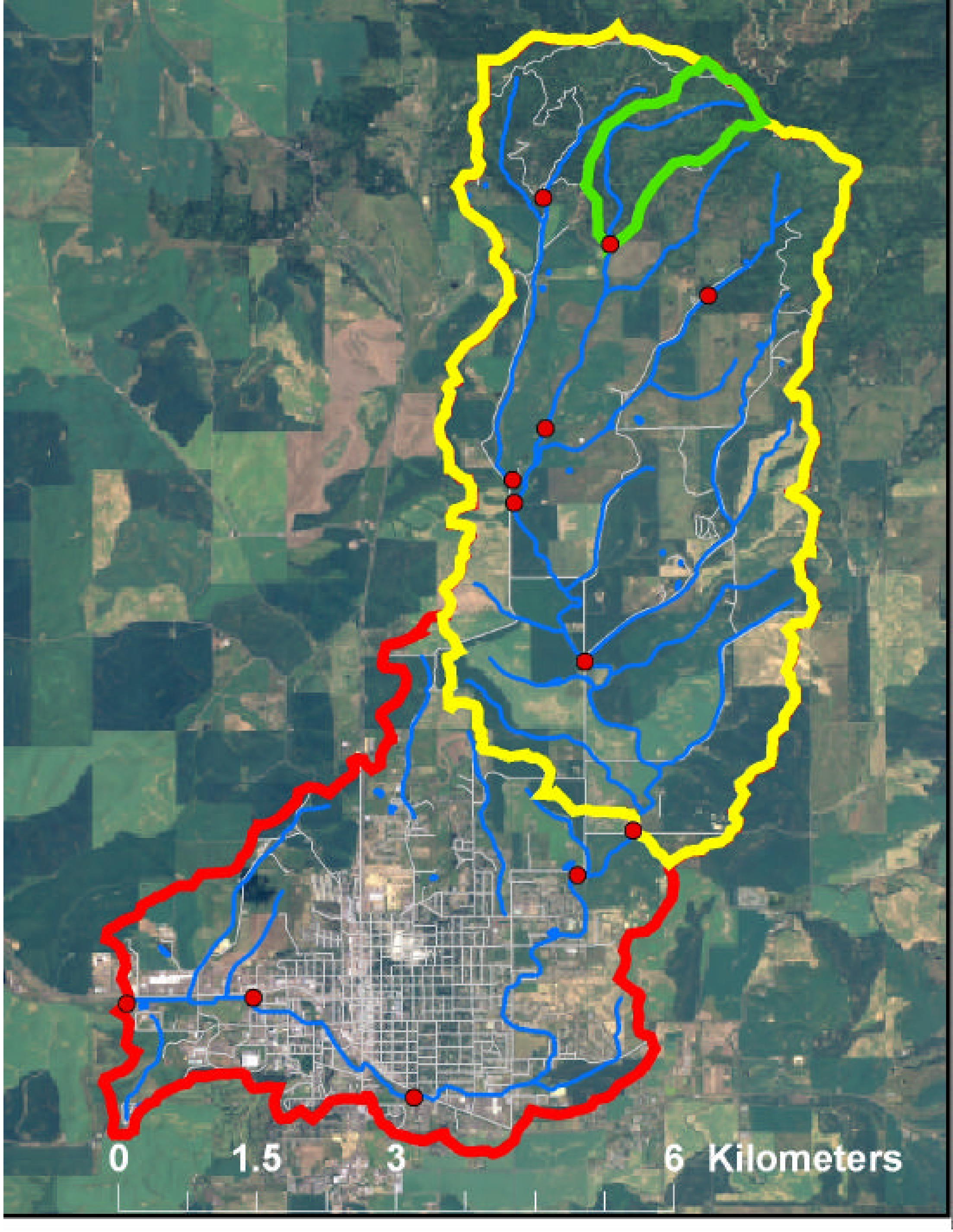
USDA-CSREES

Conservation
Effects
Assessment
Project

Evaluation of Conservation Practices in a Mixed-Land Use Watershed using Cumulative Effects Modeling and Interdisciplinary Analyses

Paradise Creek Watershed

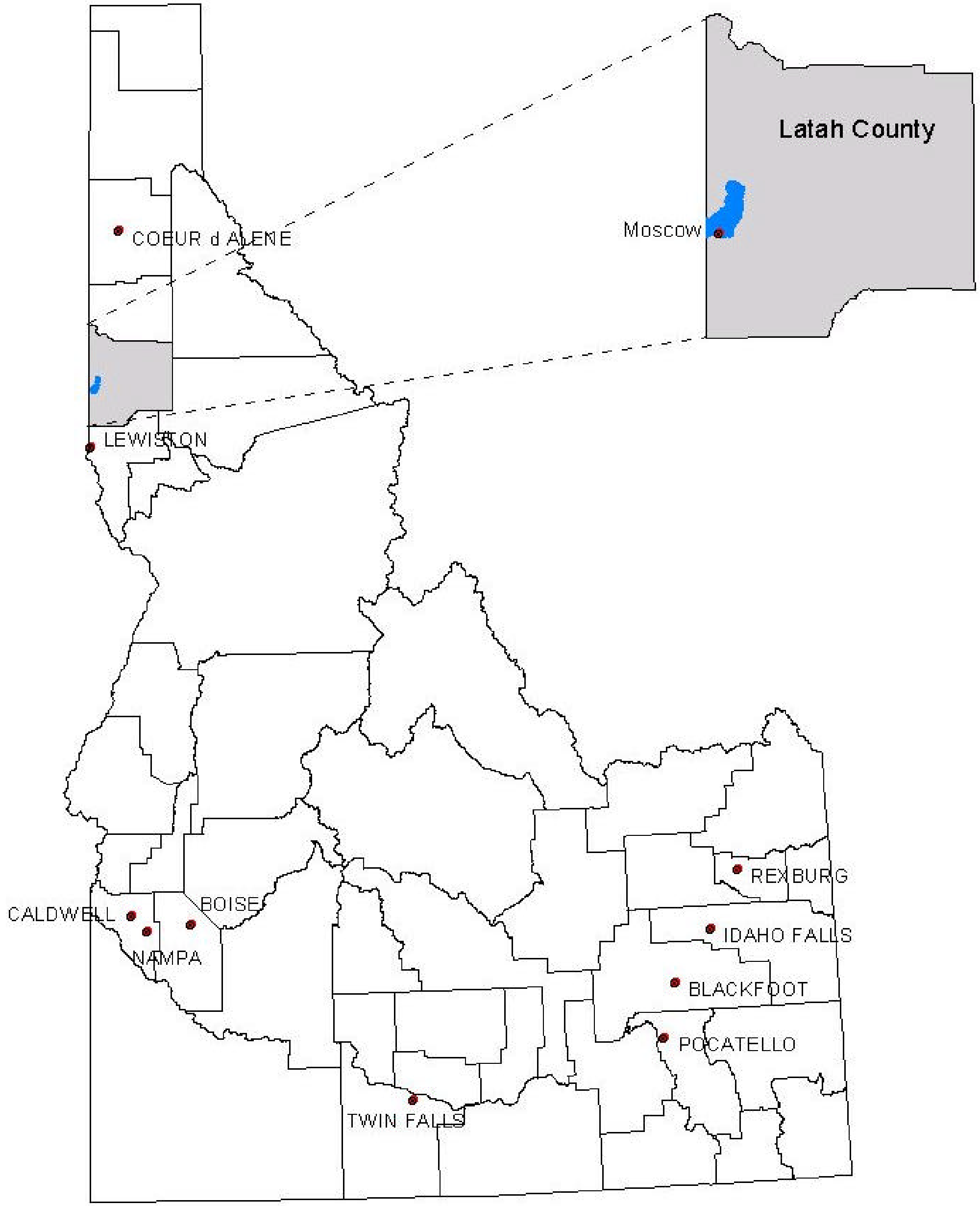


Investigators

- Jan Boll*, Erin Brooks, Kzrysztof Ostrowski, Brian Crabtree, Jeremy Newson: Biological and Agricultural Engineering
- JD Wulfhorst*, Larry Van Tassel, Naga Srinivasa Tosakana*: Agricultural Economics and Rural Sociology
- Robert Mahler*: Plant, Soil, and Entomological Sciences
- Tom Lamar, Greg Fizell, David Vollmer: Palouse Clear Water Environmental Institute, Moscow, ID

University of Idaho

Paradise Creek Watershed Location Map



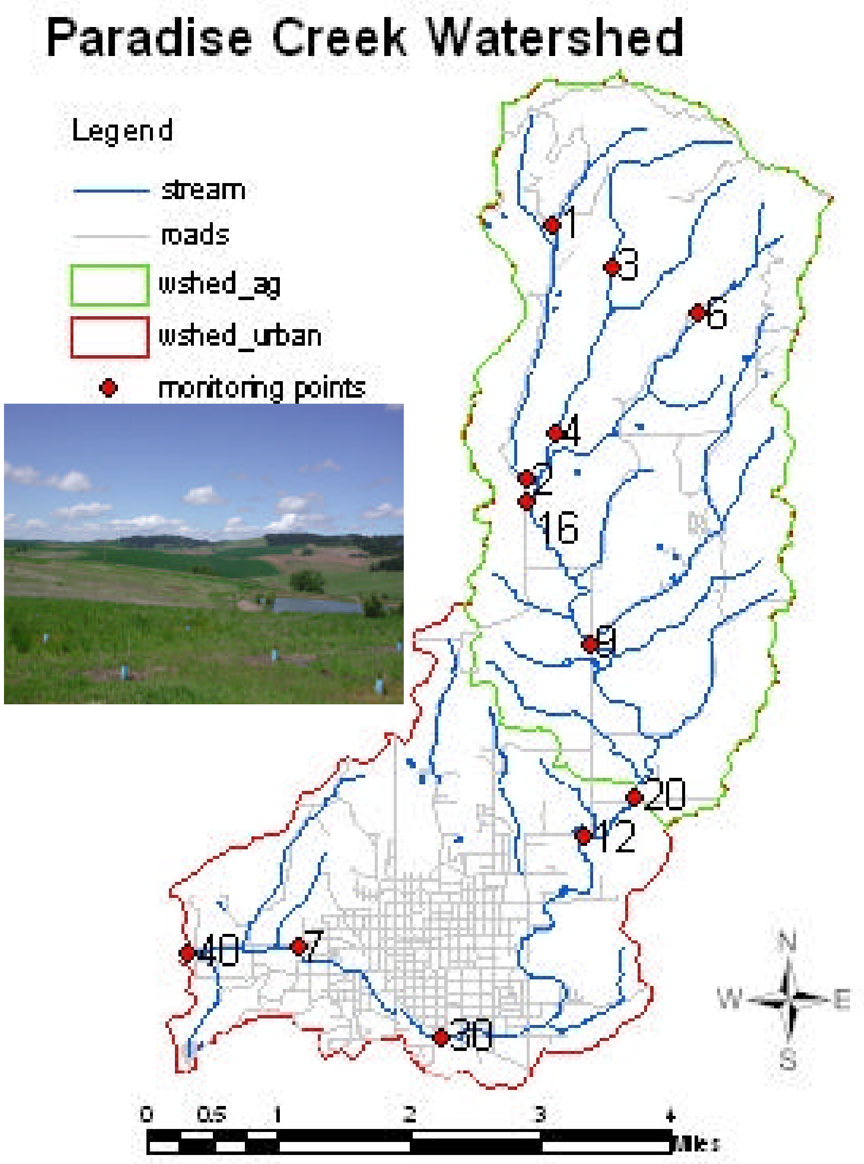
CEAP Project Outline

- Monitoring program
- GIS-based modeling
- Sediment transport and lag time
- Socio-economic data collection
- Bio-economics Model (see poster W39)
- Data management (see pcw.ag.uidaho.edu)

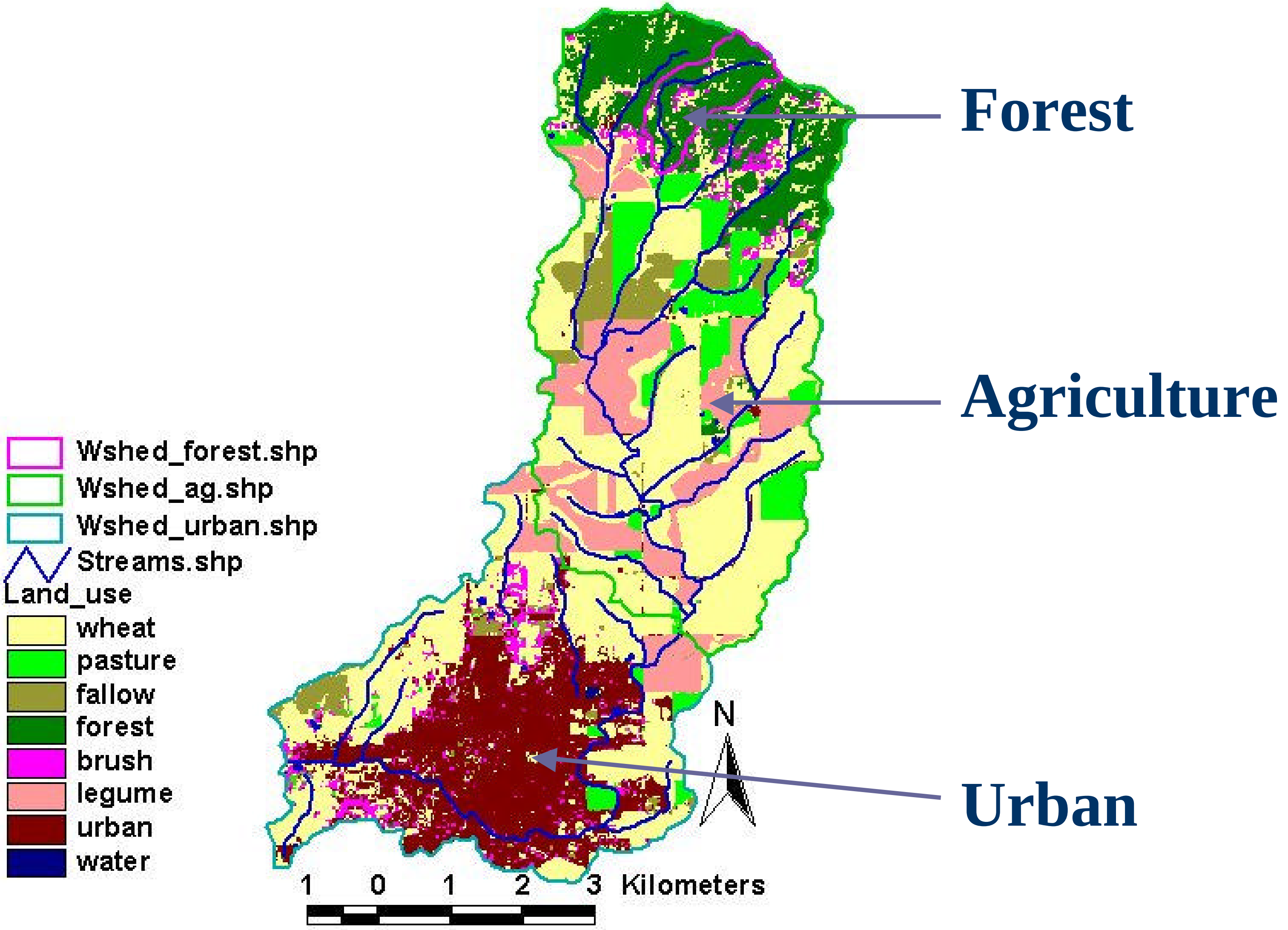
Research Area (PCW)

- mixed-land use
- area 4890 ha (48.8 km^2)
- elevation 1330m – 770m
- soils – silt loam formed in loess
- **very susceptible to erosion**
- perched water tables in winter/spring
- 40% precipitation falls during November-January

- Primary NPS
  - Non irrigated croplands
  - Grazing lands
  - Land development (construction)
  - Urban runoff
  - Roads
  - Forest land activities



Paradise Creek Watershed Land Use



What's the problem in PCW?

PCW must reduce from 1040 tons/yr to 150 tons/yr (TMDL)

- 25 water & sediment control structures (gully plugs)
- 15% of non-irrigated cropland converted to direct seeding
- Crop rotations changes & residue management
- 4 rock chutes
- 6 ha filter strips
- Diversions
- Roof runoff management

Residue – Conventional vs. Direct Seed

photo: Bill Dansert ISCC

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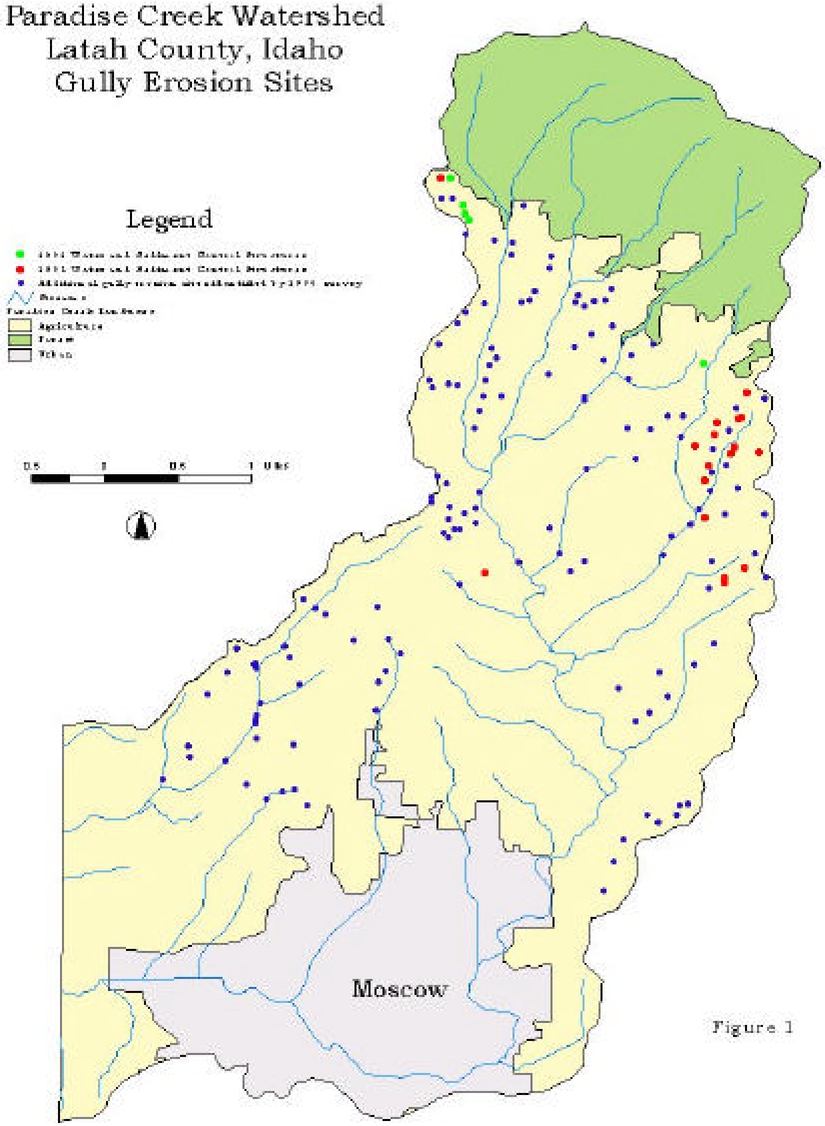


photo: Bill Dansert ISCC

Water and Sediment Control Structure

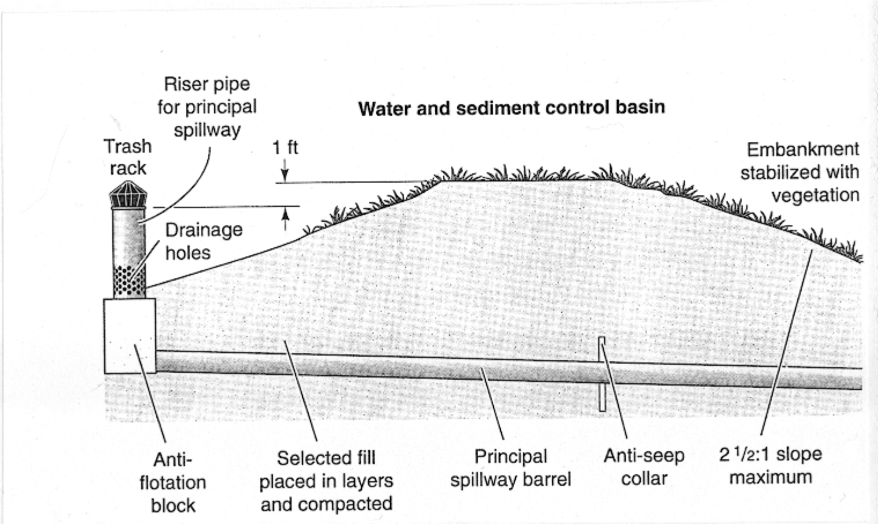


photo: Bill Dansert ISCC


Rock Chute

Filter Strip

Diversion

Roof management

Monitoring: Objective

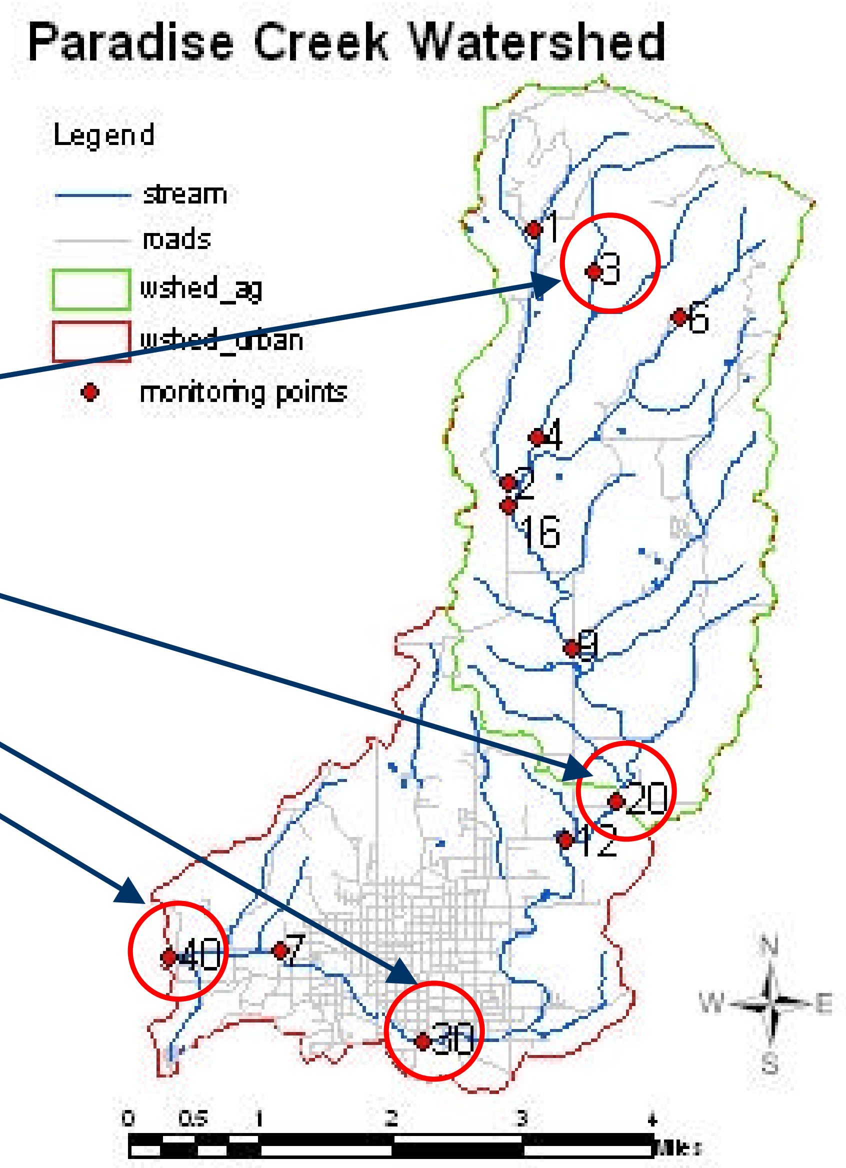
To analyze water quality monitoring data to determine effectiveness of conservation practices and evaluate the value of spatial and temporal monitoring


Is there a pollution problem?

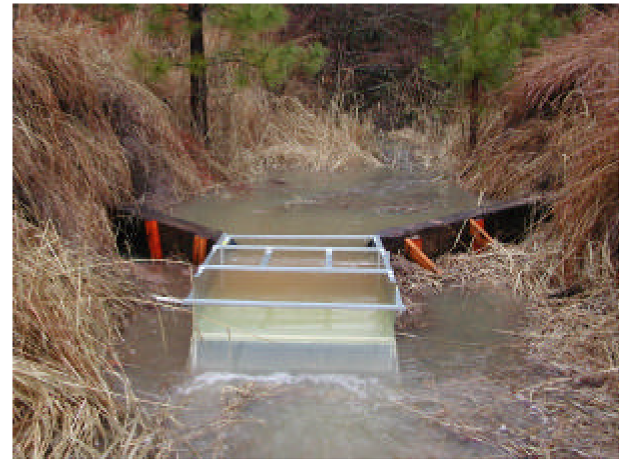
Where is the sediment coming from? and when?

Ongoing study

- Monitoring (H, NTU, EC, T, event TSS)
  - Continuous (4 locations)
    - 3 (since 2002)
    - 20 (since 2001)
    - 30 (since 2004)
    - 40 (since 2002)
  - Biweekly (12 locations)
    - "Before" (2001)
    - "After" (2002, 2005)



Flow & Sediment Monitoring in PCW (Stations 20 and 3)

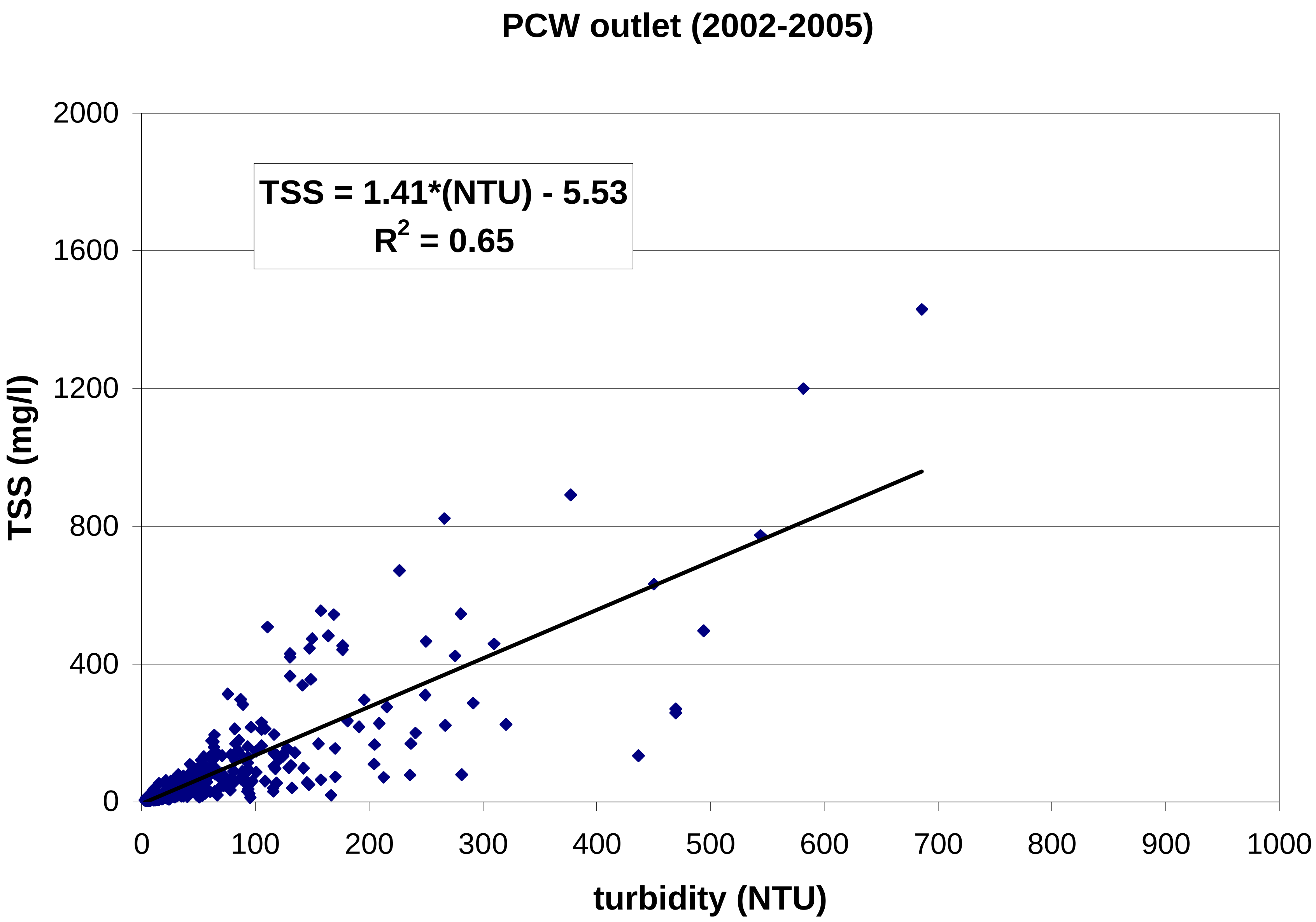


Sediment Loads
(using TSS=2*NTU from TMDL report)

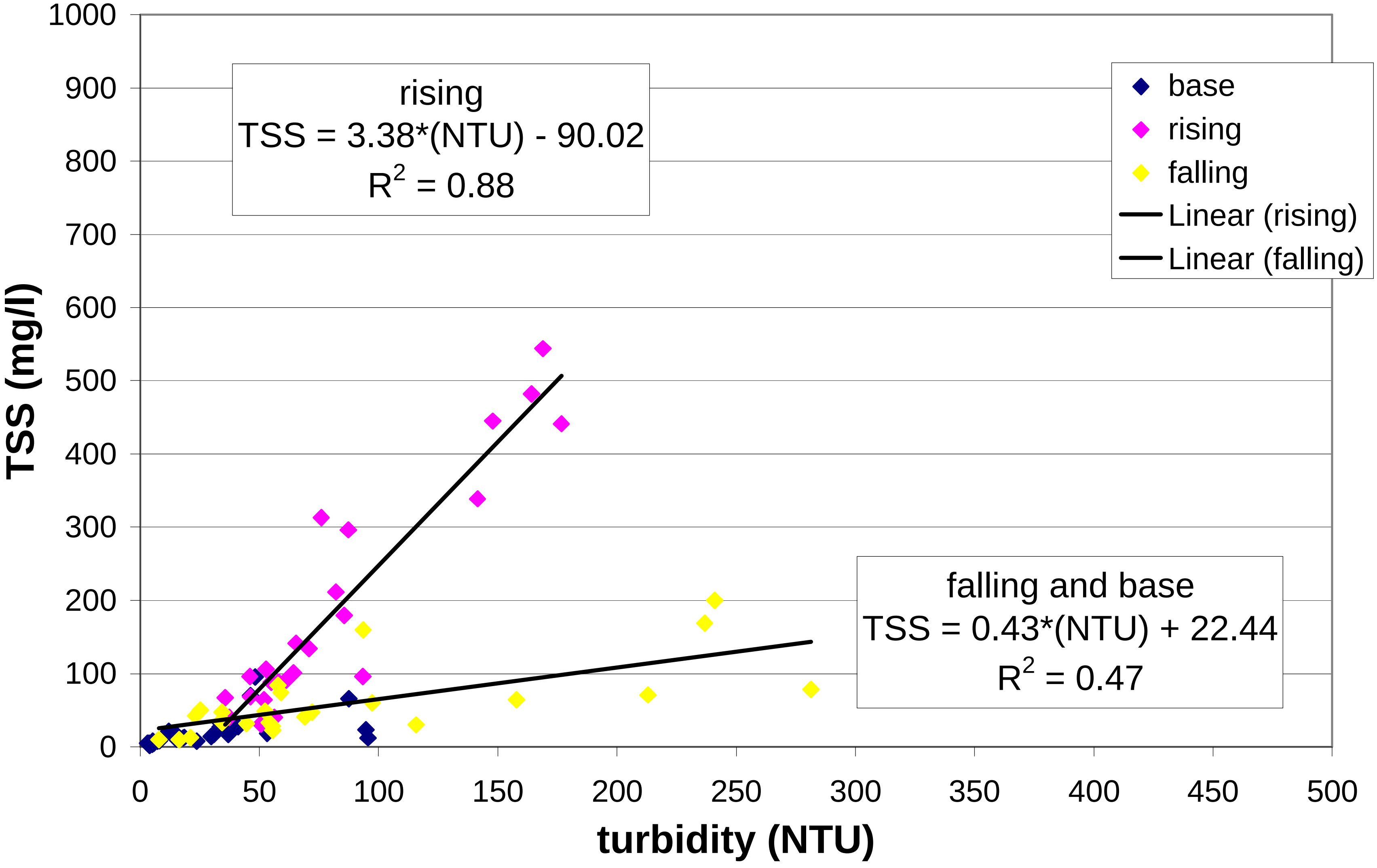
Year	Load (tons/year)
2001	120
2002	2241
2003	2831
2004	873
2005[1]	195

[1] Precipitation from Jan 1, 2005 – Mar 20, 2005 was ¼ inch

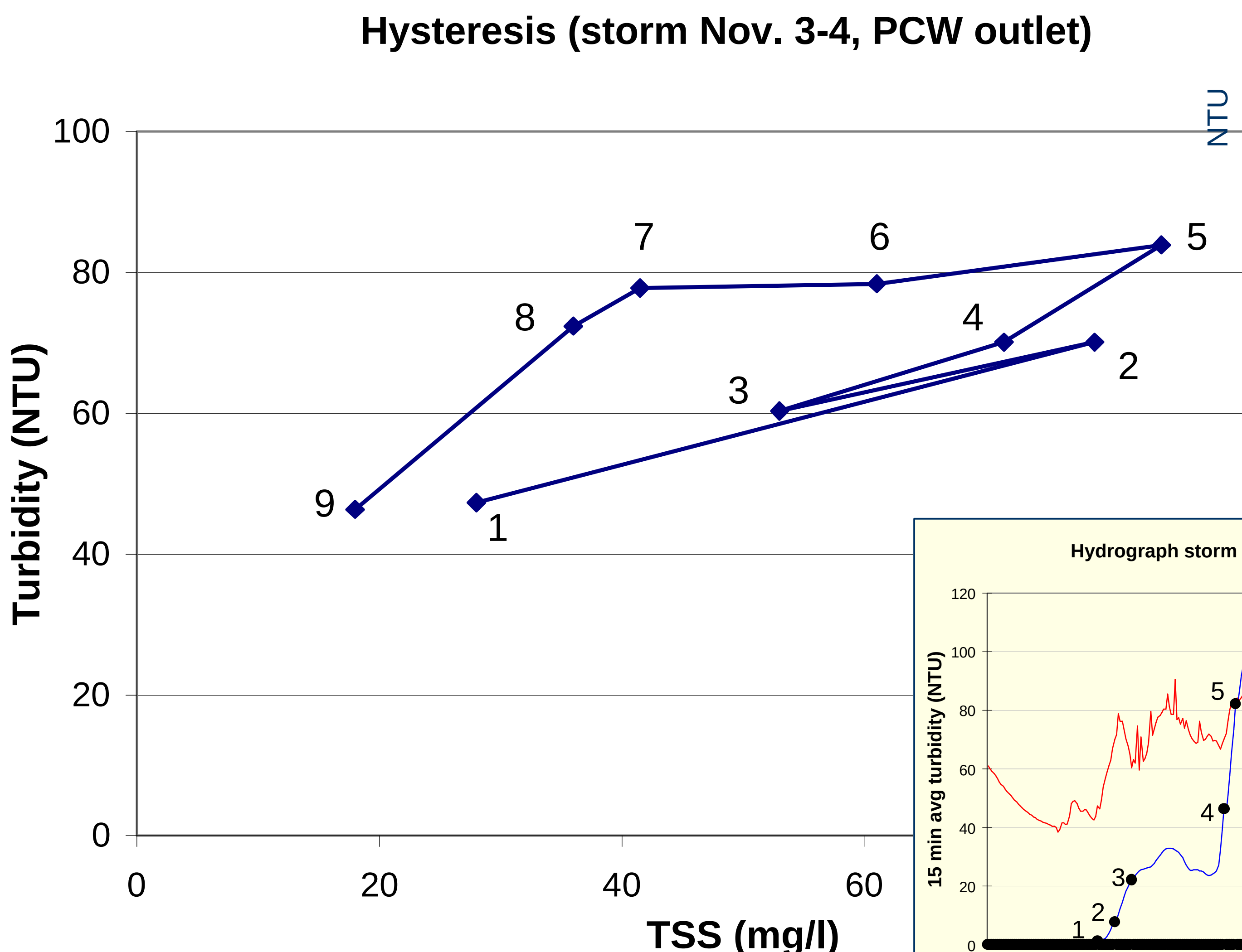
Preliminary results (TSS vs. NTU)

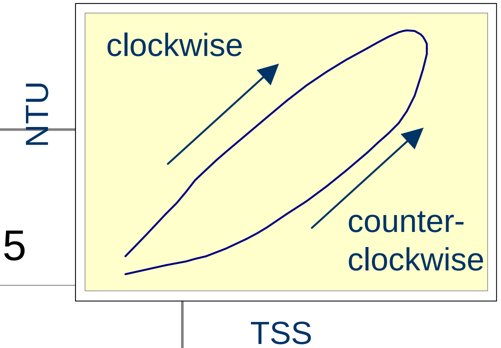


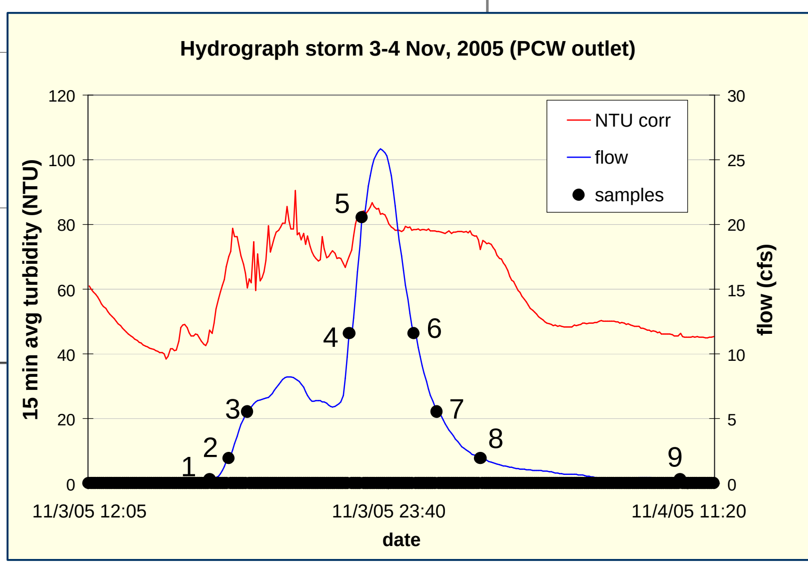
Preliminary results (PCW outlet 2005)



Preliminary results (hysteresis)





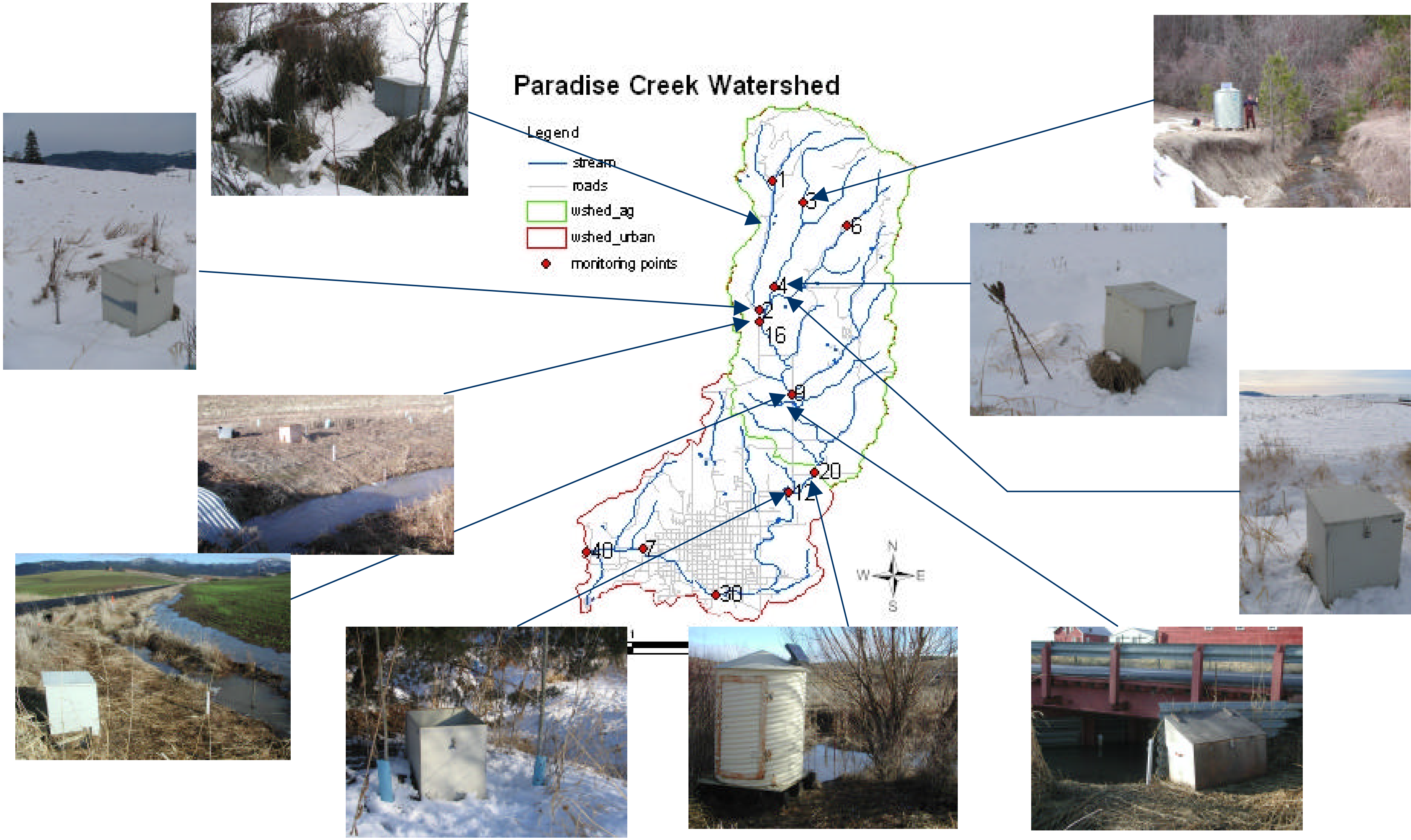


Preliminary results (sediment loads)

	TSS = 2 * NTU	TSS = 1.41 * NTU	separation procedure	% decrease
2002	2241	1545	885	42.7
2003	2831	1951	1467	24.8
2004	873	601	618	-2.8
2005	195	160	90	43.8

(Sediment loads in metric tons per year)

Event-based sampling at all points (2006)



GIS Based Modeling

- **Primary Objectives:**
  - Spatially explicit predictions of runoff, soil erosion, and soil delivery to the edge of a field at the grid scale (10 x 10 m) or hillslope scale (< 10 ha)
  - Streamflow prediction at any point in the stream network
  - Predict the cumulative effect of management practices on pollutant loading at the field edge and at the watershed outlet.

GIS Based Modeling

- **S**oil **M**oisture **R**outing (SMR) model
  - Grid-Based Hydrology Model
- Wu[1]-**WEPP** (Water Erosion Prediction Project)
  - Hillslope-Based Hydrology and Erosion Model

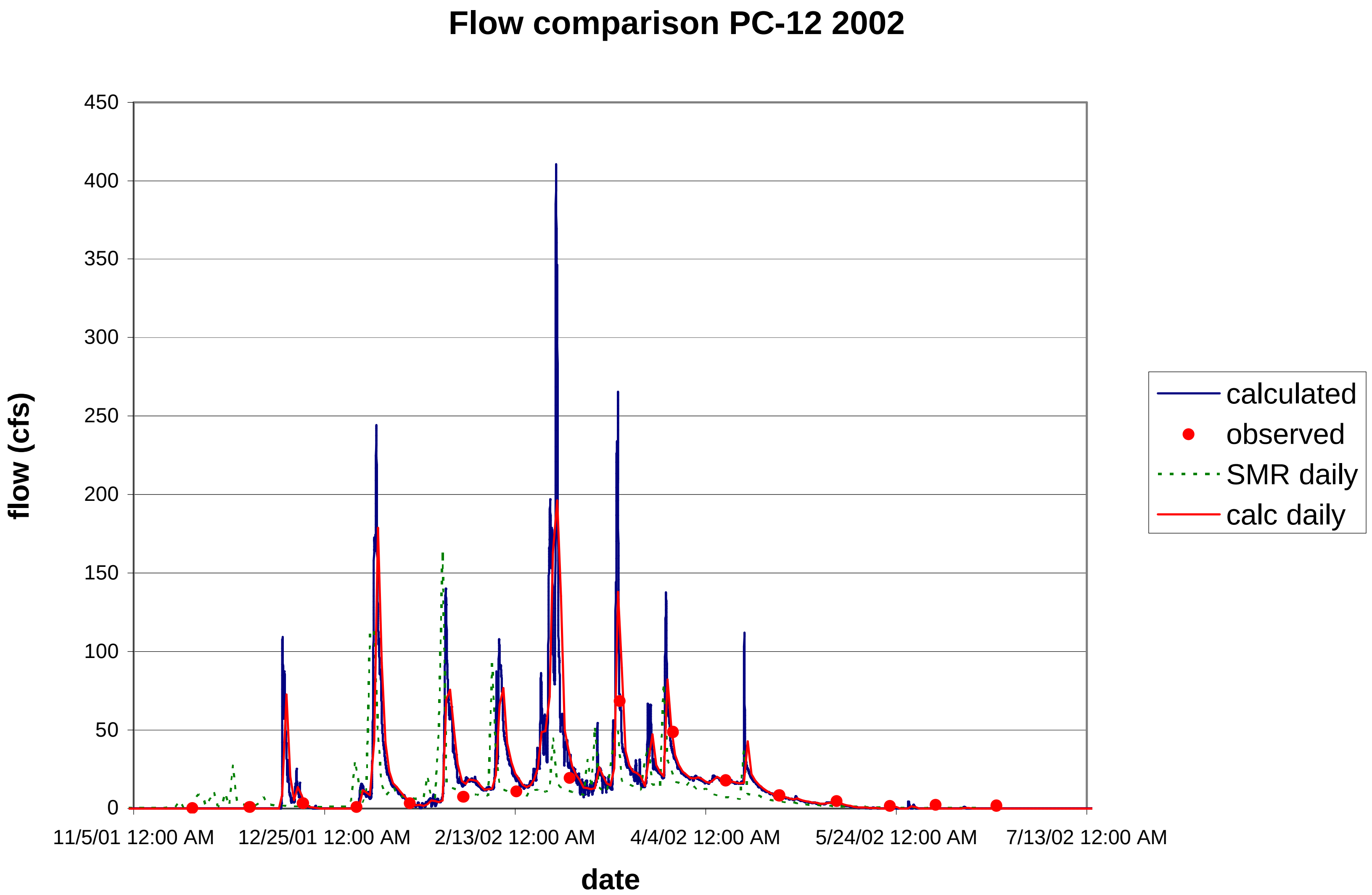
1 Joan Wu[1], Washington State University

Soil Moisture Routing Model

Frankenberger et al. (1999), Boll et al. (2001), Brooks et al. (2006)

- Predicts surface runoff and streamflow using daily weather data, a digital elevation model, a land use (field) map, and a soils map

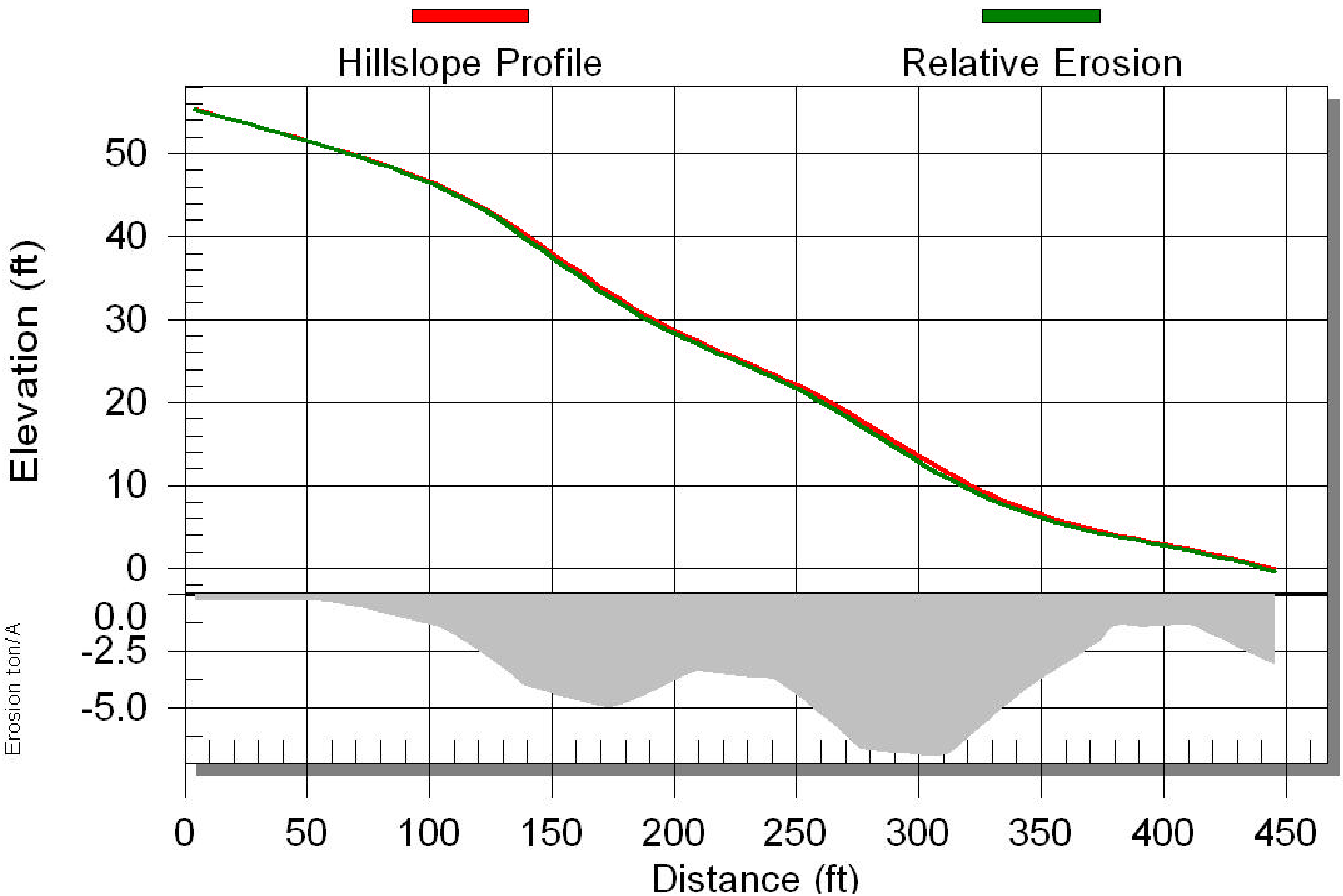
SMR: Results



Flow comparison PC-12 2002
450
400
350
300
250
200
150
100
50
0
flow (cfs)
11/5/01 12:00 AM
12/25/01 12:00 AM
2/13/02 12:00 AM
4/4/02 12:00 AM
5/24/02 12:00 AM
7/13/02 12:00 AM
date
calculated
observed
SMR daily
calc daily

GeoWEPP Simulated hillslopes

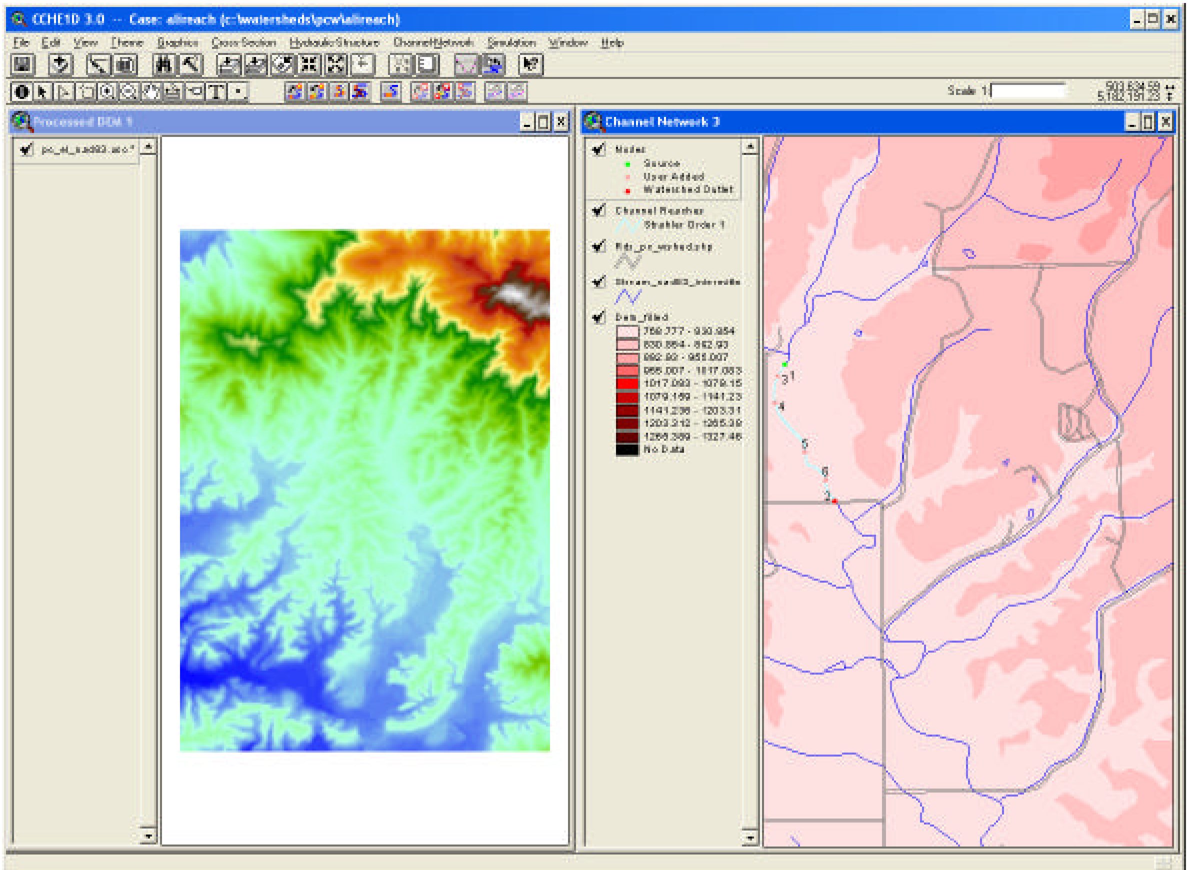
Hillslope 434: Winter Wheat with no buffer



GeoWEPP sediment delivery map

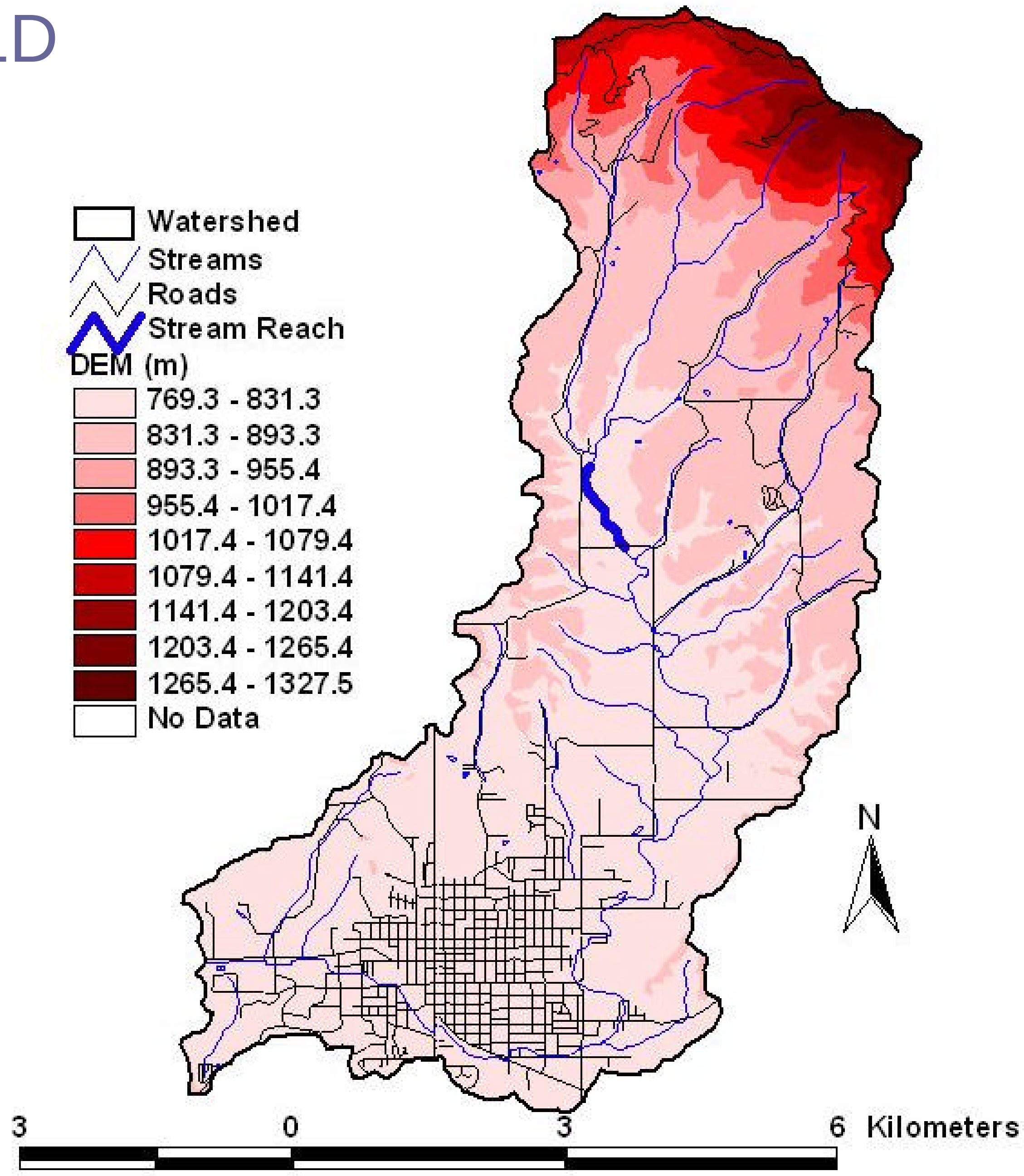
CCHE1D

- National Center for Computational Hydroscience and Engineering (NCCHE) of the University of Mississippi



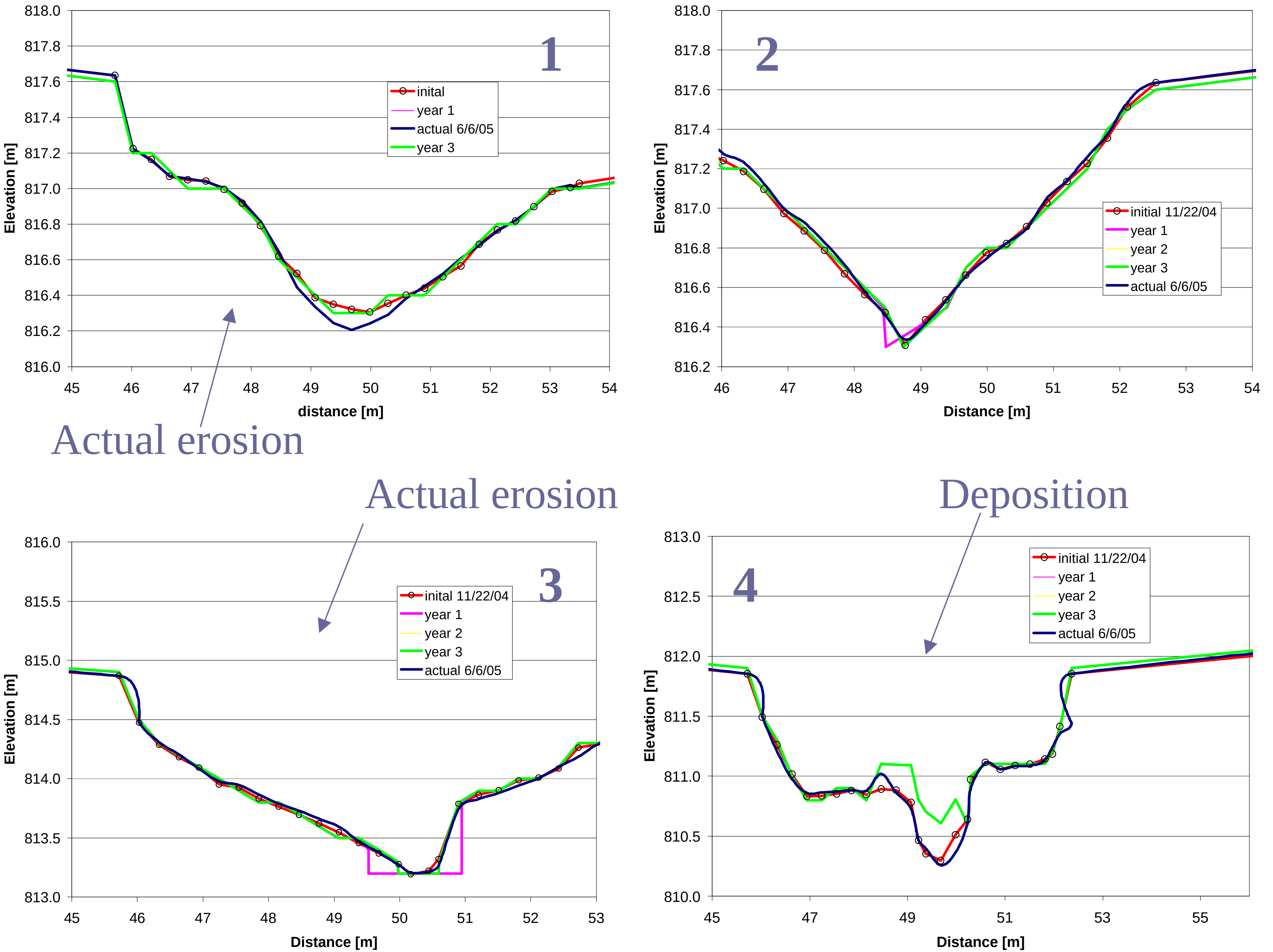
- CCHE1D is a 1-D model of flow and sediment transport in channel networks.

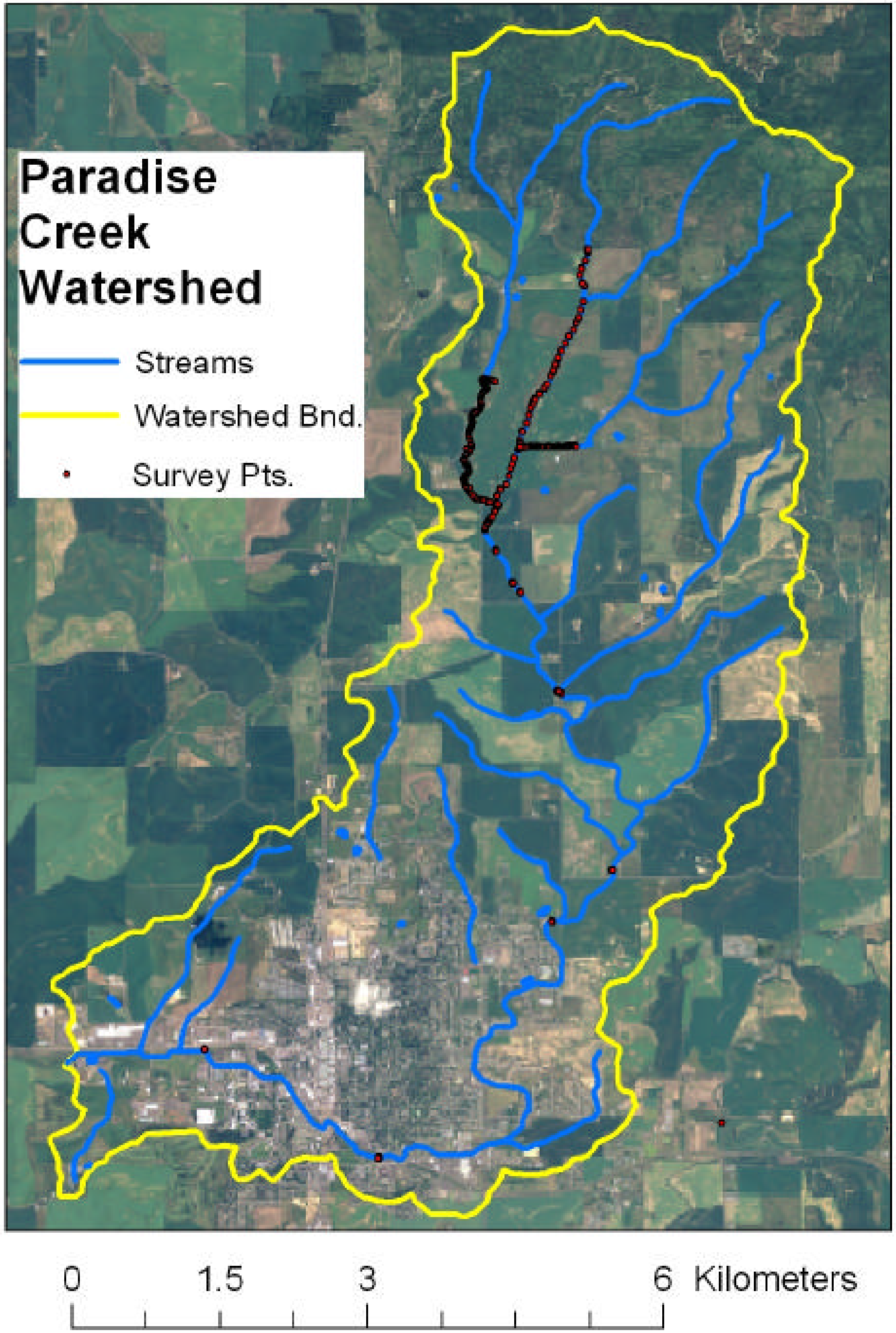
CCHE1D

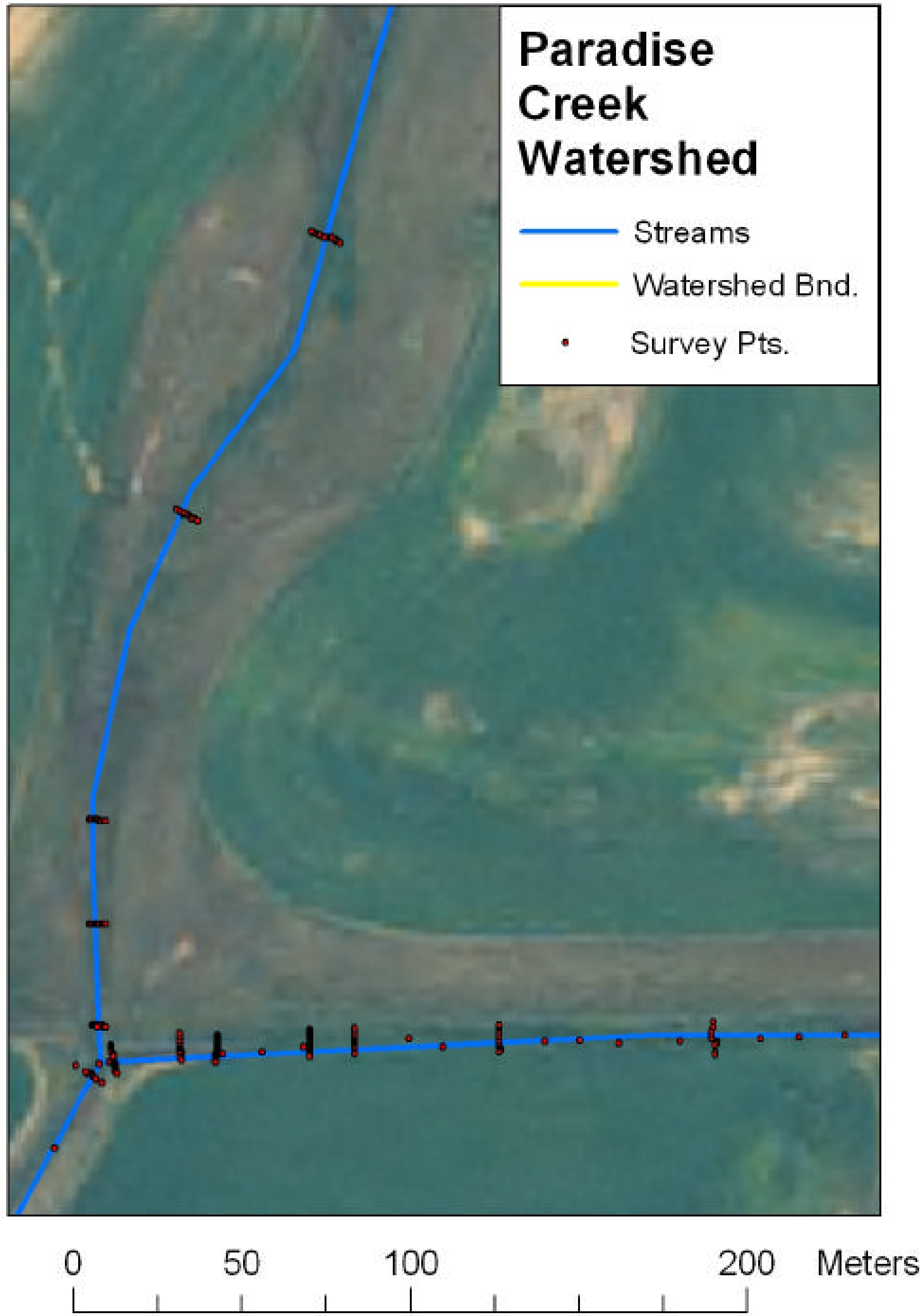


Watershed
Streams
Roads
Stream Reach
DEM (m)
769.3 - 831.3
831.3 - 893.3
893.3 - 955.4
955.4 - 1017.4
1017.4 - 1079.4
1079.4 - 1141.4
1141.4 - 1203.4
1203.4 - 1265.4
1265.4 - 1327.5
No Data
N
3
0
3
6 Kilometers

Nov, 2004
- May, 2005


1
inital
year 1
actual 6/6/05
year 3
Elevation [m]
distance [m]
Actual erosion
2
initial 11/22/04
year 1
year 2
year 3
actual 6/6/05
Elevation [m]
Distance [m]
Actual erosion
3
inital 11/22/04
year 1
year 2
year 3
actual 6/6/05
Elevation [m]
Distance [m]
Deposition
4
initial 11/22/04
year 1
year 2
year 3
actual 6/6/05
Elevation [m]
Distance [m]

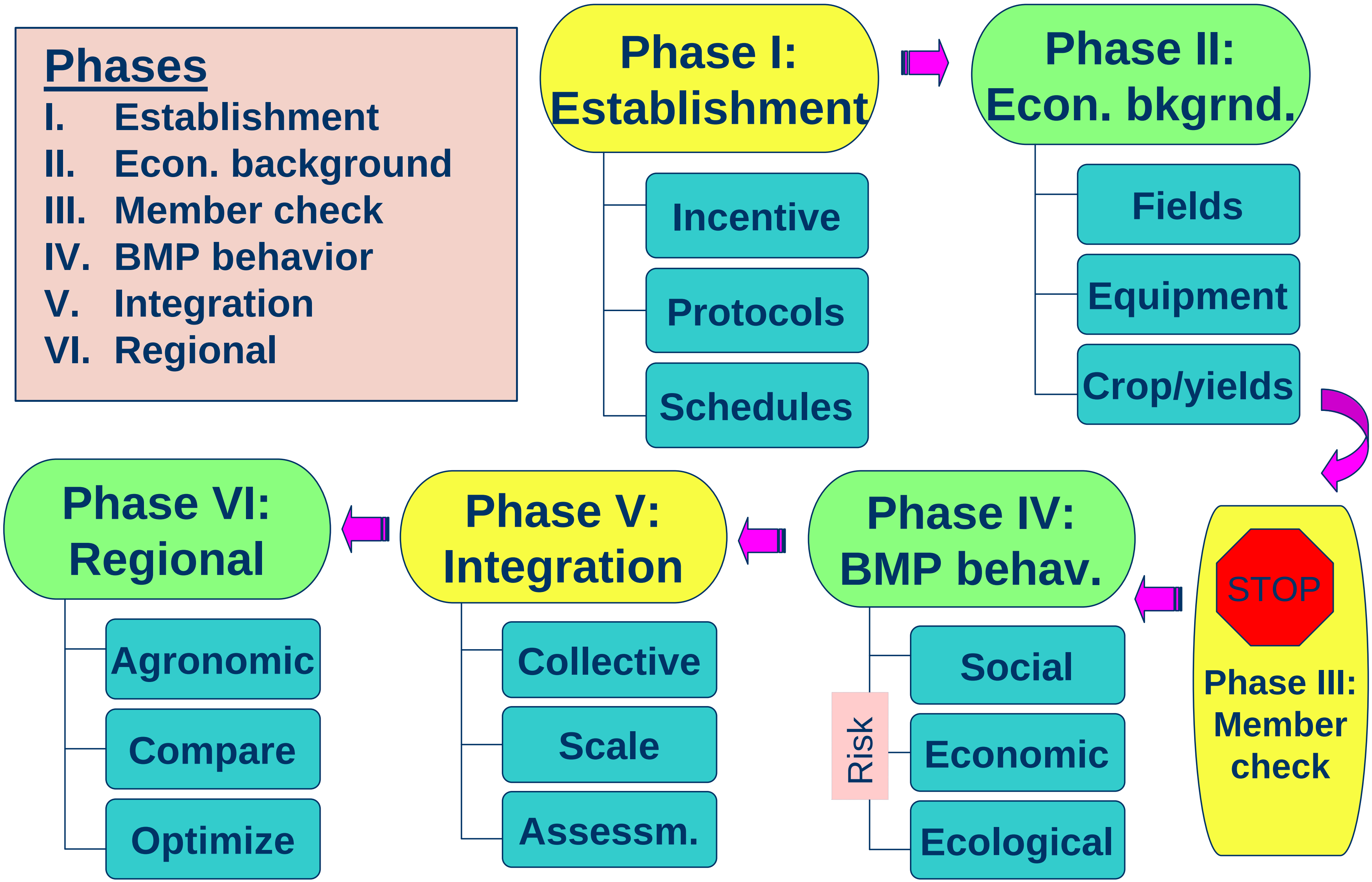

Paradise
Creek
Watershed
Streams
Watershed Bnd.
Survey Pts.
0
1.5
3
6
Kilometers


Paradise Creek Watershed
Streams
Watershed Bnd.
Survey Pts.
0
50
100
200
Meters

Conservation Behavior Risk Index

- Social
  - Stress/anxiety over decisions
- Economic
  - *Can I afford to do conservation*?
  - Short-term, smaller-scale
- Ecological
  - *Can I afford **not** to do conservation*?
  - Long-term, larger-scale

Participatory Socio-Economic Methodology



Questions?