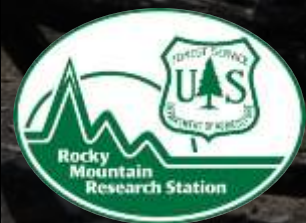


BAER and ES & R Treatments, Tools and Other Stuff



Pete Robichaud
Rocky Mountain Research Station
USDA Forest Service





WHAT A YEAR, 2014

- Monitoring Results
- BAER DB
- FS WEPP
- Technological Developments
 - Unburned soils in ERMiT
 - Online GIS WEPP
 - Geo-WEPP
 - Ravel Rat
 - 6 pubs
- *Continued Monitoring*
 - 2011 Wallow Fire, AZ
 - 2012 High Park Fire, CO
- *New Sites*
 - 2013 Rim Fire, CA
 - 2014 Preacher Fire, ID wind

Burned Area Emergency Response (BAER) Tools

Remote Sensing Imagery

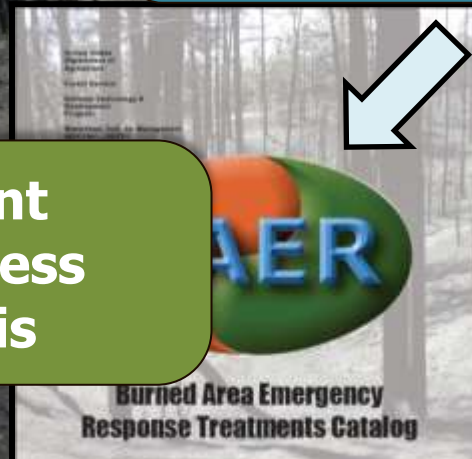
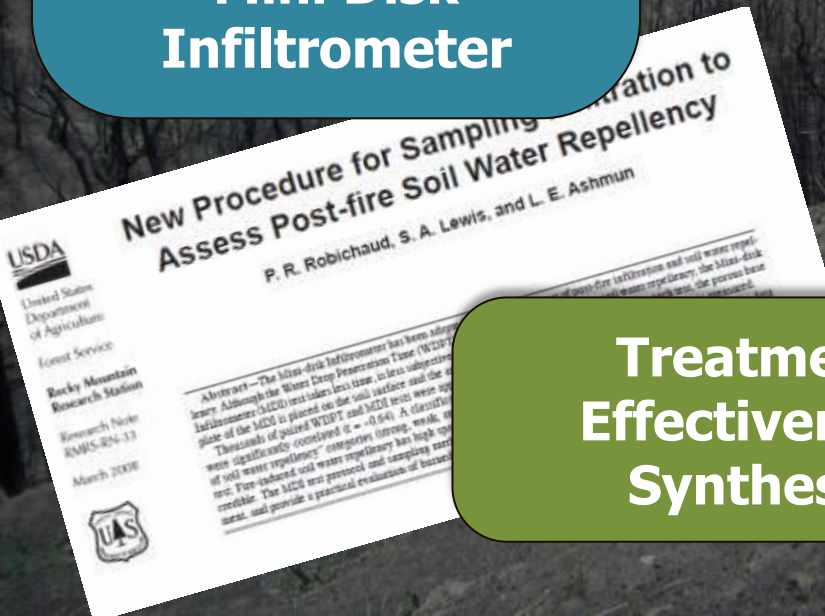
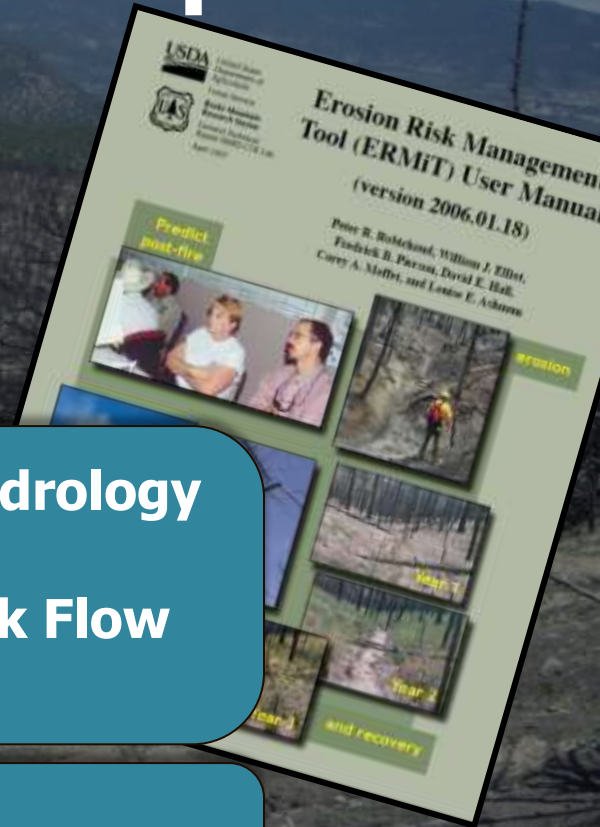
Soil Burn Severity Guide

Mini Disk Infiltrometer

Erosion/Hydrology Predictions
ERMIT, Peak Flow Calculator

VAR Tools

Treatment Effectiveness Synthesis



Evaluating Rehabilitation Treatments

Evaluating the Effectiveness of Postfire Rehabilitation Treatments

USDA United States Department of Agriculture
Forest Service
Rocky Mountain Research Station
General Technical Report RMRS-GTR-63
September 2000

Peter R. Robichaud
Jan L. Beyers
Daniel G. Neary

2000



A Synthesis of Post-Fire Road Treatments for BAER Teams: Methods, Treatment Effectiveness, a Decisionmaking Tools for I

USDA United States Department of Agriculture
Forest Service
Rocky Mountain Research Station
General Technical Report RMRS-GTR-228

Randy B. Foltz, Peter R. Robichaud, and

2007



Post-Fire Treatment Effectiveness for Hillslope Stabilization

USDA United States Department of Agriculture
Forest Service
Rocky Mountain Research Station
General Technical Report RMRS-GTR-340
August 2010

Peter R. Robichaud, Louise E. Ashmun, and Bruce D. Sims



2010



A SUMMARY OF KNOWLEDGE FROM



Evaluating Rehabilitation Treatments

 		Straw mulches	Wood mulches	Hydro-mulches	Soil binders (PAM)	Contour-felled logs (LEBs)	Straw wattles
Overall effectiveness rating (1, 2, or 3)	High intensity rainfall (>2-yr return interval)	1	1	3	3	3	3
	Low intensity rainfall	1	1	1	2	1	1
	High rainfall amount (>50 mm in 6 hr)	1	1	2	3	2	2
Specific function	Remains functional for more than one year	more	more	less	less	more	more
	Provides ground cover	more	more	more	less	less	less
	Traps sediment	more	more	less	less	more	more



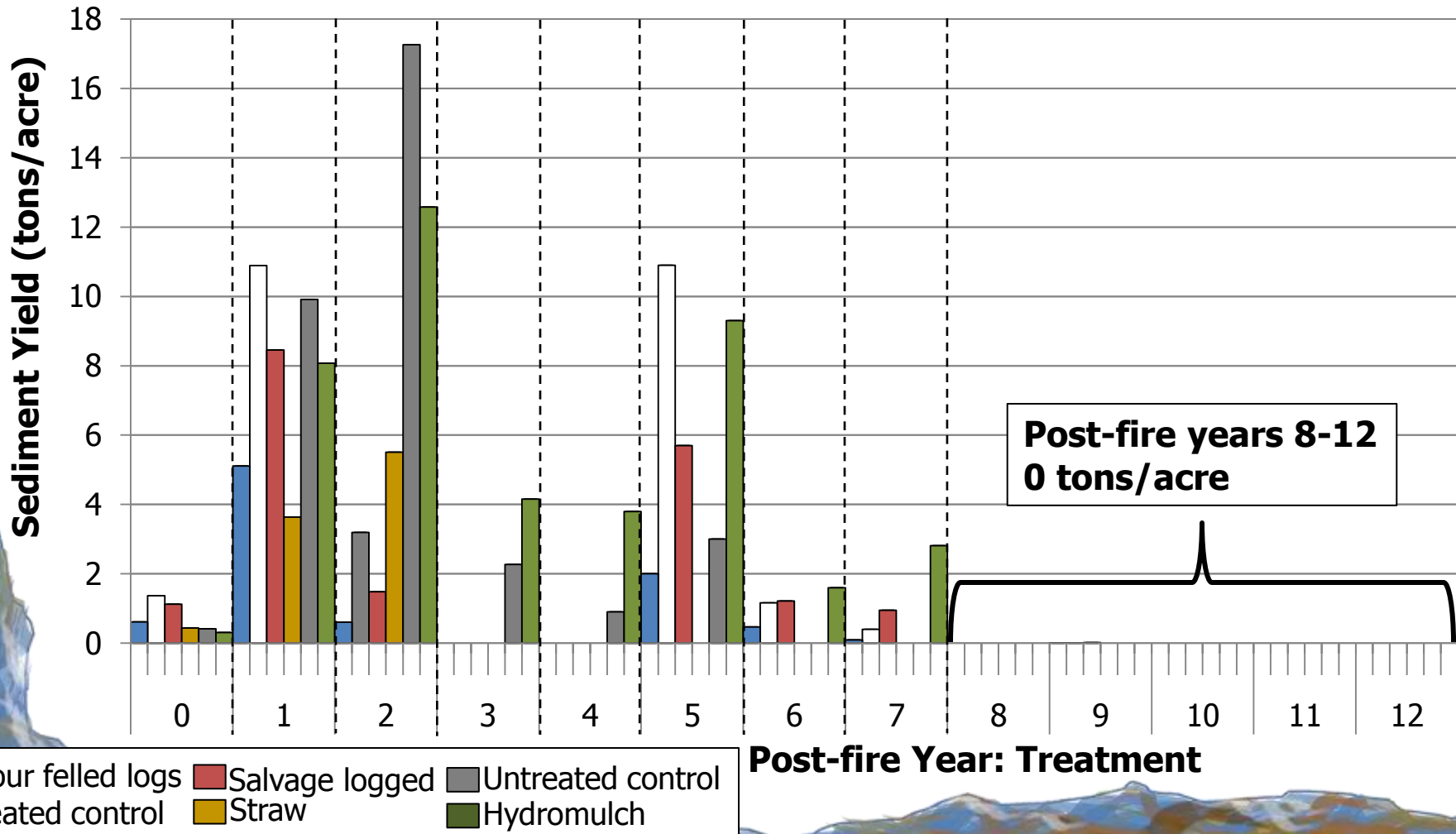
2002 HAYMAN FIRE

WATERSHED TREATMENT MONITORING

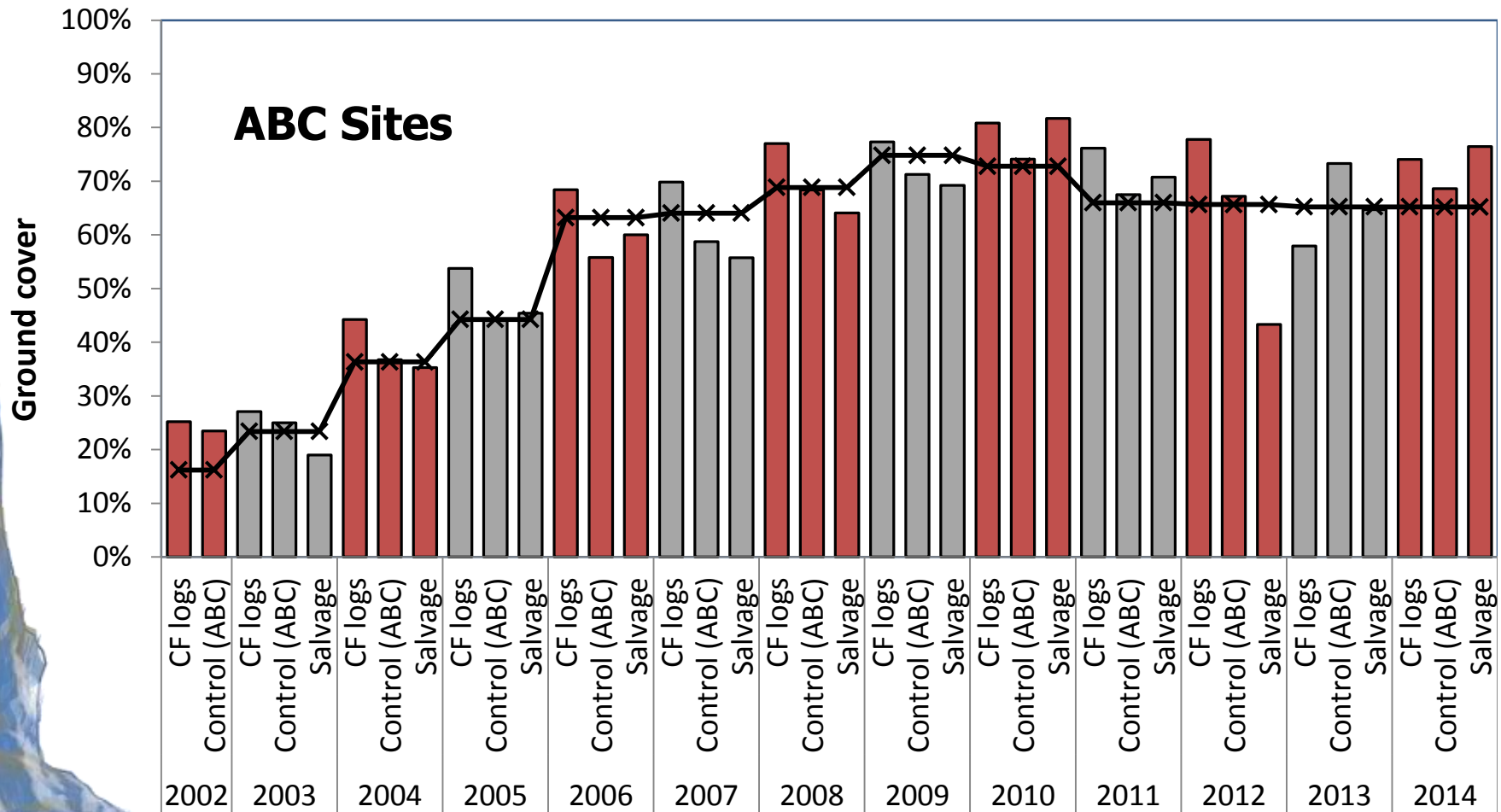
12 Years after the Fire



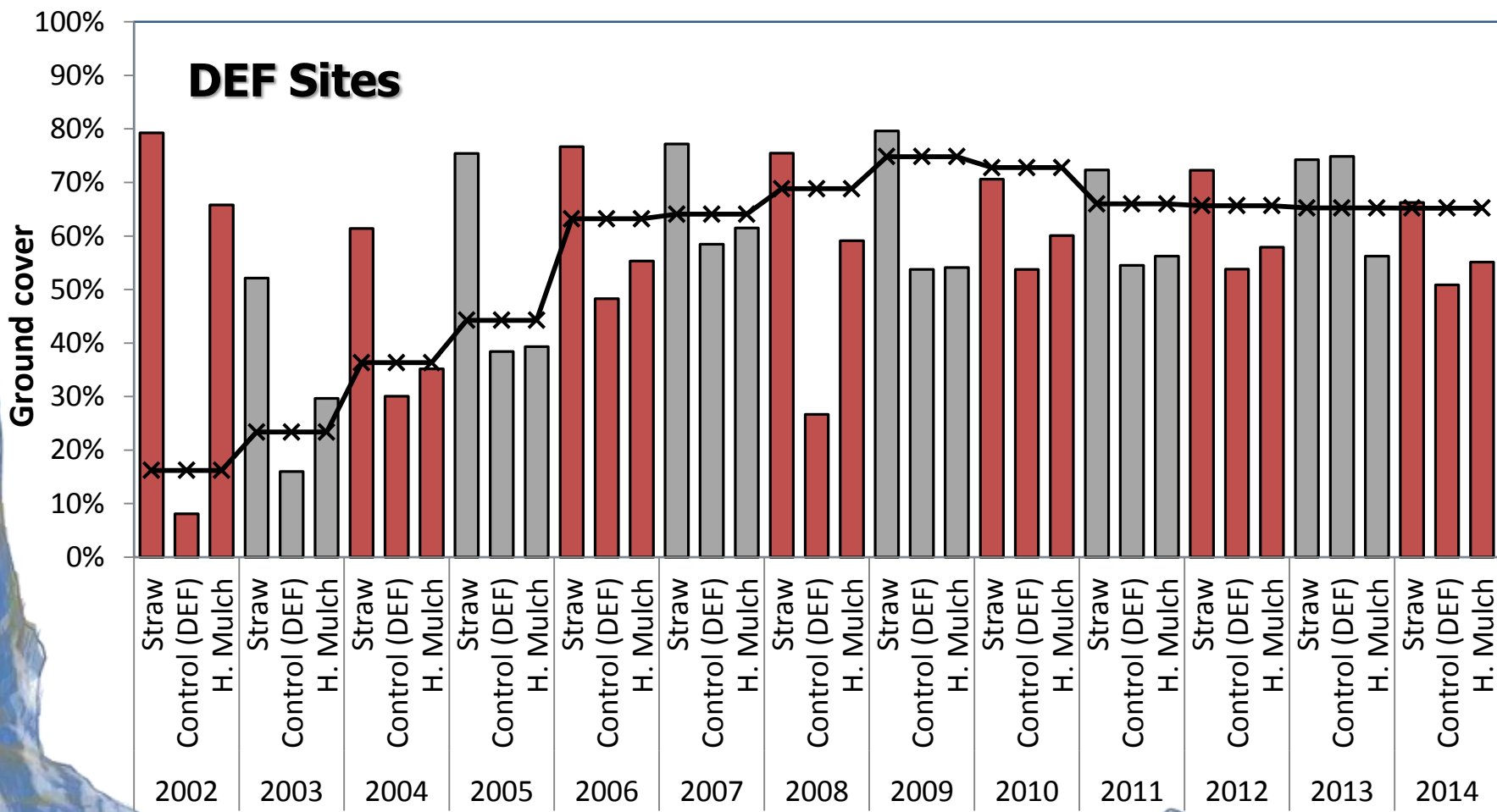
HAYMAN ANNUAL SEDIMENT YIELDS



HAYMAN GROUND COVER 2002-2014



HAYMAN GROUND COVER 2002-2014



The slide features a decorative border at the top and bottom. The top border shows a storm on the left with grey clouds and blue rain falling, and a fire on the right with orange and red flames and black smoke rising. The bottom border shows a blue and brown rocky or sandy terrain. The main content is a title and a list of bullet points.

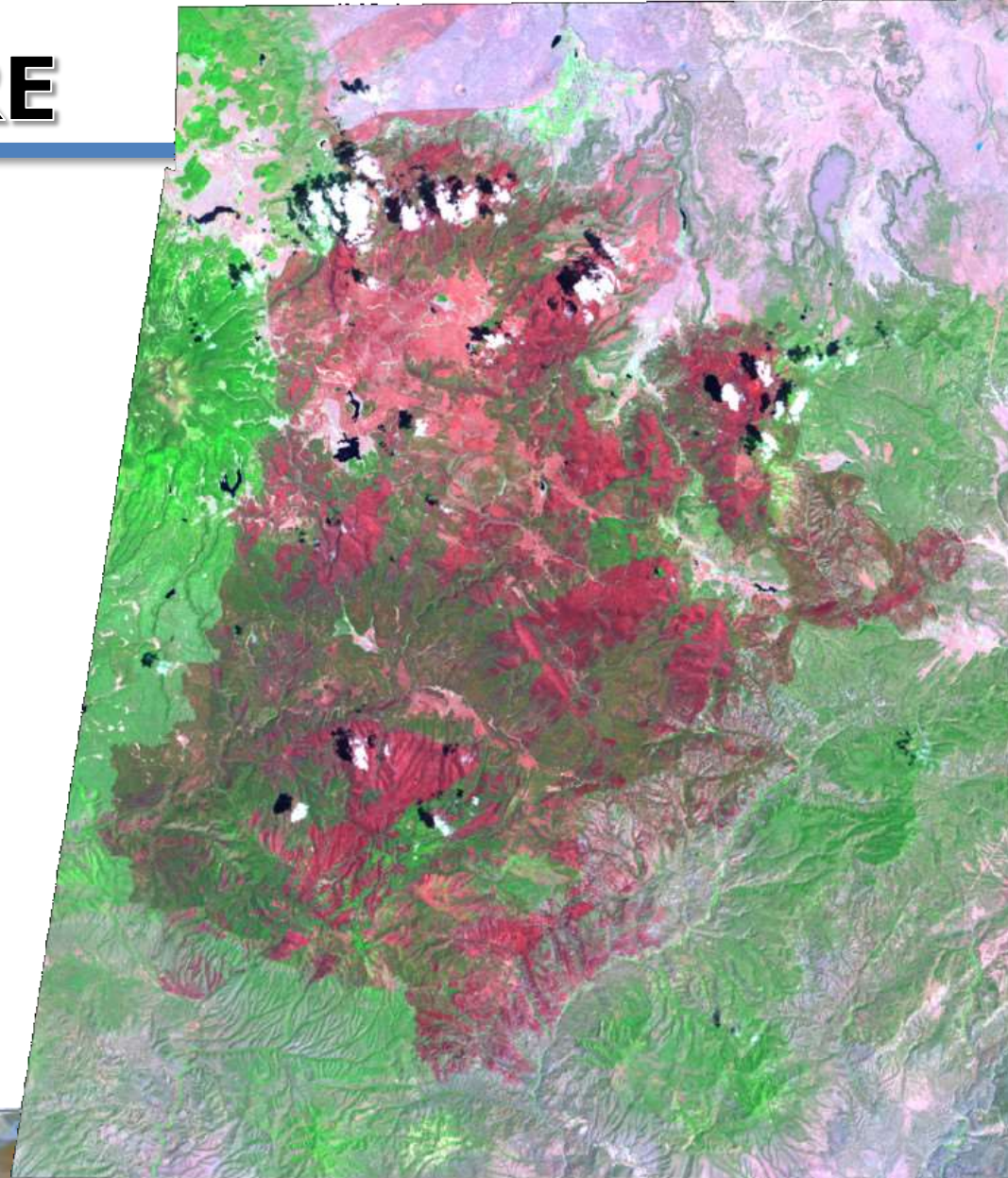
SUMMARY OF HAYMAN MONITORING

- Ground cover consistency
 - When will ground cover exceed 70%?
 - Development of canopy
- Max I_{10} in 2014 was 1.8 in/hr
- No sediment was produced
- Sediment through post-fire year 7 occurred during storms with 0.1 to 4.0 in/hr intensity



WALLOW FIRE

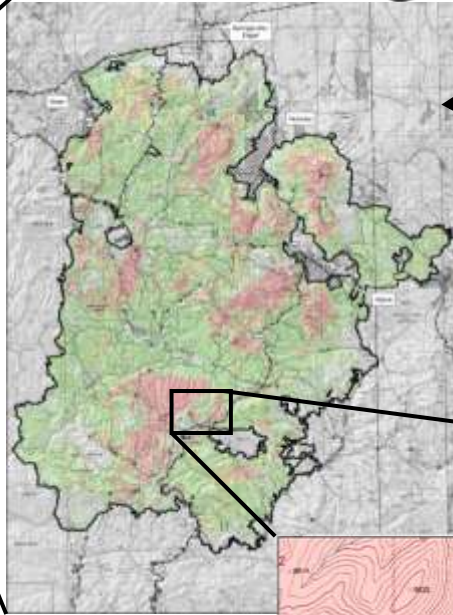
AZ, 2011



*Map is from Regional
Application Center

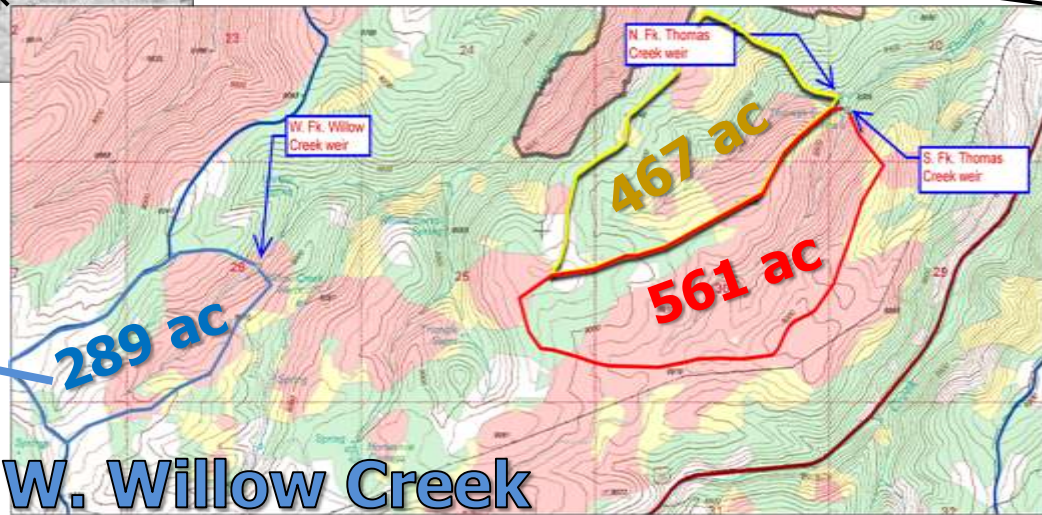


ARIZONA



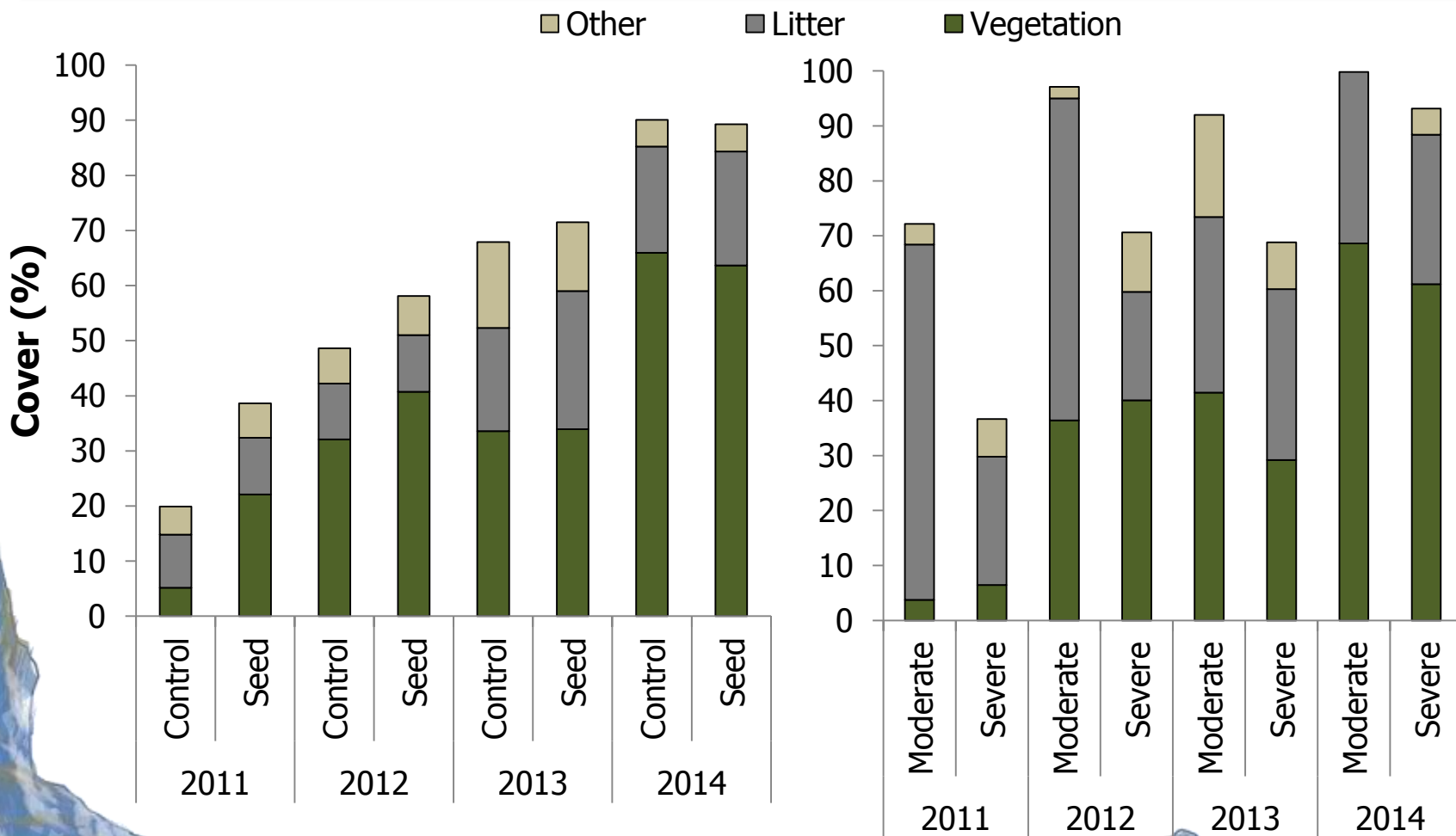
**2011 Wallow Fire
536,000 ac**

Seeded plots



W. Willow Creek

WALLOW GROUND COVER





WALLOW GROUND COVER PROGRESSION

AUG 2011

JUNE 2012

JUNE 2013

AUG 2014

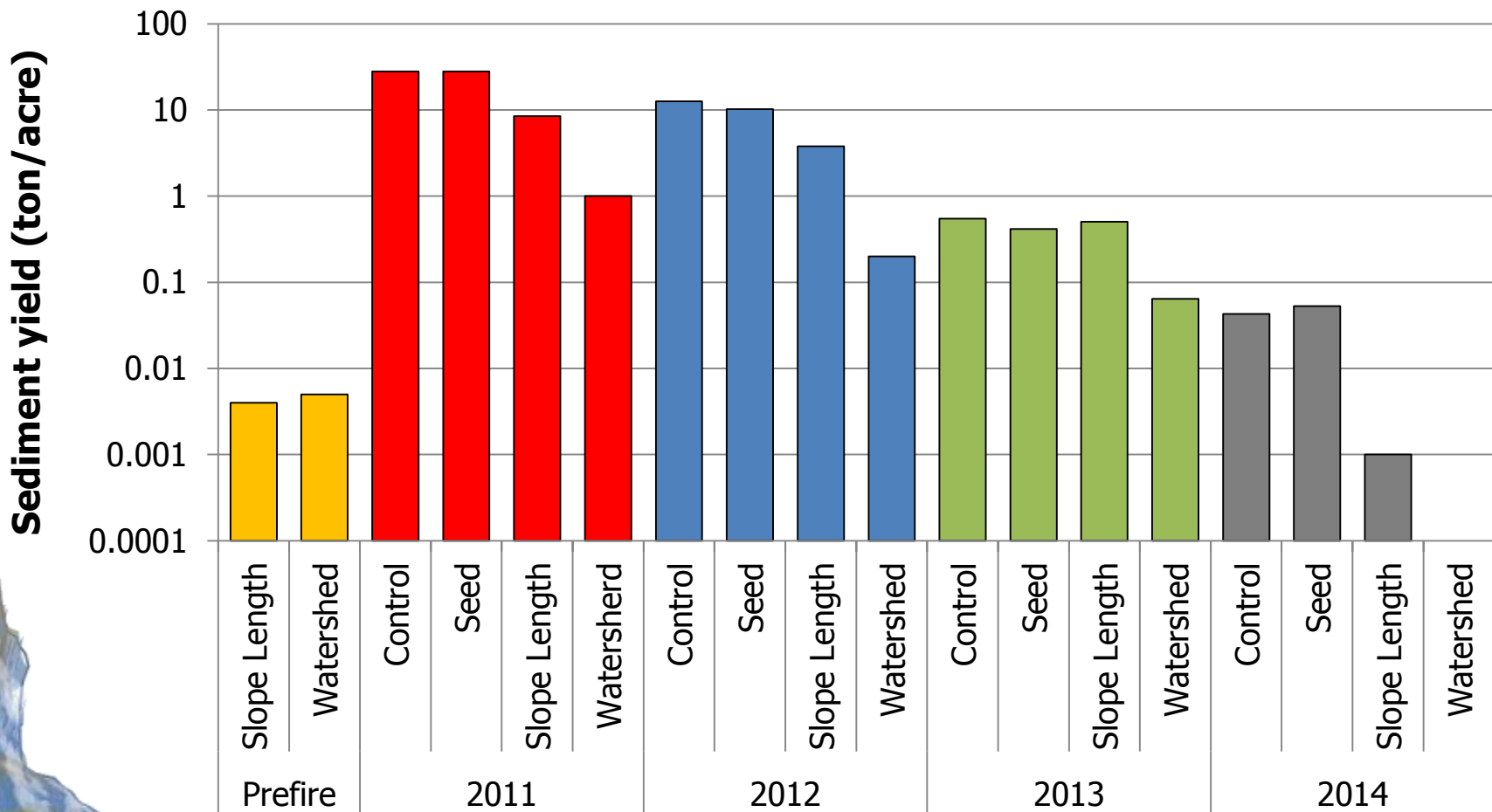
SEED



CONTROL



WALLOW SEDIMENT, 2014





CONCLUSIONS

- Fall 2011
 - Seeding increased vegetative cover
 - Larger effect on NW aspect than SW
 - No difference in sediment yields between treatments
- Fall 2012 through Fall 2014
 - No difference in vegetative cover between treatments or aspects
 - No difference in sediment yields between treatments in 2012, 2013 or 2014

TWITCHELL CANYON FIRE

Straw Bale Check Dams Effectiveness

- 2010 - 2014

**Twitchell Canyon
Fire**

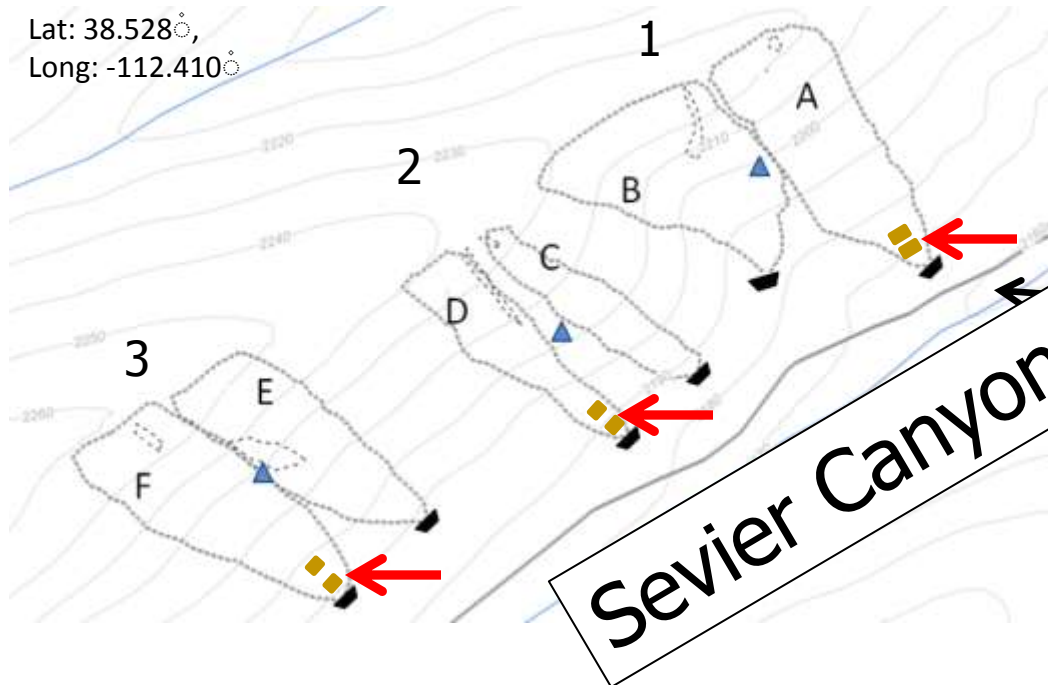
44874 ac

Site Elevation: 7380 ft

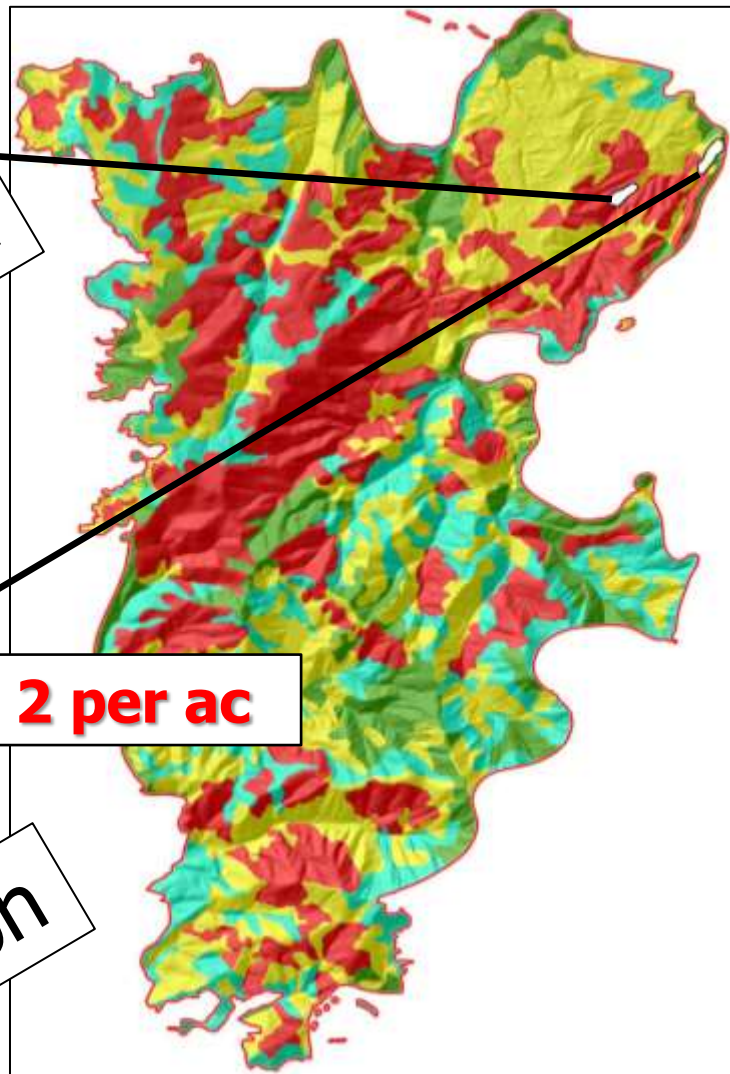
Average rainfall: May-Sep: 9.5 "



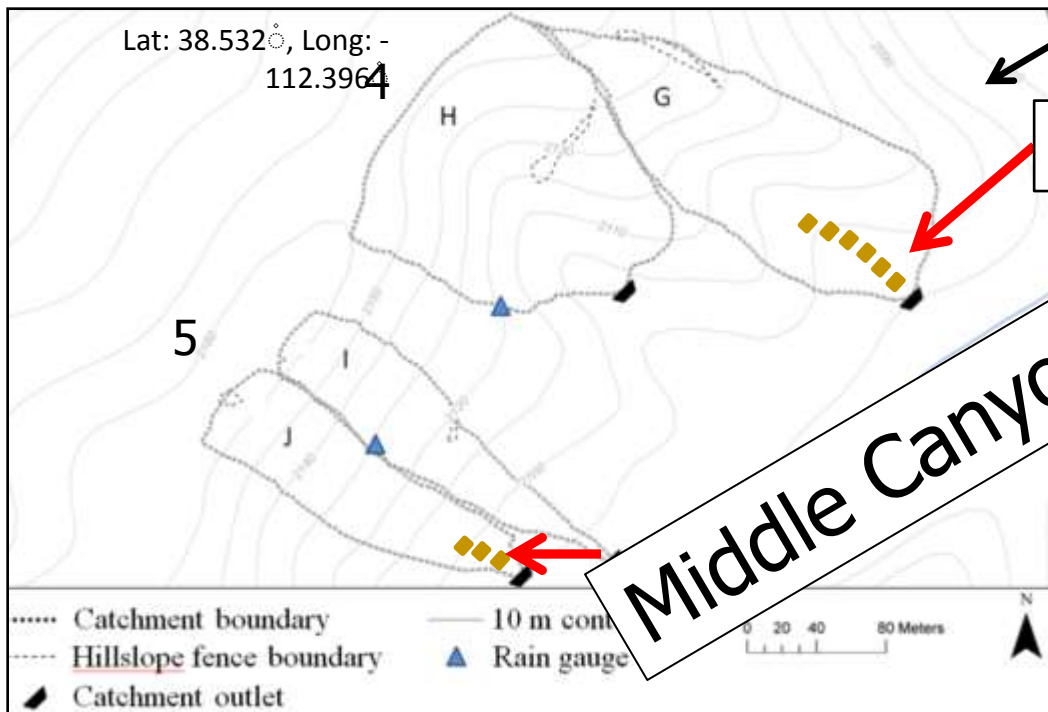
Lat: 38.528°,
Long: -112.410°



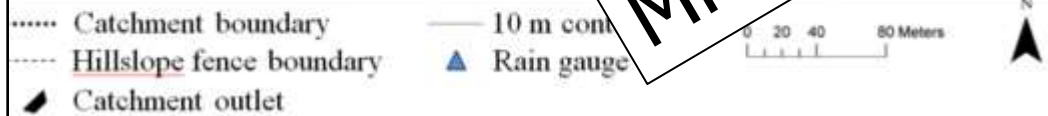
Sevier Canyon



2 per ac



Middle Canyon





TRAPPED SEDIMENT

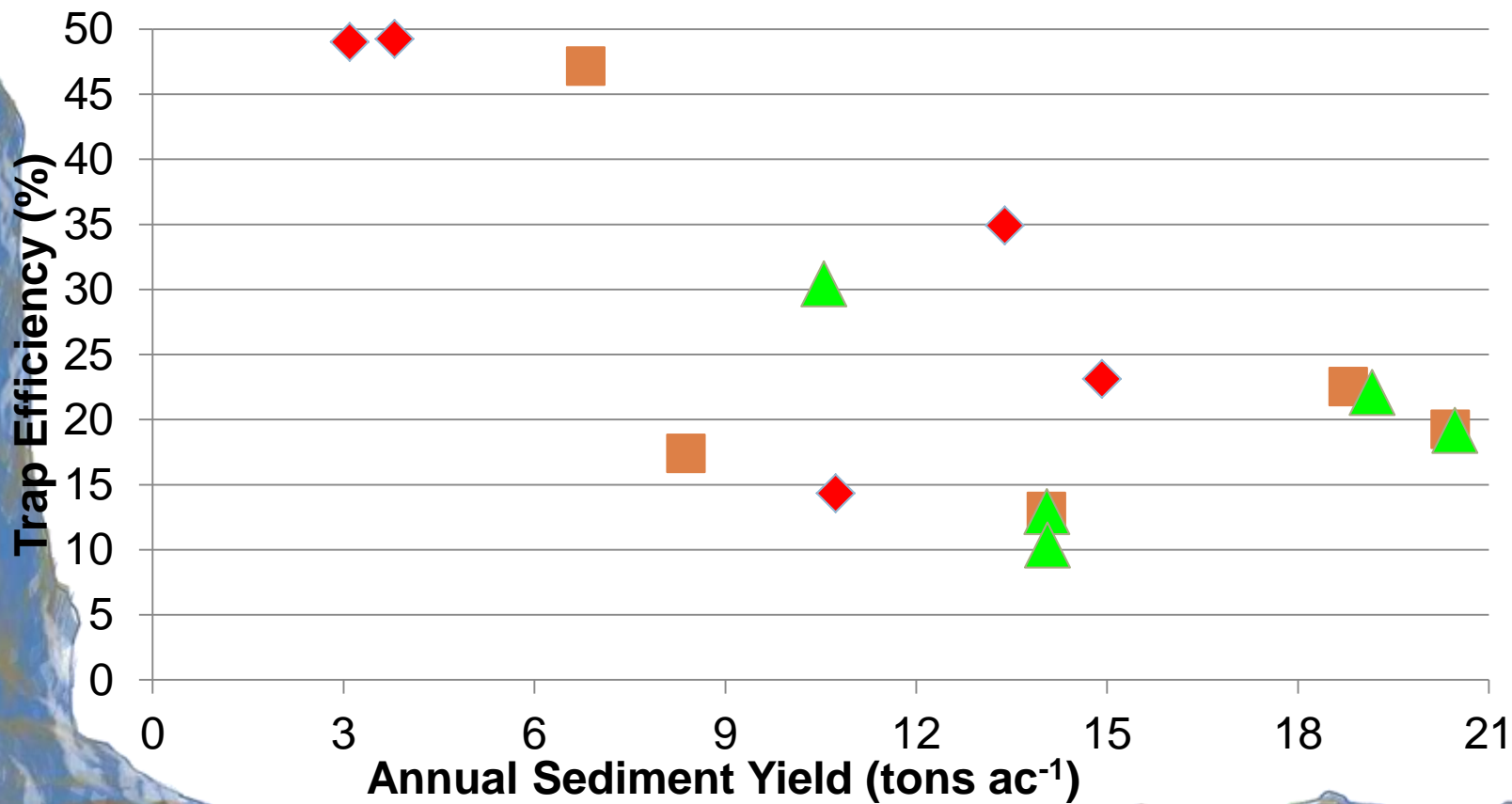
- **Treatment Rate:
2 strawbale checkdams/ac**
 - **1st year: 2.6 tons ac⁻¹ (1.5-4.7)**
 - **3rd year: 2.9 tons ac⁻¹ (1.5-4.2)**





ANNUAL DECREASE IN TRAP EFFICIENCY

Decreases with increasing total sediment yield



STRAWBALE CHECKDAMS

TREATMENT CONSIDERATIONS



- Treatment rate
- Underlying geology
 - Channel stability
- Channel gradient
- Channel shape
 - (U or V shaped)
- Storm intensity /
Erosion potential



2012 HIGH PARK FIRE, CO

- **Do BAER treatments influence soil N availability for plant growth?**
- **Microbial processing of soil organic matter**
- **What are drivers?**
 - **Decomposition – fast or slow?**
 - **Mulch quality (C:N, labile C)**
 - **Physical changes**
 - **Increased moisture**






MULCH TYPES



WoodStraw®
(1.3-2 kg/ha)



Ag/Wheat Straw
0.4-0.6 kg/ha



Wood Shreds
(1.3-2 kg/ha)

20/07/2012

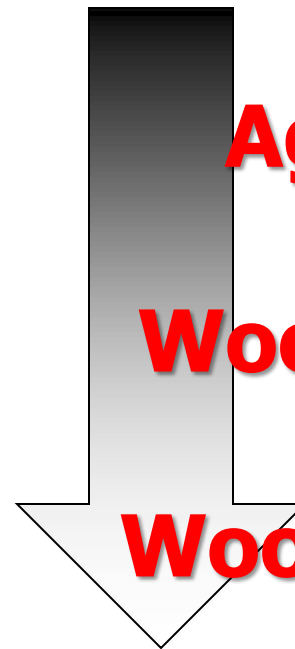


Rubber Mulch
70% cover

MONITORING PLANT N AVAILABILITY

- Expect **rapid initial** immobilization in fastest-decomposing mulch (highest quality)
- **Slower**, but longer lasting N immobilization in high C:N material (wood)

Lowest N availability



Ag Straw



Wood Shreds

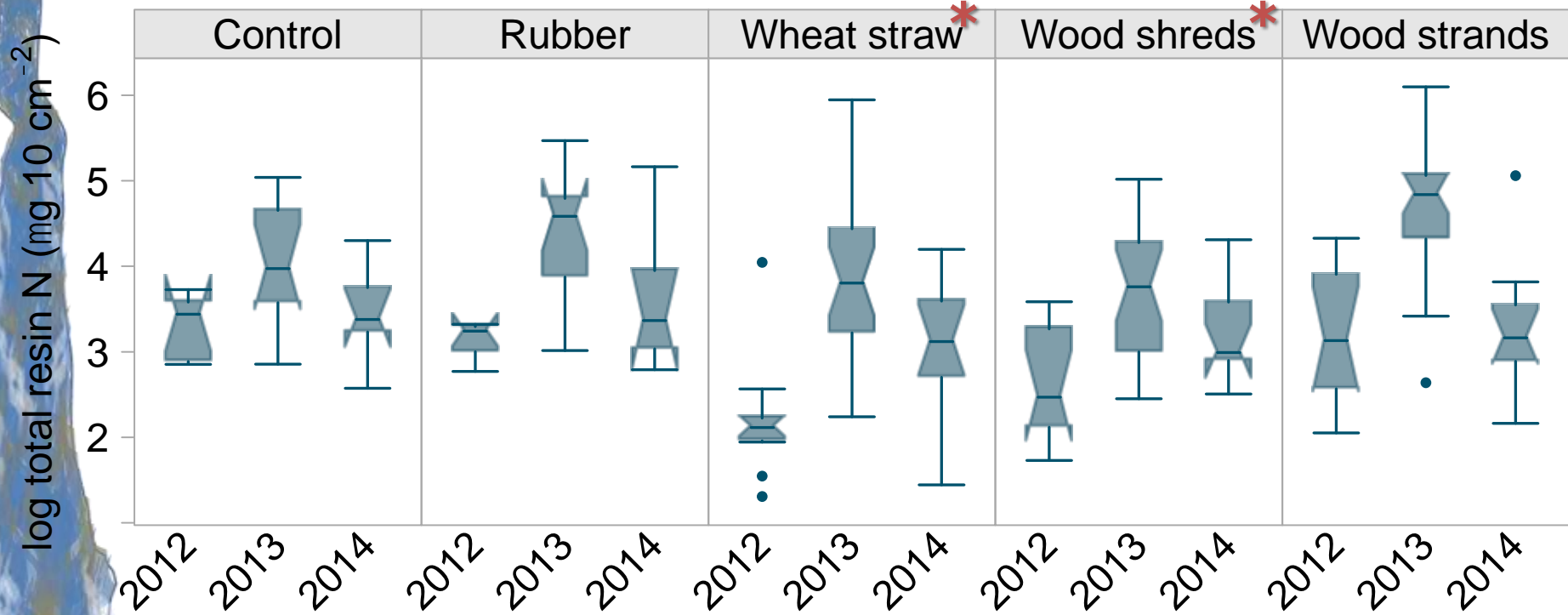


Wood Strands



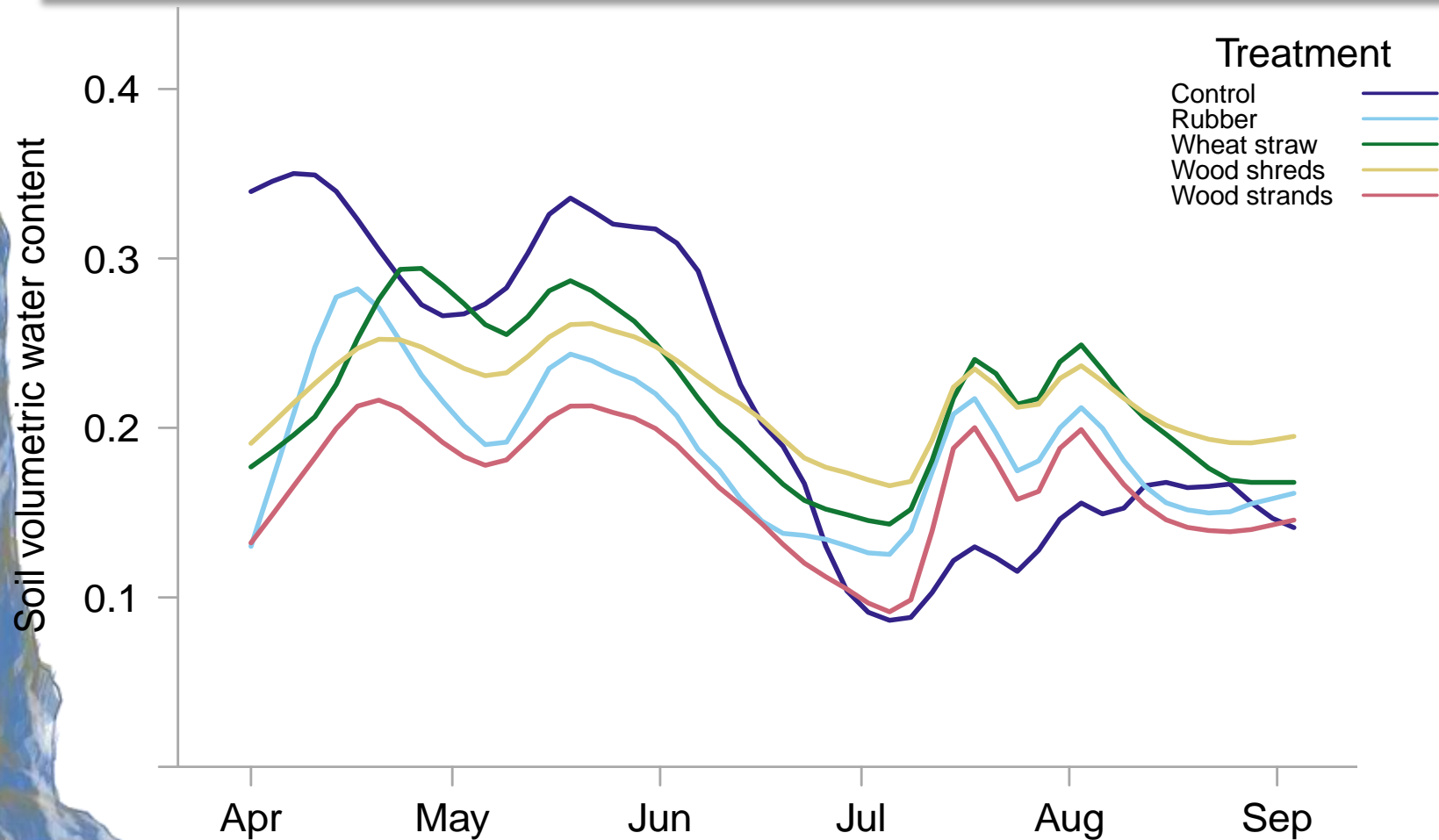
Most N availability

PLANT-AVAILABLE N WAS REDUCED BY WHEAT AND WOOD SHREDS

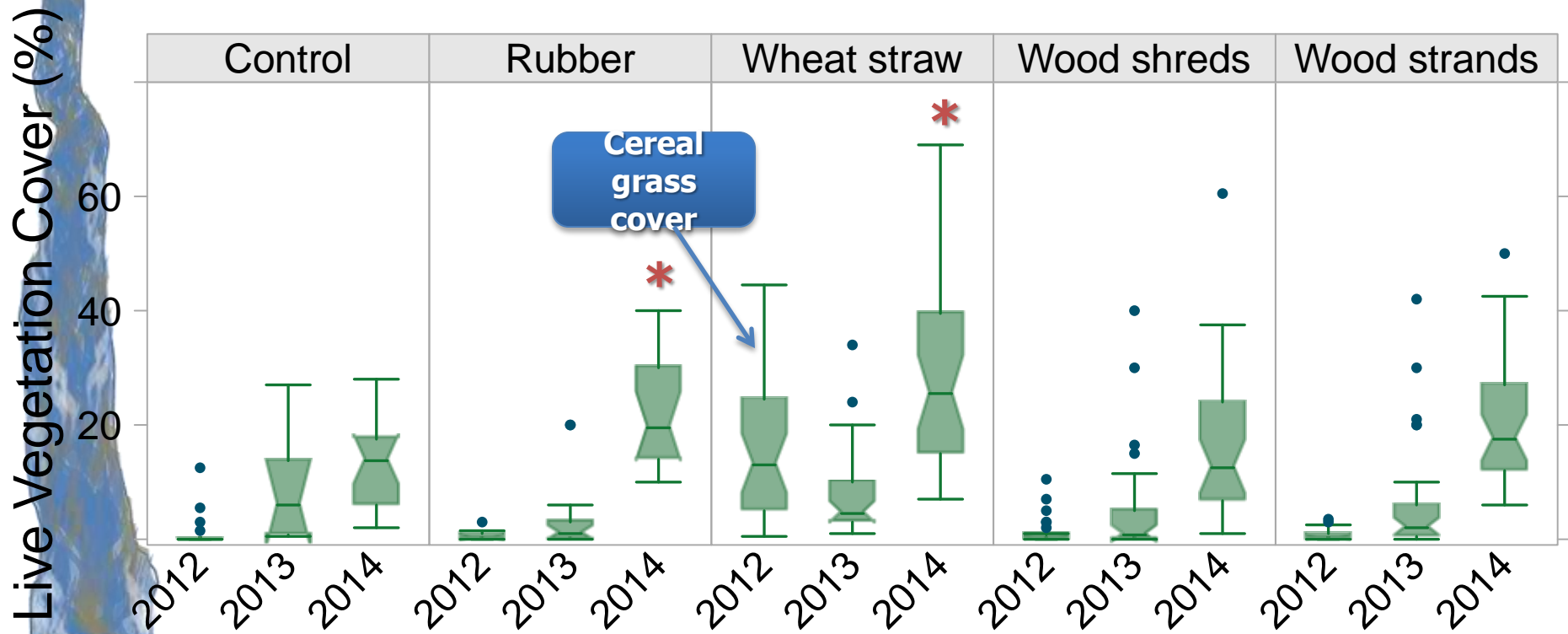


*Indicates significantly ($P < 0.05$) lower N than control (all years combined)

MULCH INCREASED SOIL MOISTURE IN 2014



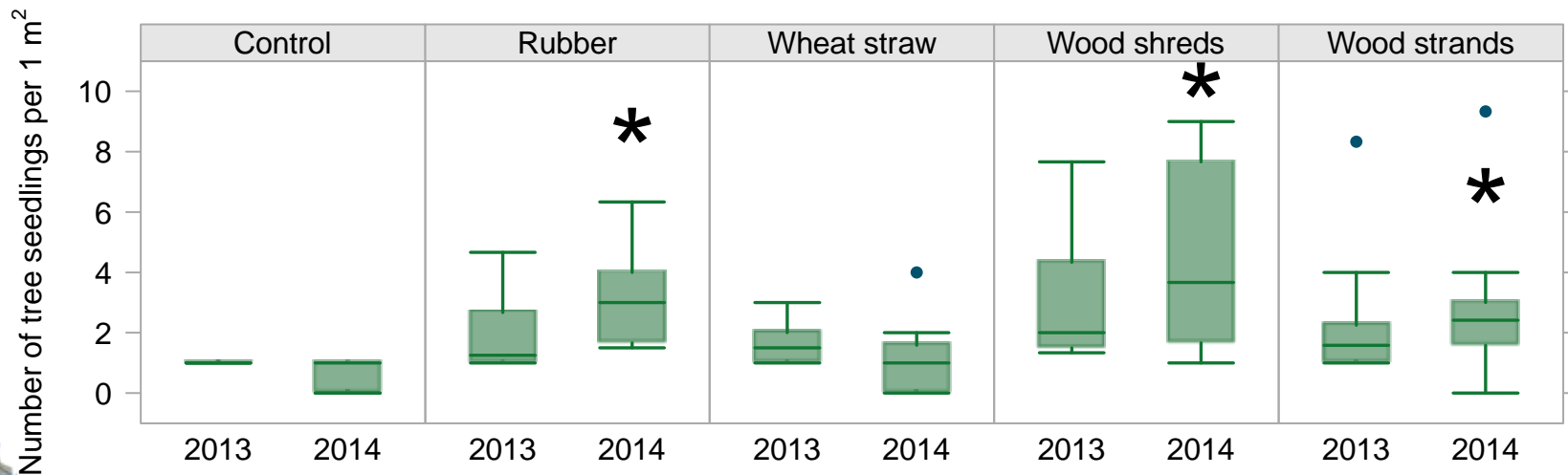
RUBBER AND WHEAT MULCH INCREASED LIVE PLANT COVER



*Indicates significantly ($P < 0.05$) higher plant cover than control (2014 only).

MULCH INCREASED TREE SEEDLINGS, BUT NOT WHEAT STRAW

PICO seedlings



***Indicates significantly ($P < 0.05$) higher seedling counts than control (2014 only).**



HIGH PARK CONCLUSIONS

- Mulch treatments increased soil moisture
- Mulch treatments promoted seedling establishment in year 2
- Wheat straw yielded high plant cover initially compared to other mulches and controls but declining in year 2
- Wheat and wood shreds supports microbial immobilization of soil N, possibly affecting recovering vegetation
- Important to follow through the degradation of wheat mulch to see if effects continue



BAER BURNED AREA REPORTS DATABASE

- A searchable online database
- 1500+ 2500-8 reports, 4 decades, updated annually
- Displays summaries, complete 2500-8 reports downloadable
- Moscow Lab: <http://forest.moscowfsl.wsu.edu>
> BAERTOOLS
- 1,000 queries in 2014

BAER BURNED AREA REPORTS DATABASE

USDA FOREST SERVICE

[MFSL Home](#) > [BAER Tools](#)

BAER Burned Area Reports DB

BAER Burned Area Reports DB is a database containing post-fire assessment information from four decades of US Forest Service Burned Area Reports. For more information and help, see [BAER Burned Area Reports DB Guide](#).

Select which reports you want:

Location, by: <input type="text" value="National Forest"/>	Treatment Types:
<input type="text" value="[All]"/> Angeles Apache-Sitgreaves Arapaho-Roosevelt Ashley Beaverhead-Deerlodge Bighorn Bitterroot Black Hills Boise	<input type="text" value="[All]"/> armored ford crossing channel debris clearing channel deflectors contour felling contour trenching cross drain ditches culvert inlet/outlet armoring culvert maintenance culvert overflow bypass

From date to (YYYY-MM-DD, or blank)

Choose how to view your reports:

List view
Order by

Show reports per page

Map view

And finally:

BAER BURNED AREA REPORTS

Found 51 BAER reports with this search:

Forests: [All]

Treatments: [All]

From 2013-01-01 to 2013-12-31

Map View





BAER BURNED AREA REPORTS

List View

Showing reports **1-10** out of **51 selected**, ordered by most recent fire date:

[expand all](#) [shrink all](#) [English units](#)

#	Fire	Forest	Started	Area	Expand
1	Table Rock Fire	Westwide Info (NC, rgn 0)	2013-NOV-12	1,044 ha	expand
2	Rock Creek	Custer (MT, rgn 1)	2013-AUG-20	389 ha	expand
3	Hough Complex	Plumas (CA, rgn 5)	2013-AUG-19	136 ha	expand
4	Lolo Creek Complex	Lolo (MT, rgn 1)	2013-AUG-18	4,412 ha	expand
5	Chestnut Fire	Humboldt And Toiyabe (NV, rgn 4)	2013-AUG-18	1,689 ha	expand
6	Rim Fire	Stanislaus (CA, rgn 5)	2013-AUG-17	103,962 ha	expand
7	Cleghorn	San Bernardino (CA, rgn 5)	2013-AUG-17	45 ha	expand
8	Spring Peak	Humboldt And Toiyabe (NV, rgn 4)	2013-AUG-14	5,759 ha	expand
9	Eureka	Beaverhead-Deerlodge (MT, rgn 1)	2013-AUG-12	2,618 ha	expand
10	Damnation	Flathead (MT, rgn 1)	2013-AUG-11	3,337 ha	expand

[Previous 10 Reports](#)

[Next 10 Reports](#)

Go to report #:

of 51





BAER BURNED AREA REPORTS

TOTAL EXPENDITURE FOR HILLSLOPE TREATMENTS IN MILLIONS OF \$USD

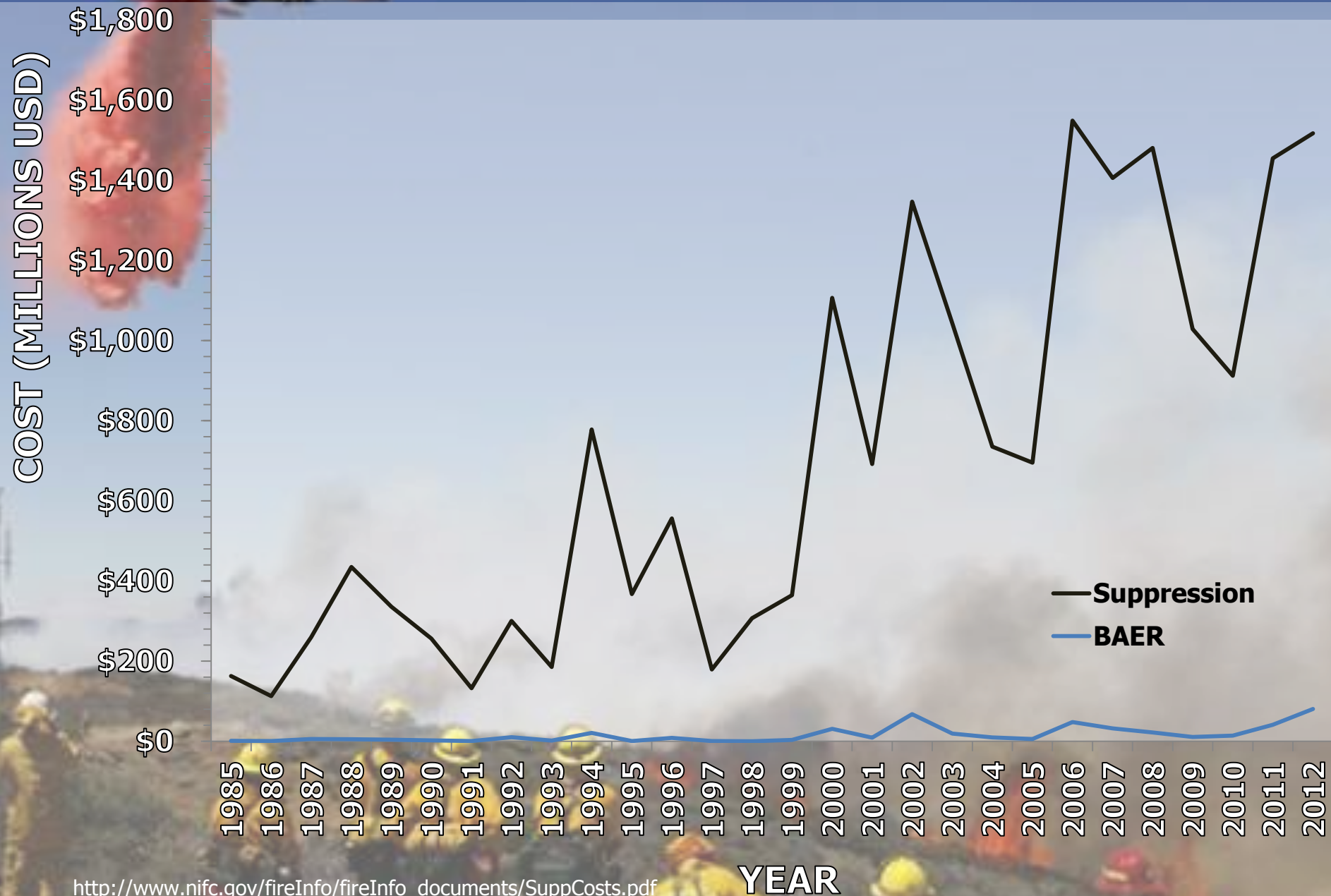
Treatment category ^a	Decade			
	1970s	1980s	1990s	2000s
Seeding	3.5	13.5	12	21
Fertilizer and seeding	2	3	1.3	1.4
Contour felled logs	0.2	6	29	8
Agricultural straw mulch	<0.1	0.2	3	80
Hydromulch	n.a.	n.a.	n.a.	41
Wood strand mulch	n.a.	n.a.	n.a.	3

10 FIRES ON USFS LANDS WITH LARGEST EXPENDITURES

BAER Expenditure				Suppression Expenditure			
Fire name	State	Yr	Expenditure Millions (\$)	Fire Name	State	Yr	Expenditure Millions (\$)
Tripod Complex	WA	2006	30	Biscuit	OR	2002	153
Hayman	CO	2002	25	Klamath	CA	2007	126
Cerro Grande	NM	2000	15	Zaca Two	CA	2008	122
Rodeo/Chediski Complex	AZ	2002	13	Wallow	AZ	2011	109
Foothills	ID	1992	13	Station	CA	2009	96
Rabbit Creek	ID	1994	12	Lightning Complex	CA	2008	95
Valley-Skalkaho Complex	MT	2000	12	Basin Complex	CA	2008	78
Biscuit	OR	2002	11	Day	CA	2006	78
Tyee Creek Complex	WA	1994	9	Iron & Alps Complex	CA	2008	74
Gap	CA	2008	7	Tripod Complex	WA	2006	68

Robichaud, P.R.; Rhee, H.; Lewis, S.A. 2014 *A synthesis of post-fire Burned Area Reports from 1972 to 2009*. . . Int. J. of Wildland Fire 2014, 23, 929–944.

SUPPRESSION & BAER COST IN THE U.S.



http://www.nifc.gov/fireInfo/fireInfo_documents/SuppCosts.pdf

http://a57.foxnews.com/global.fncstatic.com/static/managed/img/U.S./660/371/073110_fire.jpg?ve=1

<http://forest.moscowfsi.wsu.edu/fswepp/>



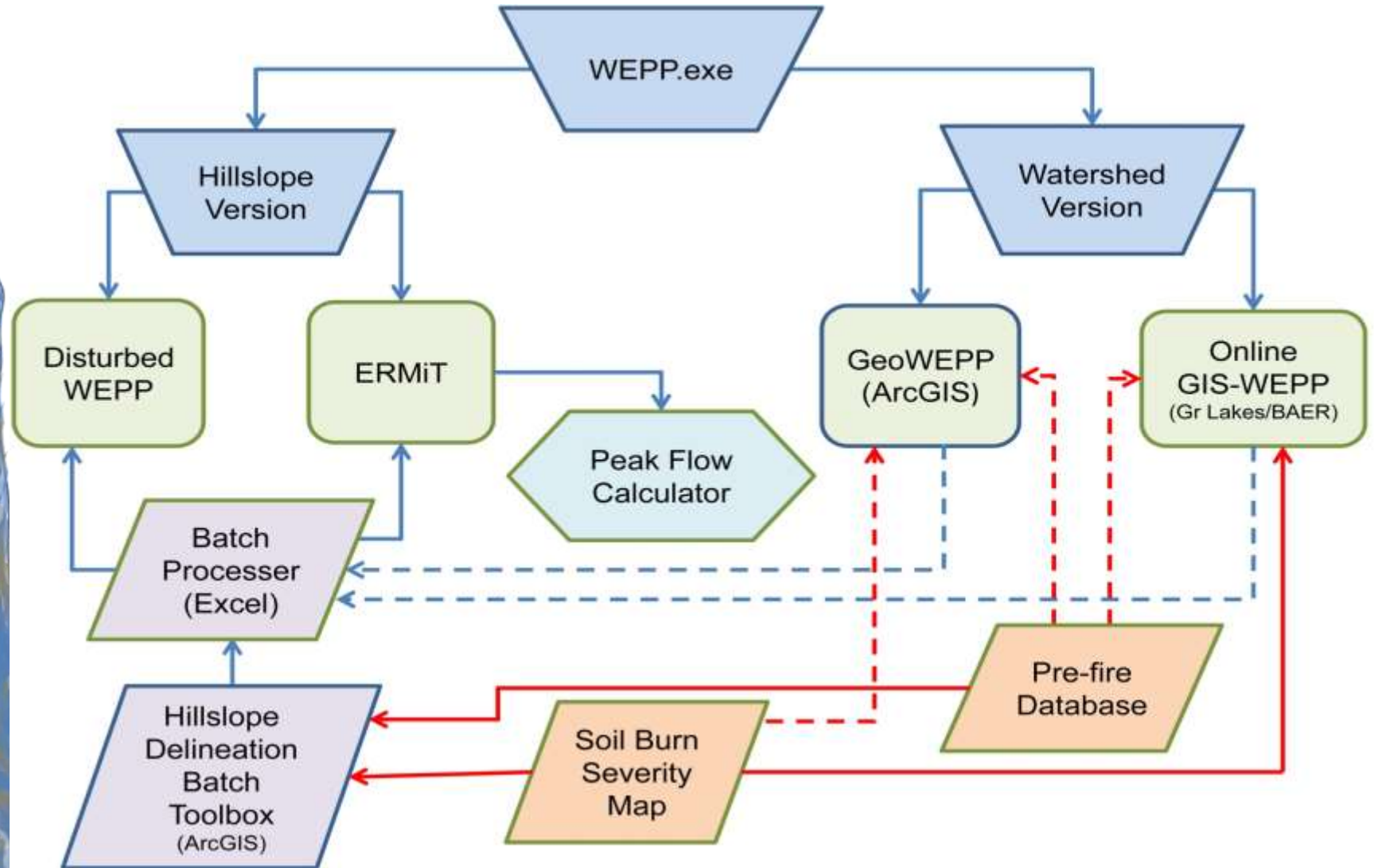
Forest Service WEPP Interfaces



	WEPP:Road 1989 runs YTD	WEPP:Road Batch 277 runs, 5478 segments YTD	
	ERMiT 1732 runs YTD	ERMiT batch (download) 43 runs YTD	
	Disturbed WEPP 4643 runs YTD	Disturbed WEPP batch (download) 208 runs YTD	
	Tahoe Basin Sediment Model 863 runs YTD	Biomass Sediment Model 43 runs YTD	
	FuME (Fuel Management) 210 runs YTD	Rock:Clima	
	WEPP Watershed Online GIS	Peak Flow Calculator	
	Water And Sediment Predictor Under development	Other WEPP resources	

Units: metric U.S. customary [personality](#) (a to z)

WEPP Models

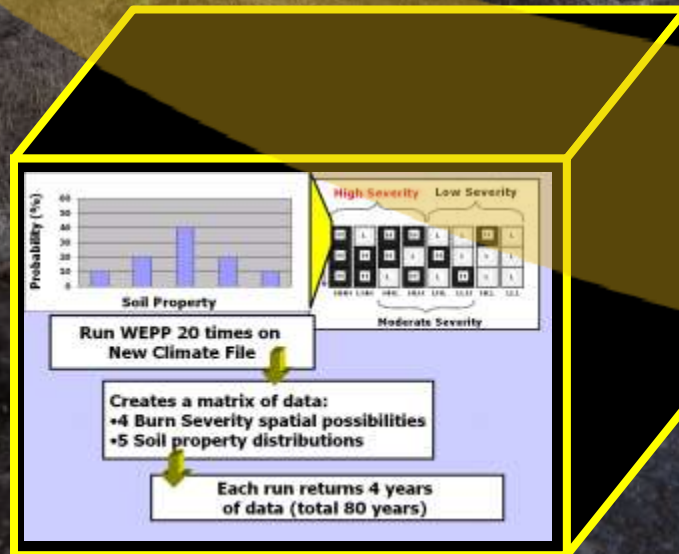


User Input

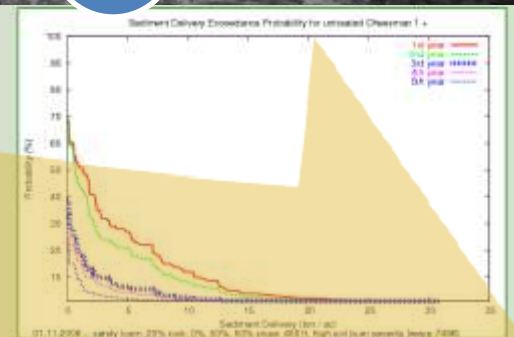
ERMIT

- Event based
- Probabilistic
- Incorporates Variability

Calculations



Output



Mitigation Treatment Comparisons

Probability that sediment yield will be exceeded (%)	Event sediment delivery (ton/acre)	1st year	2nd year	3rd year	4th year	5th year
Untreated	10.96	6.81	2.69	1.7	0.89	
Seeding	10.96	3.71	2.42	1.47	0.89	
Mulch (0.5 ton/acre)	3.73	3.5	2.69	1.7	0.89	
Mulch (1 ton/acre)	3.46	3.38	2.69	1.7	0.89	
Mulch (1.5 ton/acre)	3.45	2.81	2.69	1.7	0.89	
Mulch (2 ton/acre)	3.44	2.73	2.69	1.7	0.89	
Log & Water	10.96	0.81	2.69	1.7	0.89	

Sediment Delivery

Probability that sediment yield will be exceeded

20 %

Event sediment delivery (ton ac⁻¹)

Year following fire

1st year 2nd year 3rd year 4th year 5th year

Untreated

6.37

2.64

0.69

0.28

0.01

Seeding

6.37

0.89

0.36

0.15

0.01

Mulch (0.5 ton ac⁻¹)

1.11

0.87

0.69

0.28

0.01

Mulch (1 ton ac⁻¹)

0.37

0.63

0.69

0.28

0.01

Mulch (1.5 ton ac⁻¹)

0.03

0.61

0.69

0.28

0.01

Mulch (2 ton ac⁻¹)

0.02

0.44

0.69

0.28

0.01

Erosion Barriers: Diameter ft Spacing ft

Logs & Wattles

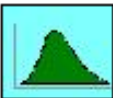
2.6

0.35

0

0

0

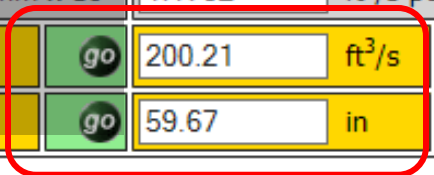


Forest Service Peak Flow Calculator

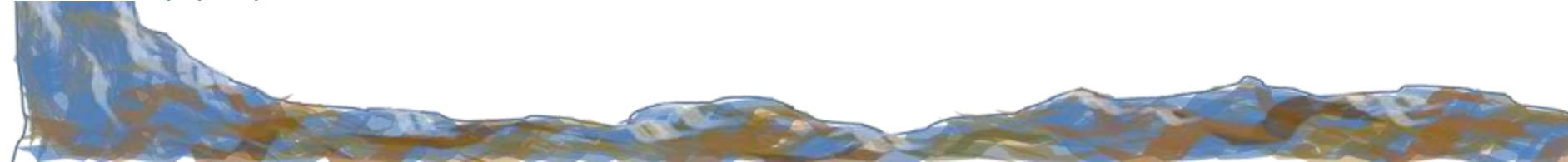
Estimated peak flow for burned areas using Curve Number technology

- Manual entry
- From ERMIT
- From [WEPP Online GIS](#)

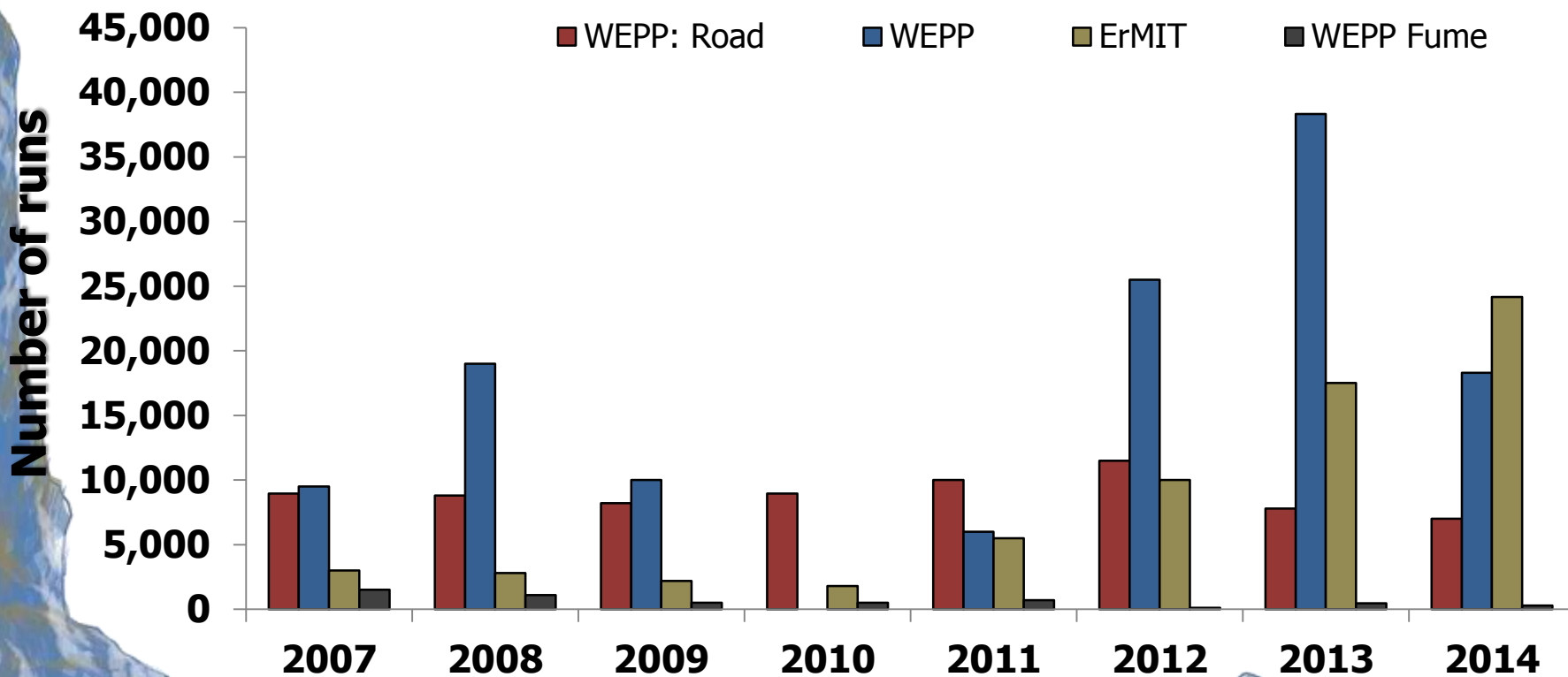
Run Description	Levan Fire Watershed 3		
Storm runoff, Q	17.5 mm	0.69 in	
Storm precipitation, P	33.3 mm	1.31 in	if Q > P use P ~ 2 Q
Watershed area, A	155.8 ha	385 ac	
Watershed flow length, L	3011.9 m	9882 ft	
Avg watershed gradient, Sg	0.14 m/m	0.14 ft/ft	
Curve number, CN	93	93	CN estimate from ERMIT: 93 (forest)
Time of concentration, T_c	.55 hr	.55 hr	T _c ~ 0.55 hr (flat watershed; dry soil)
Ponding adjustment factor, Fp	1	1 ×	0% pond: 1.0; 1.0%: 0.87; 5.0%: 0.72
RESULTS			
Surface storage, S	19 mm	0.75 in	
Initial abstraction, I_a	3.8 mm	0.15 in	
I_a/P	0.11	0.11	
Unit peak flow rate, q_u	2.08 m ³ /s per ha/mm x 10 ⁻³	1.1702 ft ³ /s per acre/in x 10 ⁻³	
Estimated peak flow rate, q	5.67 m ³ /s	200.21 ft ³ /s	<input type="button" value="view log"/> <input type="button" value="add to log"/> <input type="button" value="delete log"/>
Culvert diameter, D	151.57 cm	59.67 in	h <input type="text" value="2.0"/> m <input type="text" value="6.6"/> ft



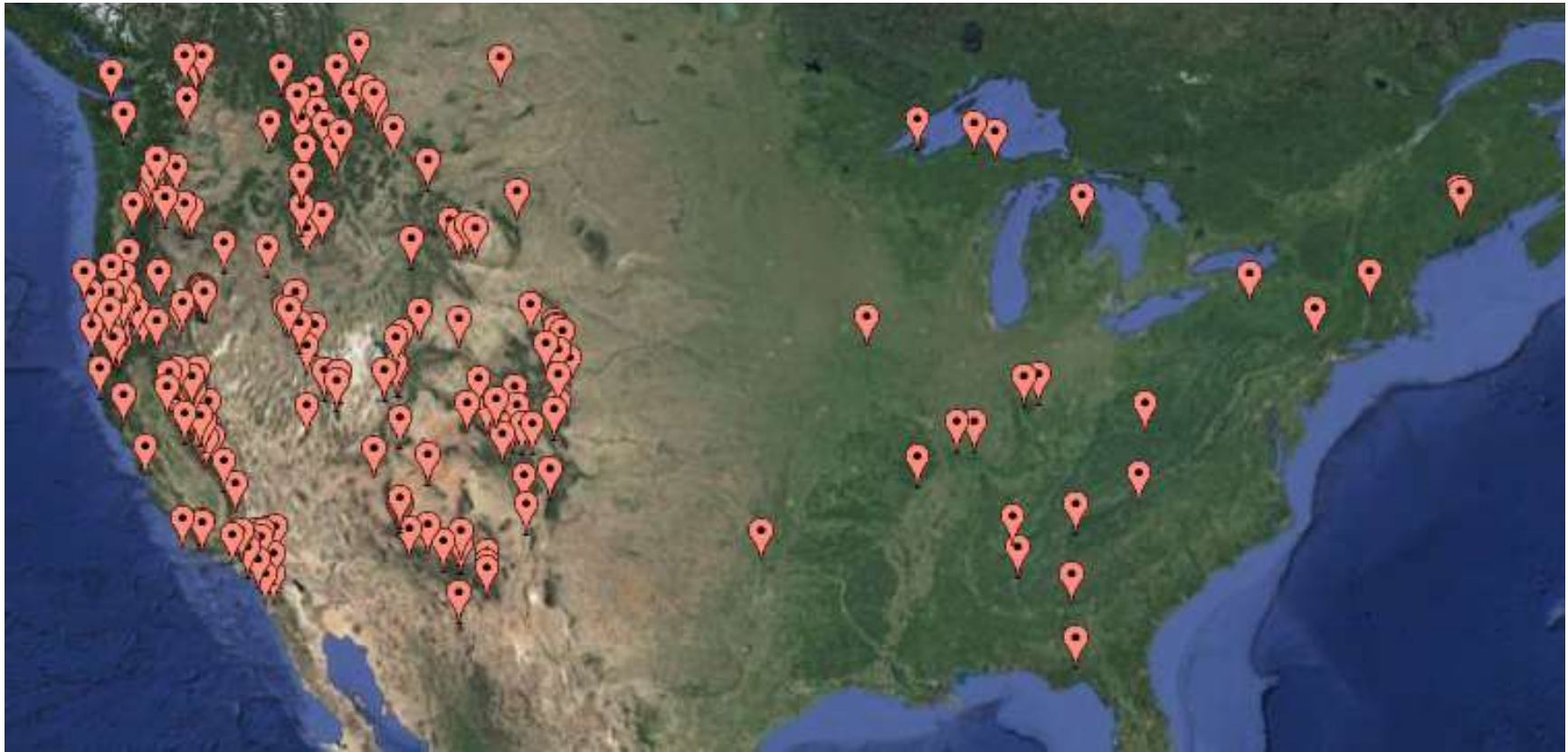
use Mica Creek example | clear |



FS WEPP Model	2014	FS WEPP Model	2014
<i>WEPP:Road</i>	7,012	<i>ERMIT</i>	24,153
<i>WEPP: Road Batch</i>	499	<i>ERMiT Batch</i>	280
<i>Disturbed WEPP 2.0</i>	18,289	<i>WEPP FuME</i>	280
<i>Disturbed WEPP Batch</i>	119	<i>Tahoe Basin</i>	492



ERMiT runs



+ 100's of international locations



GEO-WEPP (ARC GIS)

Burned Area Emergency Response Spatial WEPP Model Inputs Generator

Spatial WEPP Products Static Files

Draw Burned Area Extent on the Map

Draw Selection on Map

Or, Select an MTBS Fire

Select an MTBS fire: BOBCAT

Burn land cover and soil layers by MTBS fire

Or, Use a Custom BARC Map

Upload a New BARC Map Use My Private Key

- Products:
- Land cover and linkage files
 - Soils and linkage files
 - Digital elevation model (DEM)

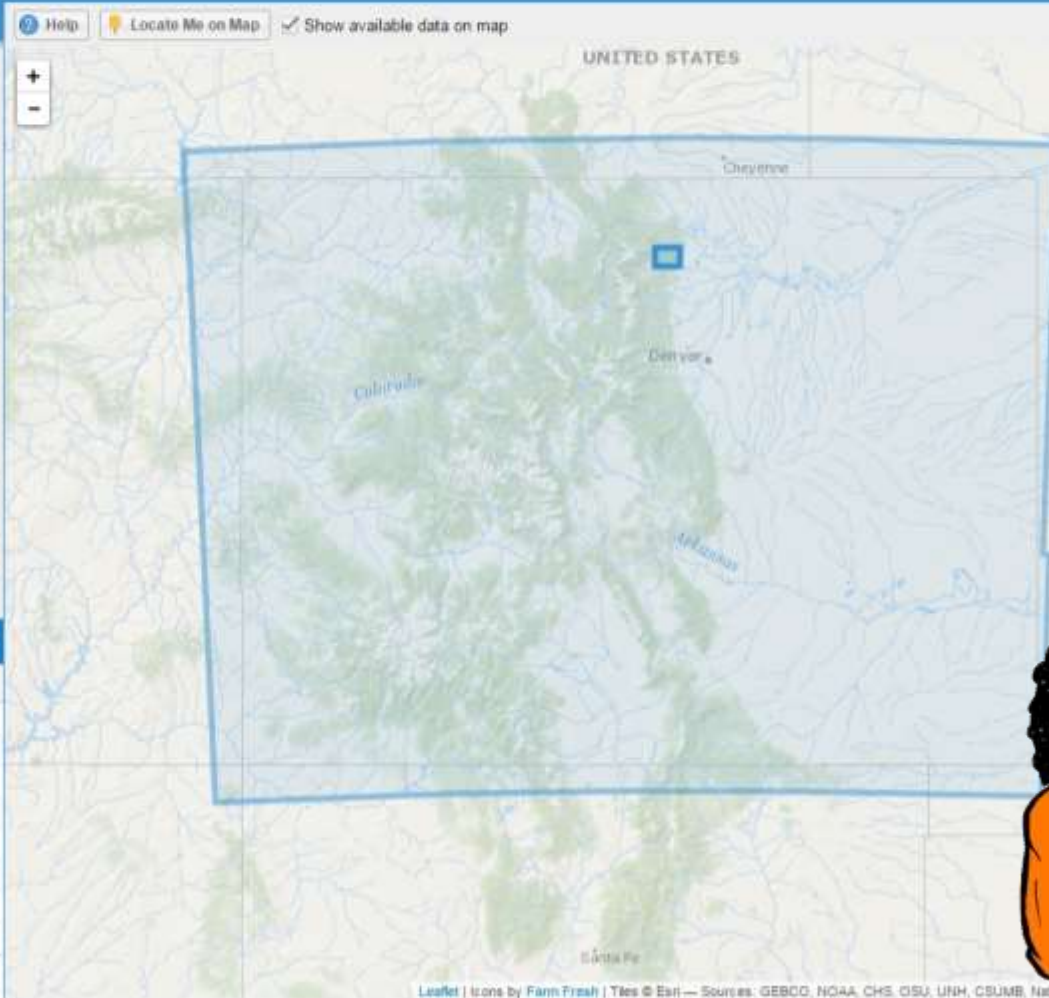
File format: ASCII Grid (*.asc)

Download ZIP Archive Add to Download

Download Queue

ROI	Filename	File Format	Link
BOBCAT	landcov.txt		Download
BOBCAT	landusedb.txt		Download
BOBCAT	soilsdb.txt		Download
BOBCAT	soilsmap.txt		Download
BOBCAT	dem.asc	ASCII Grid (...)	Download
BOBCAT	landcov.asc	ASCII Grid (...)	Download
BOBCAT	soil.asc	ASCII Grid (...)	Download

Clear Downloads




Michigan Tech
Research Institute





GEO-WEPP (ARC GIS) PRE-LOAD

- Soils: USDA SSURGO and STATSGO datasets
 - Land cover: Existing Vegetation Type
LANDFIRE
 - DEM USGS Seamless Data Warehouse
 - **Add Soil Burn Severity Map**
- 

GEO-WEPP (ARC GIS)

The screenshot displays the ArcGIS interface with the following components:

- Map View:** A central map showing a network of blue lines (channels) overlaid on a green landscape. A large red area is visible in the lower right quadrant.
- Table of Contents:** Located on the left, it shows layers including 'network', 'landcov', 'soils', 'hillshade', and 'dem'. The 'network' layer is selected.
- ArcToolbox:** Located in the middle-left, it contains various tool categories such as '3D Analyst Tools', 'Analysis Tools', 'Cartography Tools', etc.
- WEPP Management and Soil Lookup Dialog (Top Right):** This dialog shows a table with columns for Area, GIS Soil, and WEPP Soil. It includes 'Landuse', 'Soils', and 'Channels' tabs.
- WEPP Management and Soil Lookup Dialog (Bottom Right):** This dialog shows a table with columns for Area, GIS Landuse, and WEPP Management. It also includes 'Landuse', 'Soils', and 'Channels' tabs.

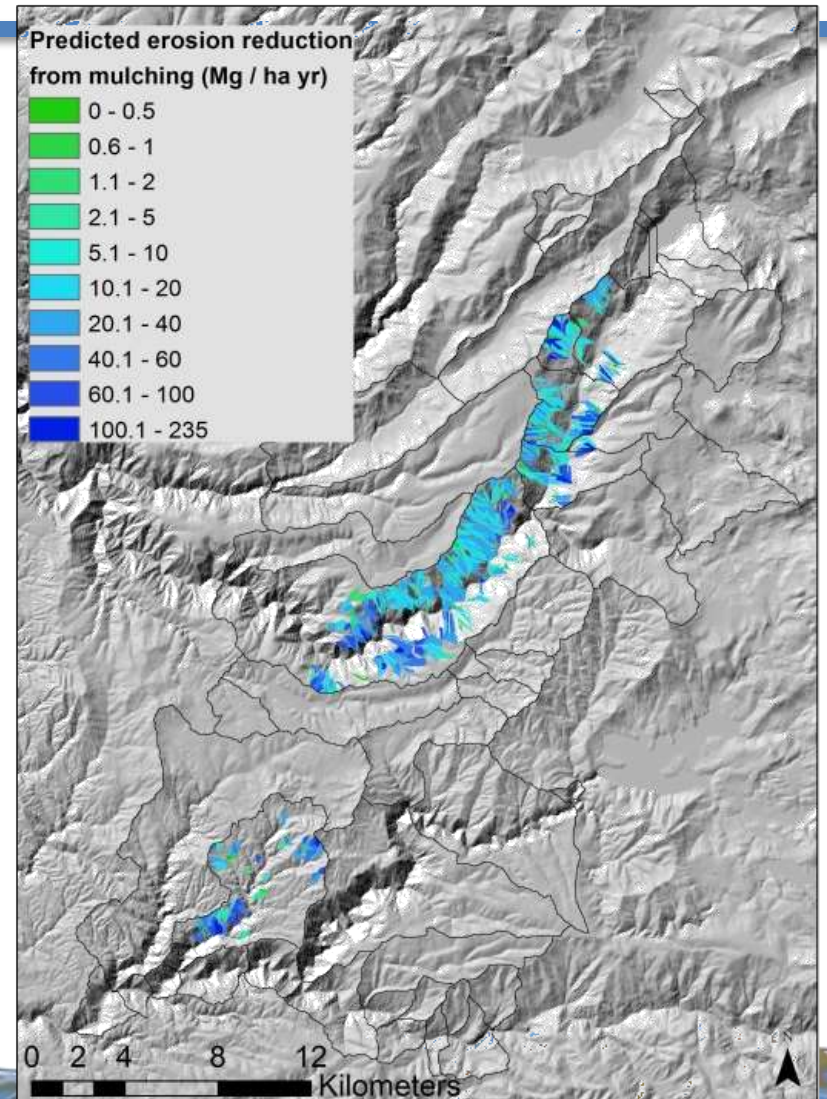
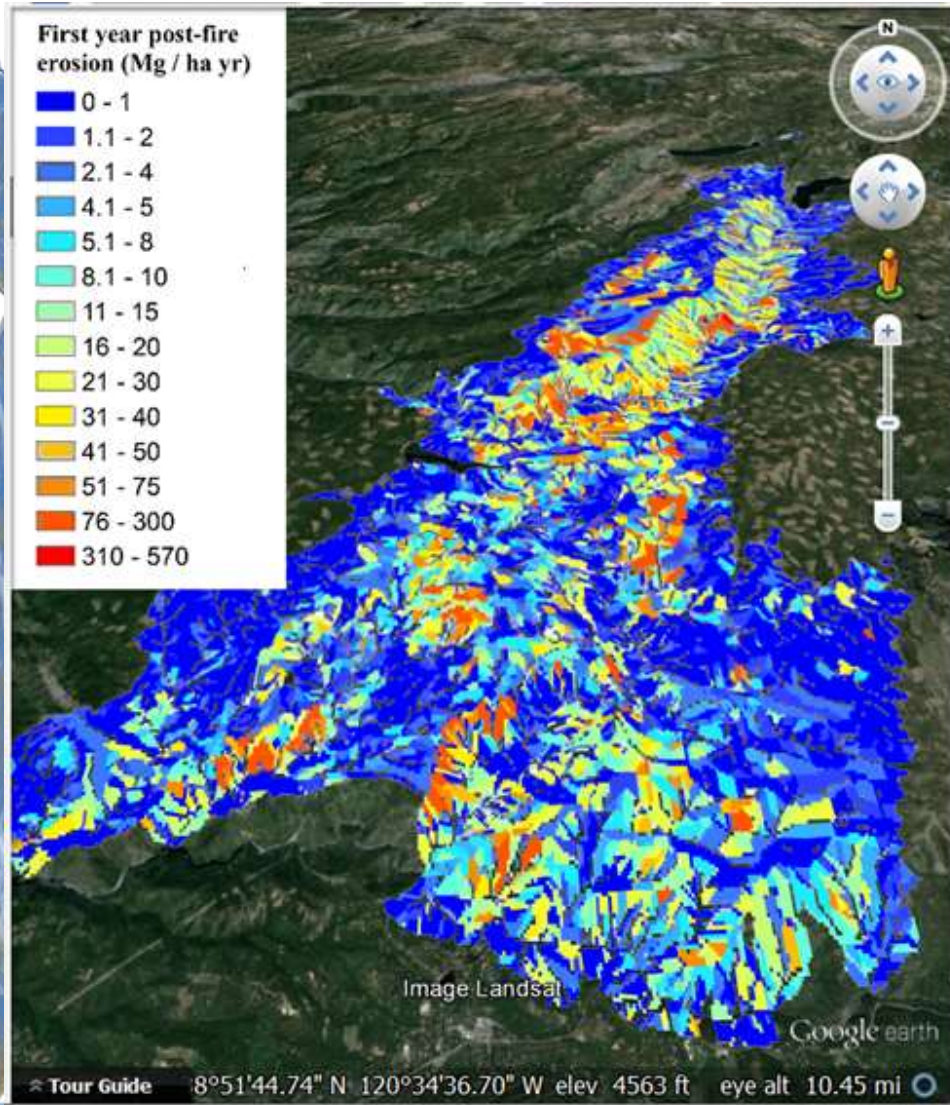
WEPP Management and Soil Lookup (Top Right) Table:

Area	GIS Soil	WEPP Soil
0.0%	s_659495300	CO_DisturbedWEPP\s_659495300.sol
0.0%	s_497691300	CO_DisturbedWEPP\s_497691300.sol
0.0%	s_659565300	CO_DisturbedWEPP\s_659565300.sol
0.1%	s_497752000	CO_DisturbedWEPP\s_497752000.sol
0.2%	s_659565000	CO_DisturbedWEPP\s_659565000.sol
0.2%	s_762958000	CO_DisturbedWEPP\s_762958000.sol
0.3%	s_762962000	CO_DisturbedWEPP\s_762962000.sol

WEPP Management and Soil Lookup (Bottom Right) Table:

Area	GIS Landuse	WEPP Management
0.0%	High Burn Severity	GeoWEPP\25% cover-high severity burn.rot
0.0%	Low Burn Severity	GeoWEPP\90% cover-low severity burn.rot
0.1%	Moderate Burn Severity	GeoWEPP\45% cover-moderate severity bur...
0.6%	Tall Grass	Forest\Disturbed WEPP Management\Tall gr...
0.7%	Low Burn Severity	GeoWEPP\90% cover-low severity burn.rot
1.4%	Short Grass	Forest\Disturbed WEPP Management\Short ...
13.3%	Forest	Forest\Disturbed WEPP Management\Forest...
19.8%	Low Burn Severity	GeoWEPP\90% cover-low severity burn.rot
27.2%	High Burn Severity	GeoWEPP\25% cover-high severity burn.rot
36.8%	Moderate Burn Severity	GeoWEPP\45% cover-moderate severity bur...

GEO-WEPP (ARC GIS): KING FIRE



ONLINE GIS WEPP: INPUT

WEPP Watershed
Online GIS Interface

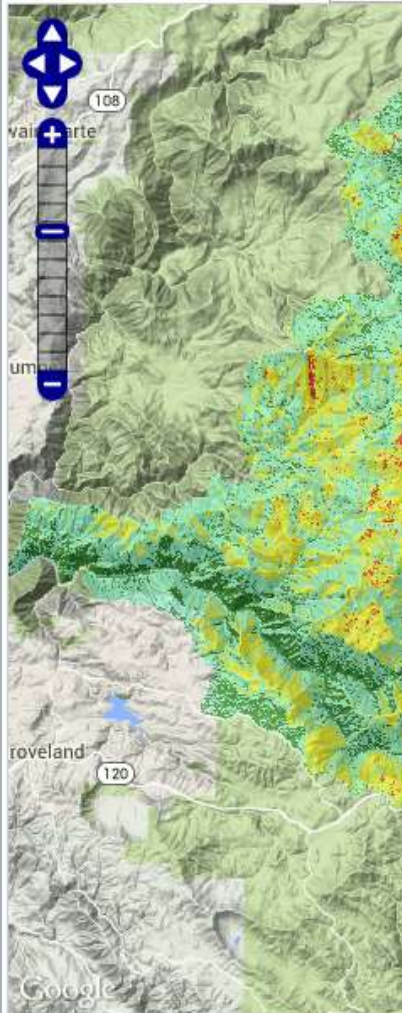
September 2011

Mapping (Rim) Projects Help

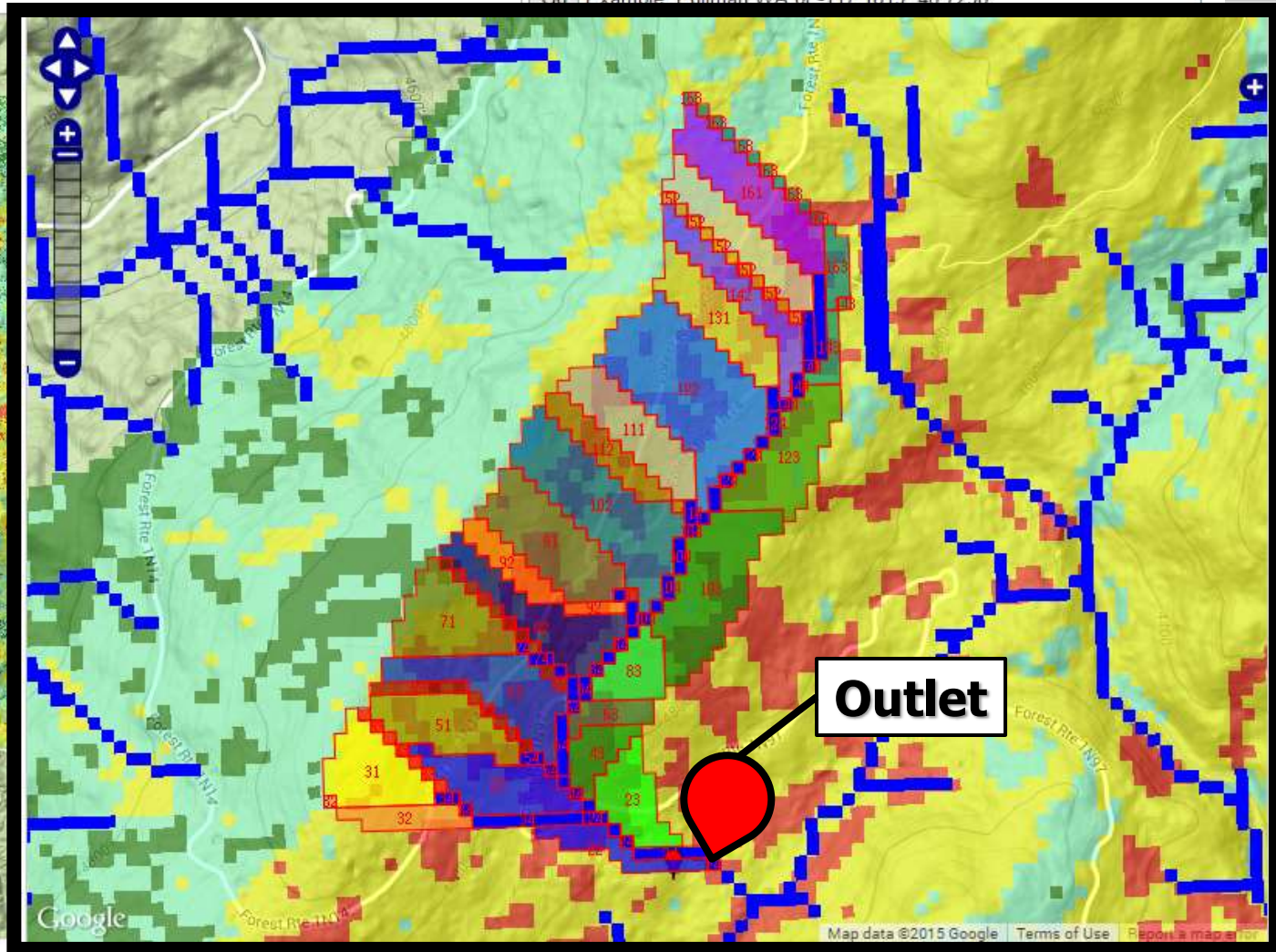
Double-click to zoom in, and drag to pan. Hold down the shift key and drag to zoom to a particular region.

Zoom to Zip Code or City, State:

Go Example: Pullman WA or -117 1819 46 7298



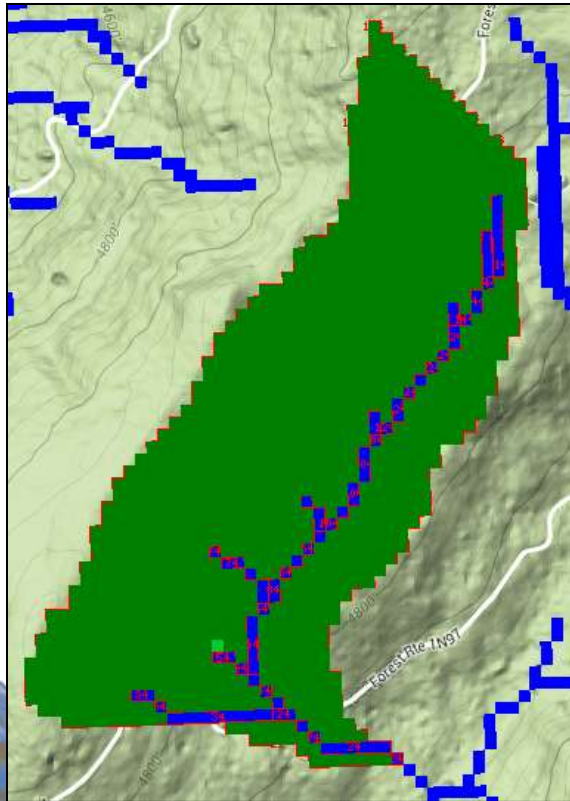
lon=-120.0932 lat=37.8770 elev=???



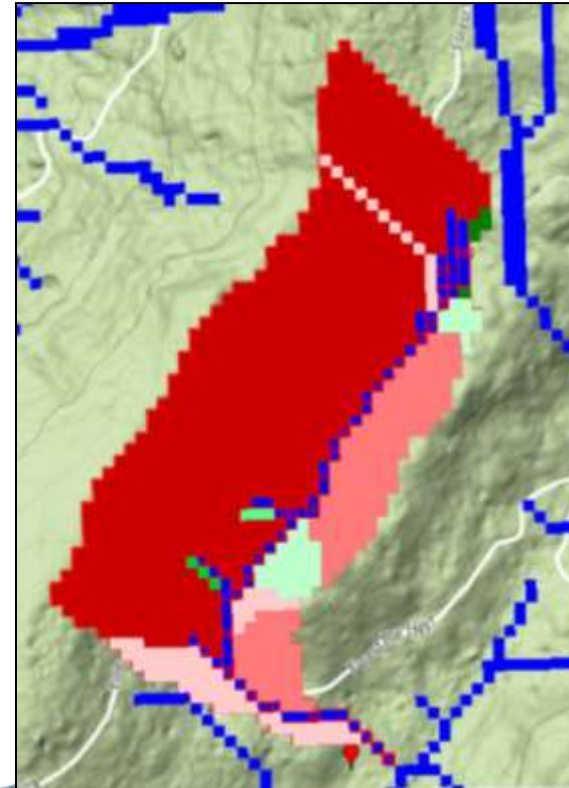
- 
- Soil Loss 0 - 1.25 t/ha/yr
 - Soil Loss 1.25 - 2.5 t/ha/yr
 - Soil Loss 2.5 - 3.75 t/ha/yr
 - Soil Loss 3.75 - 5 t/ha/yr
 - Soil Loss 5 - 10 t/ha/yr
 - Soil Loss 10 - 15 t/ha/yr

Online GIS WEPP: MAP OUTPUT

Unburned




High severity





Online GIS WEPP: OUTPUT

	Unburned		Moderate & High Severity
<i>Watershed Discharge Volume (m³/yr)</i>	4,000		780,000
<i>Watershed Sediment Yield (tonne/yr)</i>	35		3,400
<i>Watershed Sediment Yield (tonne/ha/yr)</i>	0.3		35
<i>Watershed Sediment Delivery Ratio</i>	0.99		0.30
<i>Discharge at outlet (mm/year)</i>	4		810



Online GIS WEPP : OUTPUT

10 YEAR SIMULATION FOR WATERSHED

Number of events: 3600

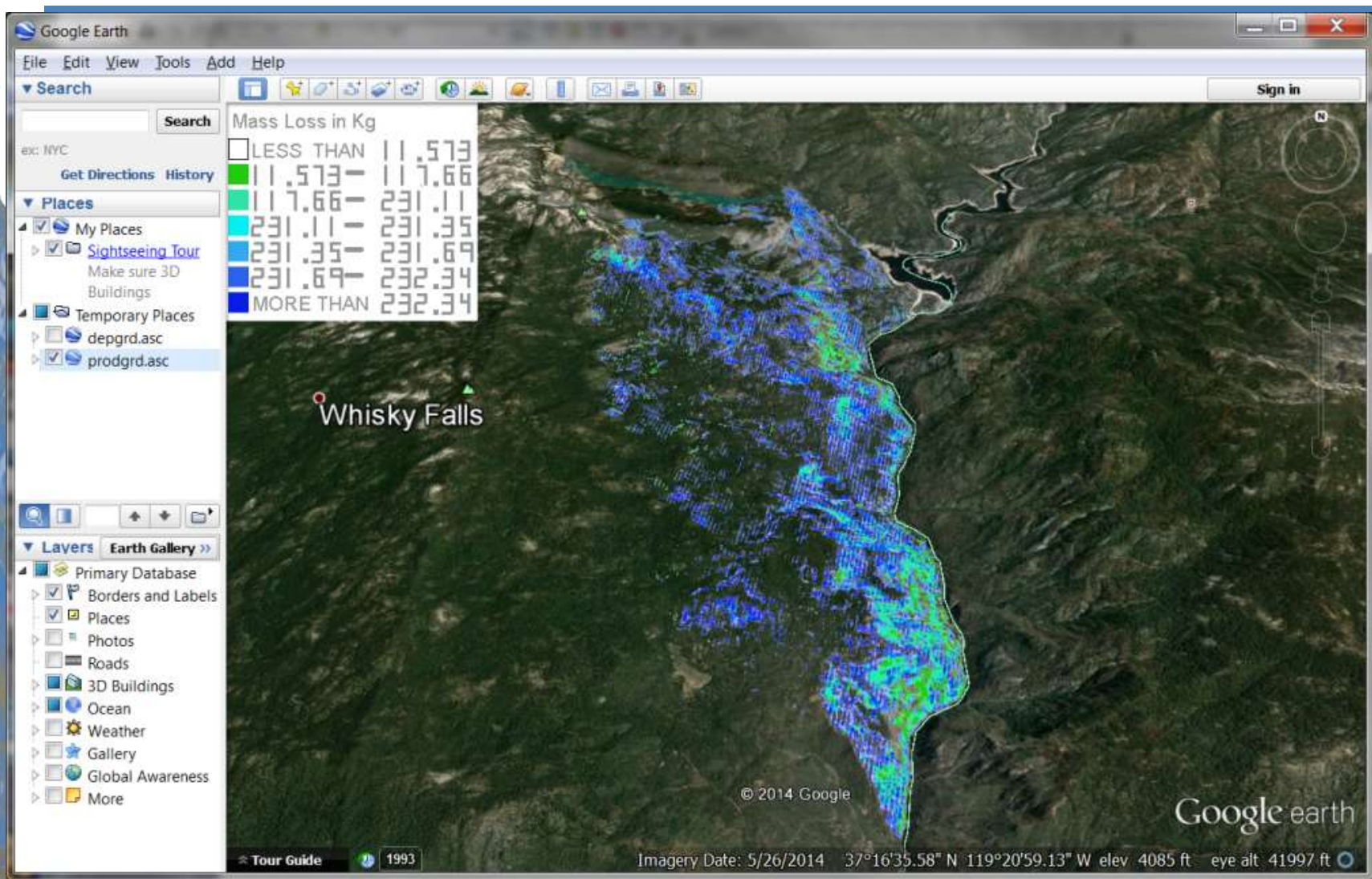
Return Period of **SEDIMENT YIELD** by Event

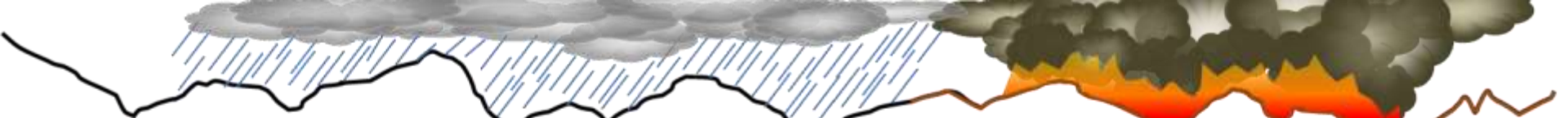
Model	Recurrence Interval years	Day	Month	Year	Precip (mm)	Runoff (m ³)	Peak (m ³ /s)	Sediment Yield (kg)
<i>Unburned</i>	2	29	1	3	41	171	0.1	4,000
	5	9	2	7	72	2350	0.9	36,000
<i>High Severity</i>	2	8	3	1	25	55,000	15	670,000
	5	12	2	5	80	95,000	25	800,000



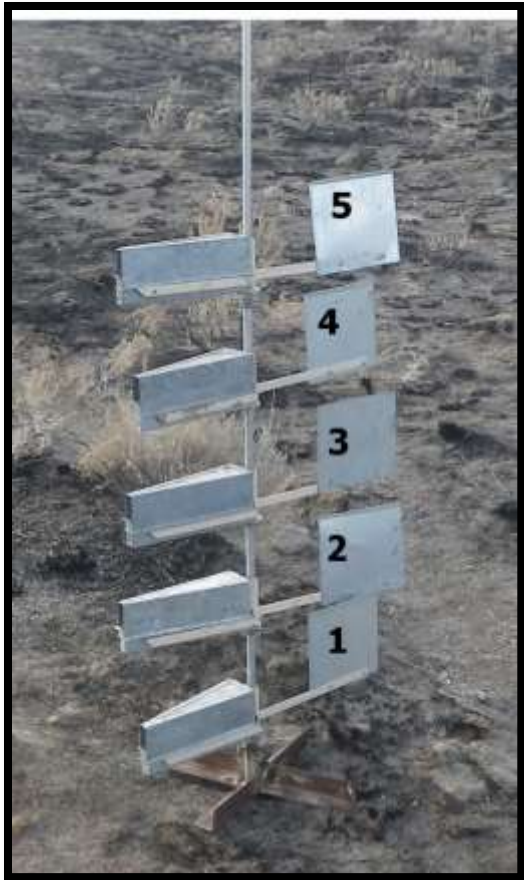
RAVEL RAT

Code for the current FS interface.
Output are google earth KMLs.





POST-FIRE WIND EROSION MONITORING BLM IDAHO



- **2014 Preacher Fire**
 - **BSNE, PM10, PM2.5**
 - **Weather station**





Alone we can do so little...



Together we can do so much! –Helen Keller
<http://forest.moscowfs1.wsu.edu>