WEPPcloud

Water Erosion Prediction Project

FS WEPP interfaces

WEPPcloud: Calibration

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University of Idaho

2025 National Burned Area Emergency Response Readiness Meeting

SALT LAKE CITY, UT

June 2–3

WEPPcloud: Calibration

- What is considered a **good model**?
- Application of WEPPcloud to **undisturbed** conditions
- Application of WEPPcloud to **post-fire** conditions
- **Sensitive parameters**
- **Calibrating approach**

Model Assessment Metrics in Hydrology

Nash-Sutcliffe Efficiency (NSE)

What it tells us: How well the model predicts time series values compared to simply using the mean of observed values?

Range: **1** = perfect model, **0** = same as mean, **< 0** = worse than mean, **0.40–0.99 = good to excellent**

Kling-Gupta Efficiency (KGE)

What it tells us: A balanced score combining correlation, bias, and variability (more comprehensive than NSE).

Range: 1 = perfect model, **> 0** = generally good performance, **−0.41** = same as mean, < **−0.41** = worse than mean
> 0.5 = satisfactory

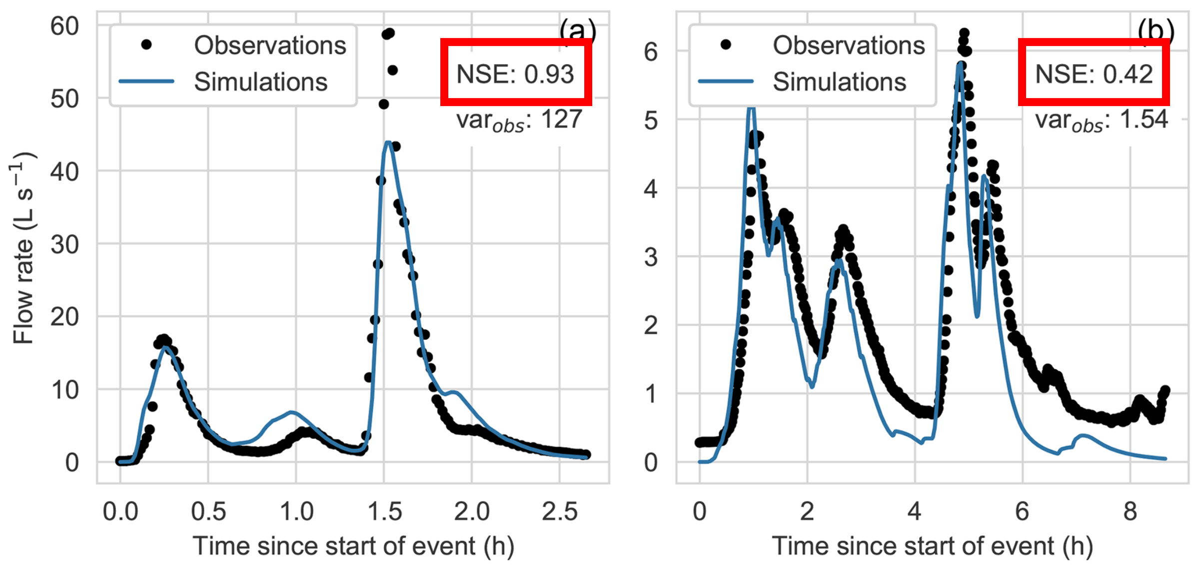
Percent Bias (PBIAS)

What it tells us: The average tendency of the model to **overpredict or underpredict**.

Range: **0 = no bias**, **>0** = model underestimates, **<0** = model overestimates

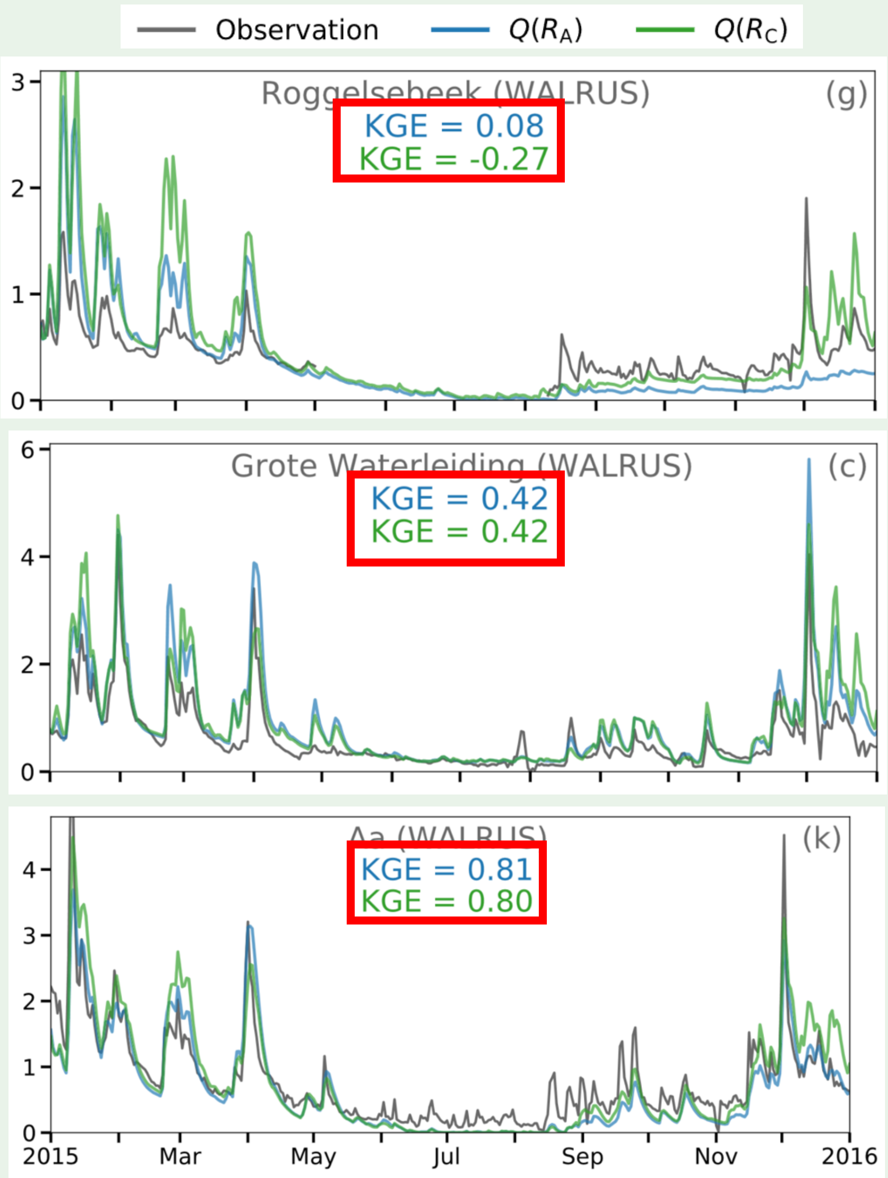
Examples

Nash-Sutcliffe Efficiency (NSE)



https://hess.copernicus.org/articles/24/869/2020/hess-24-869-2020.html

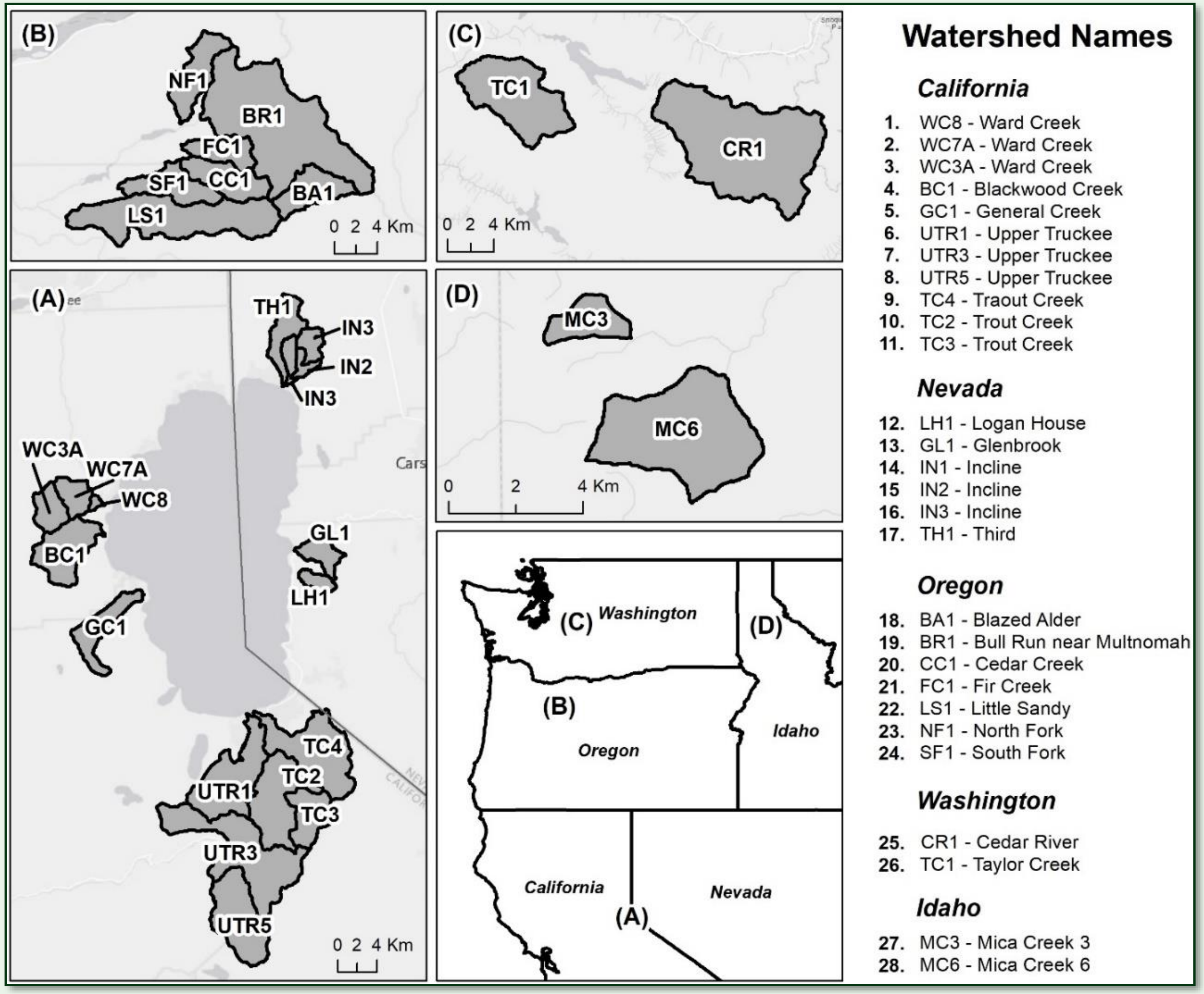
Kling-Gupta Efficiency (KGE)



https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2021WR031591

Study Sites

- → 28 forested watersheds
- → Relatively undisturbed
- → Managers interested in both pre- and post-fire simulations of runoff, sediment yield, and phosphorus yield
- → Streamflow and/or Water Quality data at USGS stations



Application of WEPPcloud to undisturbed conditions

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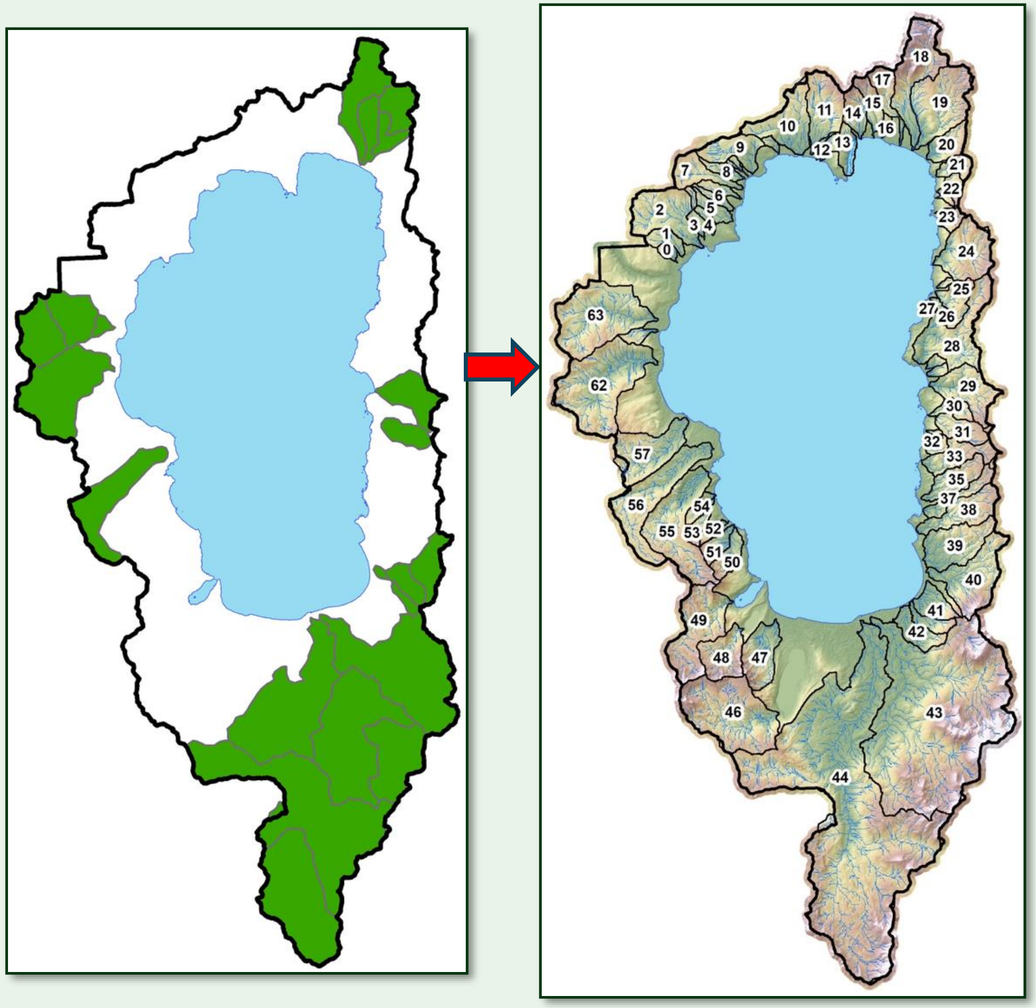
WEPP Model Calibration



→ For model to be transferable, minimal calibration is required

Streamflow

- linear baseflow recession coefficient (k_b; determined from streamflow)
- saturated hydraulic conductivity of the underlying geology (K_{sub})
- rain/snow temperature threshold ($T_{rain/snow}$)

Sediment yield

- channel bed critical shear stress (τ_c; determined from D50)
- other parameters set as default from literature and field observations

Phosphorus yield

- static average annual phosphorus concentrations in surface runoff, lateral flow, baseflow, and attached to sediment

WEPP Model Calibration

Average for multiple watersheds	N	NSE			KGE			Percent Bias (%)		
		D	M	A	D	M	A	D	M	A
Streamflow	28	0.55	0.70	0.87	0.70	0.78	0.84	0.29	0.35	0.29
Sediment yield	19	–	–	0.61	NA	NA	0.54	NA	NA	1.85

Average for multiple watersheds	N	Total Phosphorus			Particulate Phosphorus			Soluble Reactive Phosphorus		
		Annual NSE	Annual KGE	Annual Pbias (%)	Annual NSE	Annual KGE	Annual Pbias (%)	Annual NSE	Annual KGE	Annual Pbias (%)
Phosphorus	17	0.75	0.71	–0.51	0.71	0.70	–1.32	0.66	0.66	–4.61

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WEPP Model Calibration

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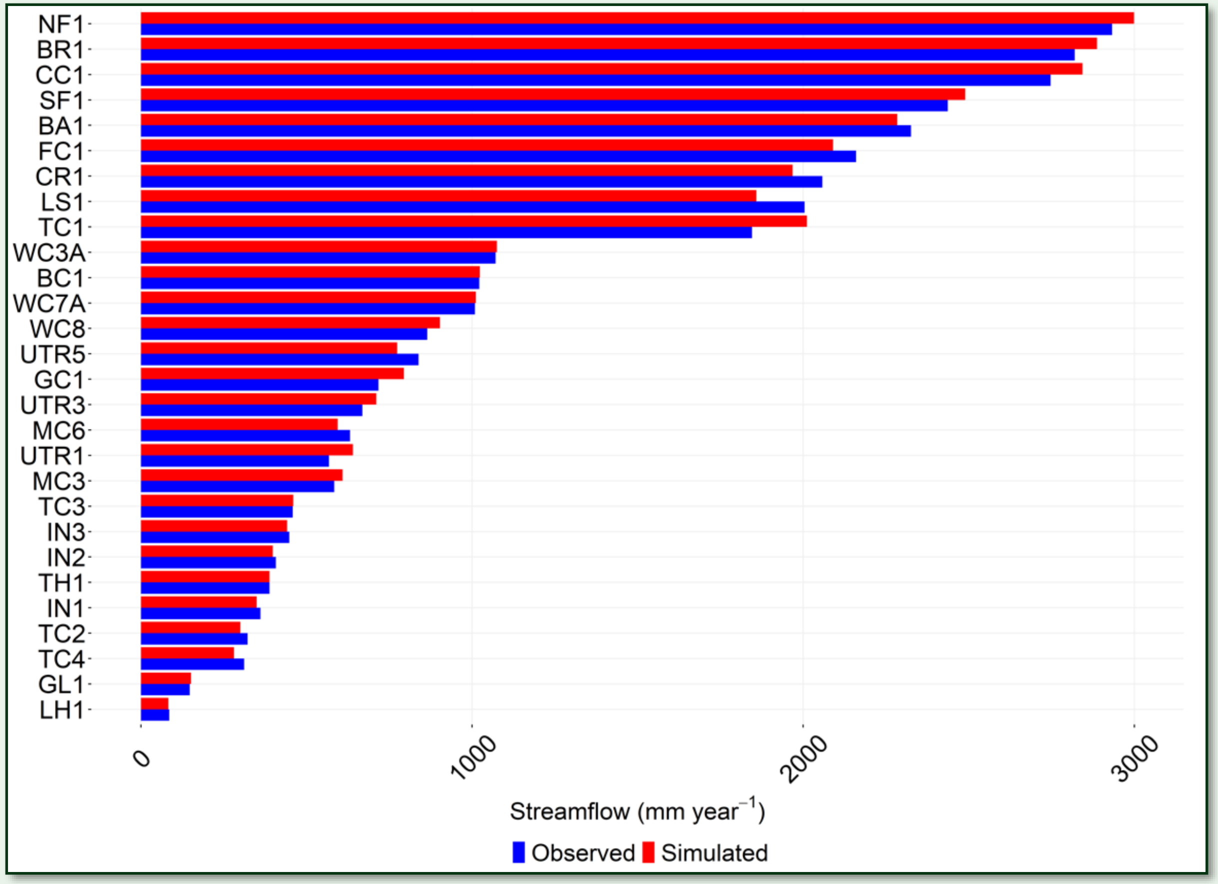
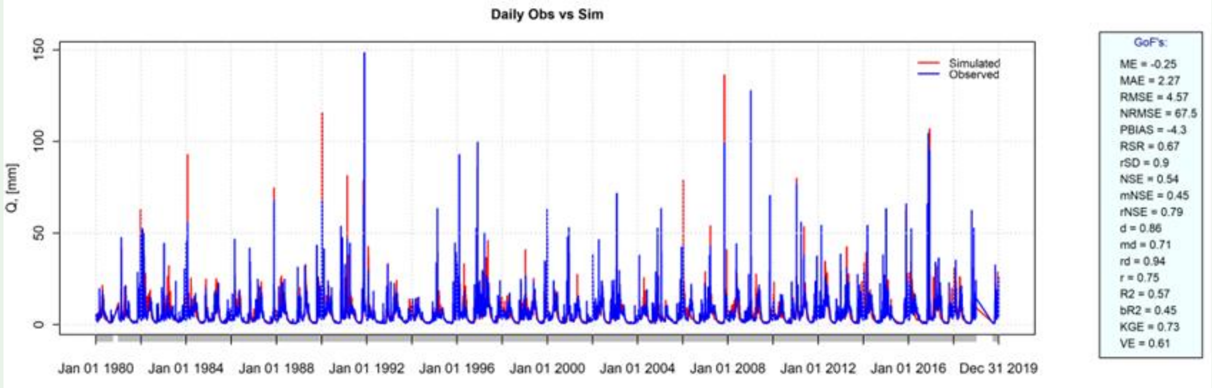
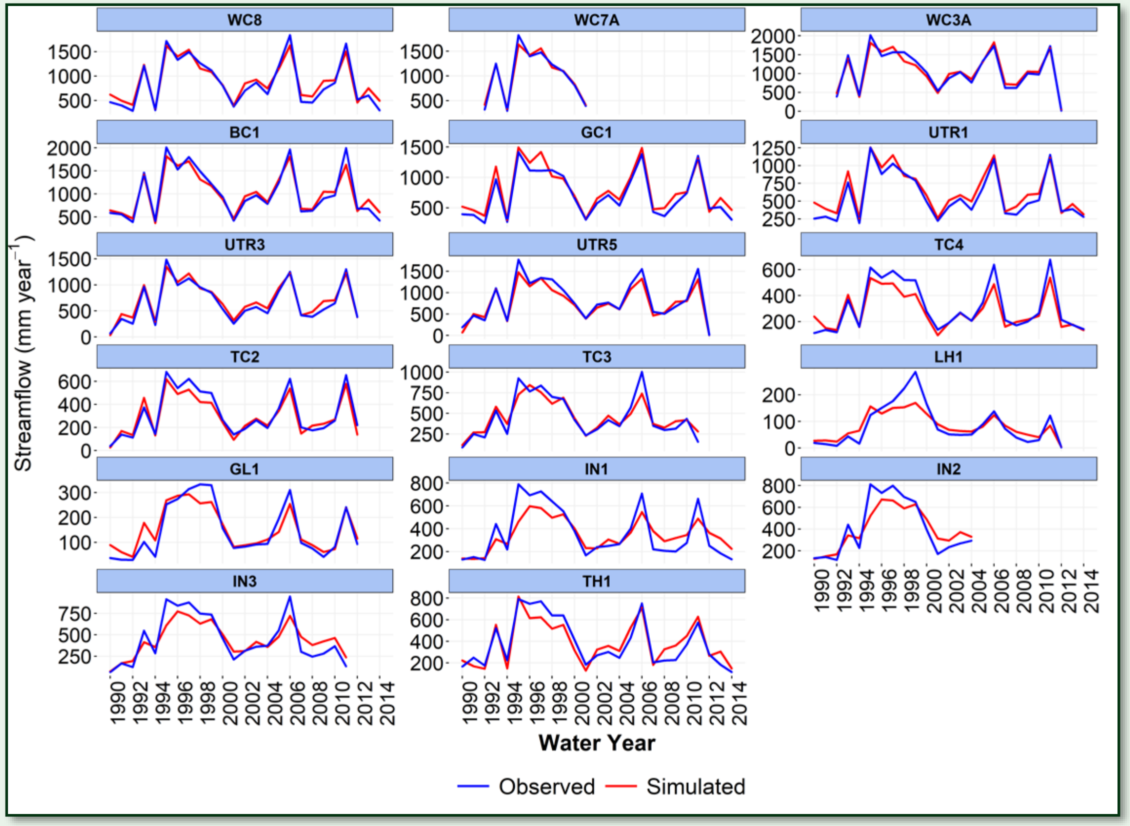
Calibration Results

(Streamflow)

WEPP-simulated and observed average annual Streamflow



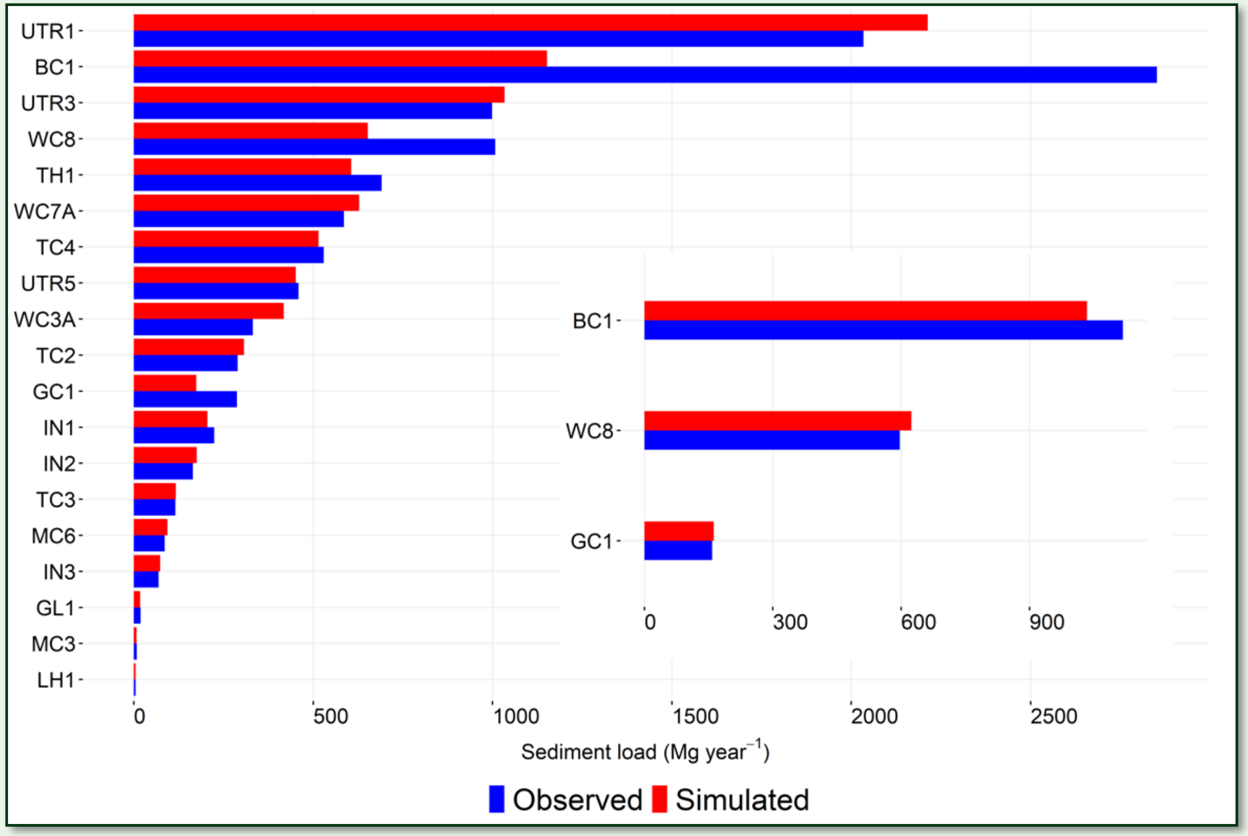




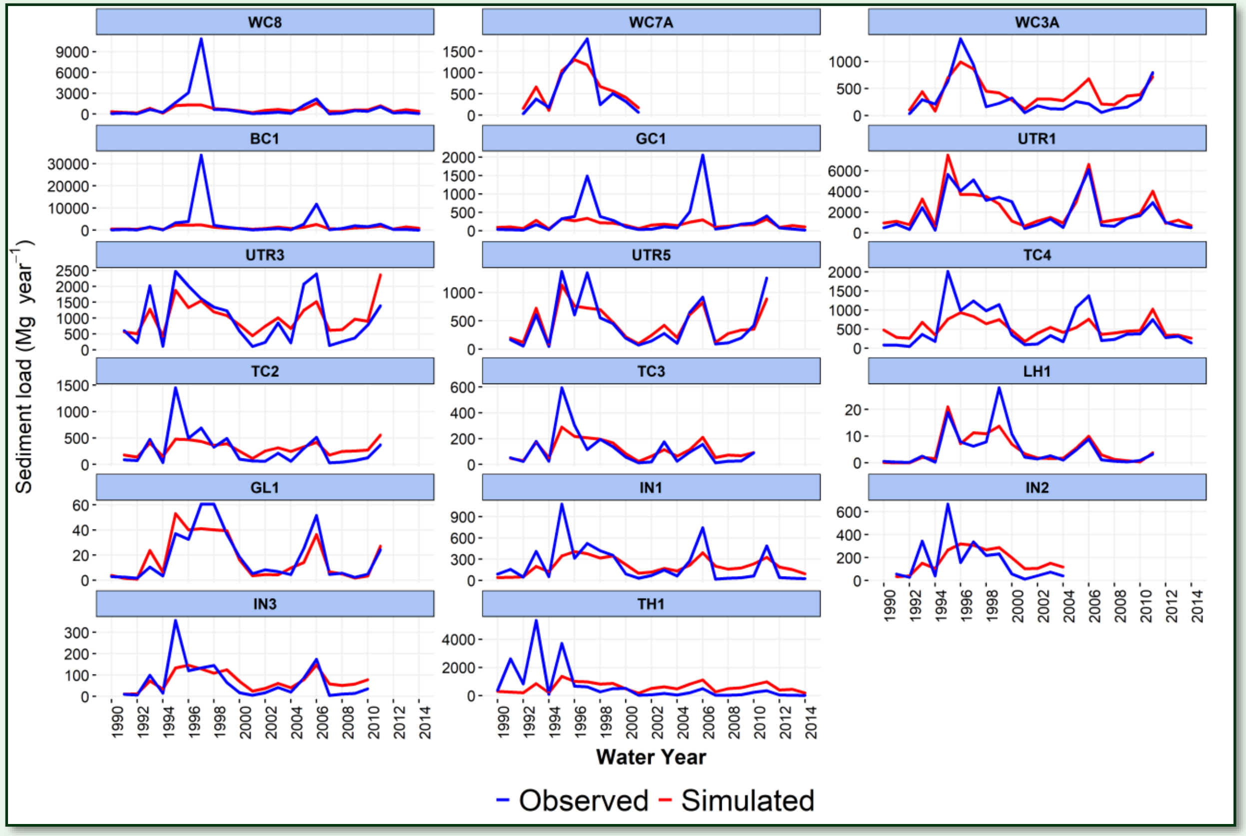
Calibration Results

(Sediment Load)

WEPP-simulated and observed average annual Sediment Load



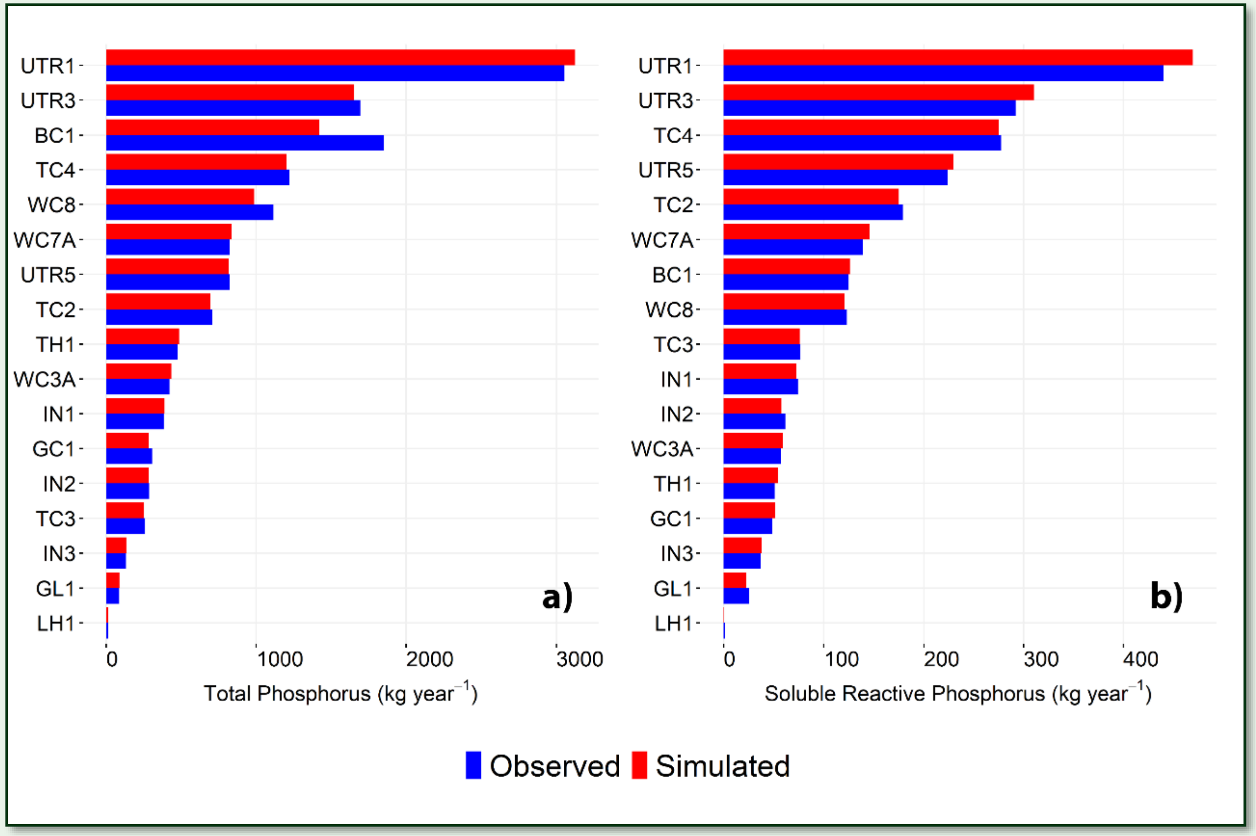
WEPP-simulated and observed annual Sediment Load

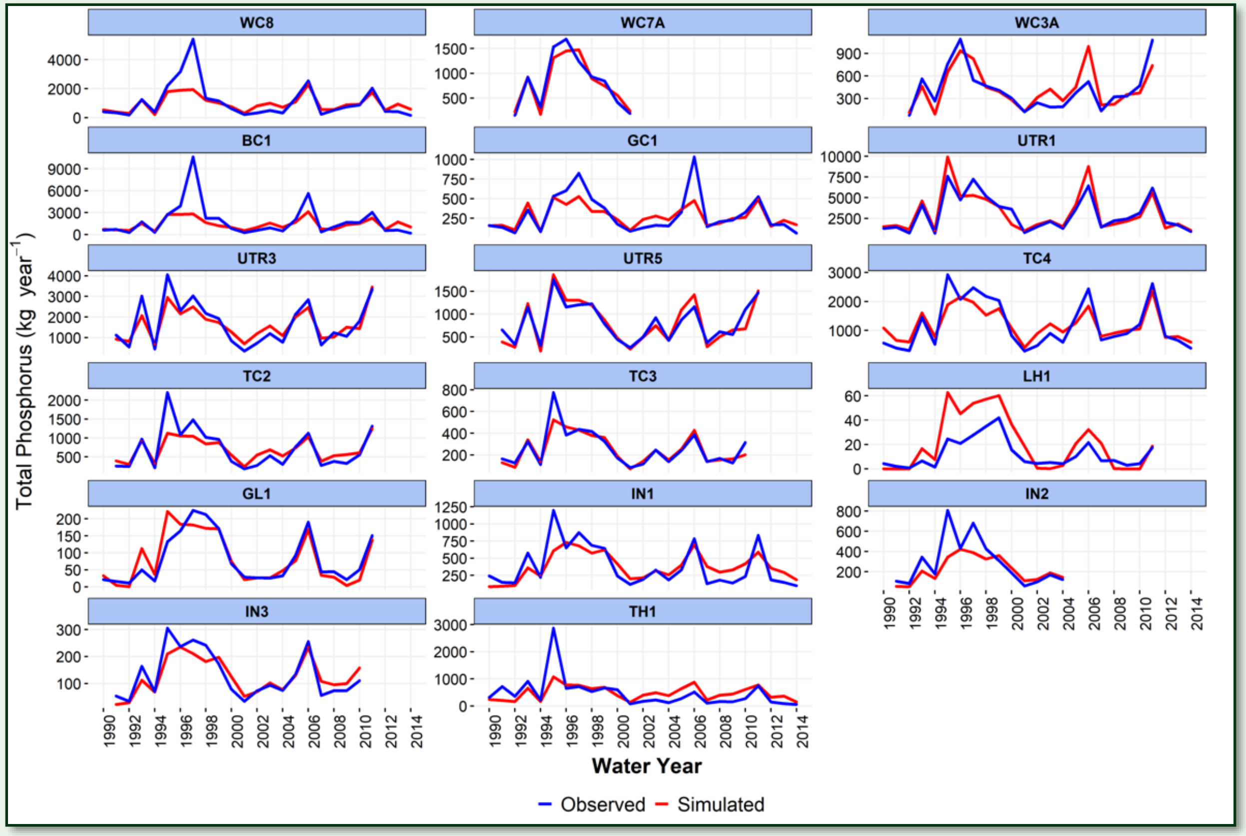


Calibration Results

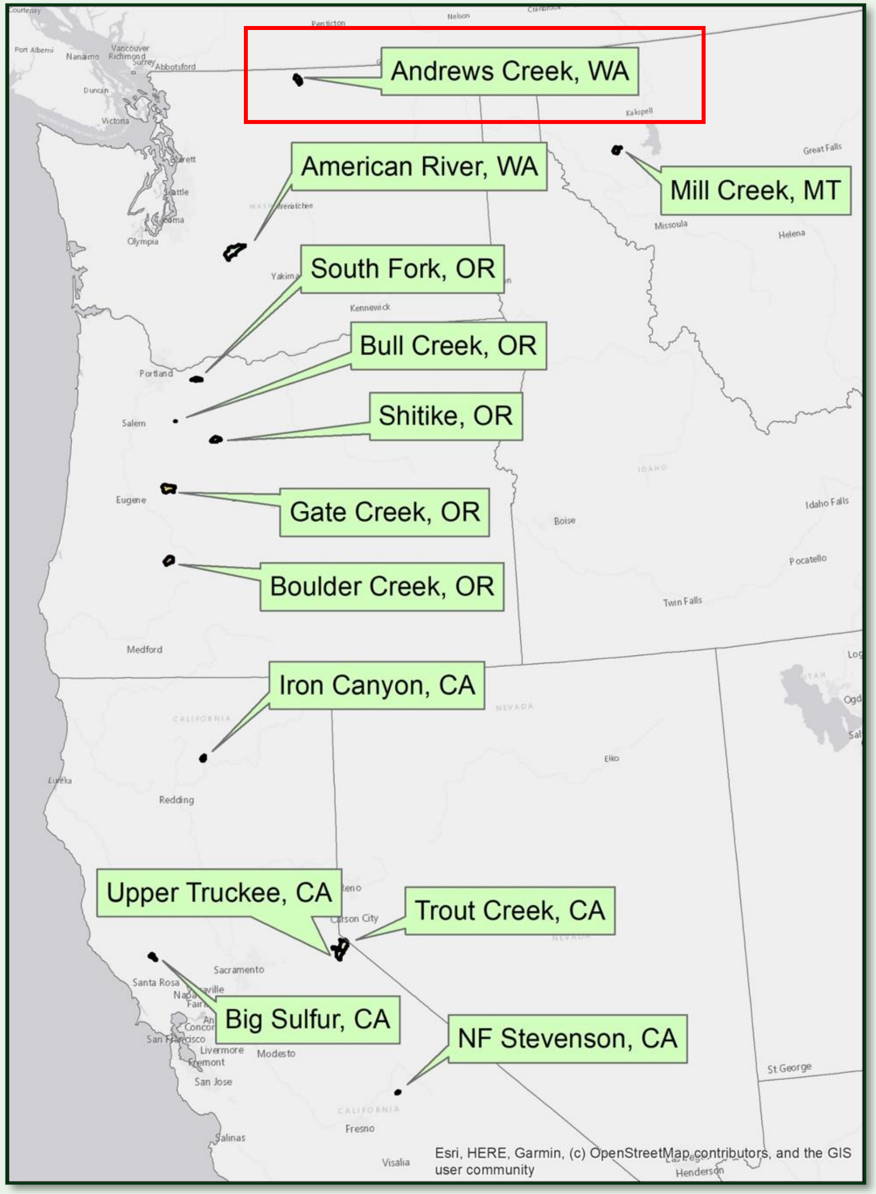
(Phosphorus Load)

WEPP-simulated and observed average annual Total Phosphorus and Soluble Reactive Phosphorus

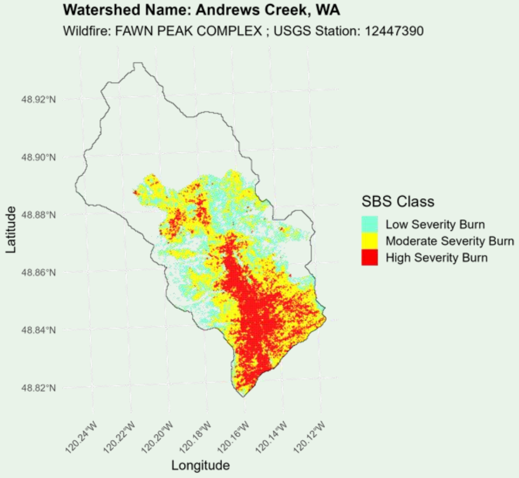


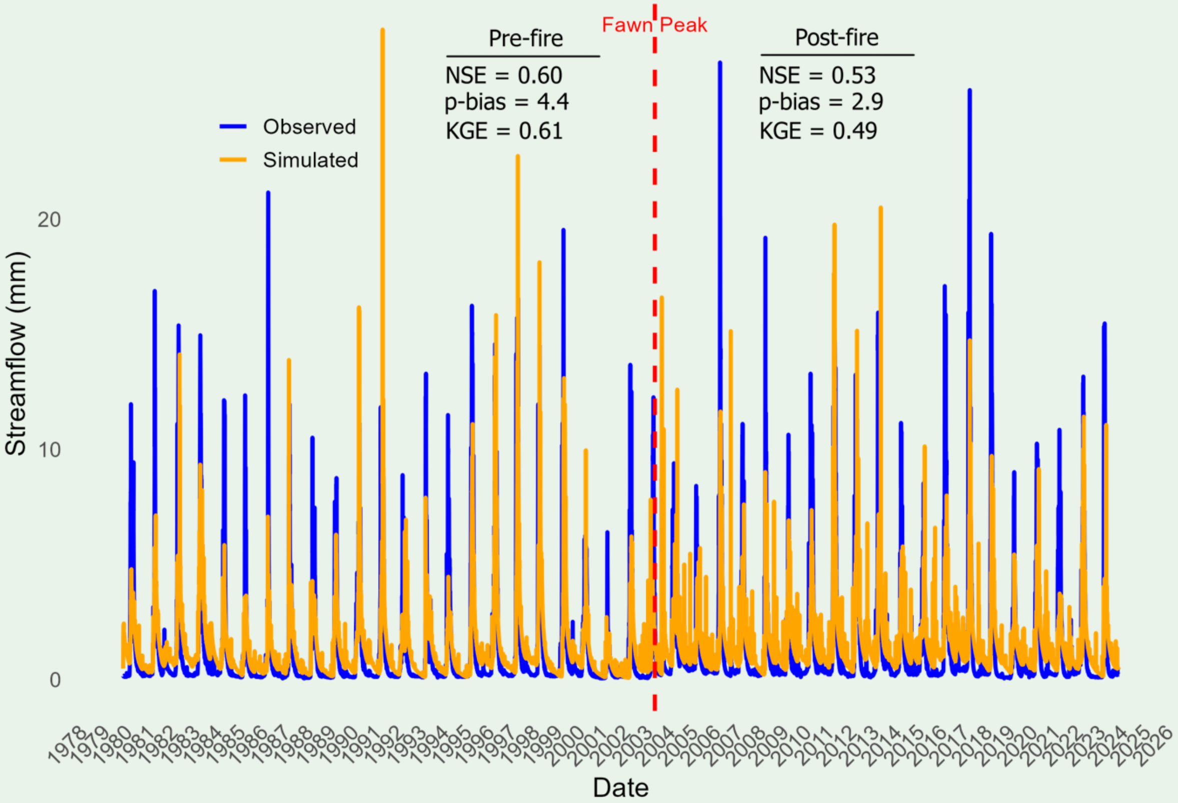


Watersheds

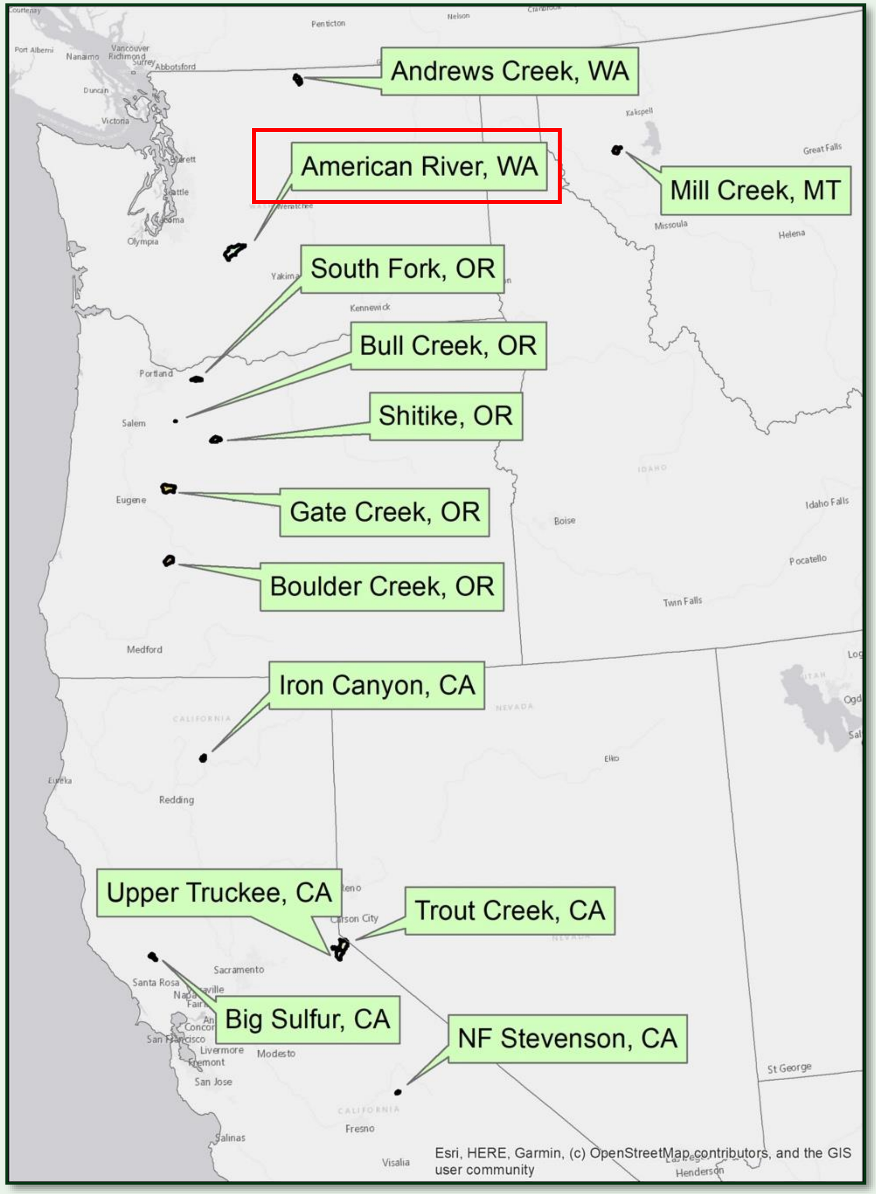


Application of WEPPcloud to post-fire conditions





Watersheds



Andrews Creek, WA
American River, WA
Mill Creek, MT
South Fork, OR
Bull Creek, OR
Shitike, OR
Gate Creek, OR
Boulder Creek, OR
Iron Canyon, CA
Upper Truckee, CA
Trout Creek, CA
Big Sulfur, CA
NF Stevenson, CA
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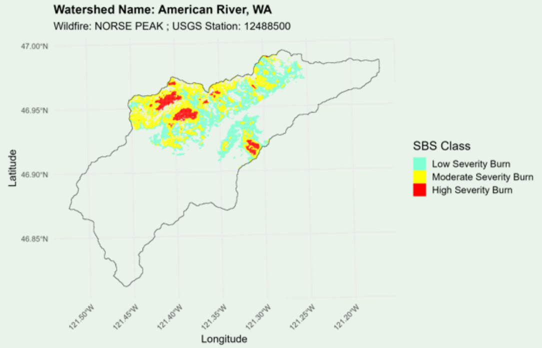
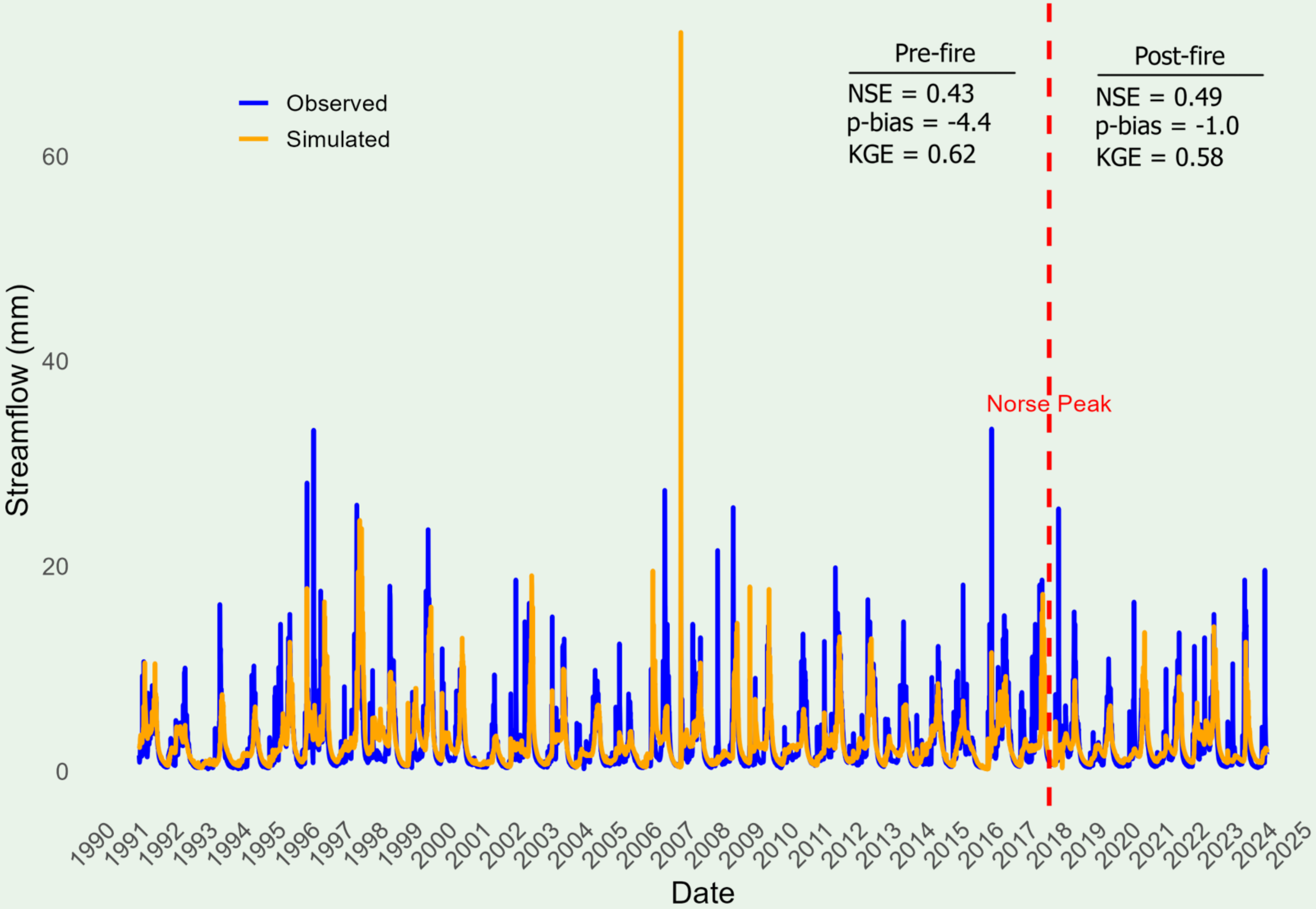
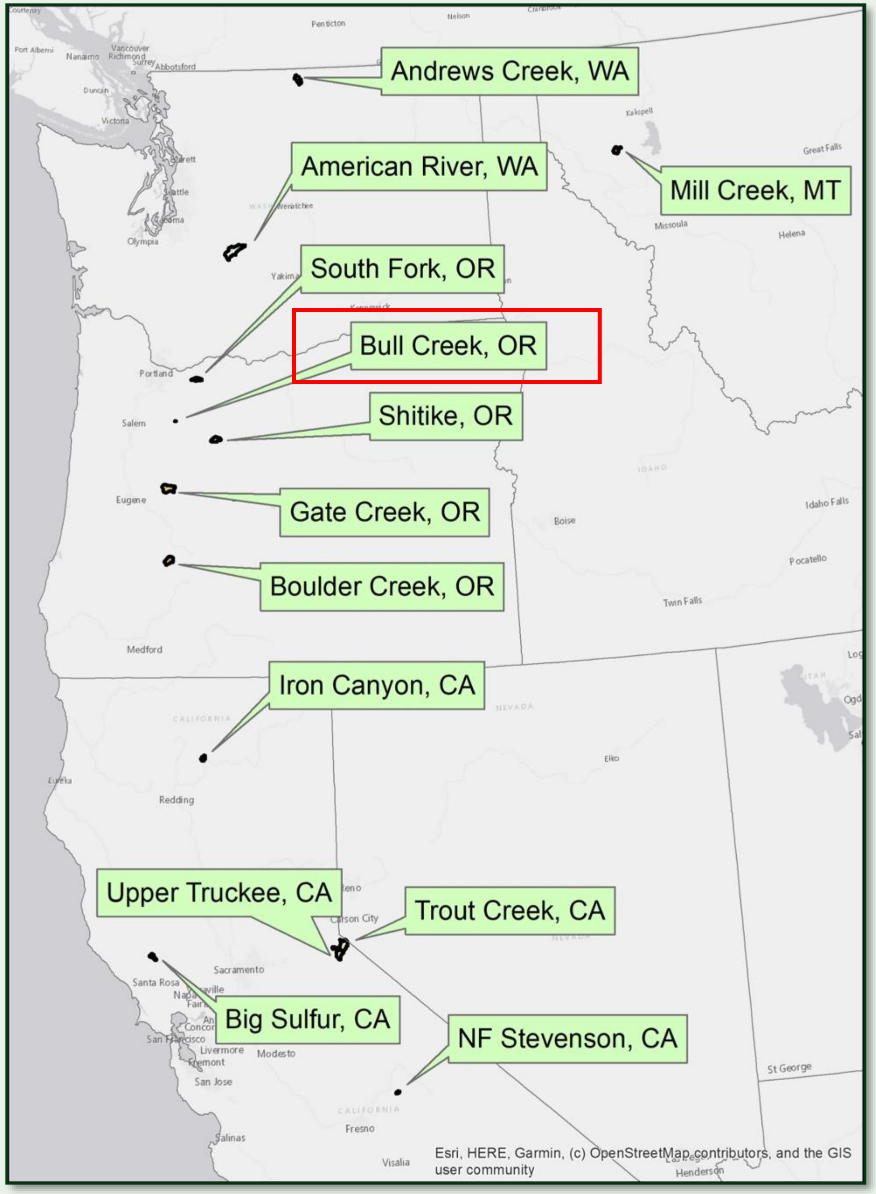


Watershed Name: American River, WA
Wildfire: NORSE PEAK ; USGS Station: 12488500
SBS Class
Low Severity Burn
Moderate Severity Burn
High Severity Burn
Latitude
Longitude



Observed
Simulated
Pre-fire
NSE = 0.43
p-bias = -4.4
KGE = 0.62
Post-fire
NSE = 0.49
p-bias = -1.0
KGE = 0.58
Norse Peak
Streamflow (mm)
0
20
40
60
Date
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

Watersheds


Andrews Creek, WA
American River, WA
Mill Creek, MT
South Fork, OR
Bull Creek, OR
Shitike, OR
Gate Creek, OR
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Upper Truckee, CA
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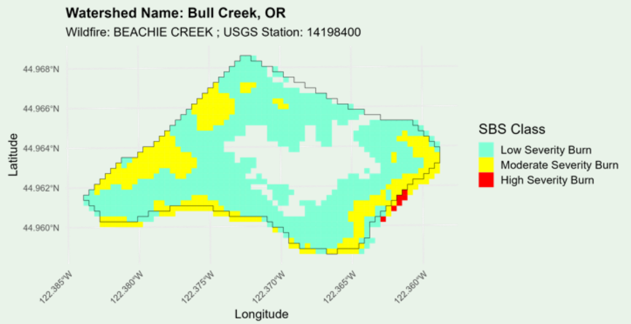
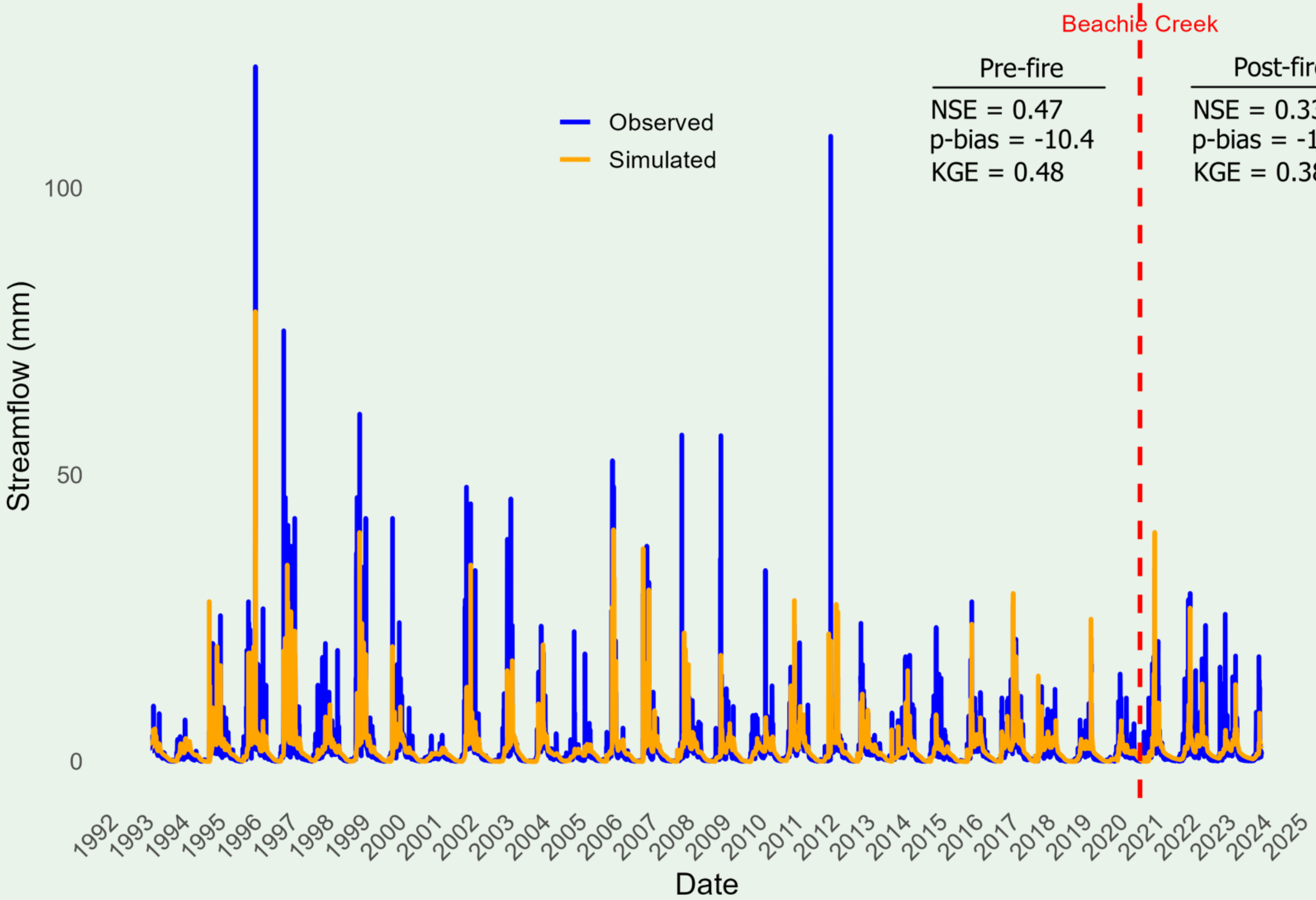
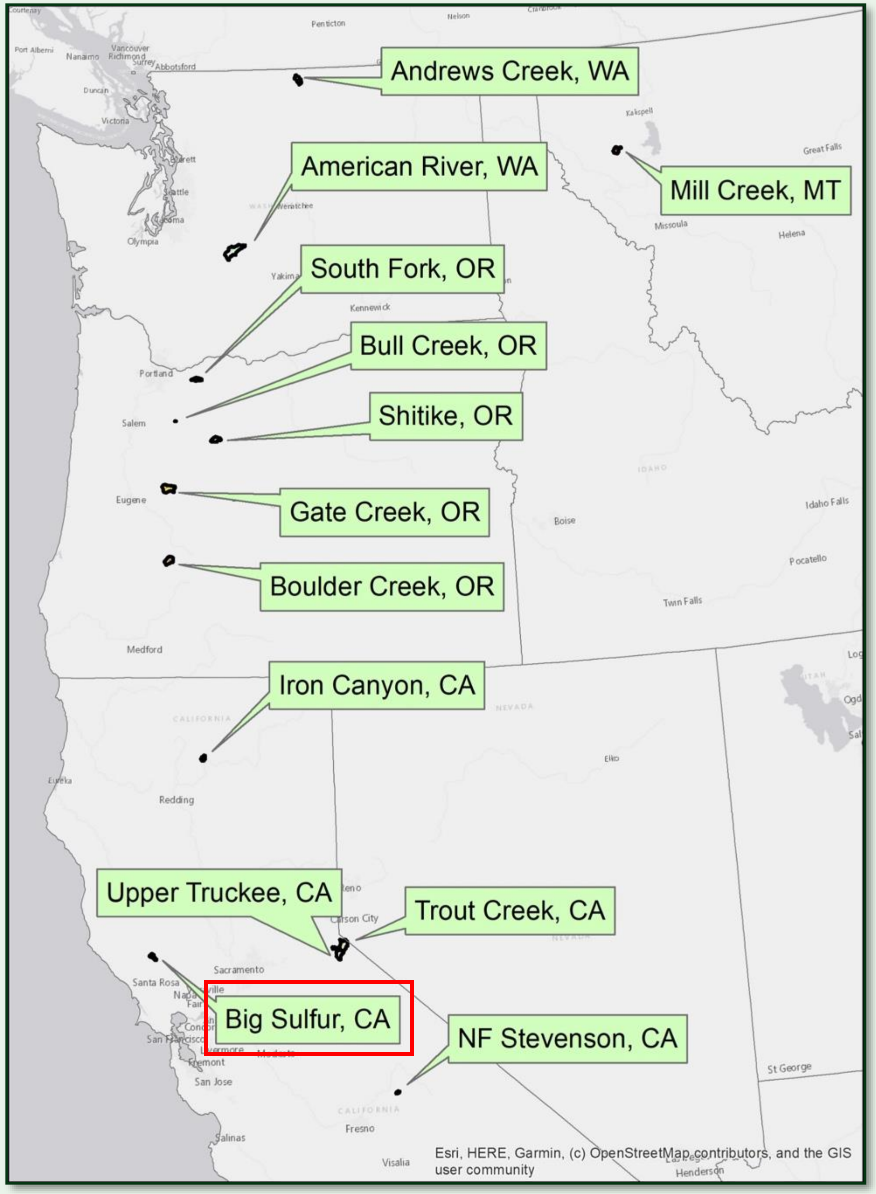

Watershed Name: Bull Creek, OR
Wildfire: BEACHIE CREEK ; USGS Station: 14198400
Latitude
Longitude
SBS Class
Low Severity Burn
Moderate Severity Burn
High Severity Burn


Beachie Creek
Pre-fire
NSE = 0.47
p-bias = -10.4
KGE = 0.48
Post-fire
NSE = 0.33
p-bias = -12.8
KGE = 0.38
Observed
Simulated
Streamflow (mm)
Date
0
50
100
1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

Watersheds


Andrews Creek, WA
American River, WA
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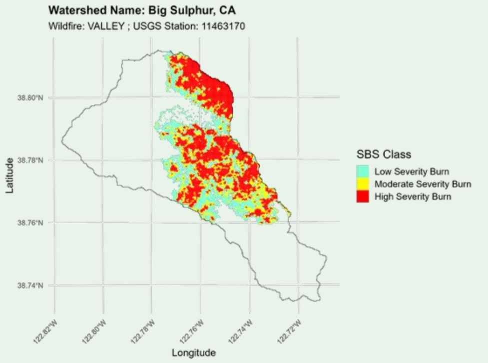
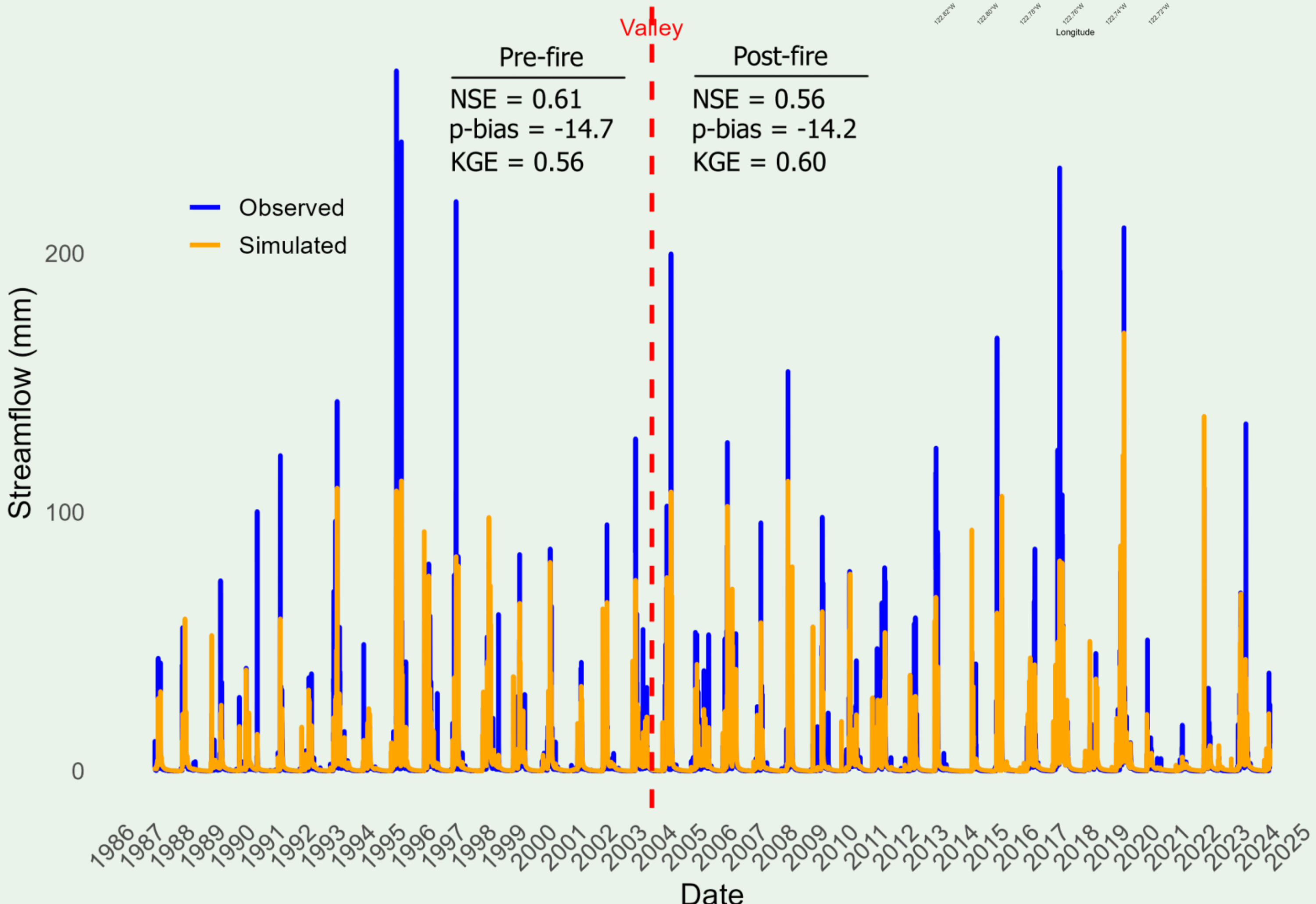
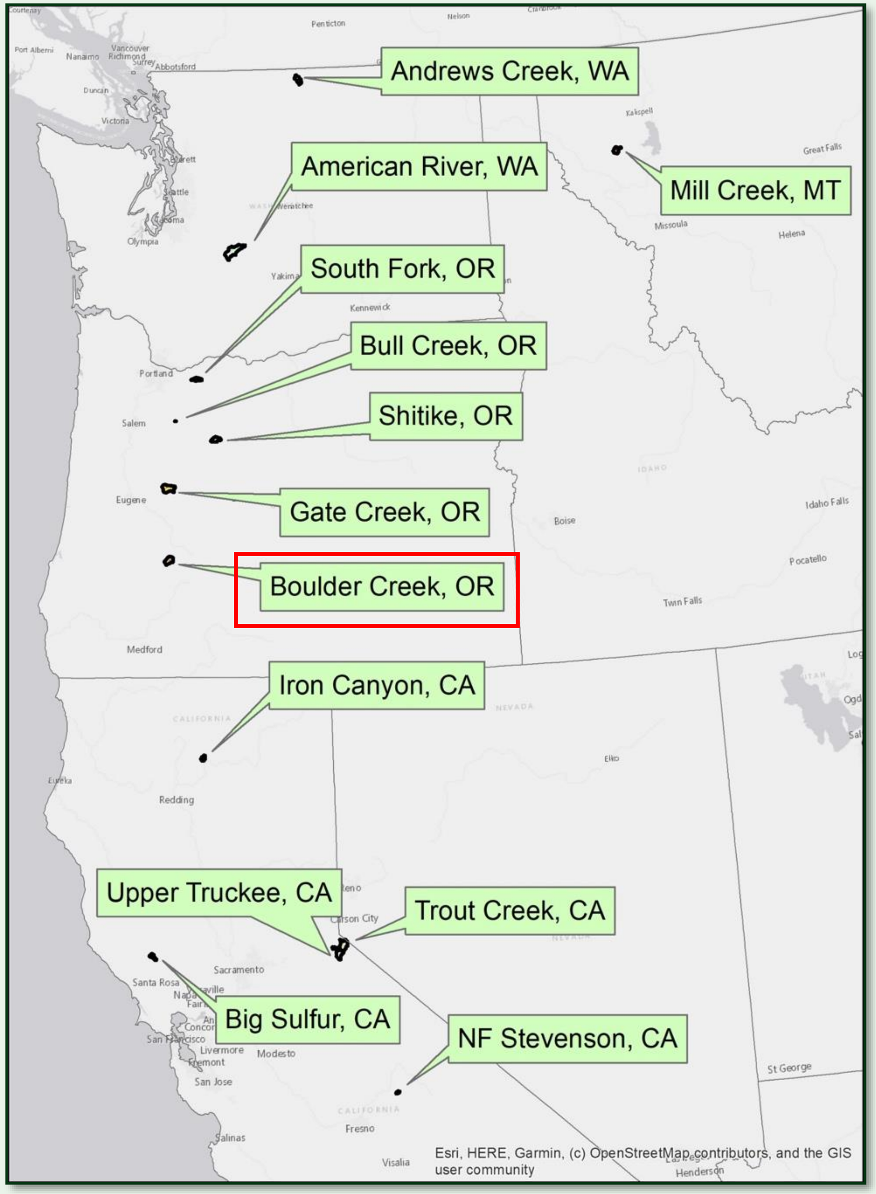

Watershed Name: Big Sulphur, CA
Wildfire: VALLEY ; USGS Station: 11463170
Latitude
38.80°N
38.78°N
38.76°N
38.74°N
122.82°W
122.80°W
122.78°W
122.76°W
122.74°W
122.72°W
Longitude
SBS Class
Low Severity Burn
Moderate Severity Burn
High Severity Burn


Valley
Pre-fire
NSE = 0.61
p-bias = -14.7
KGE = 0.56
Post-fire
NSE = 0.56
p-bias = -14.2
KGE = 0.60
Observed
Simulated
Streamflow (mm)
200
100
0
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Date

Watersheds


Andrews Creek, WA
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Bull Creek, OR
Shitike, OR
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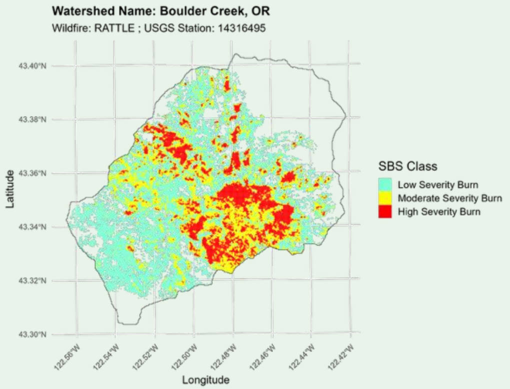
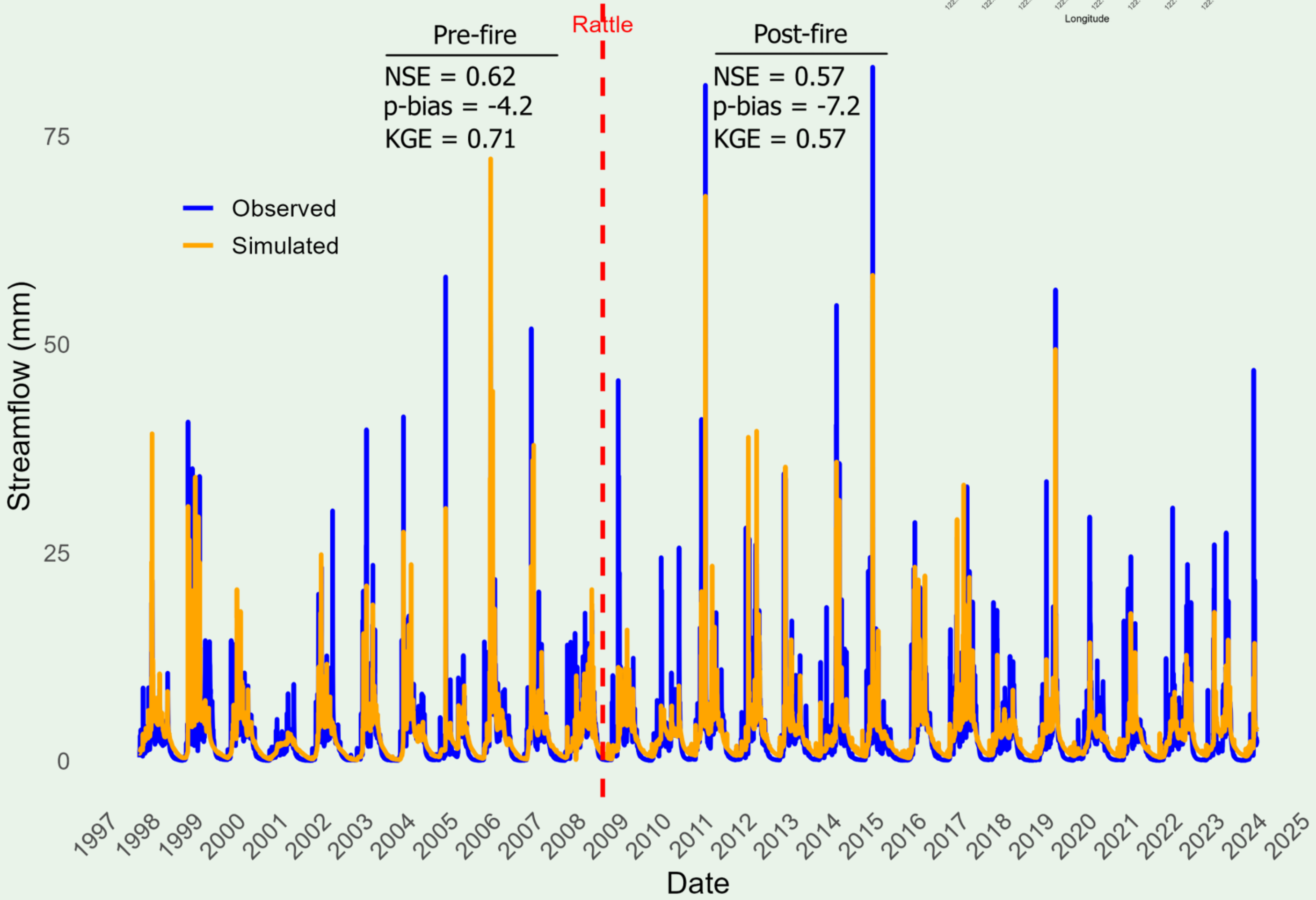
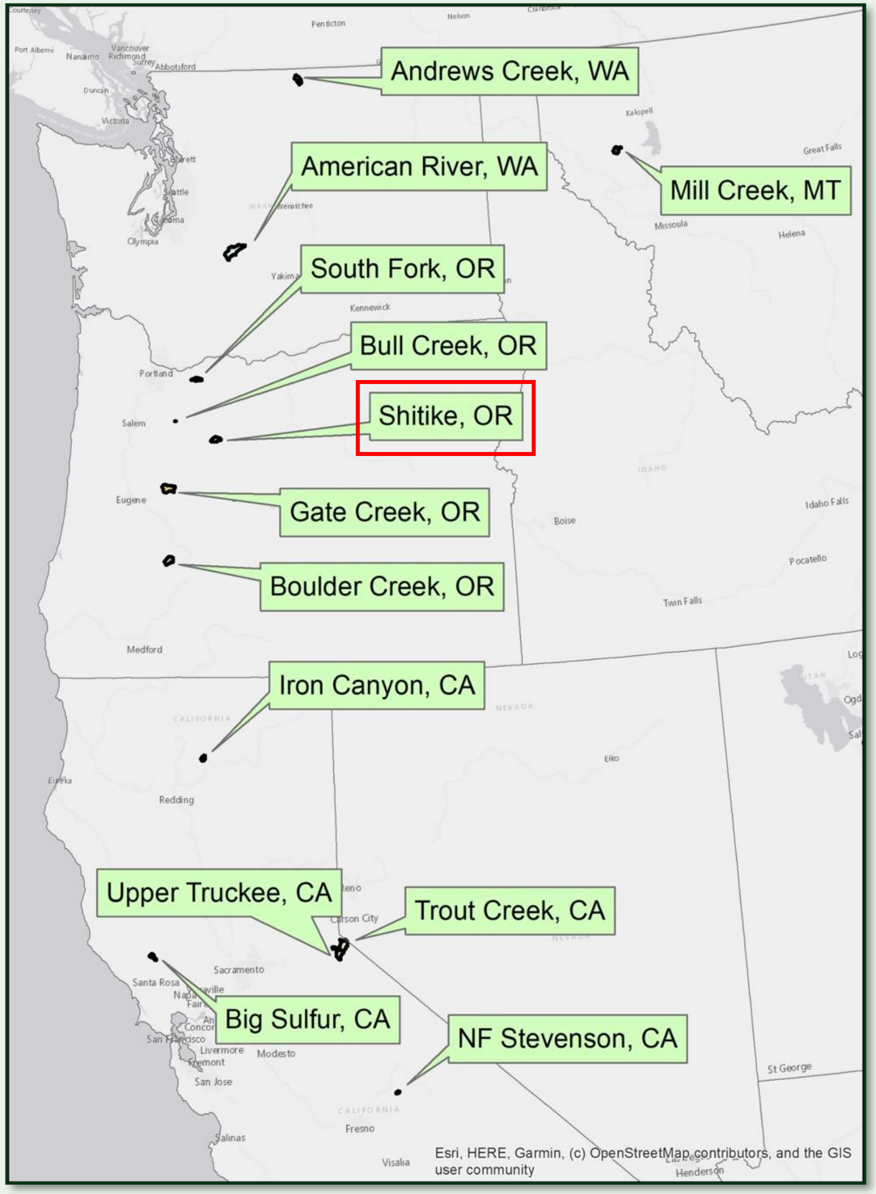

Watershed Name: Boulder Creek, OR
Wildfire: RATTLE ; USGS Station: 14316495
SBS Class
Low Severity Burn
Moderate Severity Burn
High Severity Burn
Latitude
Longitude


Pre-fire
NSE = 0.62
p-bias = -4.2
KGE = 0.71
Rattle
Post-fire
NSE = 0.57
p-bias = -7.2
KGE = 0.57
Observed
Simulated
Streamflow (mm)
0
25
50
75
Date
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025

Watersheds


Andrews Creek, WA
American River, WA
Mill Creek, MT
South Fork, OR
Bull Creek, OR
Shitike, OR
Gate Creek, OR
Boulder Creek, OR
Iron Canyon, CA
Upper Truckee, CA
Trout Creek, CA
Big Sulfur, CA
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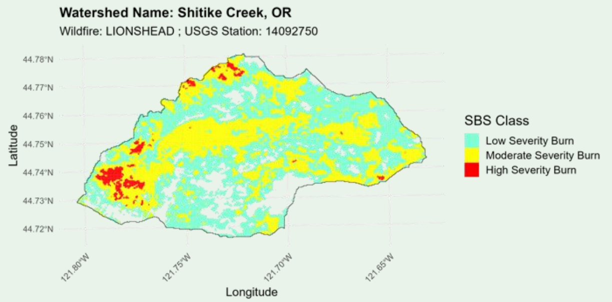
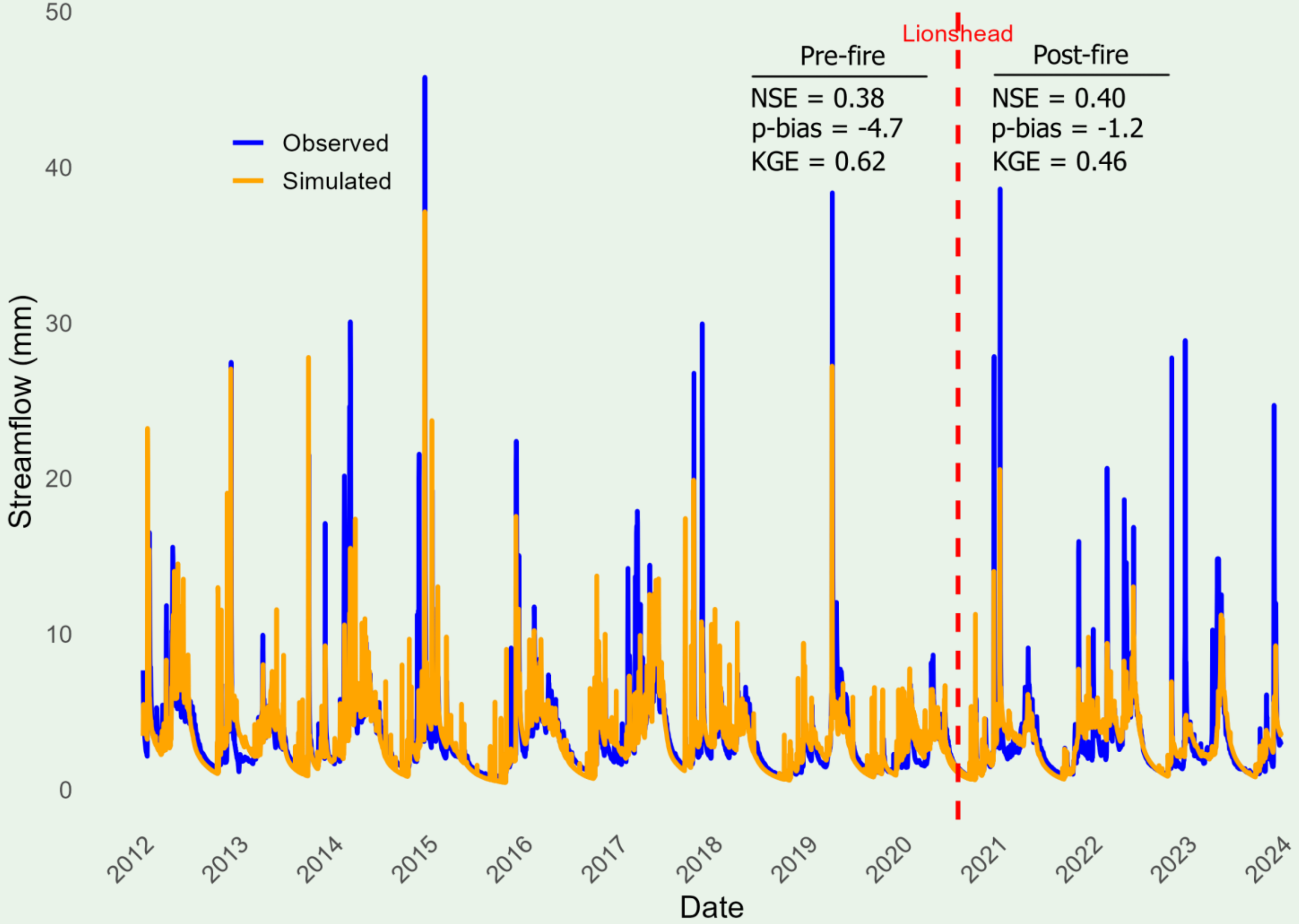
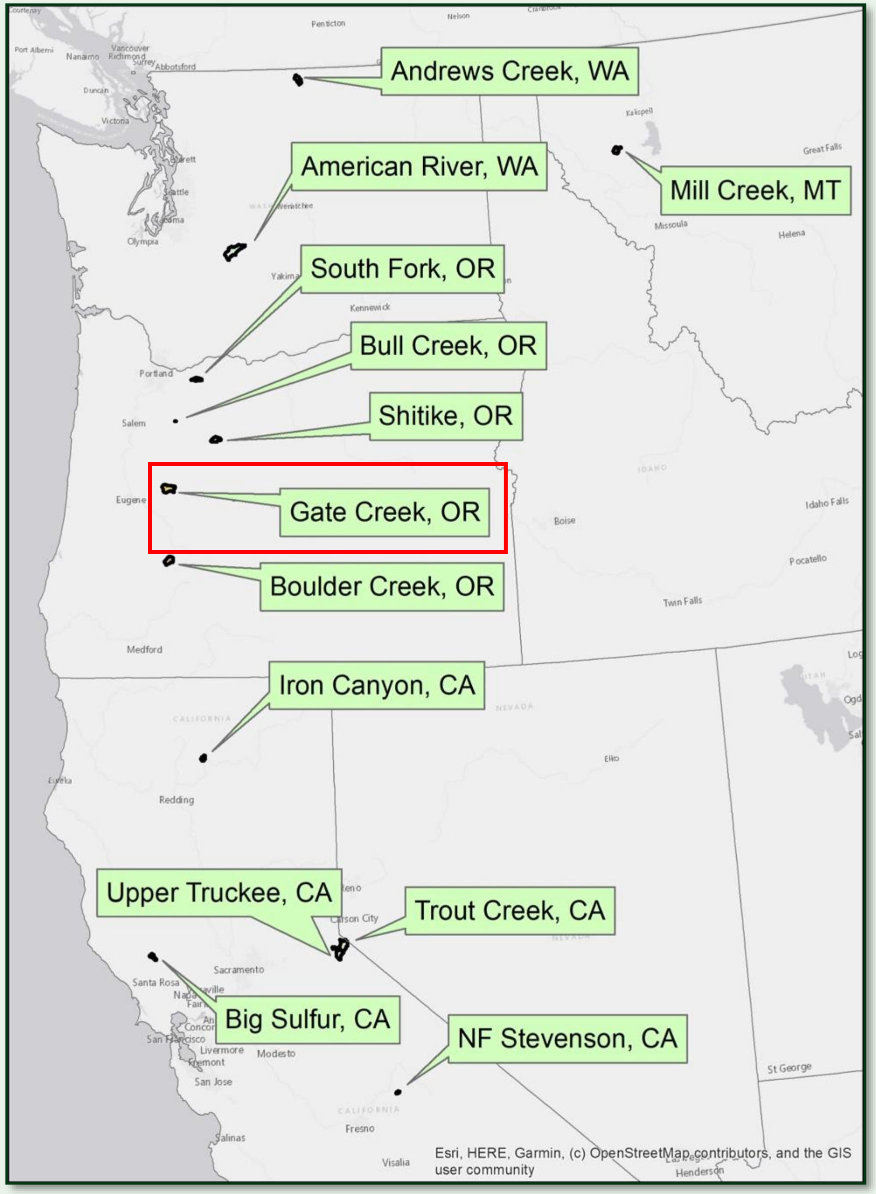

Watershed Name: Shitike Creek, OR
Wildfire: LIONSHEAD ; USGS Station: 14092750
SBS Class
Low Severity Burn
Moderate Severity Burn
High Severity Burn
Latitude
Longitude


Lionshead
Pre-fire
NSE = 0.38
p-bias = -4.7
KGE = 0.62
Post-fire
NSE = 0.40
p-bias = -1.2
KGE = 0.46
Observed
Simulated
Streamflow (mm)
Date

Watersheds


Andrews Creek, WA
American River, WA
Mill Creek, MT
South Fork, OR
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Shitike, OR
Gate Creek, OR
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Upper Truckee, CA
Trout Creek, CA
Big Sulfur, CA
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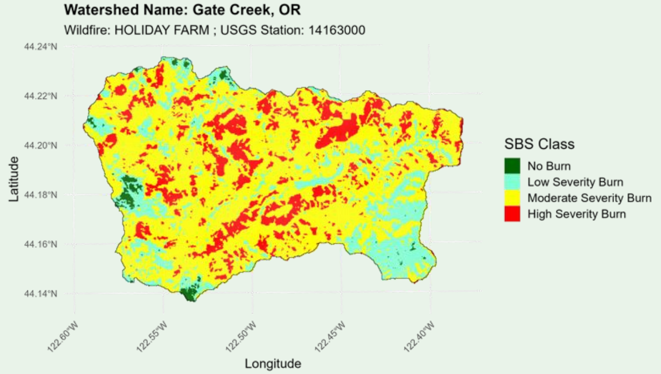
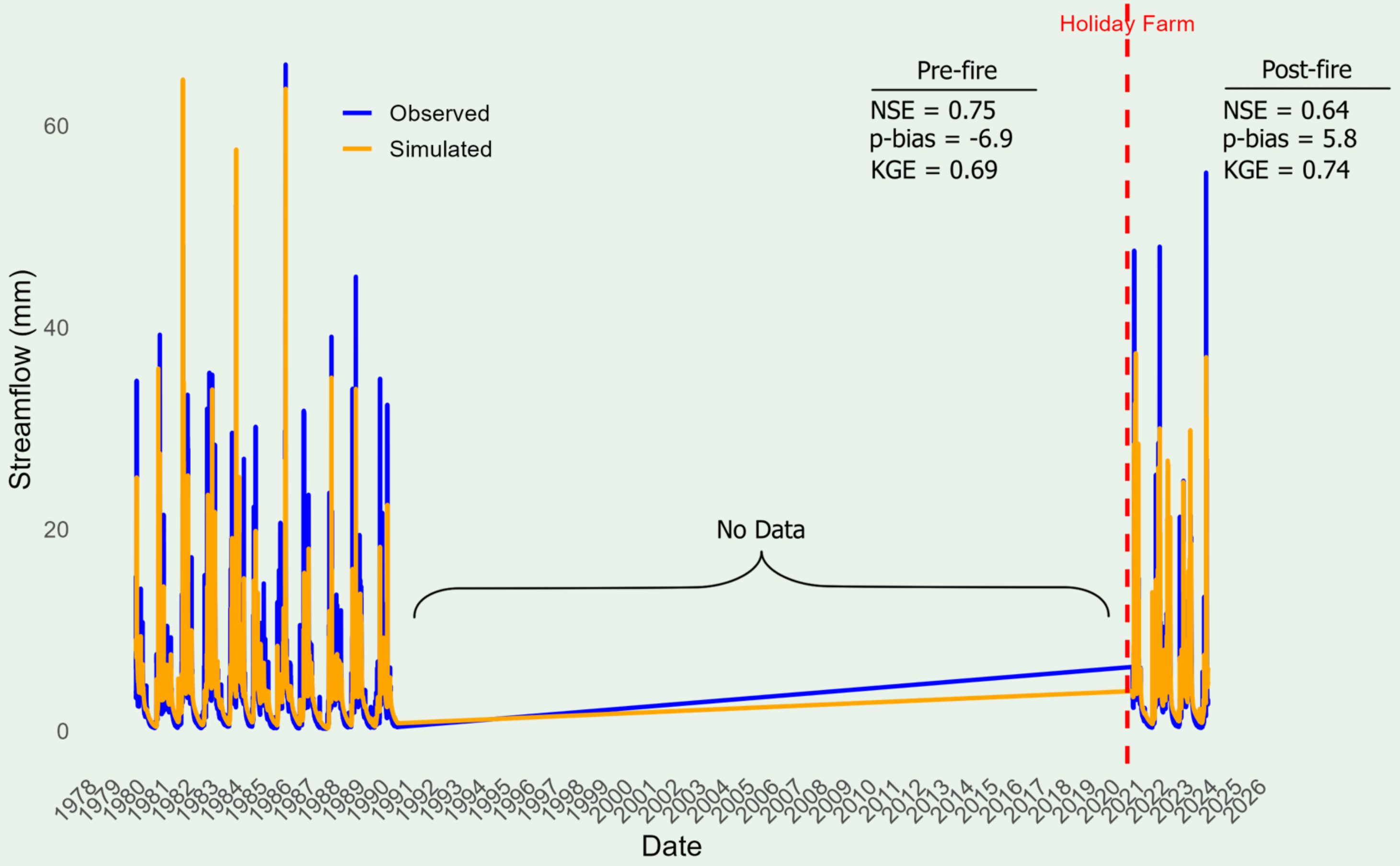
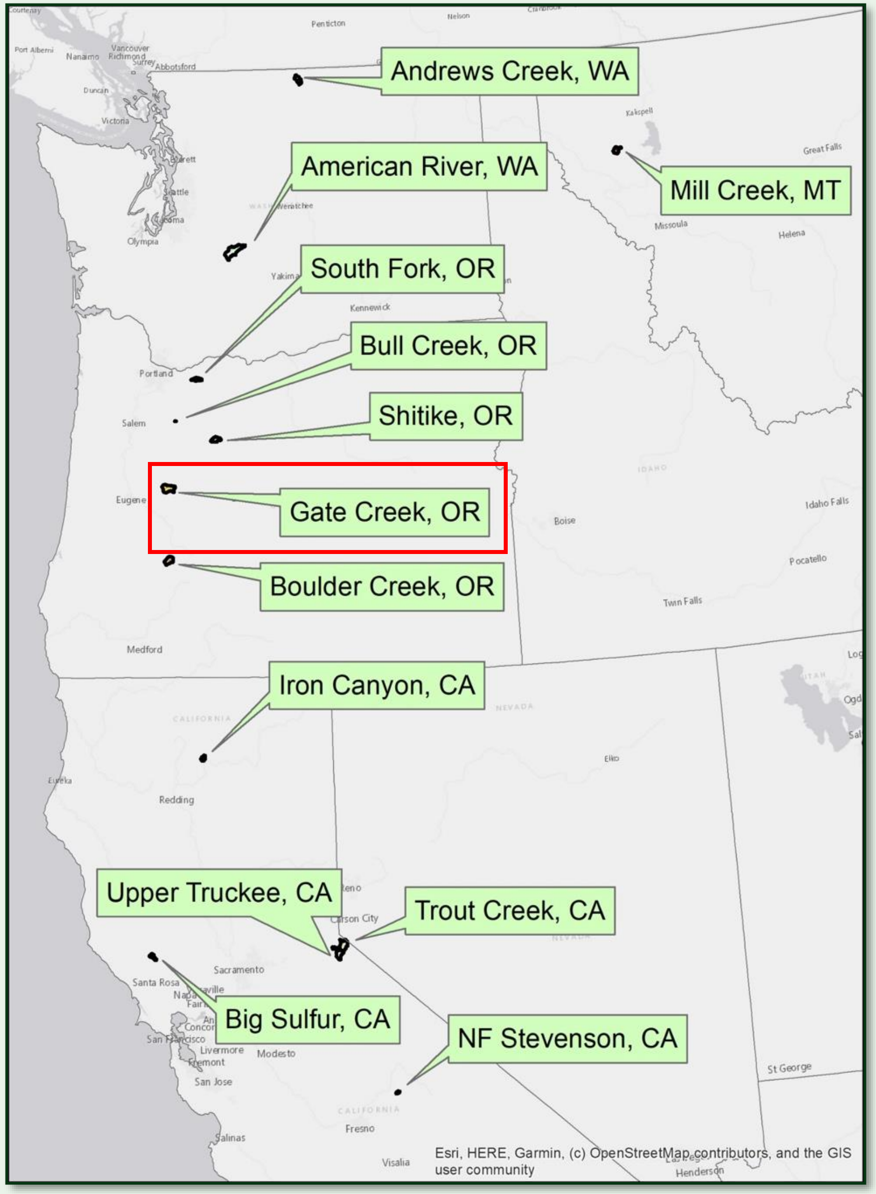

Watershed Name: Gate Creek, OR
Wildfire: HOLIDAY FARM ; USGS Station: 14163000
Latitude
Longitude
SBS Class
No Burn
Low Severity Burn
Moderate Severity Burn
High Severity Burn


Holiday Farm
Observed
Simulated
Pre-fire
NSE = 0.75
p-bias = -6.9
KGE = 0.69
Post-fire
NSE = 0.64
p-bias = 5.8
KGE = 0.74
No Data
Streamflow (mm)
Date

Watersheds


Andrews Creek, WA
American River, WA
Mill Creek, MT
South Fork, OR
Bull Creek, OR
Shitike, OR
Gate Creek, OR
Boulder Creek, OR
Iron Canyon, CA
Upper Truckee, CA
Trout Creek, CA
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NF Stevenson, CA
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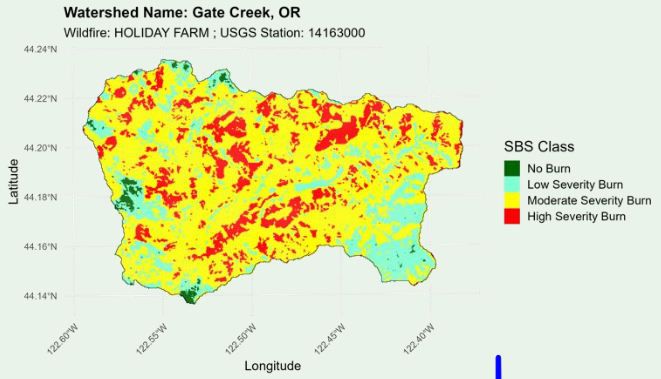
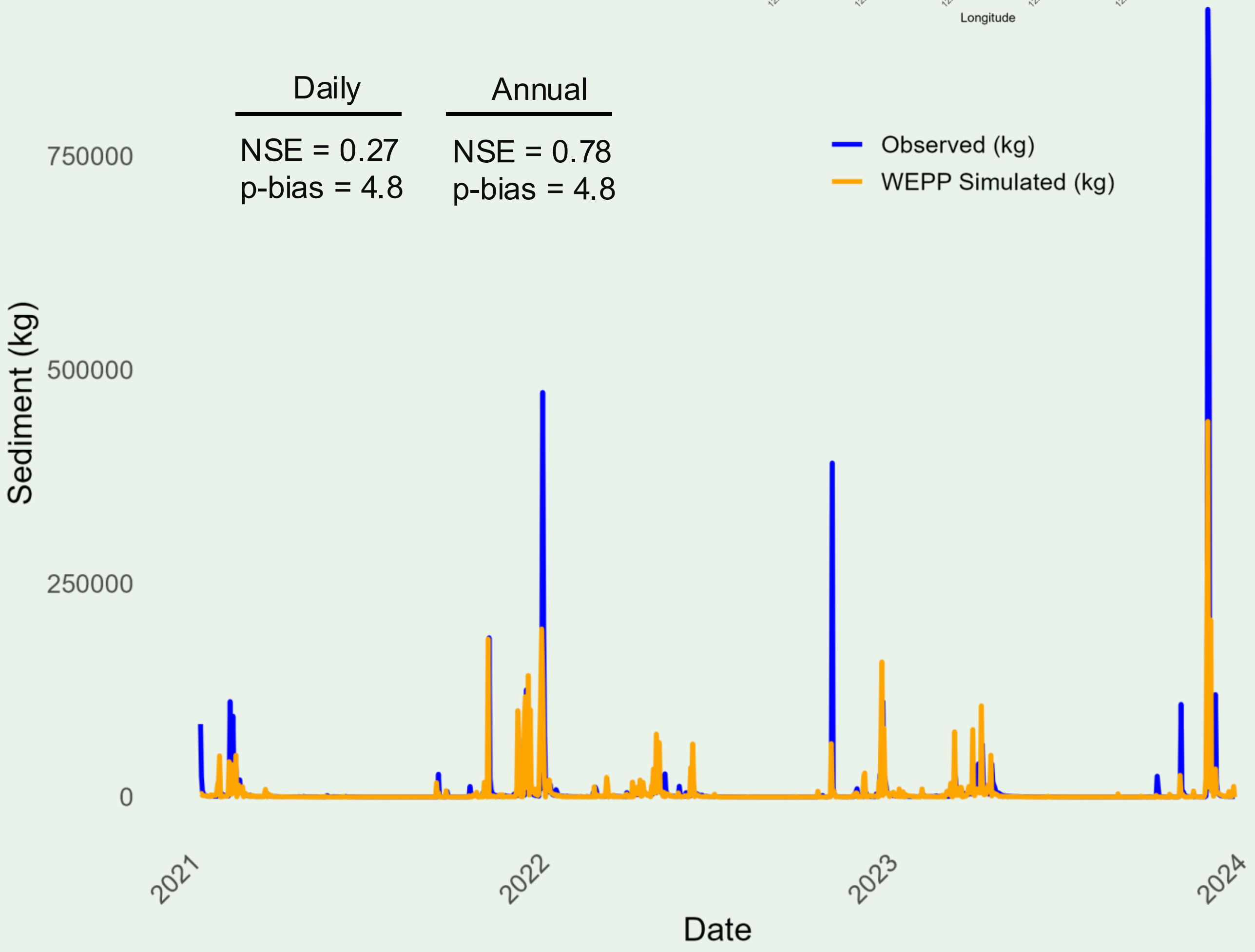
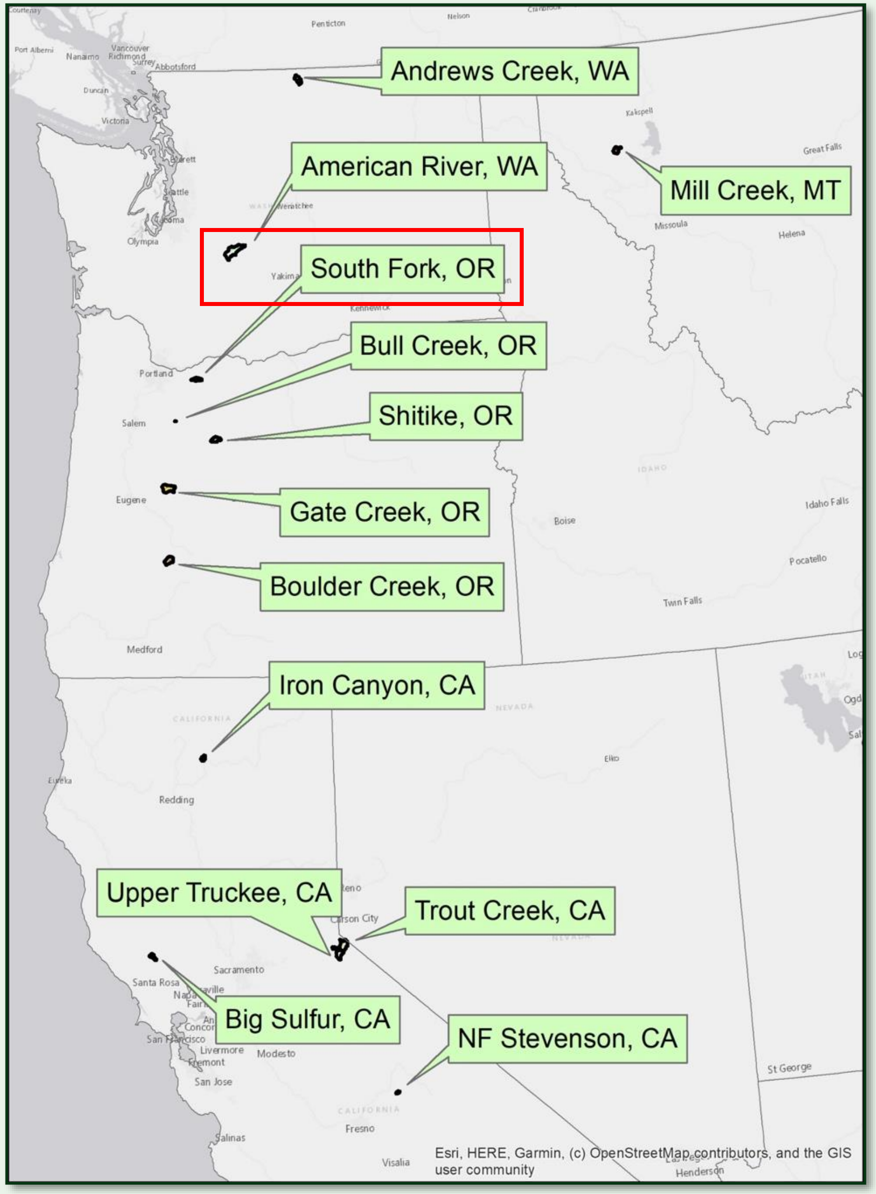

Watershed Name: Gate Creek, OR
Wildfire: HOLIDAY FARM ; USGS Station: 14163000
SBS Class
No Burn
Low Severity Burn
Moderate Severity Burn
High Severity Burn
Latitude
Longitude


Daily
NSE = 0.27
p-bias = 4.8
Annual
NSE = 0.78
p-bias = 4.8
Observed (kg)
WEPP Simulated (kg)
Sediment (kg)
750000
500000
250000
0
2021
2022
2023
2024
Date

Watersheds


Andrews Creek, WA
American River, WA
Mill Creek, MT
South Fork, OR
Bull Creek, OR
Shitike, OR
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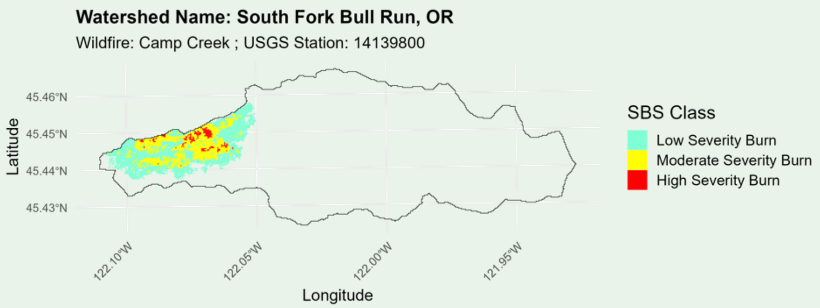
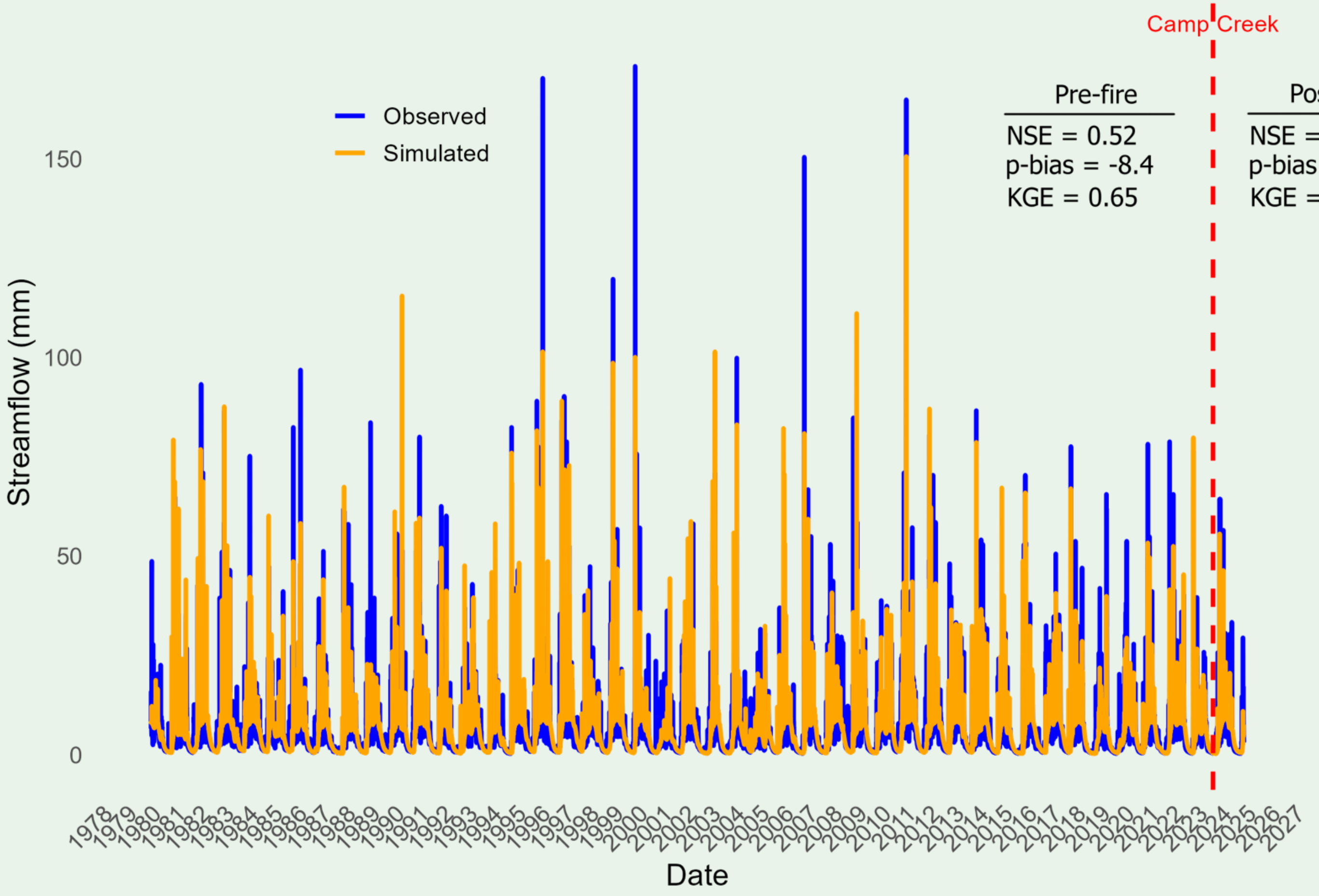
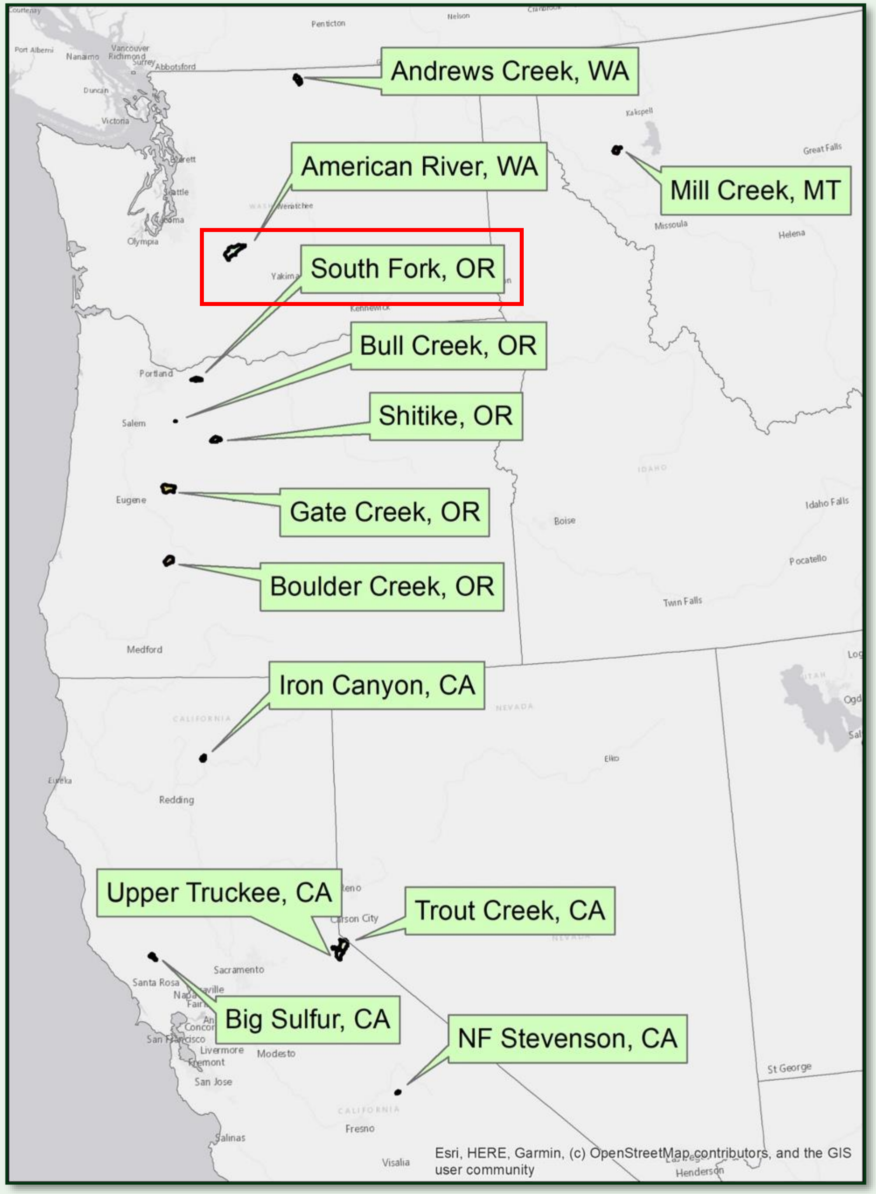
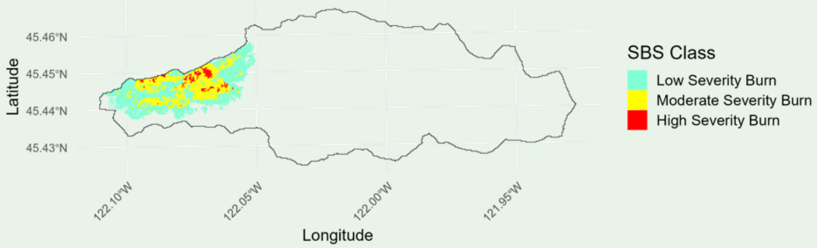
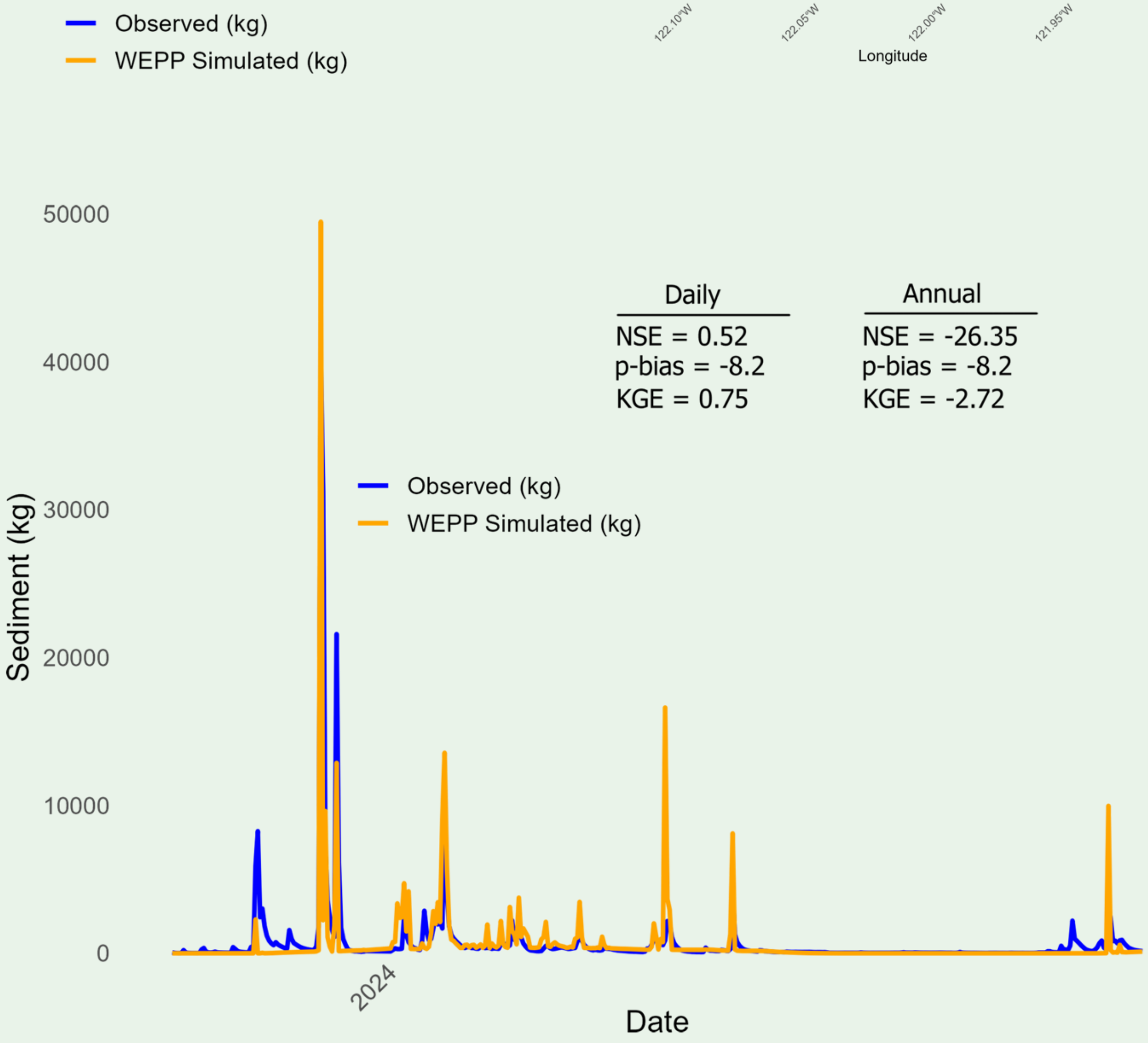

Watershed Name: South Fork Bull Run, OR
Wildfire: Camp Creek ; USGS Station: 14139800
Latitude
45.46°N
45.45°N
45.44°N
45.43°N
122.10°W
122.05°W
122.00°W
121.95°W
Longitude
SBS Class
Low Severity Burn
Moderate Severity Burn
High Severity Burn


Camp Creek
Observed
Simulated
Pre-fire
NSE = 0.52
p-bias = -8.4
KGE = 0.65
Post-fire
NSE = 0.61
p-bias = -10.1
KGE = 0.61
Streamflow (mm)
0
50
100
150
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027
Date

Watersheds







Daily	Annual
NSE = 0.52	NSE = -26.35
p-bias = -8.2	p-bias = -8.2
KGE = 0.75	KGE = -2.72

Major parameters for streamflow calibration

- **Effective hydraulic conductivity** to produce accurate surface runoff
- **Rain-snow temperature threshold** for partitioning precipitation into rain and snow
- Underlying **bedrock conductivity** to allow (or restrict) deep seepage from soil layers into baseflow reservoir
- **Baseflow coefficient** to discharge baseflow into the stream
- **Basal crop coefficient** to adjust transpiration

Where to find them and typical values

- **Effective hydraulic conductivity**

luse	stext	ki	kr	shcrit	avke	ksflag	ksatadj	ksatfac	ksatrec	pmet_kcb	pmet_rawp	rdmax	xmxlai	keffflag	lkeff
forest	clay loam	400000	2.00E-05	0.5	35	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest	loam	400000	3.00E-05	1	50	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest	sand loam	400000	8.00E-05	2	60	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest	silt loam	1000000	5.00E-05	1.5	40	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest high sev fire	clay loam	1500000	6.00E-05	0.5	14	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest high sev fire	loam	1000000	0.0001	1	15	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest high sev fire	sand loam	400000	0.00014	2	15	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest high sev fire	silt loam	1000000	0.00012	1.5	10	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest low sev fire	clay loam	1500000	5.00E-05	0.5	18	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest low sev fire	loam	1000000	8.00E-05	1	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest low sev fire	sand loam	400000	0.00012	2	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest low sev fire	silt loam	1000000	0.0001	1.5	13	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest moderate sev fire	clay loam	1500000	5.00E-05	0.5	18	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1
forest moderate sev fire	loam	1000000	8.00E-05	1	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1
forest moderate sev fire	sand loam	400000	0.00012	2	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1
forest moderate sev fire	silt loam	1000000	0.0001	1.5	13	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1

Clear Locks
Omni Migration

Where to find them and typical values

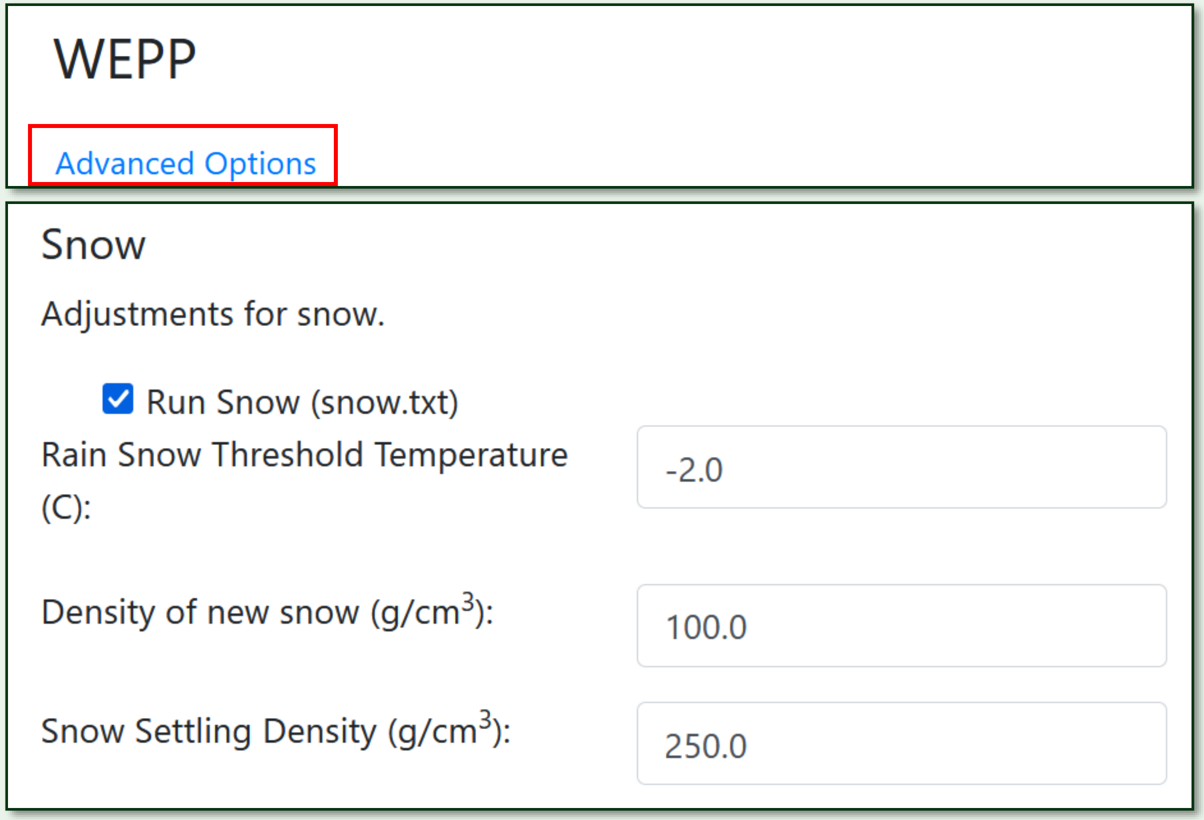
- **Effective hydraulic conductivity**

luse	stext	avke
forest	clay loam	35
forest	loam	50
forest	sand loam	60
forest	silt loam	40
forest high sev fire	clay loam	14
forest high sev fire	loam	15
forest high sev fire	sand loam	15
forest high sev fire	silt loam	10
forest low sev fire	clay loam	18
forest low sev fire	loam	20
forest low sev fire	sand loam	20
forest low sev fire	silt loam	13
forest moderate sev fire	clay loam	18
forest moderate sev fire	loam	20
forest moderate sev fire	sand loam	20
forest moderate sev fire	silt loam	13

- Units: mm/hr
- Determined from field data. Do not change unless you have a good reason
- Values for disturbed/undisturbed may be less significant west of the Cascades (e.g., in Oregon)

Where to find them and typical values

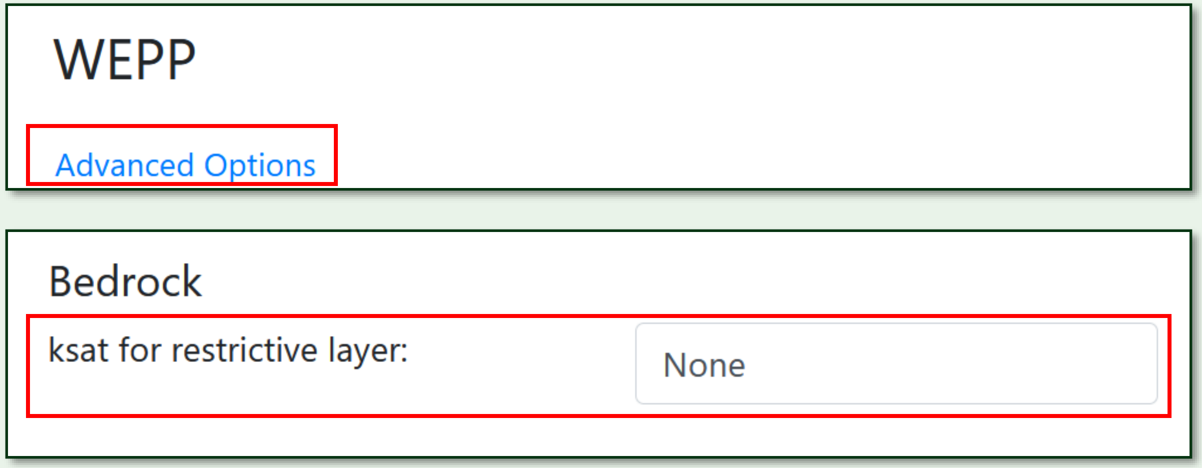
- Rain-snow temperature threshold



- Units: ^{o}C
- Can range between −3 to 1
- Use:
  - 0 (default) for CLIGEN
  - 0 (default) for Daymet
  - −2 for GridMET

Where to find them and typical values

- **Underlying bedrock conductivity**

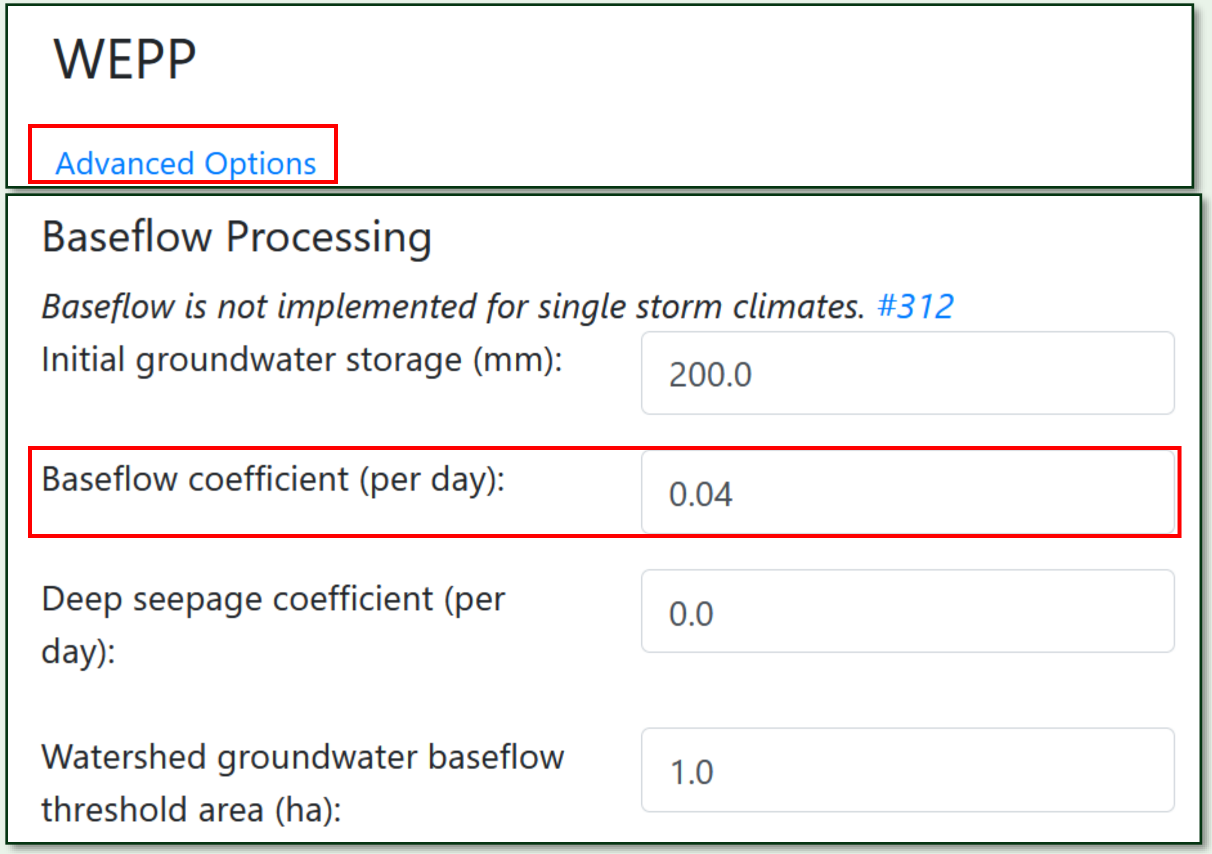


- Units: mm/hr
- Default: based on SSURGO values
  - Ksat of the last horizon/100
  - Or other rules
- Can range between 0.001 – 0.1
- Use:
  - 0.001 **restricts** flow to baseflow (more lateral flow and runoff)
  - 0.1 to **allows** flow to baseflow (less lateral flow and runoff)

Assumption: Uniform bedrock type

Where to find them and typical values

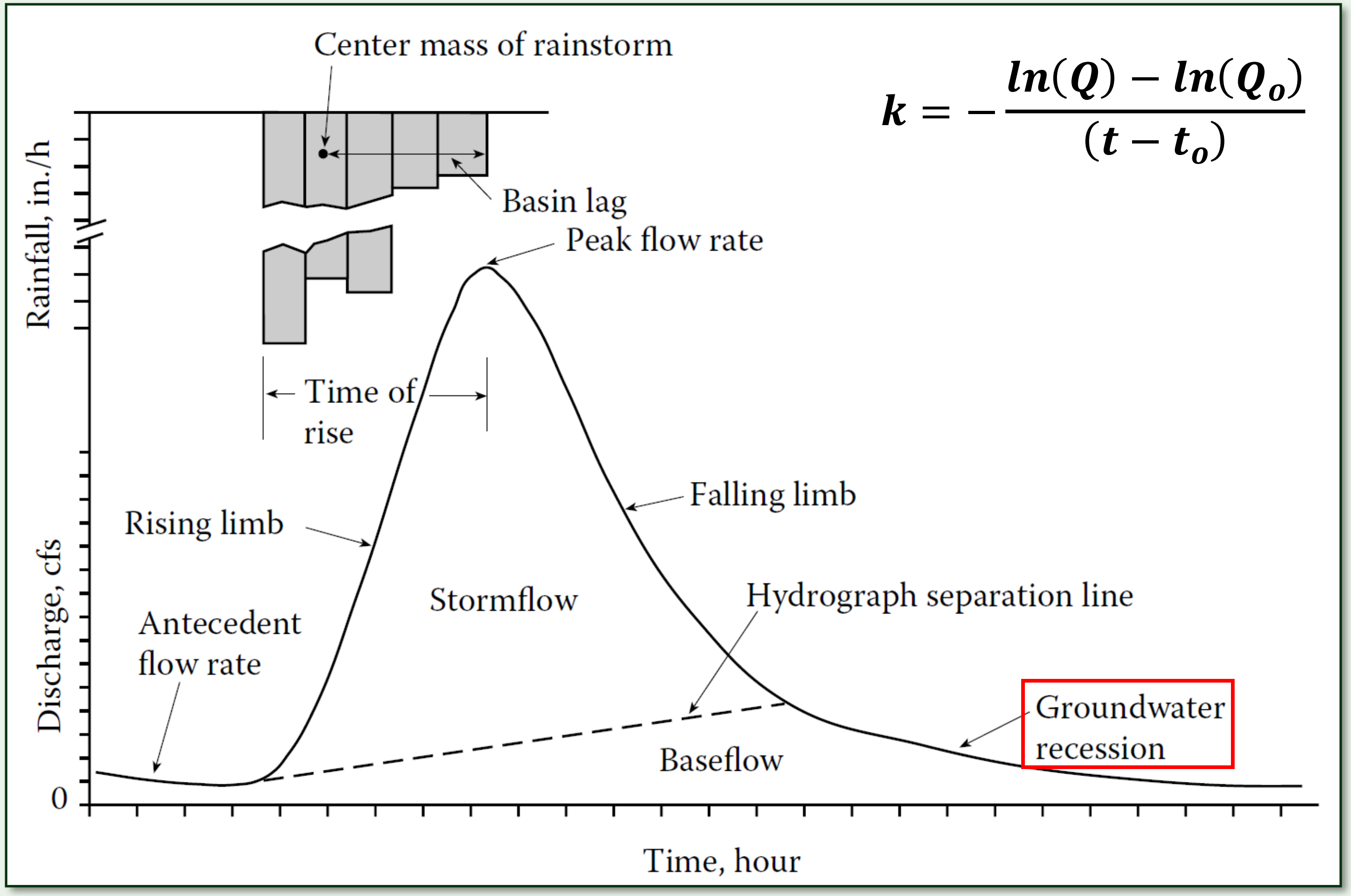
- **Baseflow coefficient**



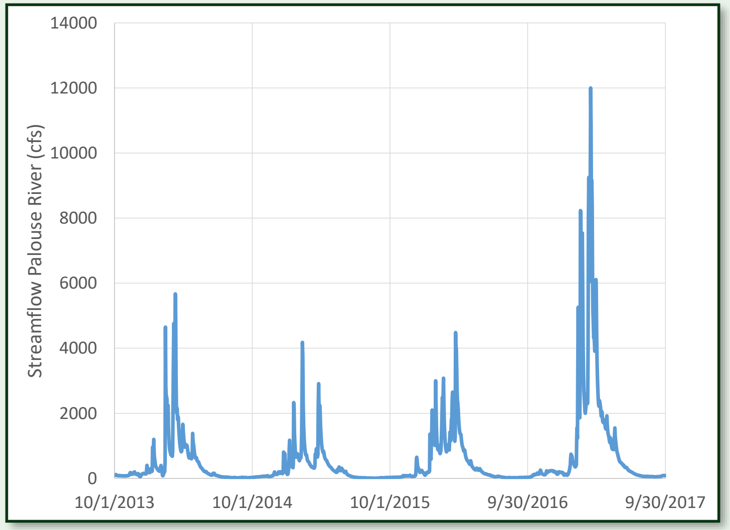
- Units: /day
- Can range between 0.01–0.04
  - 0.01 = longer recession; 100 days
  - 0.04 = shorter recession; 25 days
- Use:
  - 0.02, 0.03, or 0.04
- Can be determined from observed streamflow data; slope of streamflow during recession days

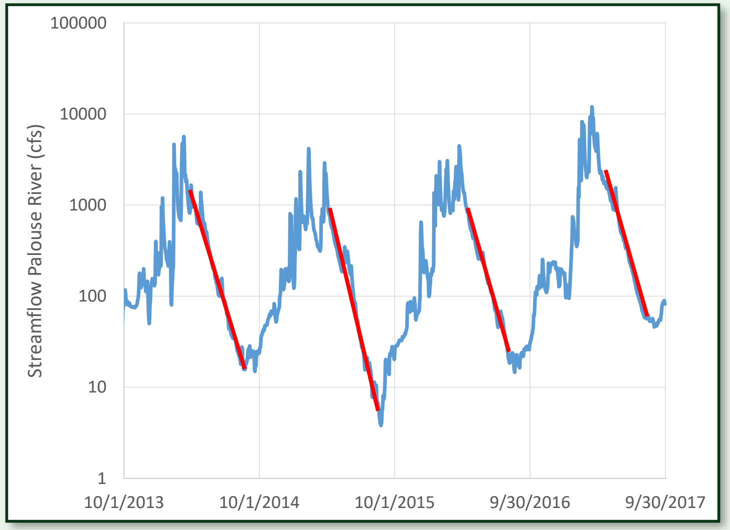
Determine from observed data

- **Baseflow coefficient**



$$k = -\frac{ln(Q) - ln(Q_o)}{(t - t_o)}$$





Where to find them and typical values

- **Basal crop coefficient**

PowerUser Panel

luse	stext	ki	kr	shcrit	avke	ksflag	ksatadj	ksatfac	ksatrec	pmet_kcb	pmet_rawp	rdmax	xmxlai	keffflag	lkeff
forest	clay loam	400000	2.00E-05	0.5	35	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest	loam	400000	3.00E-05	1	50	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest	sand loam	400000	8.00E-05	2	60	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest	silt loam	1000000	5.00E-05	1.5	40	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest high sev fire	clay loam	1500000	6.00E-05	0.5	14	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest high sev fire	loam	1000000	0.0001	1	15	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest high sev fire	sand loam	400000	0.00014	2	15	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest high sev fire	silt loam	1000000	0.00012	1.5	10	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest low sev fire	clay loam	1500000	5.00E-05	0.5	18	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest low sev fire	loam	1000000	8.00E-05	1	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest low sev fire	sand loam	400000	0.00012	2	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest low sev fire	silt loam	1000000	0.0001	1.5	13	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest moderate sev fire	clay loam	1500000	5.00E-05	0.5	18	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1
forest moderate sev fire	loam	1000000	8.00E-05	1	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1
forest moderate sev fire	sand loam	400000	0.00012	2	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1
forest moderate sev fire	silt loam	1000000	0.0001	1.5	13	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1

Where to find them and typical values

- **Basal crop coefficients**

luse	stext	pmet_kcb
forest	clay loam	0.95
forest	loam	0.95
forest	sand loam	0.95
forest	silt loam	0.95
forest high sev fire	clay loam	0.95
forest high sev fire	loam	0.95
forest high sev fire	sand loam	0.95
forest high sev fire	silt loam	0.95
forest low sev fire	clay loam	0.95
forest low sev fire	loam	0.95
forest low sev fire	sand loam	0.95
forest low sev fire	silt loam	0.95
forest moderate sev fire	clay loam	0.95
forest moderate sev fire	loam	0.95
forest moderate sev fire	sand loam	0.95
forest moderate sev fire	silt loam	0.95

- Units: NA
- For forests use default: 0.95 (default; well-watered conditions)
- Use mainly for undisturbed conditions:
  - 1.2 to **increase** ET (decrease annual water yield; well-watered conditions)
  - 0.65 to **reduce** ET (increase annual water yield; during drought conditions)
- No need to modify for disturbed conditions, as the reduction in ET is accounted for by a reduction in LAI within the model.

Major parameters for sediment calibration

Types of soil erosion

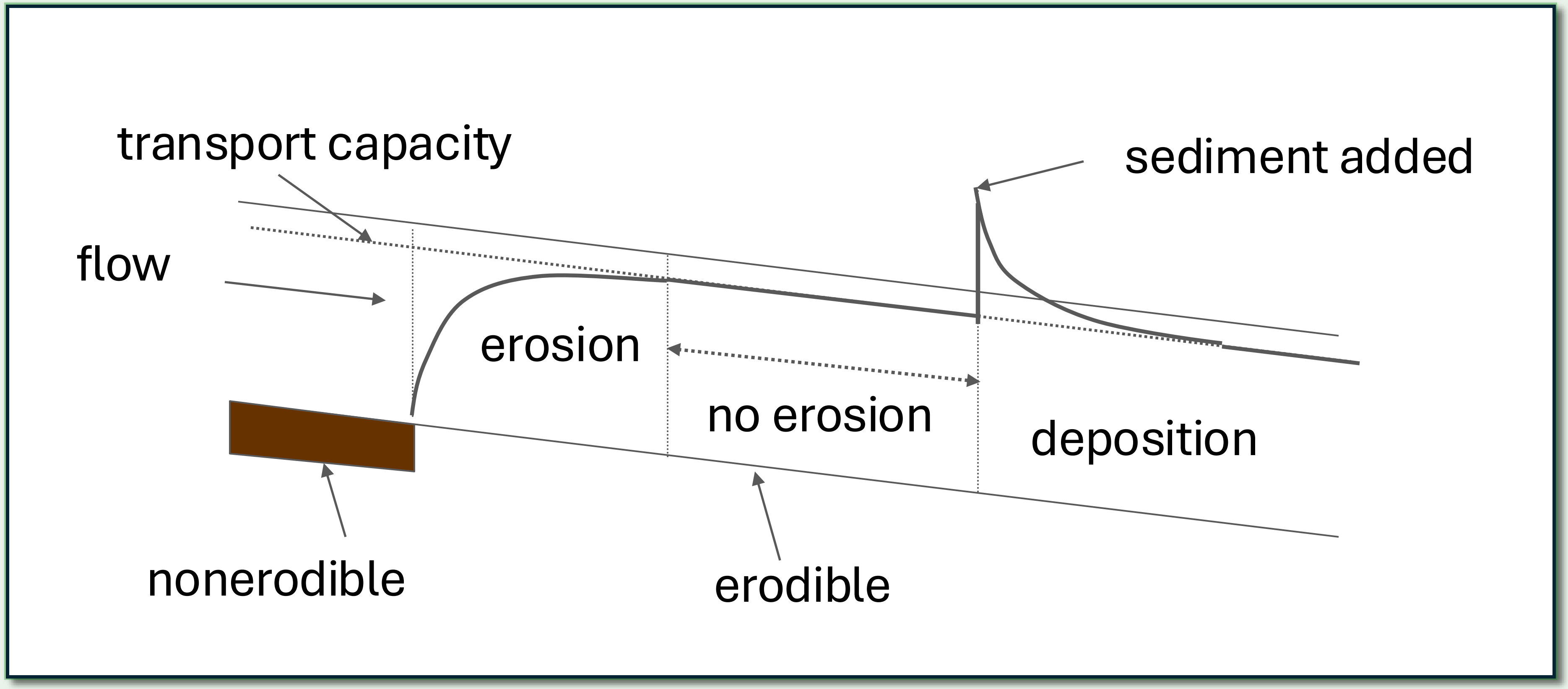
Inter-rill erosion

Rill erosion

Gully erosion X Not with WEPPcloud

Channel erosion

Sediment Processes and the Role of Transport Capacity



Process

- **Detachment and Transport** (transport capacity > sediment load; hydraulic shear > critical shear)
- **Deposition** (transport capacity < sediment load)

How Wildfire Alters Hillslope and Channel Erosion

Before Wildfire

- 🟢 **Hillslope erosion: Low**
- 🔵 **Channel erosion: High**
- 💧 Clean runoff
  - → **channels actively erode**

After Wildfire

- 🔴 **Hillslope erosion: High**
- ⚪ **Channel erosion: Low (Deposition)**
- Sediment-laden runoff
  - → fills stream
  - → **reaches transport capacity**
  - → sediment **deposits**

Major parameters for sediment calibration (hillslope)

- **Interrill- and rill-erodibilities** and **critical shear** for sediment detachment, transport, and deposition

Interrill erodibility (K_i)

- **Interrill areas** are the **sheet flow zones** between small channels (rills) on a hillslope.
- **Interrill-erodibility** measures the **soil's susceptibility to detachment** by **raindrop impact and shallow sheet flow**.
- It's influenced by:
  - Soil texture
  - Surface cover (e.g., vegetation, mulch)
  - Soil structure and cohesion
- **Units**: kg·s/m^4

Rill erodibility (K_r)

- **Rills** are **small channels** formed by concentrated flow on hillslopes.
- **Rill-erodibility** is the soil's susceptibility to **detachment by concentrated flow** (not raindrop impact).
- Rill erosion is generally more intense on steeper and/or longer slopes and can cause greater sediment transport than interrill erosion.
- **Units**: s/m

Critical Shear Stress (τ_c)

- This is the **minimum hydraulic shear stress** required to **initiate detachment** of soil particles in rills.
- Below this threshold, the flow is not energetic enough to detach soil.
- It acts as a **resistance parameter** in rill erosion models.
- **Units**: N/m^2 or Pa

Major parameters for sediment calibration (hillslope)

- **Interrill- and rill-erodibilities and critical shear**

PowerUser Panel ×

luse	stext	ki	kr	shcrit	avke	ksflag	ksatadj	ksatfac	ksatrec	pmet_kcb	pmet_rawp	rdmax	xmxlai	keffflag	lkeff
forest	clay loam	400000	2.00E-05	0.5	35	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest	loam	400000	3.00E-05	1	50	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest	sand loam	400000	8.00E-05	2	60	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest	silt loam	1000000	5.00E-05	1.5	40	0	0	1.5	0.3	0.95	0.8	2	14	0	-9999
forest high sev fire	clay loam	1500000	6.00E-05	0.5	14	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest high sev fire	loam	1000000	0.0001	1	15	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest high sev fire	sand loam	400000	0.00014	2	15	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest high sev fire	silt loam	1000000	0.00012	1.5	10	0	1	100	0.3	0.95	0.8	0.3	2	1	0.1
forest low sev fire	clay loam	1500000	5.00E-05	0.5	18	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest low sev fire	loam	1000000	8.00E-05	1	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest low sev fire	sand loam	400000	0.00012	2	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest low sev fire	silt loam	1000000	0.0001	1.5	13	0	0	1.3	0.3	0.95	0.8	0.3	4	1	10
forest moderate sev fire	clay loam	1500000	5.00E-05	0.5	18	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1
forest moderate sev fire	loam	1000000	8.00E-05	1	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1
forest moderate sev fire	sand loam	400000	0.00012	2	20	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1
forest moderate sev fire	silt loam	1000000	0.0001	1.5	13	0	0	1.3	0.3	0.95	0.8	0.3	4	1	1

Major parameters for sediment calibration (hillslope)

- **Interrill- and rill-erodibilities and critical shear**

luse	stext	ki	kr	shcrit
forest	clay loam	400000	2.00E-05	1
forest	loam	400000	3.00E-05	1.5
forest	sand loam	400000	8.00E-05	2
forest	silt loam	1000000	5.00E-05	2
forest high sev fire	clay loam	1500000	6.00E-07	1
forest high sev fire	loam	1000000	0.000001	1.5
forest high sev fire	sand loam	400000	0.0000014	2
forest high sev fire	silt loam	1000000	0.0000012	2
forest low sev fire	clay loam	1500000	5.00E-06	1
forest low sev fire	loam	1000000	8.00E-06	1.5
forest low sev fire	sand loam	400000	0.000012	2
forest low sev fire	silt loam	1000000	0.00001	2
forest moderate sev fire	clay loam	1500000	5.00E-06	1
forest moderate sev fire	loam	1000000	8.00E-06	1.5
forest moderate sev fire	sand loam	400000	0.000012	2
forest moderate sev fire	silt loam	1000000	0.00001	2

ki = interrill erodibility

- Do not change

kr = rill erodibility

- Do not change
- In West Casases divide by 10 or 100*

shcrit = critical shear

- Do not change

** New unpublished research*

Major parameters for sediment calibration (watershed)

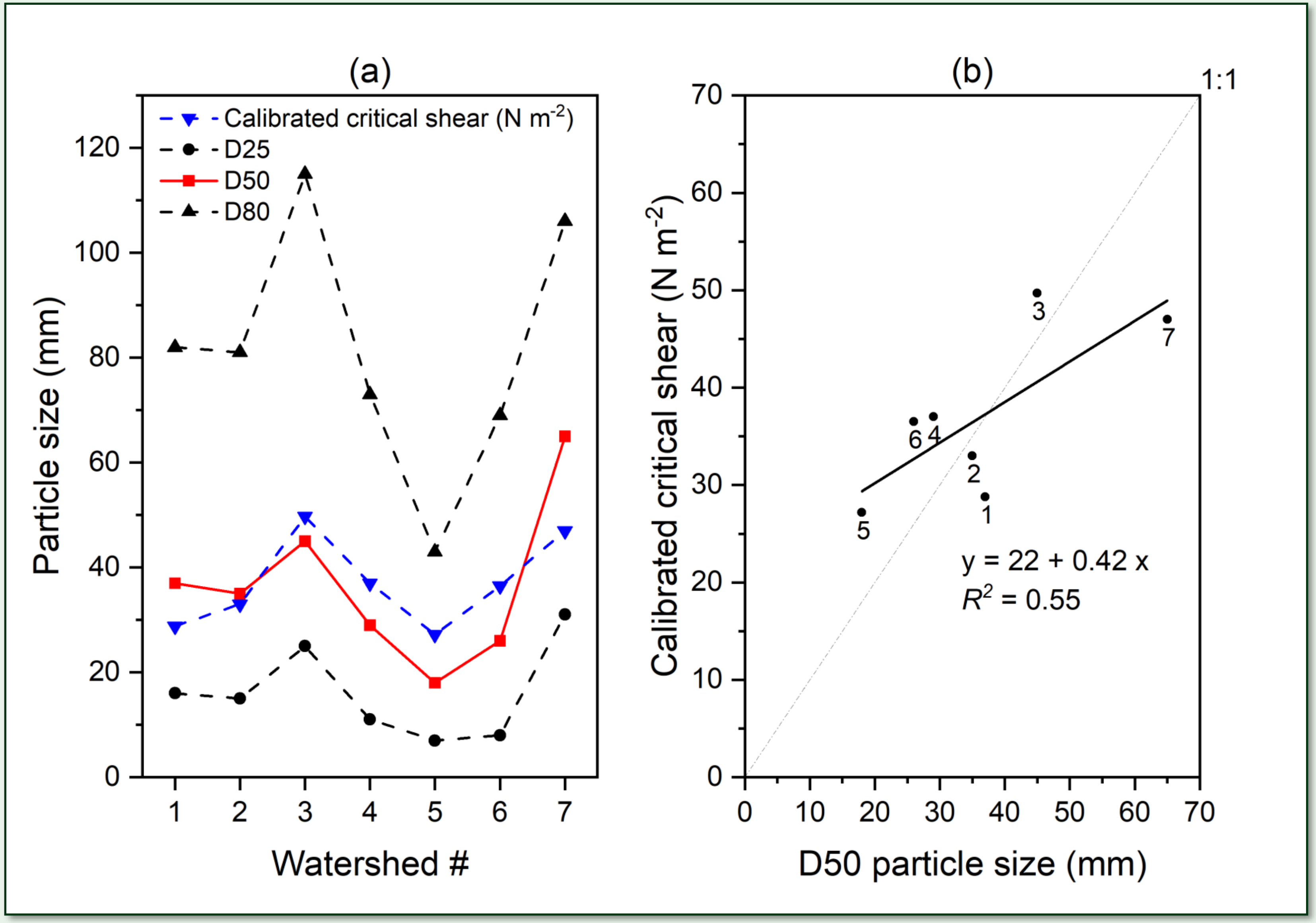
- **Critical shear stress** of channel bed substrate

- **Channel Critical Shear Stress (τ_c)**

- This is the **minimum shear stress** required to initiate the movement of sediment particles on the **bed of a channel** (such as a river, stream, or canal).
- In simple terms, it's the threshold force per unit area that water flow must exert on the channel bed to start **erosion or sediment transport**.
- **Units**: N/m^2 or Pa

Major parameters for sediment calibration (watershed)

- **Critical shear**

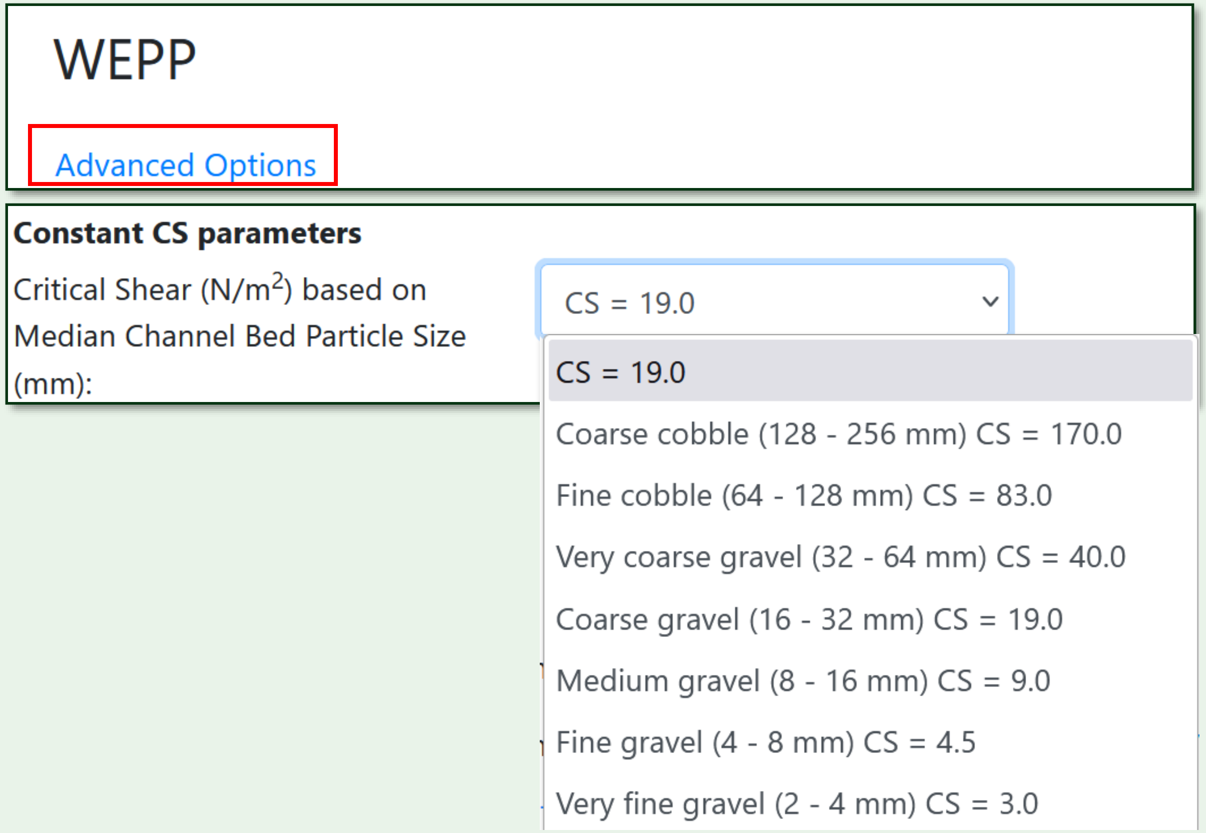


Srivastava et al., 2020

https://www.sciencedirect.com/science/article/pii/S0048969719348697

Major parameters for sediment calibration (watershed)

- **Critical shear**



- Ranges between 0.05 (fine silt) and 170 coarse cobble
- Lake Tahoe: **10–180**
- Oregon (near Portland)/Washington (near Seattle): **83**
- North Idaho (Mika Creek): **35–40**
- Oregon (near Eugene): **70**

Assumption: Same channel bed particle size in all channels

Major parameters for sediment calibration (watershed)

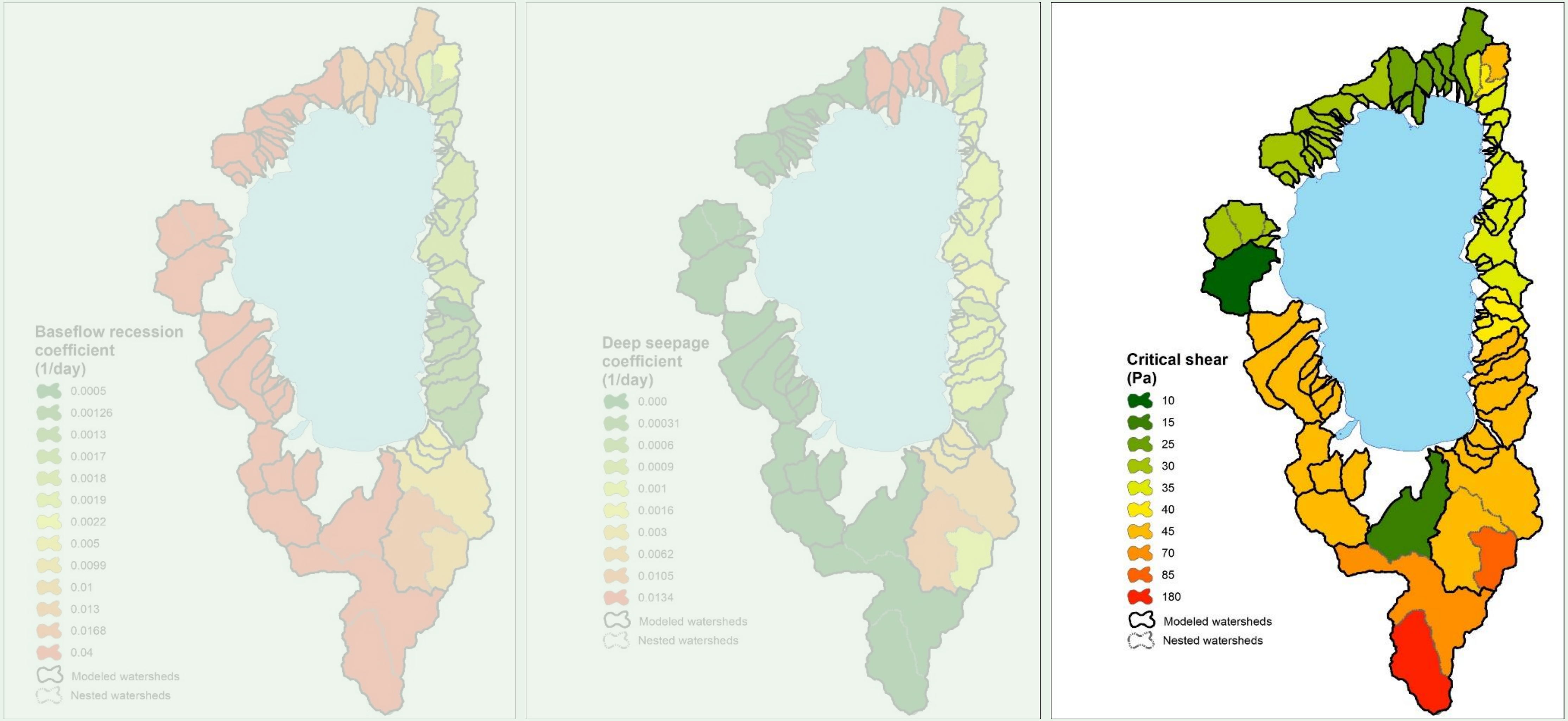
- Critical shear

Particle classification name	Ranges of particle diameters		Shields parameter (dimensionless)	Critical bed shear stress (τ_c) (N/m^2)
	φ	mm		
Coarse cobble	-7 – -8	128 – 256	0.054 – 0.054	112 – 223
Fine cobble	-6 – -7	64 – 128	0.052 – 0.054	53.8 – 112
Very coarse gravel	-5 – -6	32 – 64	0.05 – 0.052	25.9 – 53.8
Coarse gravel	-4 – -5	16 – 32	0.047 – 0.05	12.2 – 25.9
Medium gravel	-3 – -4	8 – 16	0.044 – 0.047	5.7 – 12.2
Fine gravel	-2 – -3	4 – 8	0.042 – 0.044	2.7 – 5.7
Very fine gravel	-1 – -2	2 – 4	0.039 – 0.042	1.3 – 2.7
Very coarse sand	0 – -1	1 – 2	0.029 – 0.039	0.47 – 1.3
Coarse sand	1 – 0	0.5 – 1	0.033 – 0.029	0.27 – 0.47
Medium sand	2 – 1	0.25 – 0.5	0.048 – 0.033	0.194 – 0.27
Fine sand	3 – 2	0.125 – 0.25	0.072 – 0.048	0.145 – 0.194
Very fine sand	4 – 3	0.0625 – 0.125	0.109 – 0.072	0.110 – 0.145
Coarse silt	5 – 4	0.0310 – 0.0625	0.165 – 0.109	0.0826 – 0.110
Medium silt	6 – 5	0.0156 – 0.0310	0.25 – 0.165	0.0630 – 0.0826
Fine silt	7 – 6	0.0078 – 0.0156	0.3 – 0.25	0.0378 – 0.0630

[Simulation of Flow, Sediment Transport, and Sediment Mobility of the Lower Coeur d'Alene River, Idaho]

Major parameters for sediment calibration (watershed)

- Critical shear



General guidelines for calibration

Start with streamflow for undisturbed conditions

Where is streamflow coming from?

- Lateral flow, baseflow, and possibly saturation-excess runoff

1. Make sure climate is representative of the watershed
    - Rain-snow threshold : use 0 for CLIGEN and Daymet or −2 for GridMET
2. Check the Average Annual Water Yield (P−Q = ET)
    - If over-estimating → increase ET (increase basal crop coefficient)
    - If under-estimating → decrease ET (decrease basal crop coefficient)

General guidelines for calibration

3. Check Peak Discharge for different return periods
    - If over-estimating → increase bedrock conductivity
    - If under-estimating → decrease bedrock conductivity
4. Check streamflow recession coefficient (baseflow)
    - Determine baseflow coefficient from observed data or use default

General guidelines for calibration

Continue with sediment for undisturbed conditions

Where is sediment coming from?

- Hillslopes (less likely) and channels (more likely)

5. Calibrate channel critical shear for sediment transport in channels
    - Channel critical shear = D50 particle size in mm
    - High values (e.g. 70–170) = less channel erosion (West Cascades)
    - Low values (e.g. 20 – 50) = more channel erosion (Inland PNW)

General guidelines for calibration

Streamflow for wildfire conditions (use the SBS map)

Where is streamflow coming from?

- Infiltration-excess runoff

Make no changes. WEPPcloud is parameterized to alter soil and vegetation parameters based on severity

Sediment for wildfire conditions (use the SBS map)

Where is sediment coming from?

- Hillslopes (more likely) and channels (less likely)

Make no changes. WEPPcloud is parameterized to alter soil and vegetation parameters based on severity

weppy-win-bootstrap

https://github.com/rogerlew/wepppy-win-bootstrap

Python-based tool that allows you to download and run projects on a Windows computer.

Downloading a project with python script

Use the download_weppcloud_project.py script and provide the run_id and local destination directory as arguments

e.g.

```
python3 download_weppcloud_project.py rlew-mucky-pepperoni C:\Users\rog
```

This will download the zip to C:\Users\roger\rlew-mucky-pepperoni.zip and extract the project to C:\Users\roger\rlew-mucky-pepperoni

Running a project

Use the run_project.py script to run wepp. By default it runs the hillslopes in parallel.

e.g.

```
python3 run_project.py C:\Users\roger\rlew-mucky-pepperoni
```

Thank you!

Questions?

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srivanu@uidaho.edu