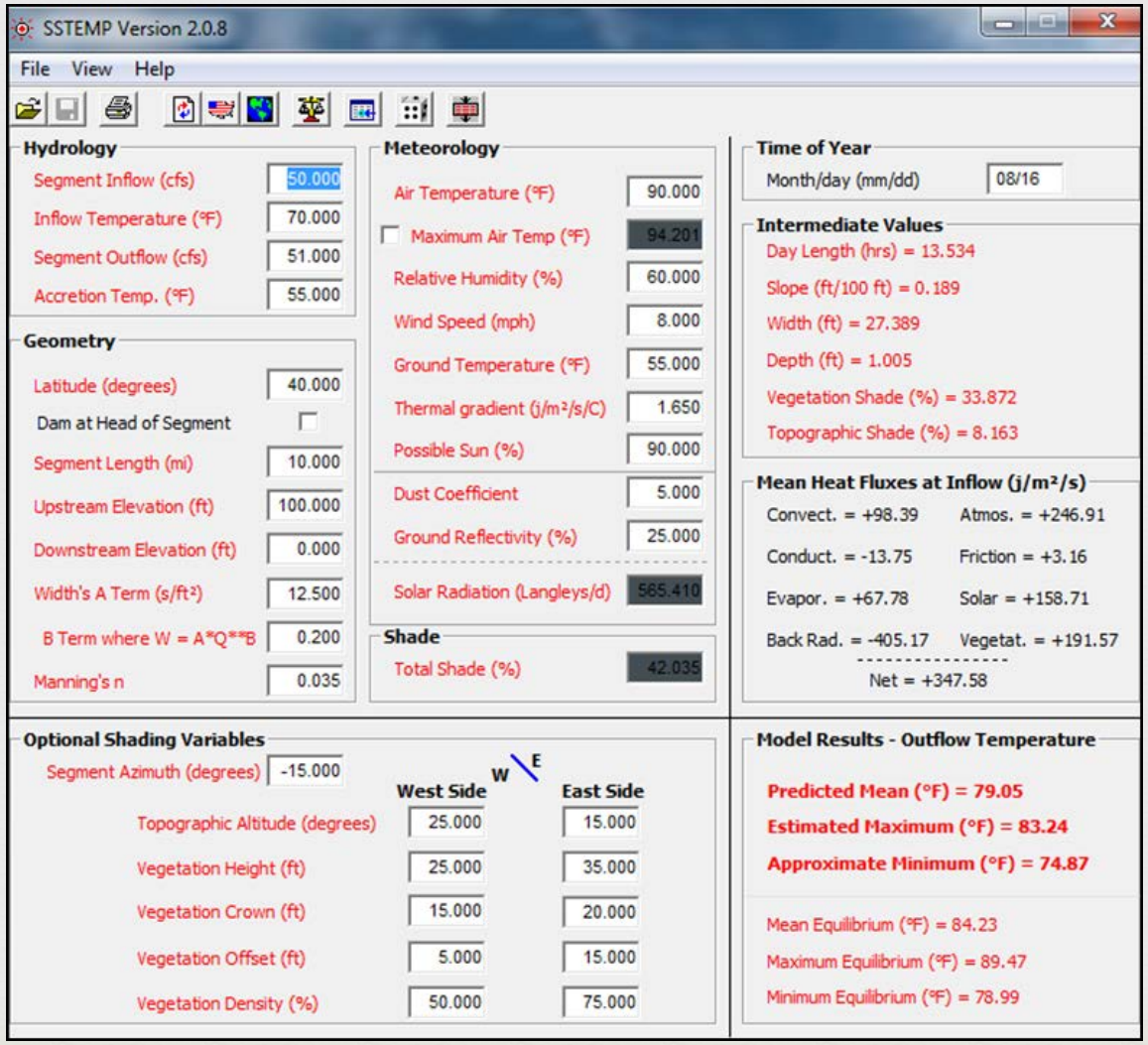
Temperature Modeling with SSTEMP

Temperature model- SSTEMP

- SSTEMP was adapted by USGS from the SNTEMP modeling software.
- SSTEMP simulates downstream water temperature in a flowing river segment over a 24-hour day, given inputs of meteorology, steam geometry, and hydrology.
- According to John Bartholow (USGS, 2002),

  "SSTEMP may be used to evaluate alternative reservoir release proposals, analyze the effects of changing riparian shade or the physical features of a stream, and examine the effects of different stream withdrawals and returns on instream temperature."

SSTEMP model inputs



SSTEMP model inputs

- Hydrology inputs
  - based on USGS gage flow data or 4Q3 calculations.
- Stream inputs
  - Geomorph paramters and shade are measured in the field
  - Cross-section is modeled with Winxspro
- Meteorological inputs
  - compiled from Western Regional Climate Center monitoring stations, SWQB thermograph data, and PRISM data.

SSTEMP model output

- The modeling date is the date of highest recorded temperature during the watershed survey.
- The SSTEMP model is first run using current conditions; the solar radiation in j/m^2/sec is noted.
- Additional iterations of the model are run ultimately aiming to meet the WQS.
- In this example, the TMDL proposes that an increase in shade by 22% will bring the stream segment down to the WQS of 20°C.

Table 6.2 SSTEMP Model Results for Canjilon Creek (perennial portions Abiquiu Reservoir to headwaters)

WQS (HQCW Aquatic Life)	Model Run Date	Segment Length (miles)	Solar Radiation Component per 24-Hours (+/-)	% Total Shade	Modeled Temperature °C (24 hour)
20°C (68°F)	7/18/10	30.63	**Current Field Condition** +123.81 j/m^2/s	54	Minimum: 15.19 Mean: 19.13 Maximum: 23.06
			Run 1 +107.66 j/m^2/s	60	Minimum: 15.02 Mean: 18.64 Maximum: 22.26
			Run 2 +64.60 [a] j/m^2/s	76	Minimum: 14.59 Mean: 17.29 Maximum: 20.00
			Actual LA 58.14 [b] j/m^2/s	78.5	Minimum: 14.53 Mean: 17.08 Maximum: 19.63

TEMPERATURE ALLOCATIONS FOR Canjilon Creek (perennial portions Abiquiu Reservoir to headwaters)

[a] **24-HOUR ACHIEVEMENT OF SURFACE WQS FOR TEMPERATURE**

[b] 24-HOUR LOAD ALLOCATION (LA) NEEDED TO ACHIEVE SURFACE WQS WITH A 10% MARGIN OF SAFETY

Actual reduction in solar radiation necessary to meet surface WQS for temperature:

Current Condition – Load Allocation =

123.81 j/m^2/s – 58.14 j/m^2/s

= 65.67 j/m^2/s

Recovery Potential Screening Tool

Recovery Potential Screening Tool

- The Recovery Potential Screening is a tool to help states and restoration planners compare restorability across all watershed.
- The tool includes ecological, stressor, and social indicators.
- EPA has completed or are finalizing RPS projects for 15 states.
- RPS Tools can be used to prioritize restoration efforts, TMDL development, or impaired waters prioritization.

RPS Tool in New Mexico

- SWQB hosted staff from Cadmus and Doug Norton (EPA Office of Water) in September 2012 for the New Mexico RPS kick-off meeting in Santa Fe to discuss the tool metrics and potential data sources.
- Staff from SWQB as well as Groundwater Quality Bureau, Drinking Water Bureau, and Construction Programs Bureau assisted Cadmus in the compilation of the datasets.
- After a number of conference calls, Cadmus was ready to present the NM RPS Tool in September 2013.

RPS Tool in New Mexico

- The NM RPS Tool includes:
  - **27 ecological metrics**, including stream density, sinuosity, natural cover, and stream condition indices.
  - **50 stressor metrics**, including impaired waters, grazing, wildfire, road density, and percent urban.
  - **29 social metrics**, including watershed groups, land management, water supply intakes, and restoration projects.

Sample NM RPS Tool Runs

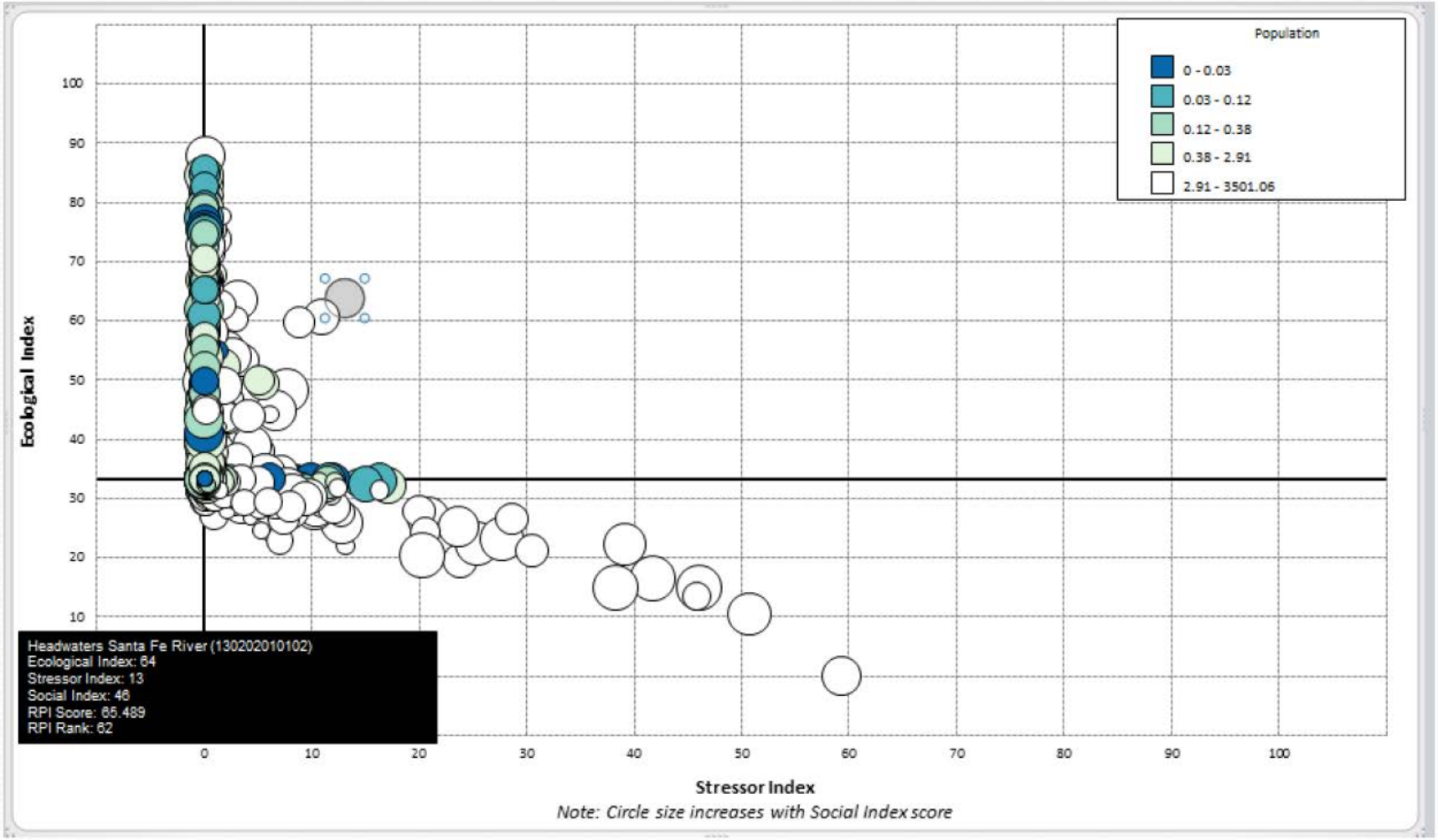
Prioritizing restoration efforts in areas experiencing development.

ECOLOGICAL INDICATORS	STRESSOR INDICATORS	SOCIAL INDICATORS
Perennial Stream Density	Watershed % Urban	Category 5A Stream Miles
Perennial Riparian % Forest	Impervious Cover Change	# of Watershed Groups
Watershed % Natural Cover	Projected Loss of Rural Lands	Median Household Income
	Population Density (people / sq. mi.)	
	Oil Gas Wells Per sq. mi.	
	Population	

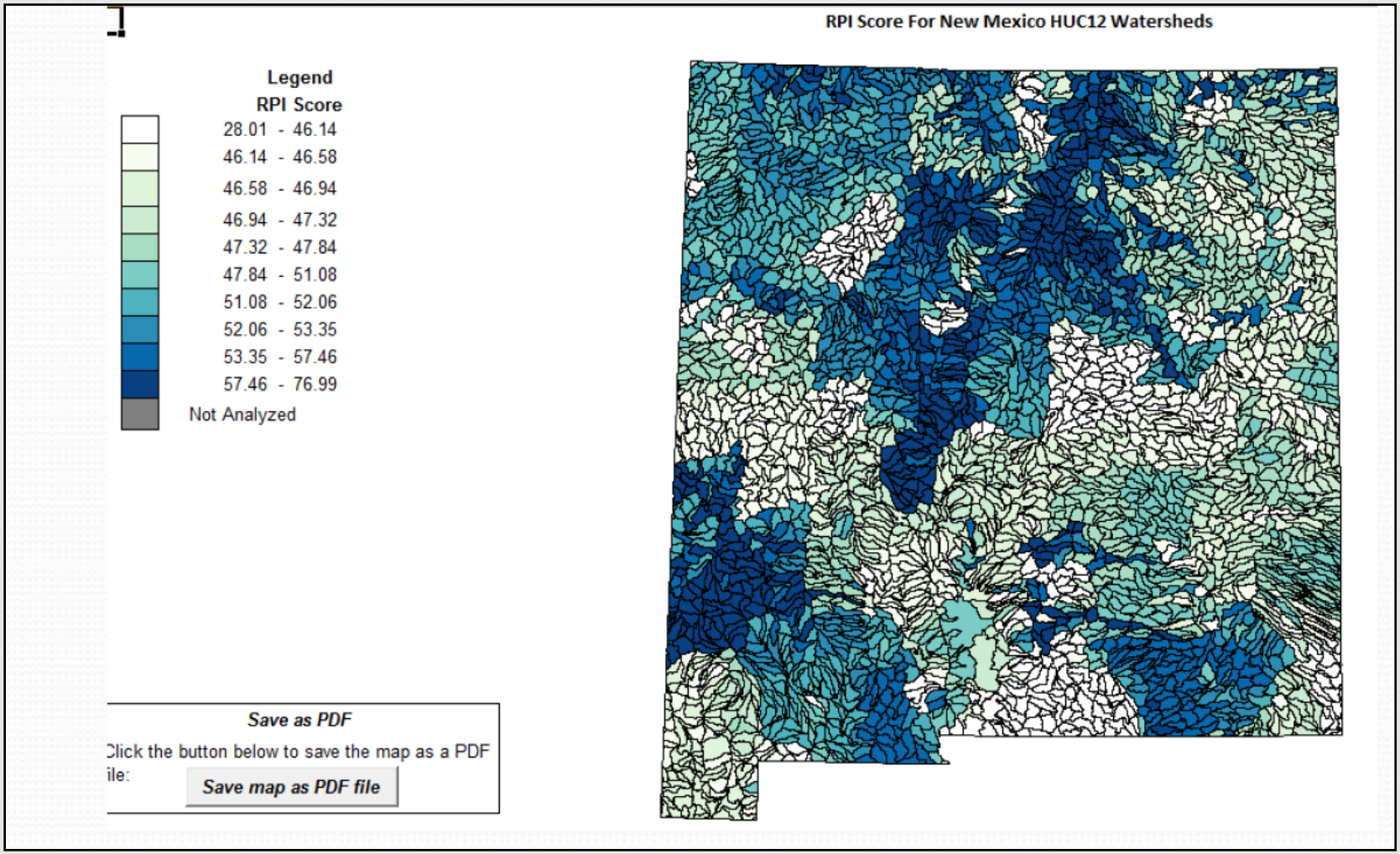
Prioritizing restoration in watersheds with nutrient-impaired streams.

ECOLOGICAL INDICATORS	STRESSOR INDICATORS	SOCIAL INDICATORS
All Riparian % Natural Cover	Dam Density (# per stream mi.)	Population
Watershed % Forest	% Area with Grazing Allotment	Median Household Income
NFHAP - Cumulative Disturbance Index	Erosion Risk	# of Watershed Groups
% Perennial Streams	Nitrogen Deposition	Watershed % Publicly Managed Land
	Watershed % UIndex	
	Oil Gas Wells	

Prioritizing sensitive areas under development pressures



Prioritizing sensitive areas under development pressures



RPS Tool in New Mexico – Next Steps

- EPA selected New Mexico as one of the 4 states in the nutrients RPS demonstration project.
- Cadmus will continue to refine the NM RPS Tool, especially the nutrient-related components.

Modeling Needs

Looking ahead- TMDL modeling needs

- New Mexico is interested in an alternate method for temperature modeling and TMDL development.
- Lake modeling
  - New Mexico has 30 impaired lakes and reservoirs
  - Impairments such as mercury, nutrients, and temperature.

- To date, New Mexico has not yet developed any TMDLs for lakes or reservoirs and is interested in lake modeling.

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