Road Decommissioning and TMDL Implementation: Homewood Case Study

Presented by

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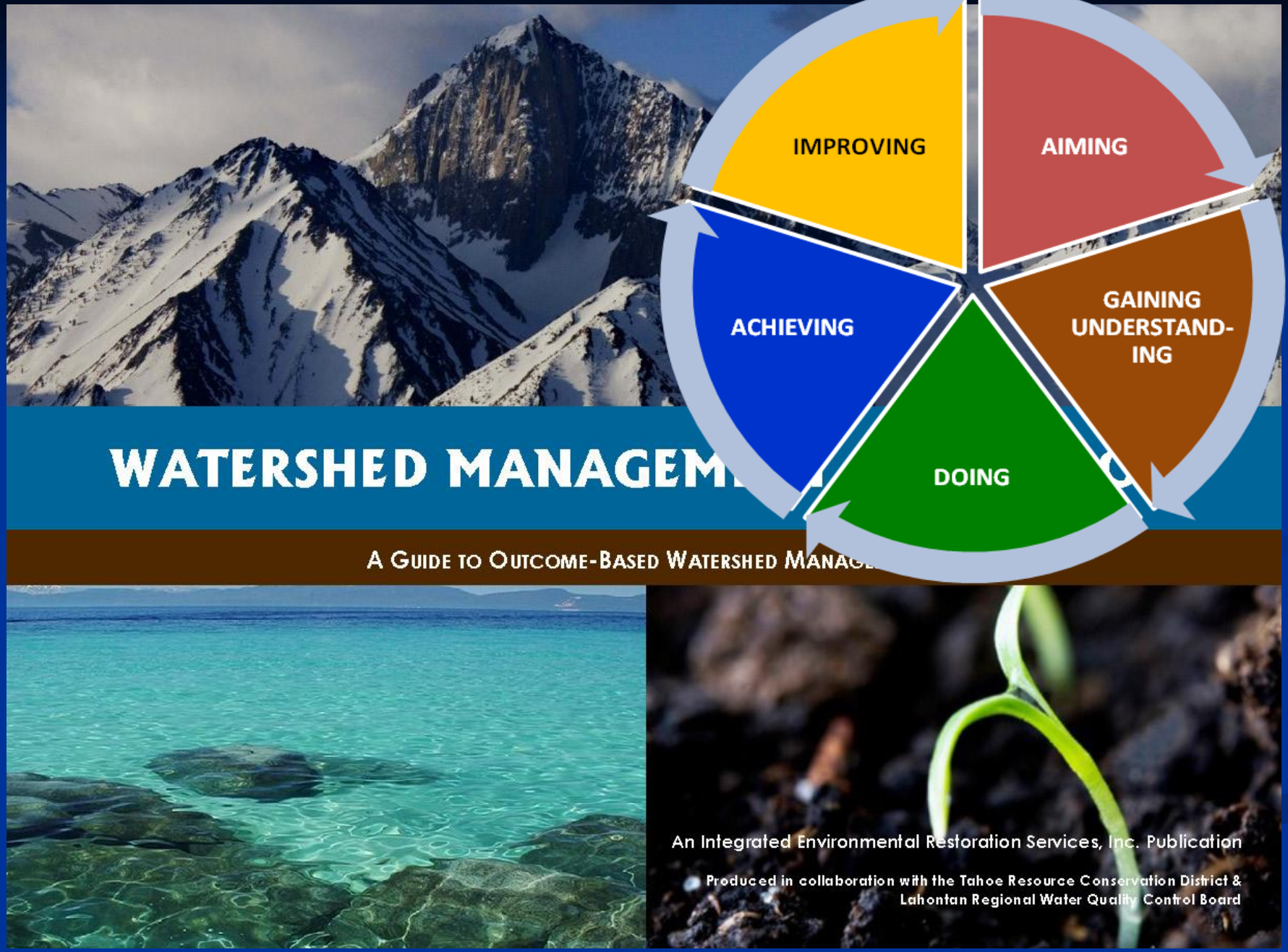
Integrated Environmental Restoration Services, Inc.

June 13, 2013

Today's Discussion

- Project background and Tahoe TMDL context
- Where are the erosion problems?
- Can we stop erosion at the source?
- Can we detect watershed sediment reductions with stream monitoring?

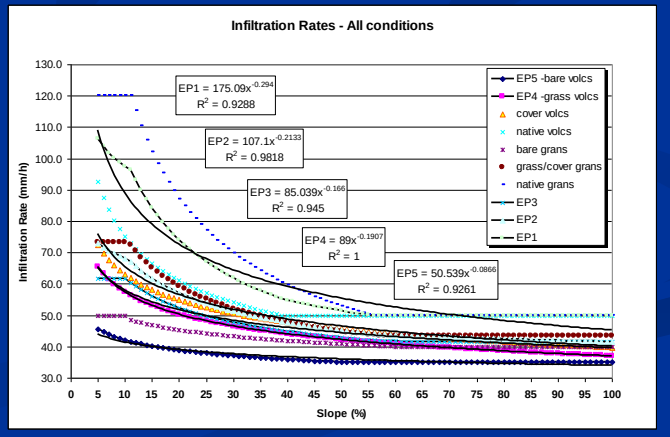

IMPROVING
AIMING
ACHIEVING
GAINING UNDERSTAND-ING
DOING
WATERSHED MANAGEM
A GUIDE TO OUTCOME-BASED WATERSHED MANAG
An Integrated Environmental Restoration Services, Inc. Publication
Produced in collaboration with the Tahoe Resource Conservation District & Lahontan Regional Water Quality Control Board

Tahoe TMDL – Forested Uplands Group

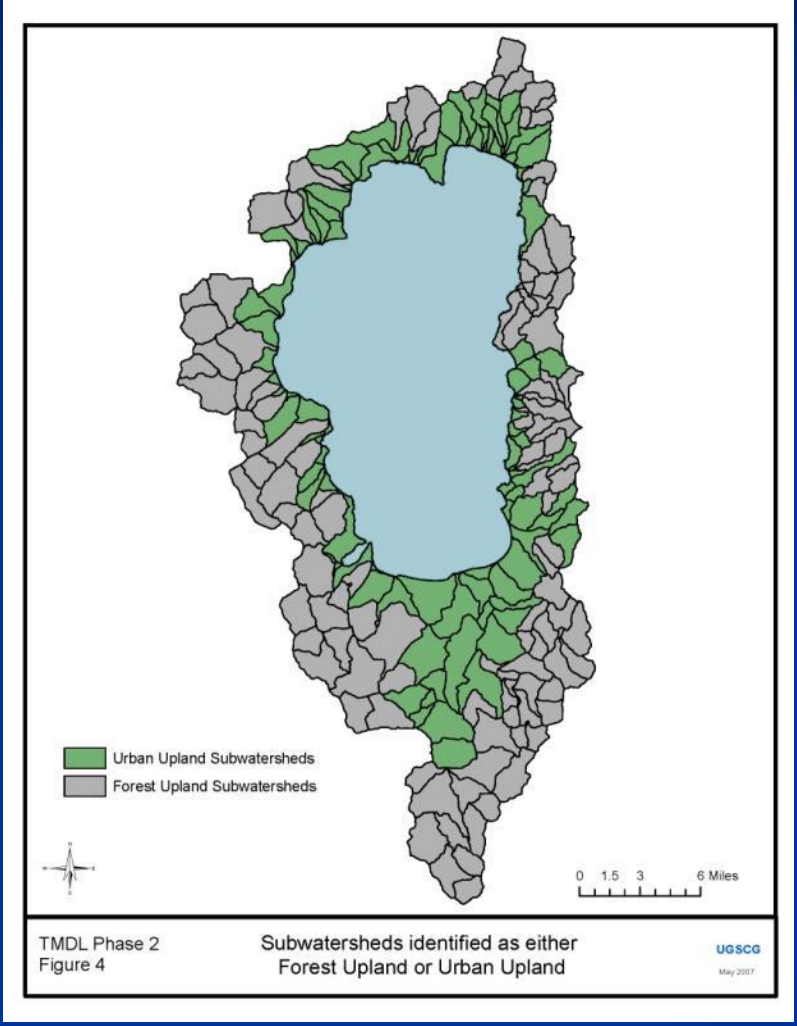
Why IERS?

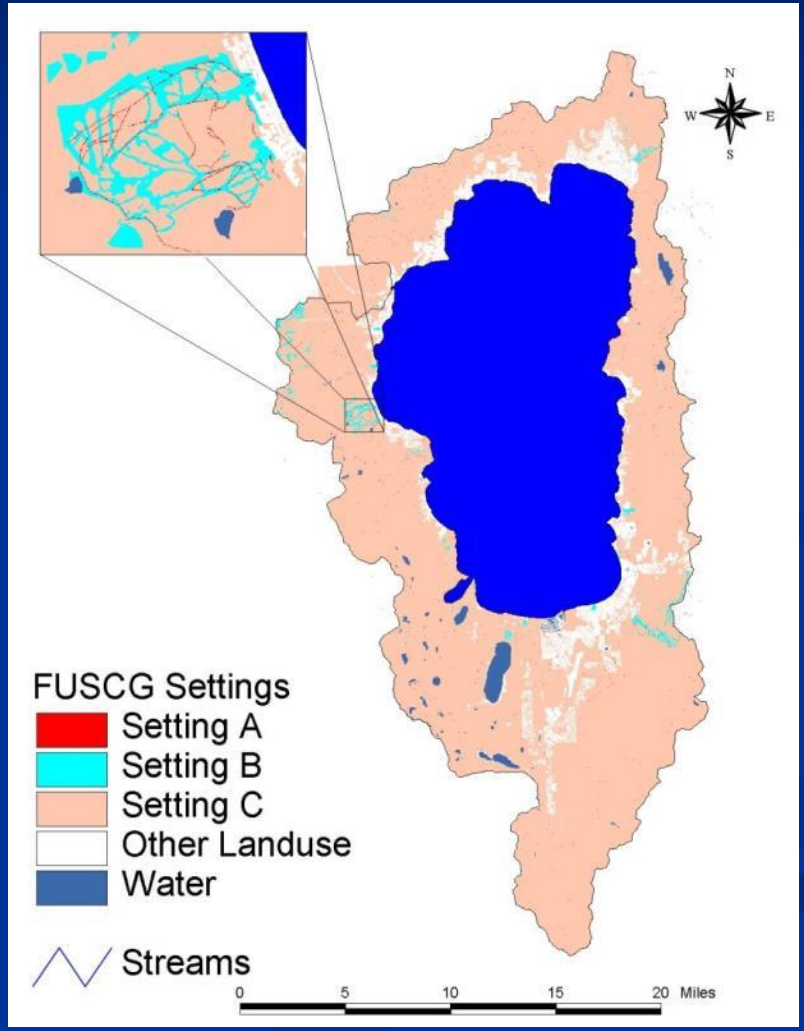
- Large body of Tahoe area erosion and restoration data
- Focus on cost-effective restoration practices

Task: Estimate sediment loading and sediment reductions for "forested" land uses (~80% of Basin)



Tahoe TMDL – Forested Uplands Group





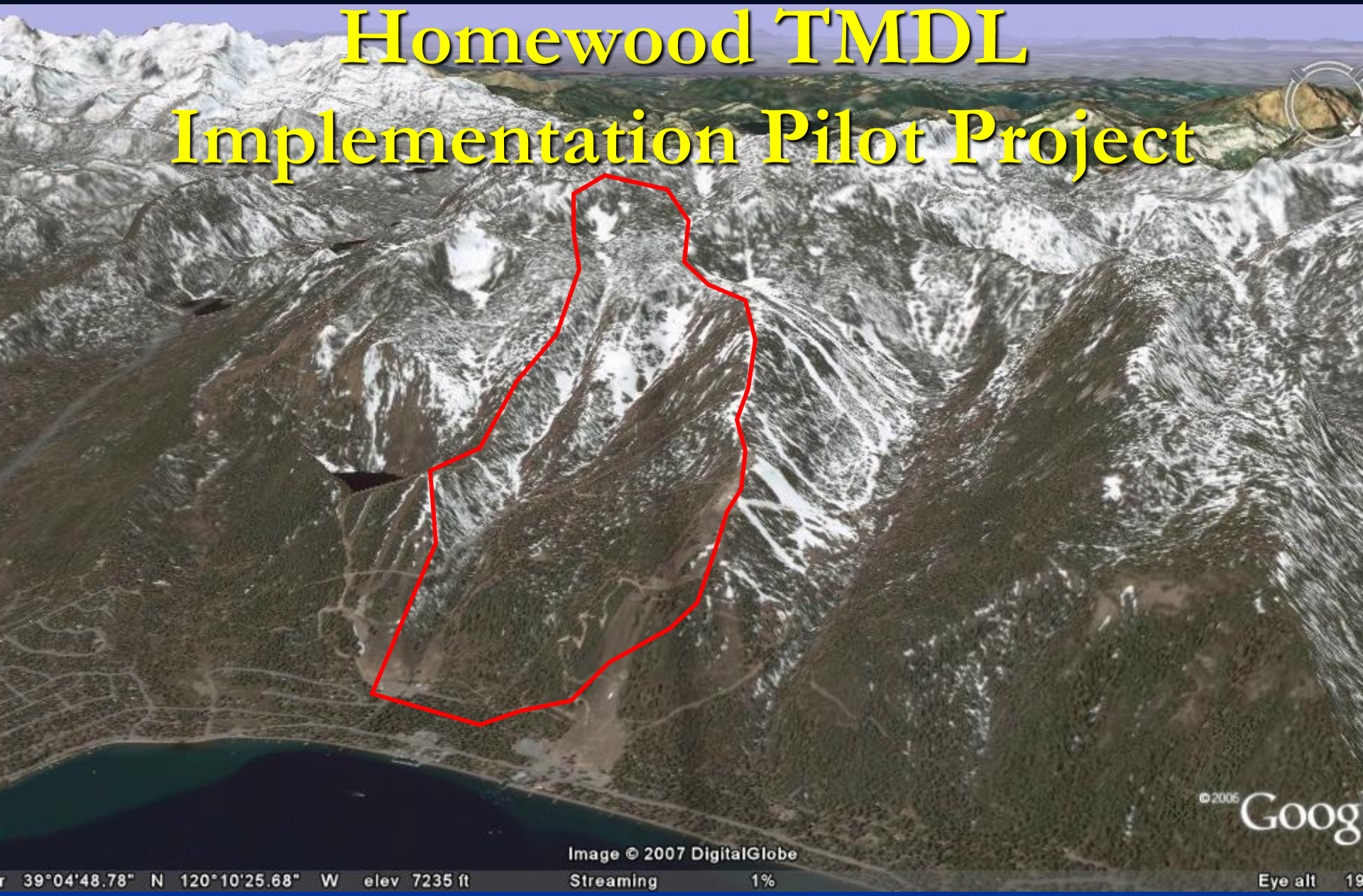
TMDL - Key Findings

- Greatest load reductions per-acre are disturbed volcanic soils on the north and west sides of the Basin.
- Per-acre load reductions from unpaved roads, ski slopes and campgrounds are 1-2 orders of magnitude larger than undisturbed forested areas.
- Per-acre fine sediment loading rates from unpaved roads are roughly double that from ski trails and 20–40 times greater than loading rates from undeveloped forested areas.
- Most cost-effective load reductions: obliteration of roads and legacy areas in combo with mechanical fuels reduction efforts.

Key Info Gaps

- Quantification of sed yields (SY) for different land uses and mgmt/treatment practices
- Up-scaling of rainfall sim-derived SY results
- More refined measurement and modeling of sub-watershed hydrologic processes
- Road density and legacy areas - incomplete inventories
- Sediment connectivity from source to stream
- Can we detect load reductions with in-stream monitoring?

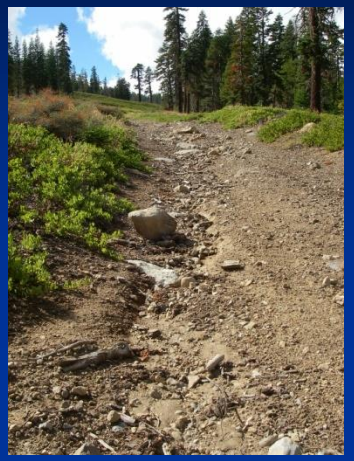
Homewood TMDL Implementation Pilot Project

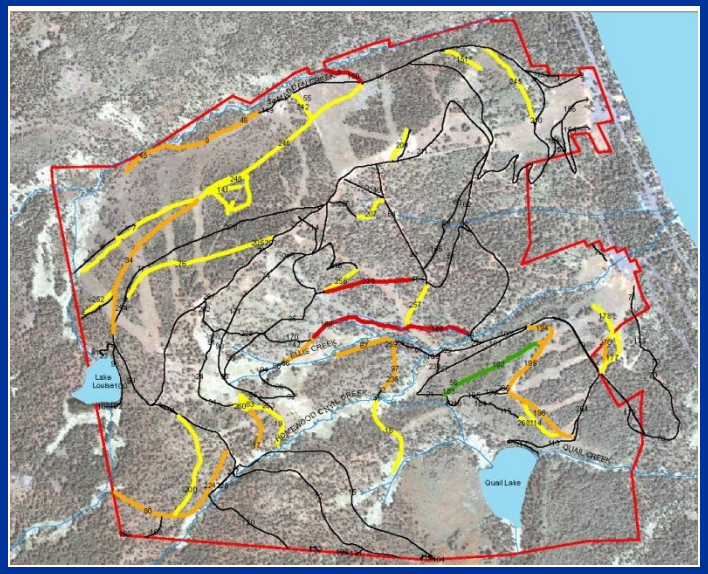


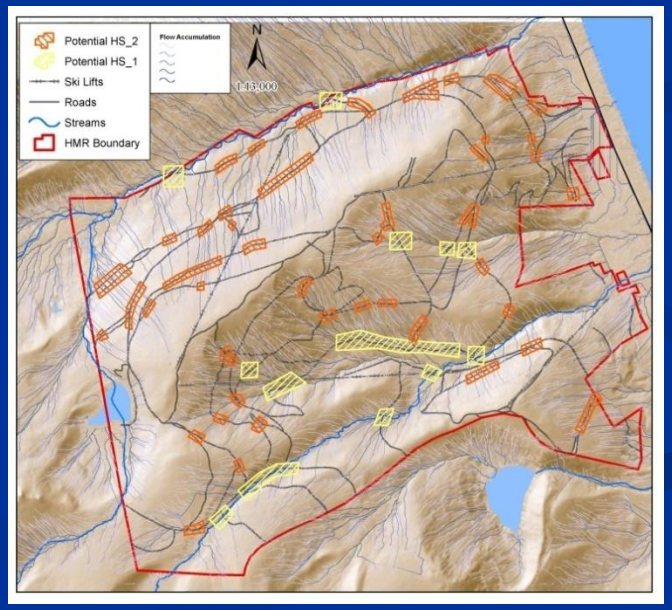
3 Big Questions

1. Where are the erosion "hot spots"?
2. Can we stop erosion (and runoff) at the source?
3. Can we detect watershed-scale sediment reductions with in-stream monitoring?

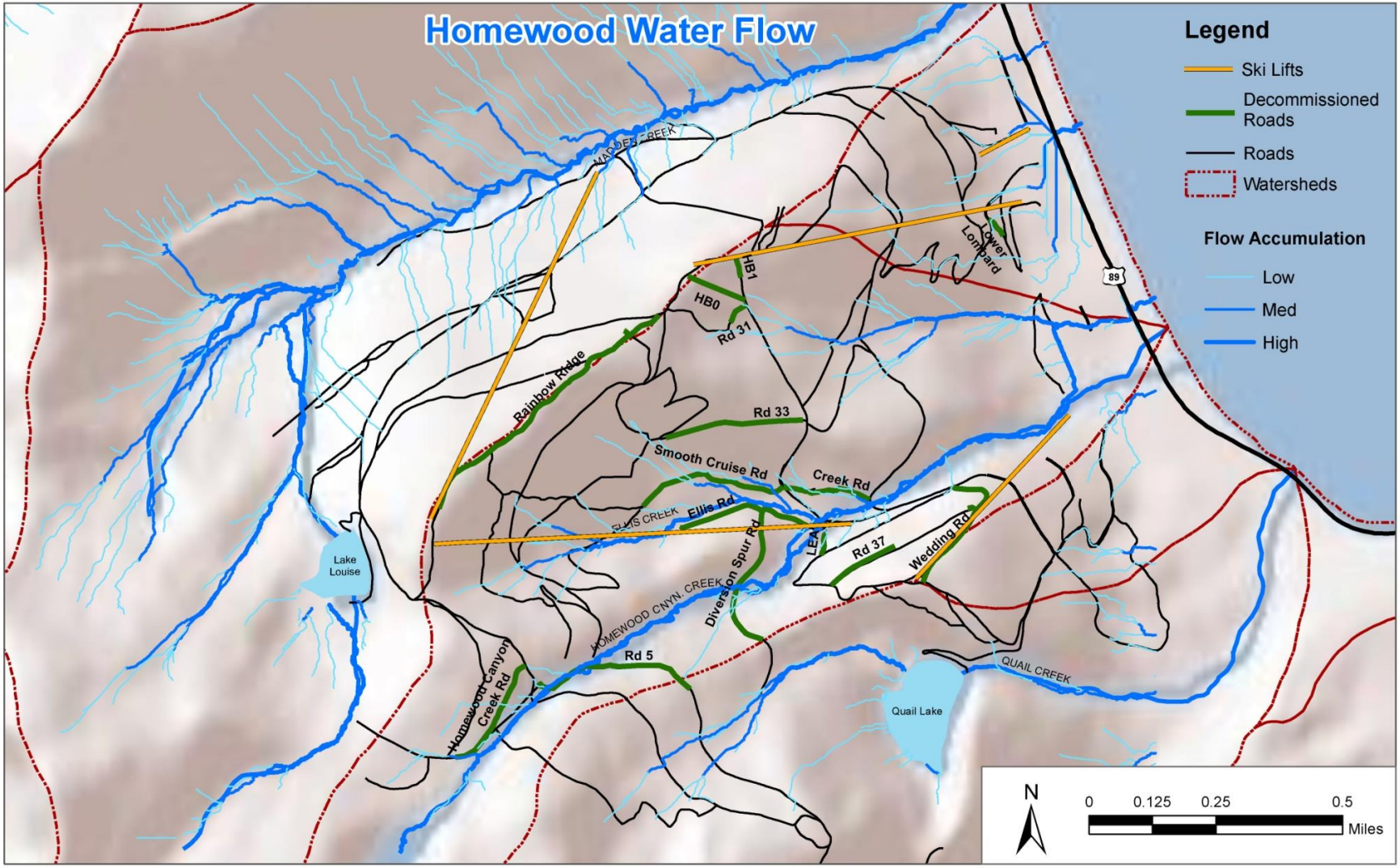
Where are the erosion hot spots?







Water Flow and Drainage Context

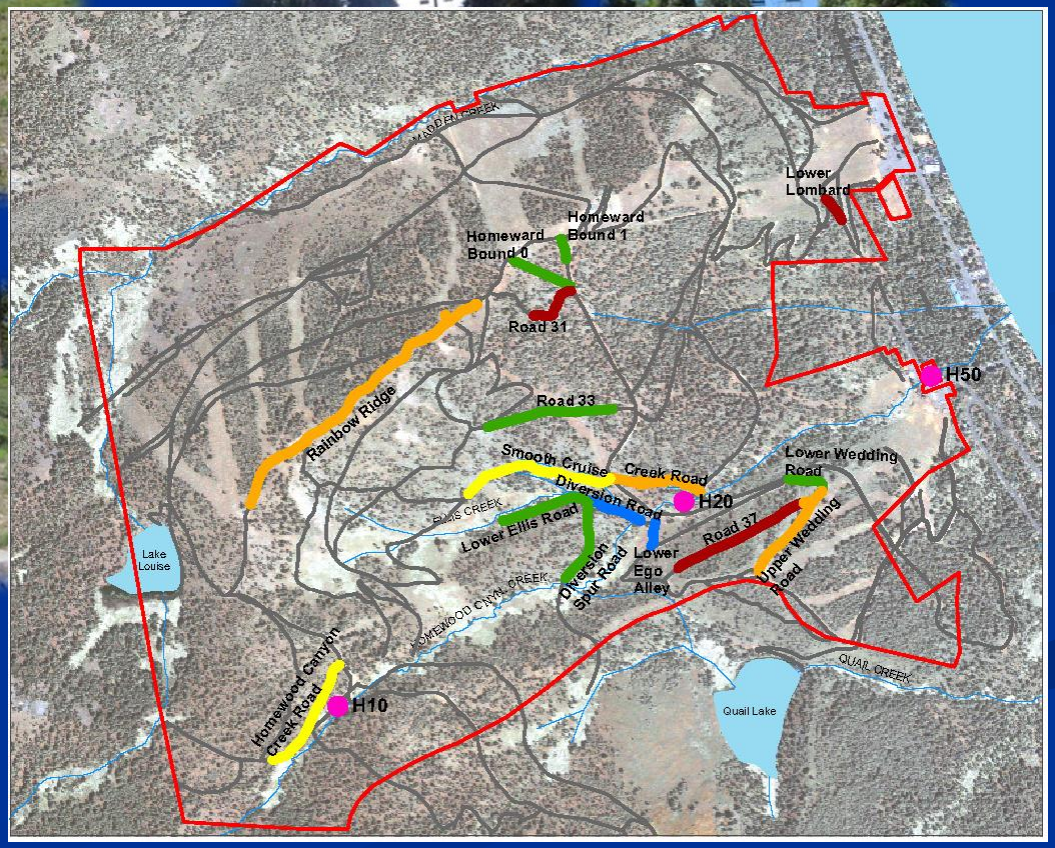


Can we stop erosion at the source?

- If it doesn't run off, it can't get to the stream

- Treatment Tiers
  - Tier 1: Surfacing
  - Tier 2: Targeted Loosening
  - Tier 3: Full Restoration/ Recontouring

Disconnecting the Dots



Is it working?

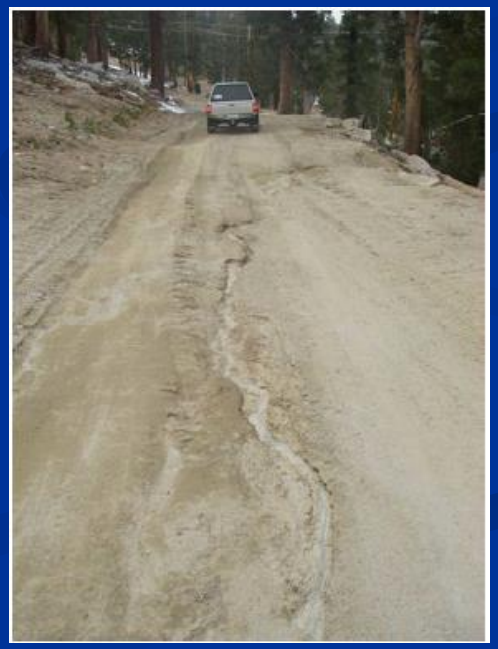
Direct measurement of erosion with rainfall and runoff simulation

Other assessment techniques used

- Soil density (cone penetrometer)
- Cover (total, mulch, veg)
- Soil organic matter
- Surface roughness

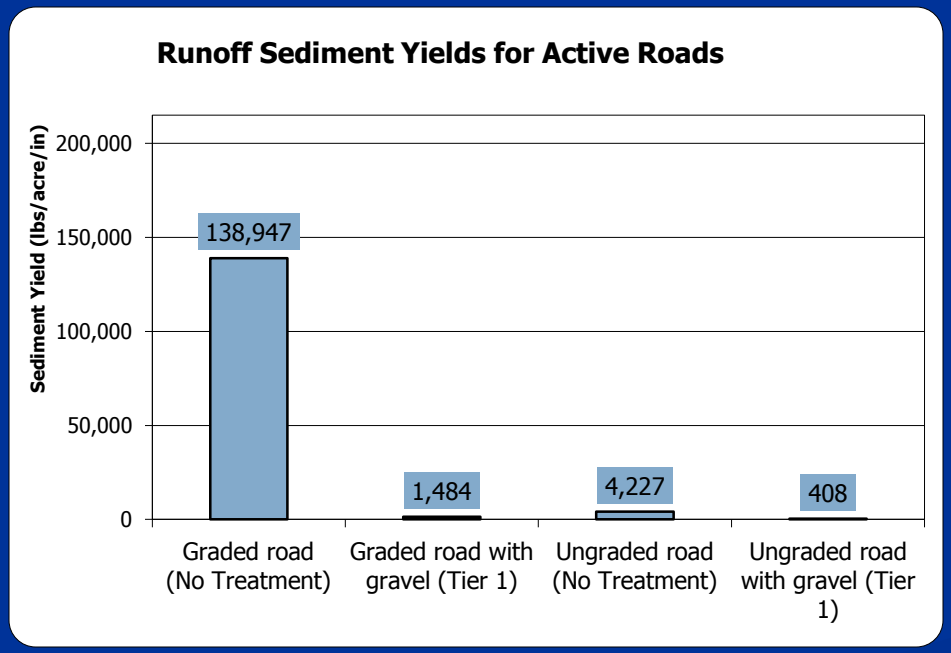
Active vs. Inactive Roads

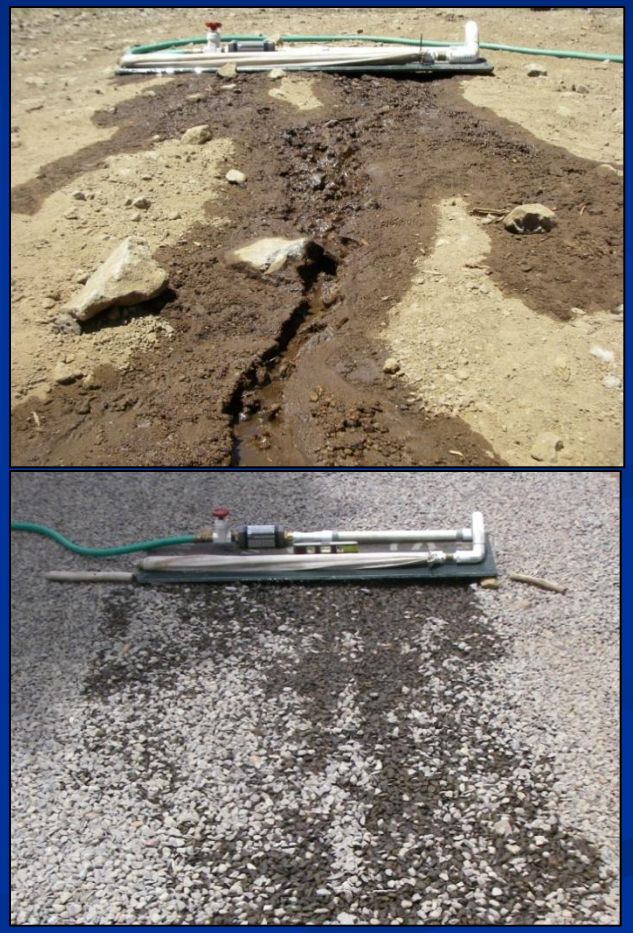
- Inactive road SYs: ~1000-6000 lbs/ac/in
- Active road SYs: ~20,000-140,000 lbs/ac/in
- Fine sediment particle content (<20 microns):
  - Active roads: 45-52%
  - Inactive roads: 12-43%



Grading and Gravel Surfacing

- Grading increased sediment yield by 33 times compared to ungraded conditions.
- Applying gravel to active roads reduced sediment by up to 2 orders of magnitude (and can reduce maintenance costs).



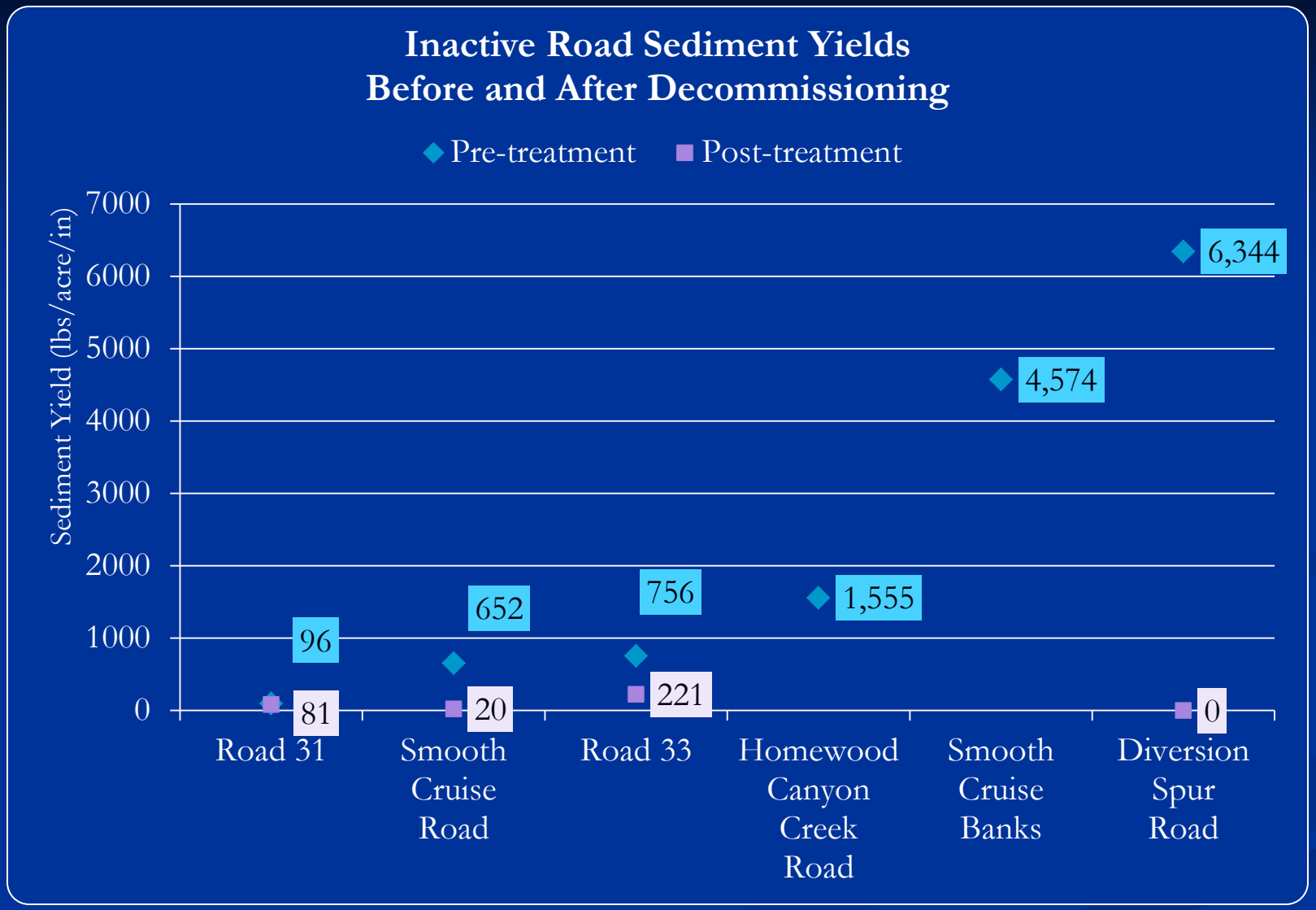


Other Road Surfacing Treatments

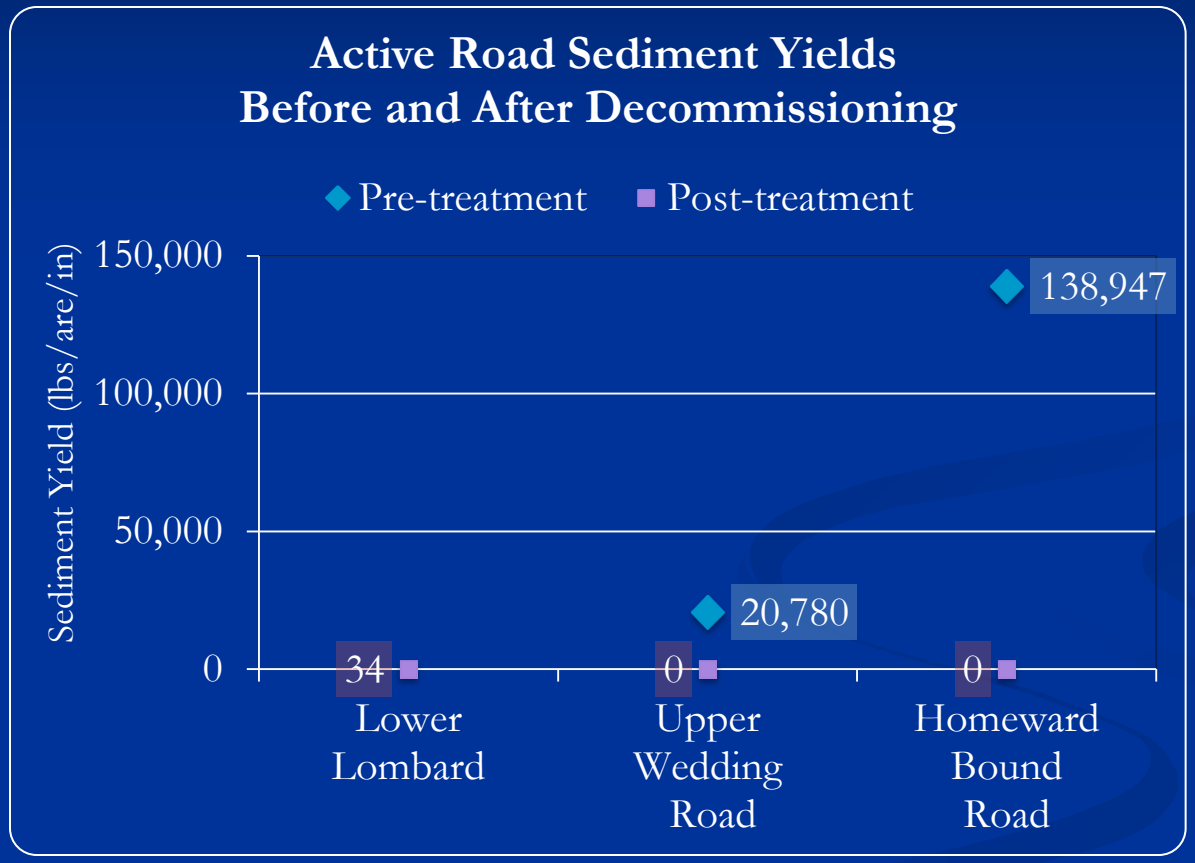
- **Wattle Ranch**: AC grindings and wood chips on inactive road = 90% reduction in runoff turbidity (measured with rainfall sim)
- **Homewood**: Mulch (2-4 inches of wood chips or pine needles) reduced SYs on inactive roads by 72-96% and 60-90% on a ski run.

Deeper mulch =

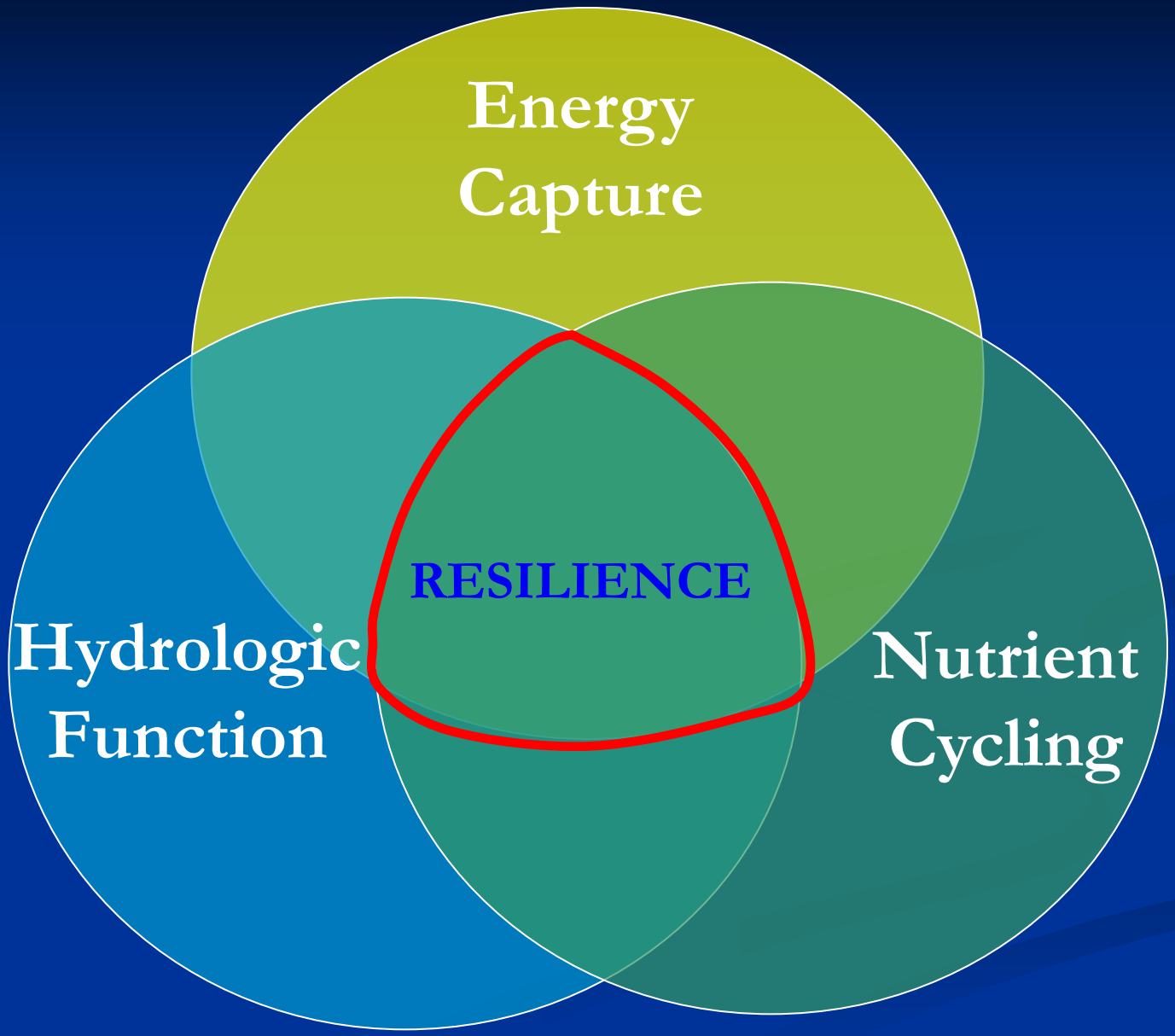
greater SY reductions


Inactive Road Sediment Yields
Before and After Decommissioning
Pre-treatment
Post-treatment
Sediment Yield (lbs/acre/in)
7000
6000
5000
4000
3000
2000
1000
0
96
81
652
20
756
221
1,555
4,574
6,344
0
Road 31
Smooth Cruise Road
Road 33
Homewood Canyon Creek Road
Smooth Cruise Banks
Diversion Spur Road

Mark it a zero, dude



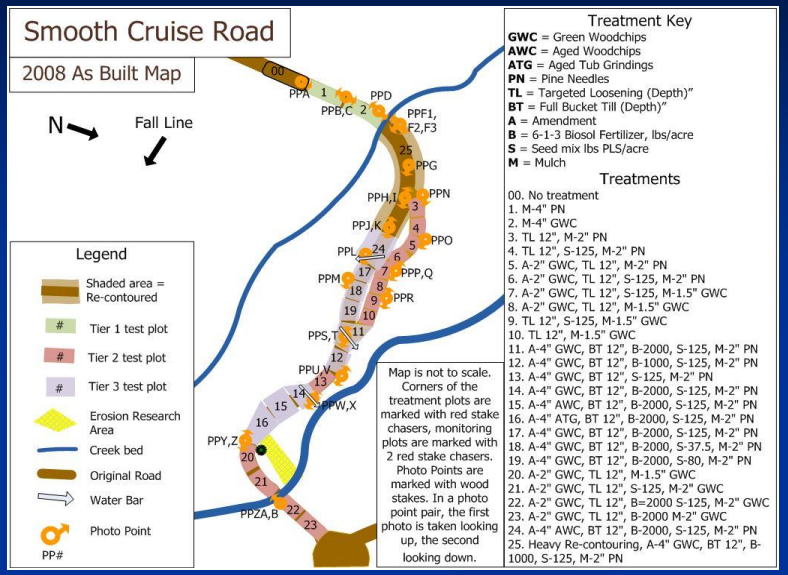
Rebuilding Erosion *Resistance*

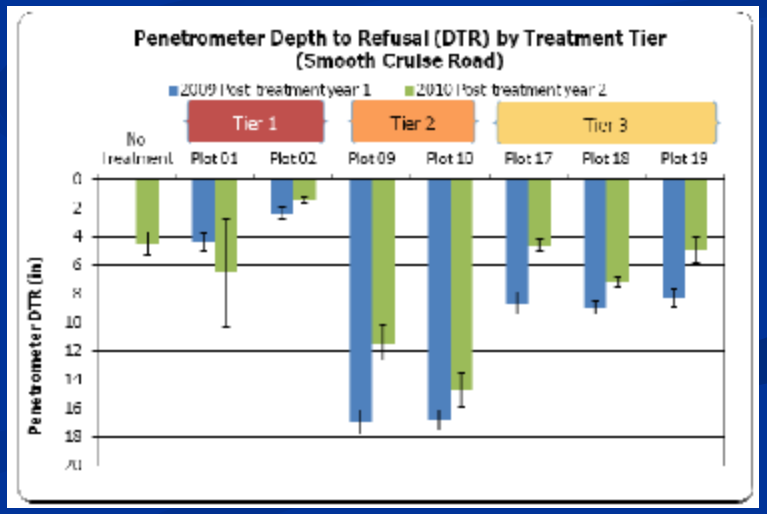


Cummings, 2003

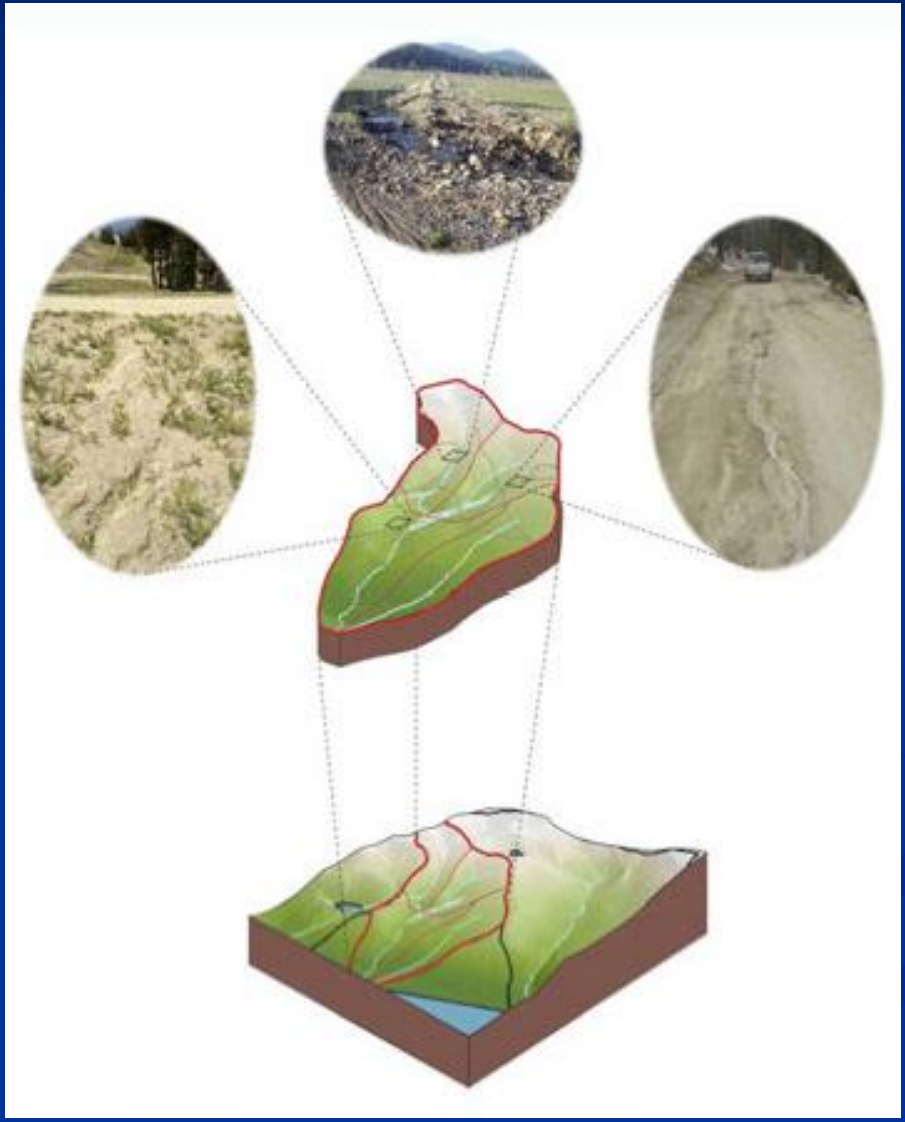
Focusing on cost-effectiveness

- **Tier 2 compared to Tier 3**
  - Deeper average penetrometer depths
  - Higher plant cover
  - Similar sediment reductions
  - Faster implementation



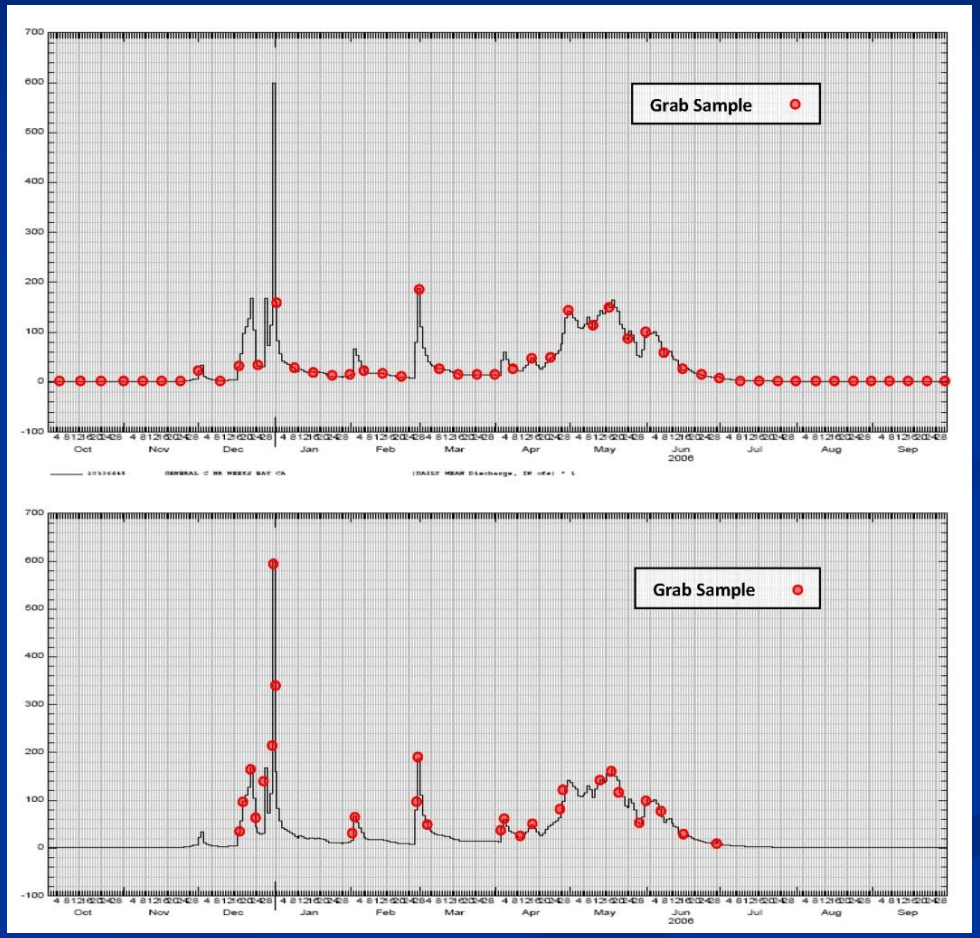


Can we detect watershed-scale sediment reductions with stream monitoring?

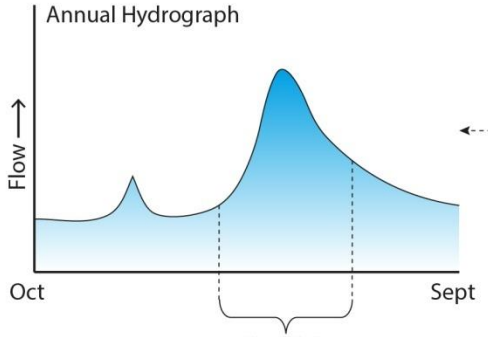


Can we detect watershed-scale sediment reductions with stream monitoring?

- Are we sampling for compliance… or effectiveness and improvement?



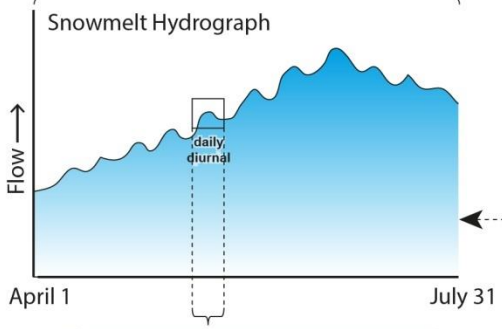
Targeted Water Quality Monitoring for Sediment Load Detection in the Homewood Creek Watershed



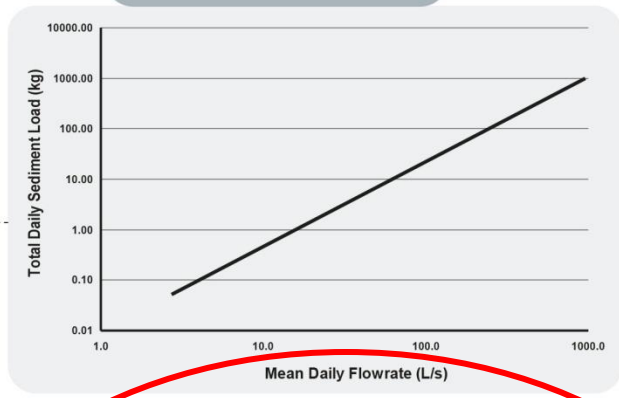
Snowmelt-driven watersheds, like those in the Sierra Nevada, require targeted monitoring approaches to accurately characterize year-to-year changes in sediment loading.

Between 90 and 99% of annual runoff occures between April and July, with the other 10% primarily consisting of summer and fall rain storms.

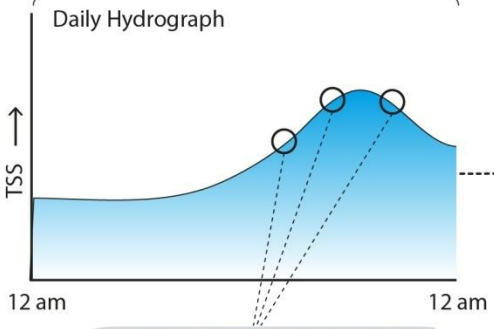
A flow-load rating curve was established using continuous turbidity and flow monitoring and targeted grab sampling.



Targeting grab samples on the rising limb of the seasonal and daily hydrograph during spring snowmelt can dramatically improve "signal-to-noise" in water quality data.

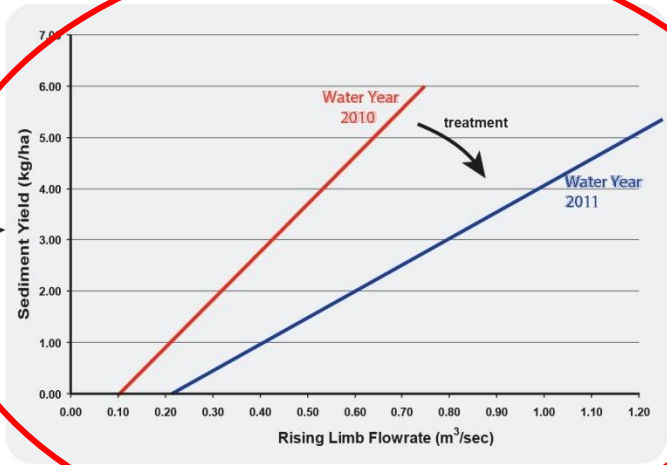


Measuring sediment loads on the rising limb of the daily hydrograph during the snowmelt period removes the load variability associated with the recession (falling) limb of the hydrograph.



At Homewood Creek, grab sampling was focused between 12pm and 5pm during daily peak flows.

Rising limb sediment yield is plotted against rising limb flow rate to normalize for different water years. Between WY 2010 and 2011, rising-limb sediment yield per unit flow decreased substantially, presumably as a result of targeted restoration of sediment source areas throughout the watershed.



Key Outcomes

- ~3.5 miles (~300,00 SF) of roads decommissioned
- 80-100% SY reductions at most sites
- Initial signal of WQ improvement – JMA commitment to continue load detection monitoring (new WDRs!)
- Measured cost per unit of sediment reduction – its imperfect, but a very important start. ***What's the ROI on road mgmt/decommissioning?***
- 6 peer-reviewed publications (download at www.IERStahoe.com)
- Watershed Management Guidebook (download at www.IERStahoe.com)
- TRPA Best in Basin award
- NSAA Golden Eagle award

- Bonus: No challenge to Homewood redevelopment EIR on hydro and WQ

Recommendations

- Prioritize road mgmt efforts based on drainage and connectivity – expand beyond road-stream crossings. Go out when its raining.
- Clarify goals: Closure? Erosion reduction? Hydrologic function?
- Measure outcomes, especially for "common sense" BMPs. Predictions are not outcomes. Checking outcomes enables learning and improvement.
- Track costs and results to determine cost-effectiveness: **What's the ROI?**
- Link road and legacy site restoration with mechanical fuels reduction projects
- Public-private partnerships: incentive and recognize effective watershed mgmt by private landowners

"Common sense is the collection of prejudices acquired by age eighteen."
Albert Einstein

Acknowledgements

- Lahontan Water Board – Cindy Wise, Hannah Schembri, Bob Larsen, Doug Cushman, Bud Amorfini
- TRPA – Ethan Casaday, Brian Judge
- Tahoe Resource Conservation District
- Dr. Mark Grismer (UC Davis)
- Homewood/JMA Ventures

Moments of Zen

- We learn about the potential of natural systems… mainly through experience with management itself, rather than through basic research or the development of general ecological theory.

  Walters, 2001, Adaptive Management of Renewable Resources

- "Restoration of a disturbed ecosystem is an *acid test* of our understanding of that ecosystem."

  A.D. Bradshaw

Thank you

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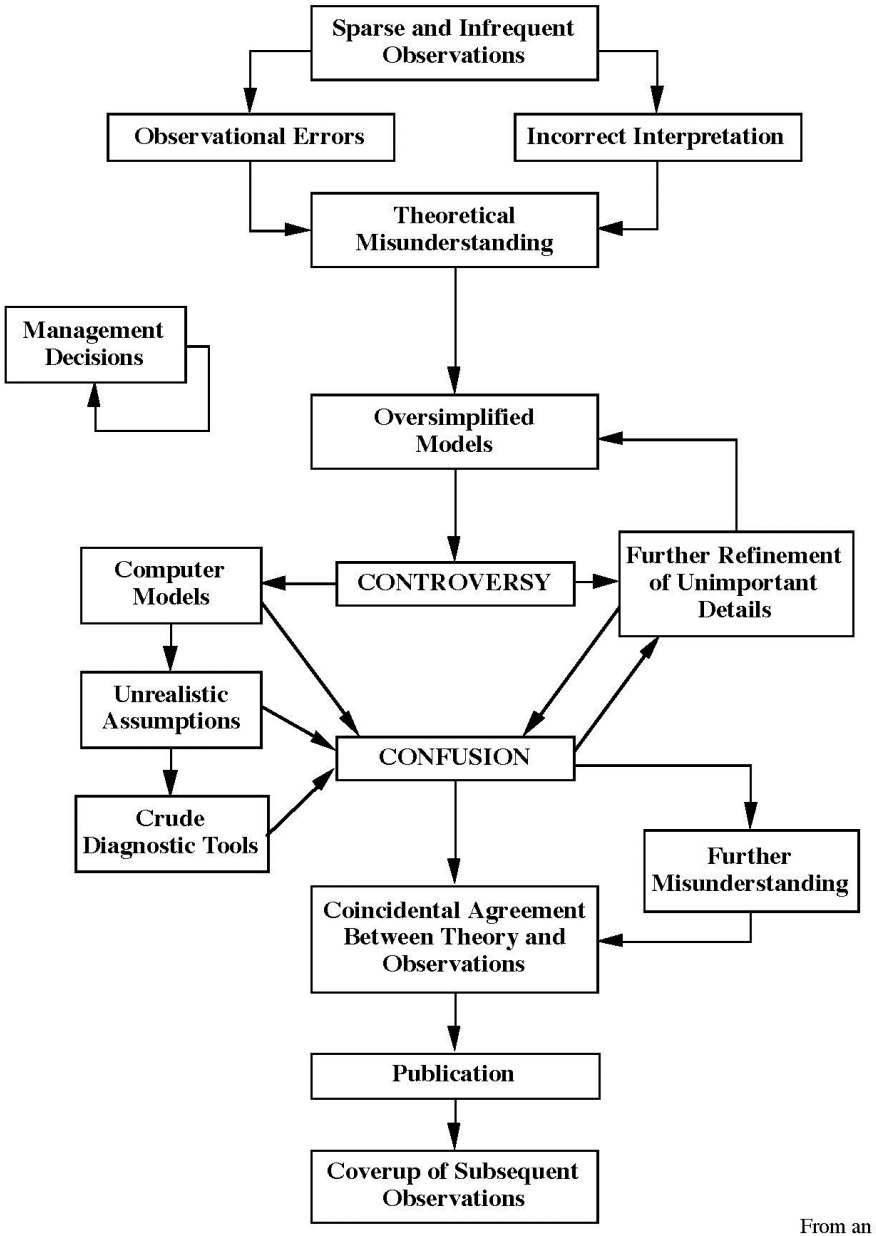
Key Distinctions

PLAN ≠ PROJECT

PROJECT ≠ OUTCOME

TREATED ≠ RESTORED

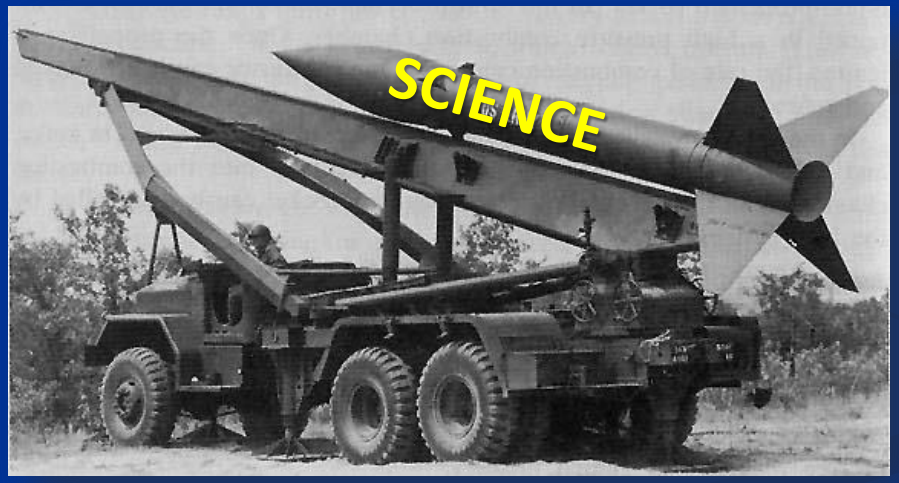
The Course of Science

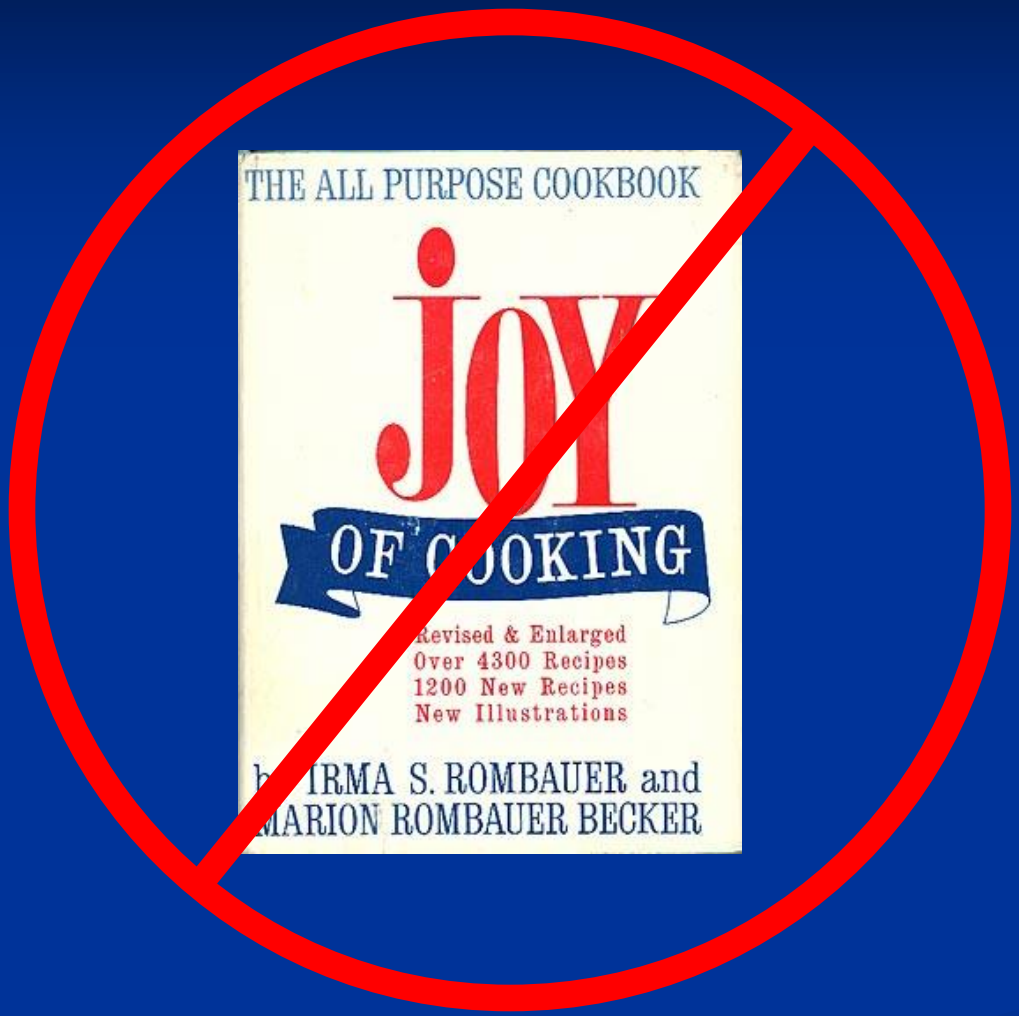


From an original idea by Sue Briggs (?)

New science model

- Use of science:
  - Ammunition for adversaries?
  - Path to mutual discovery?

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OF COOKING
Revised & Enlarged
Over 4300 Recipes
1200 New Recipes
New Illustrations
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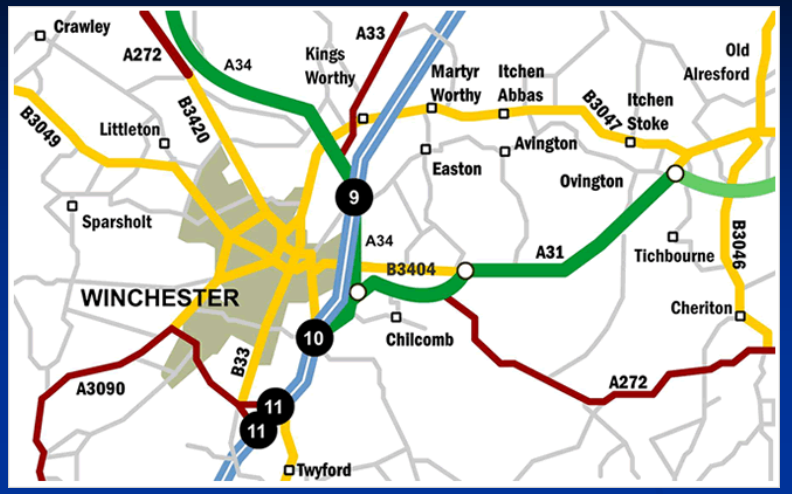
MARION ROMBAUER BECKER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Kings Worthy
Martyr Worthy
Itchen Abbas
Old Alresford
B3049
Littleton
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Itchen Stoke
Avington
Easton
Ovington
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Sparsholt
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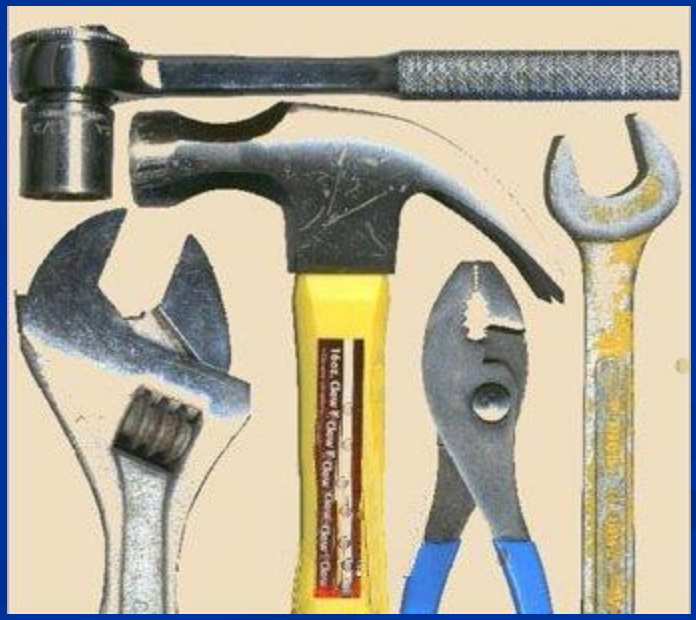
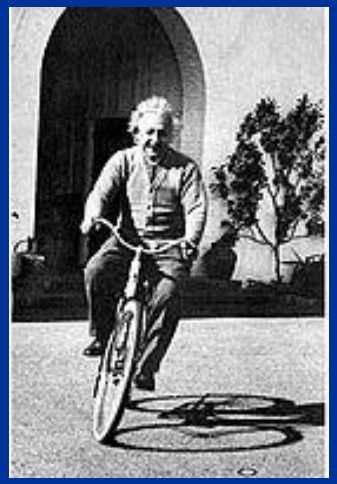
Twyford



What do we know?
The Curse of Knowledge

- How do we know what we know?
  - Measurement
  - Modeling
  - Common sense

"It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so."
Mark Twain



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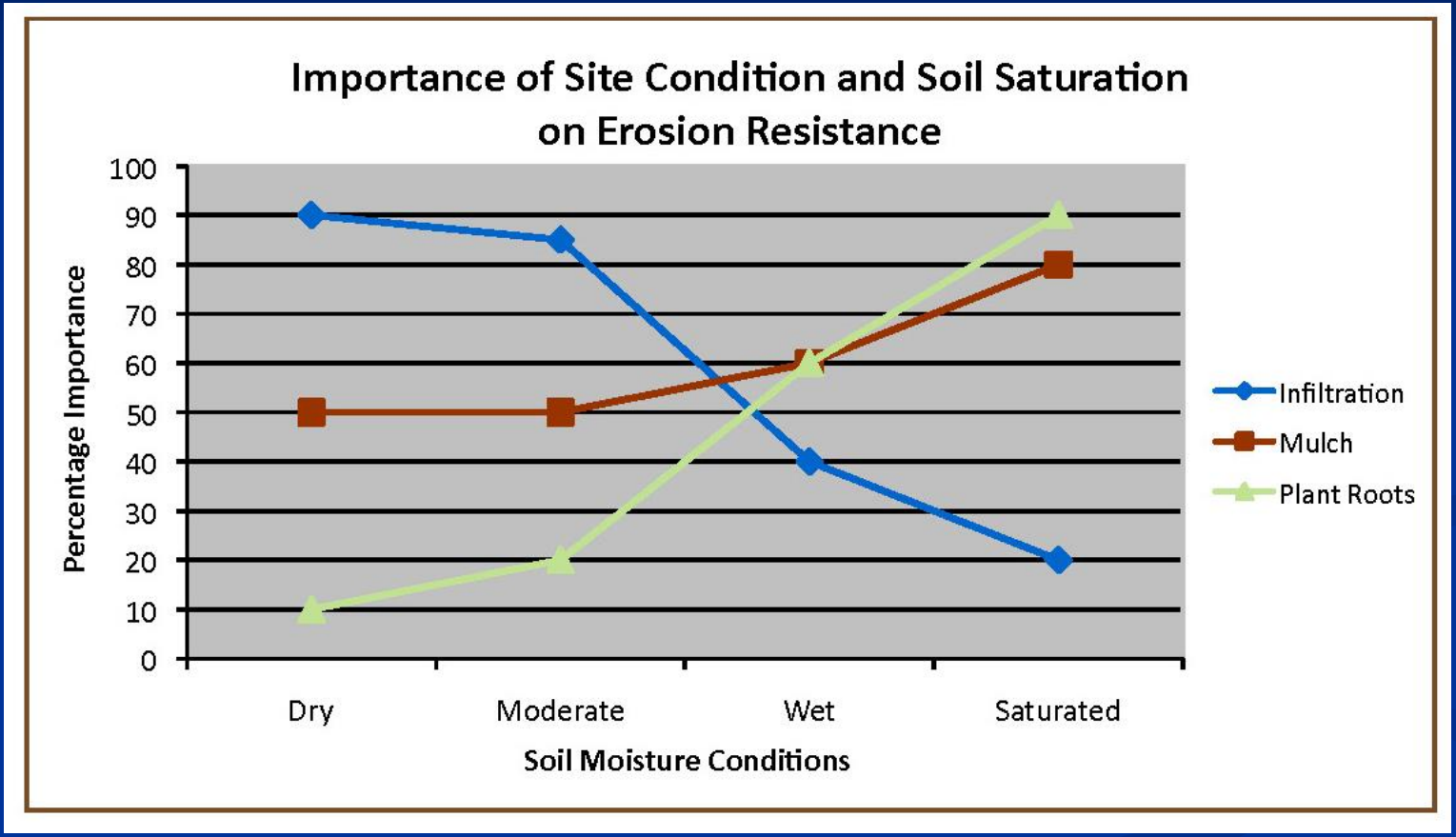
Key Consideration



What SHOULD BE:

wood chips can't be used as a soil amendment, they'll prevent plant growth!

What **IS**…

Ponderosa Ranch, test plots, 2005

Ponderosa Ranch, pre-treatment, 2006

Ponderosa Ranch, post-treatment, 2008

Soil Amendments and Mulch



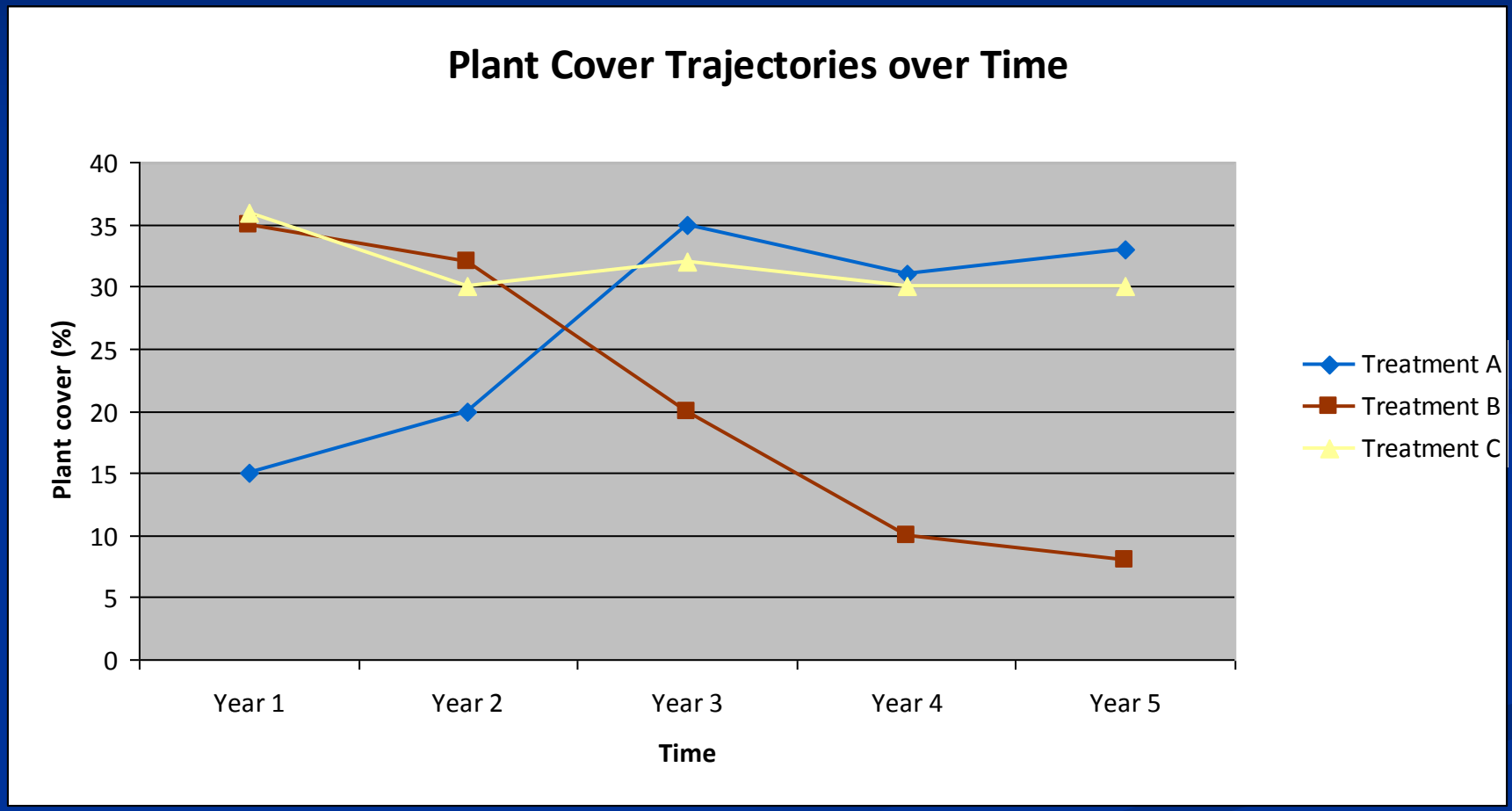






Topsoil Salvage and Reuse

Defining and Measuring Success Over Time



Forest Fuels Reduction and Water Quality Protection

Take Home Points

- We don't know most of what we need to know to manage natural systems
- Focus on the goals, question assumptions, ask lots of naïve questions
- Erosion is a soil-based problem and lasting solutions start in the soil
- A plan is not a project and a project is not an outcome
- Monitor to understand outcomes relative to goals and success criteria (not just correct implementation of the plan)