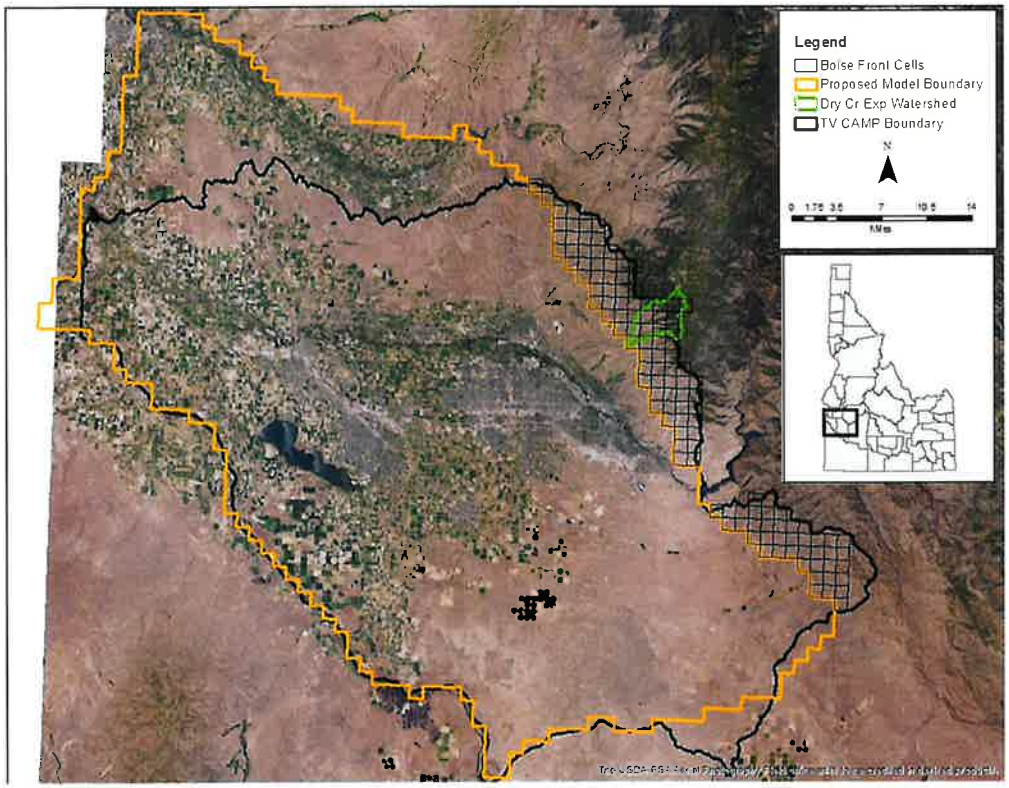
Tributary Underflow along the Northern Boundary

Presented by Alex Moody

August 30th, 2019

Previous recommendation

- Calculate relationship between elevation and infiltration to calculate underflow
- Make Boise Front Recharge an adjustable parameter and use the various estimates to establish an acceptable range
  - 0 – 9000 AF Annually
- Will not contribute significantly to predictive uncertainty



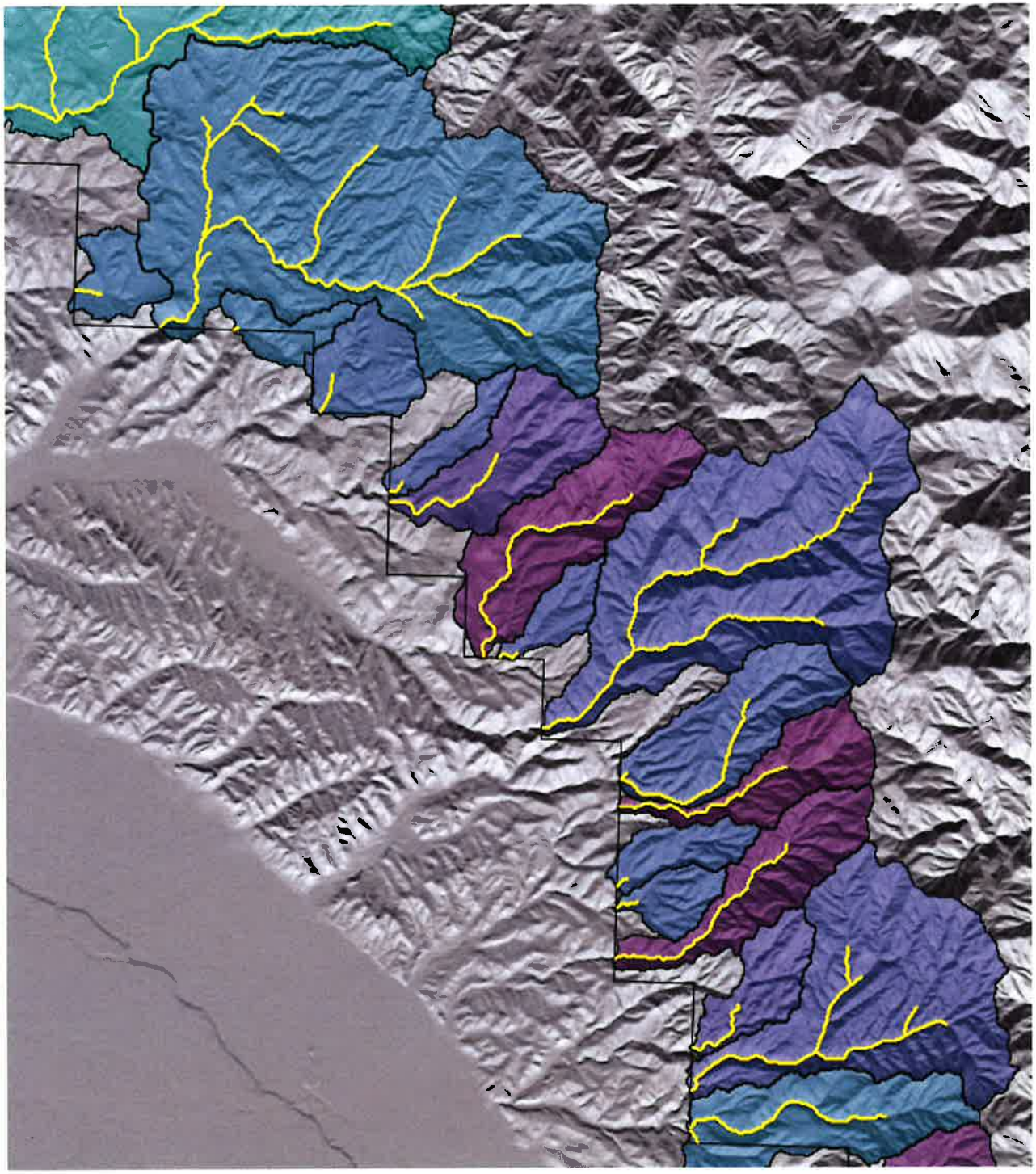
Updates

- Modified Wylie's infiltration fraction method to use raster math
- Spatial distribution: delineated tributary basins and assign underflow to grid cells
  - Expand to Payette mountain front
- Temporal distribution

Tributary basin delineation

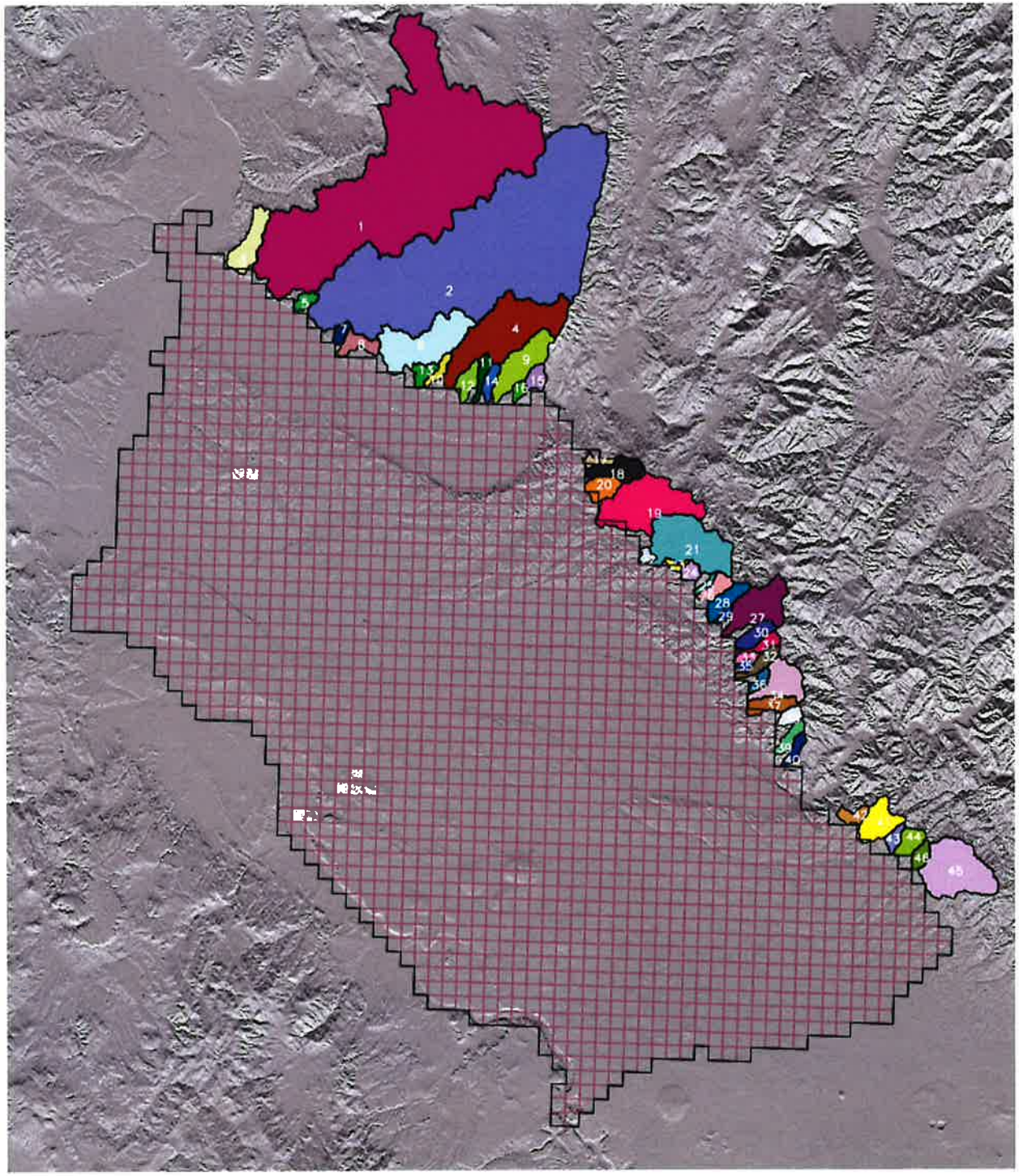
Build flow accumulation raster derived from 30m DEM

1. Calculate drainage directions
2. Accumulate flow
3. Extract streams and define outlet at model boundary
4. Delineate all cells draining to outlet

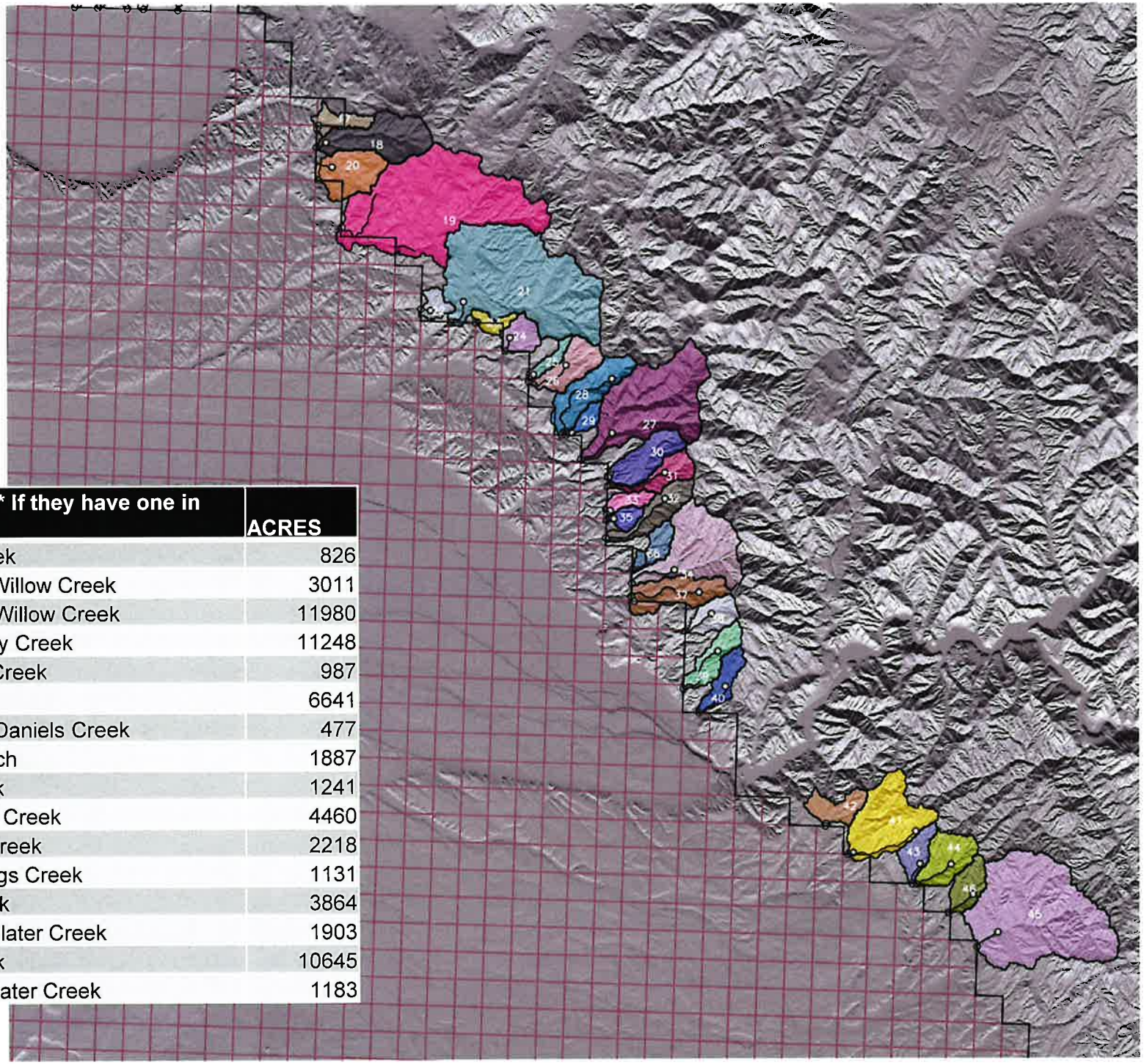


Proposed tributary basins

- Align well with National Hydrography Database watersheds and streams
- Some cells recharged by multiple tributaries

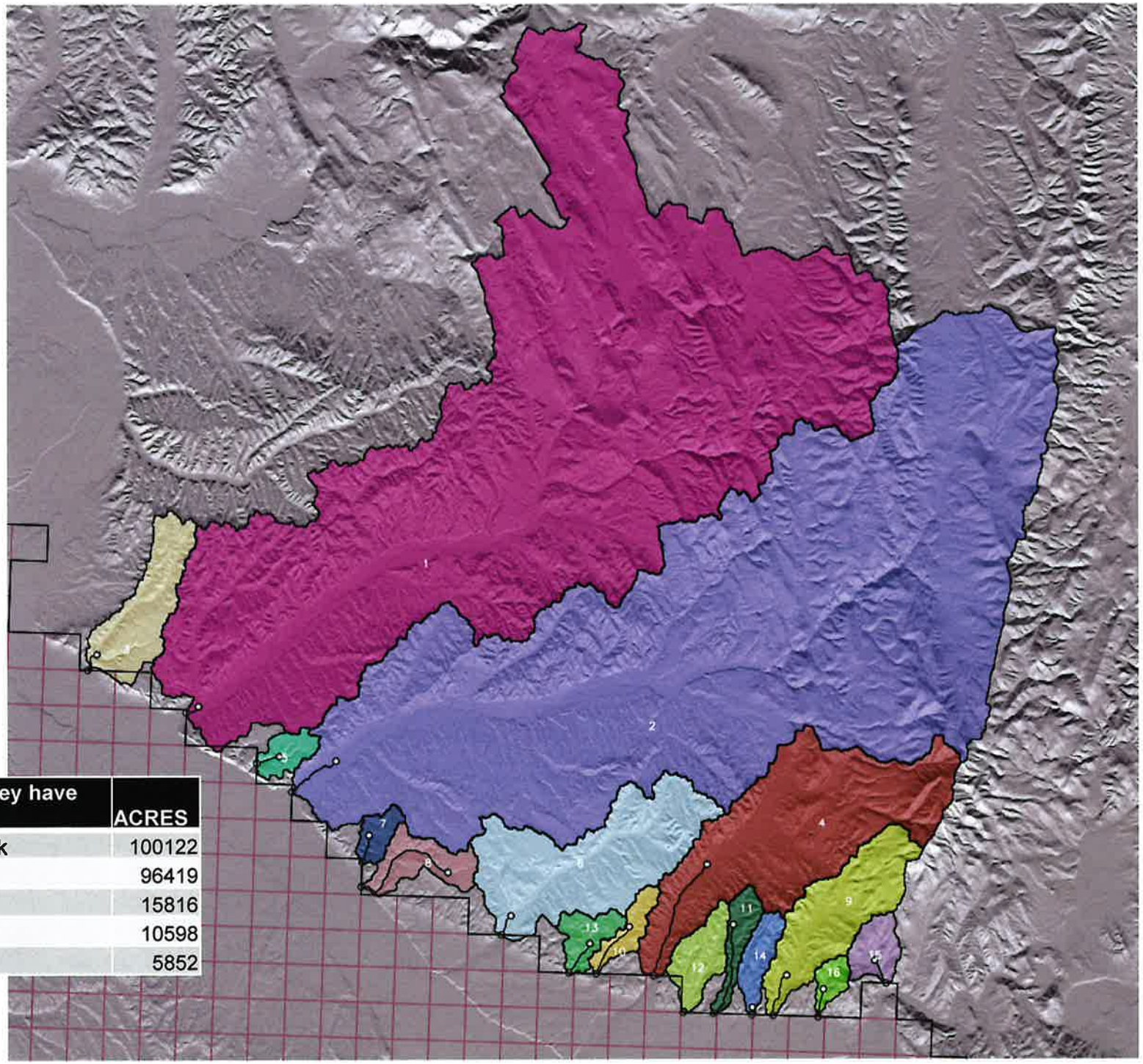


Boise



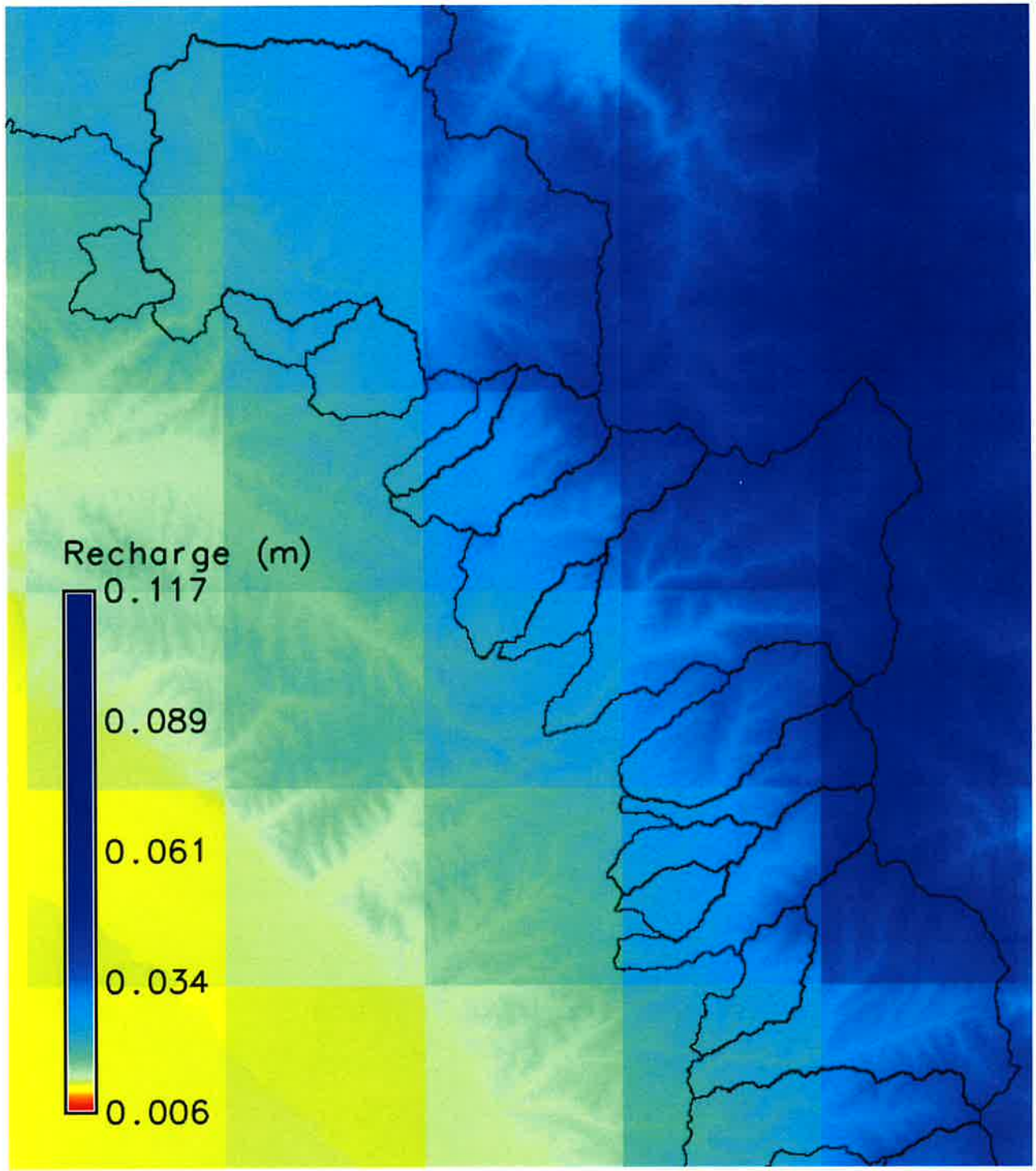
Cat (GIS)	Trib name (* If they have one in NHD)	ACRES
17	Schiller Creek	826
18	North Fork Willow Creek	3011
19	South Fork Willow Creek	11980
21	Spring Valley Creek	11248
24	McFarland Creek	987
27	Dry Creek	6641
29	South Fork Daniels Creek	477
30	Stewart Gulch	1887
31	Crane Creek	1241
34	Cottonwood Creek	4460
37	Picket Pin Creek	2218
38	Warm Springs Creek	1131
41	Blacks Creek	3864
44	West Fork Slater Creek	1903
45	Indian Creek	10645
46	East Fork Slater Creek	1183

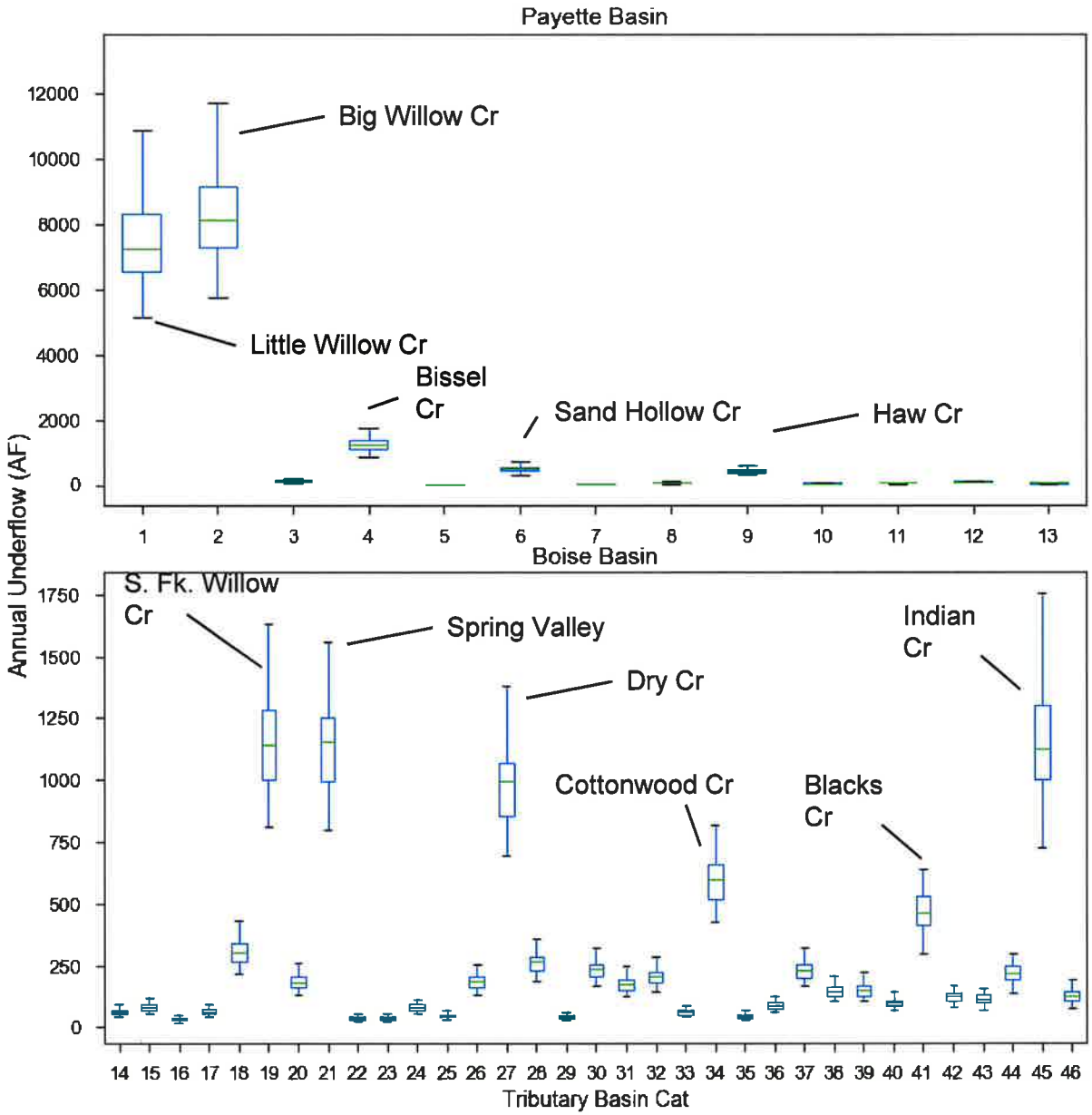
Payette

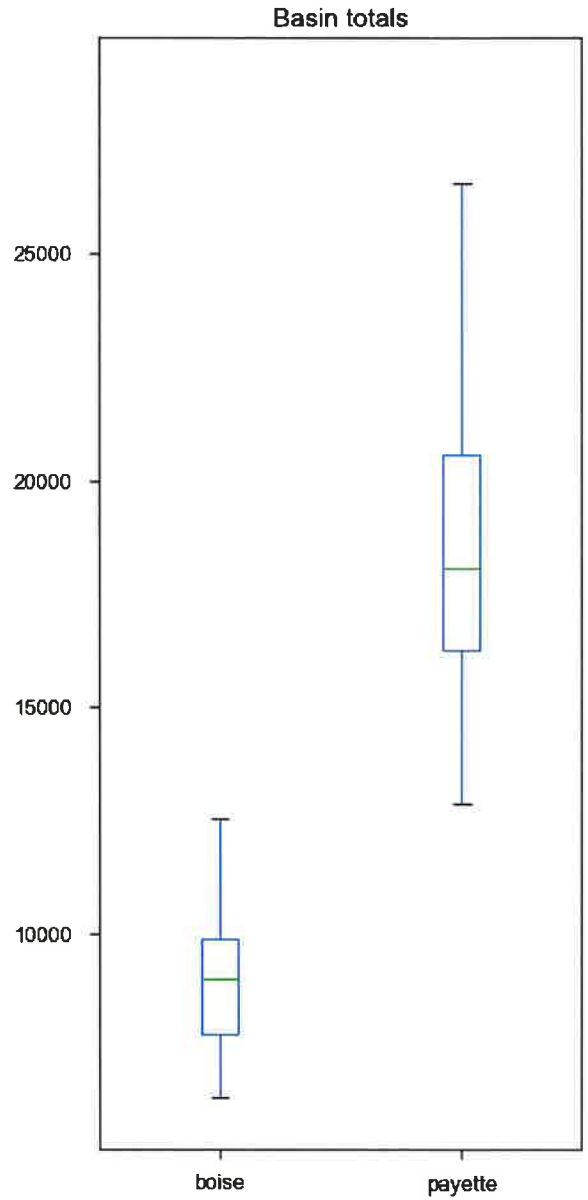


Cat (GIS)	Trib name (* if they have one in NHD)	ACRES
1	Little Willow Creek	100122
2	Big Willow Creek	96419
4	Bissel Creek	15816
6	Sand Hollow	10598
9	Haw Creek	5852

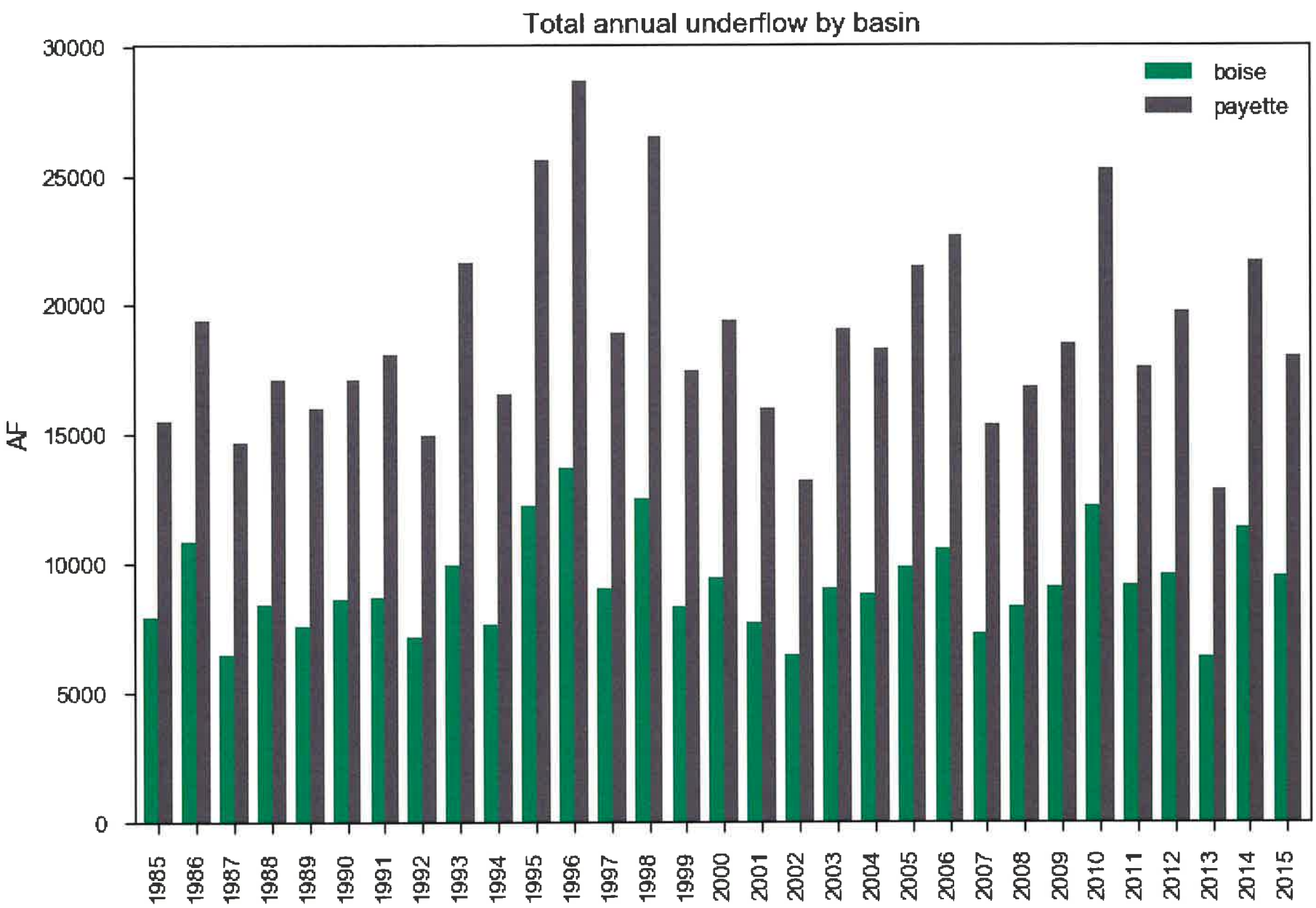
Recharge contributing to underflow





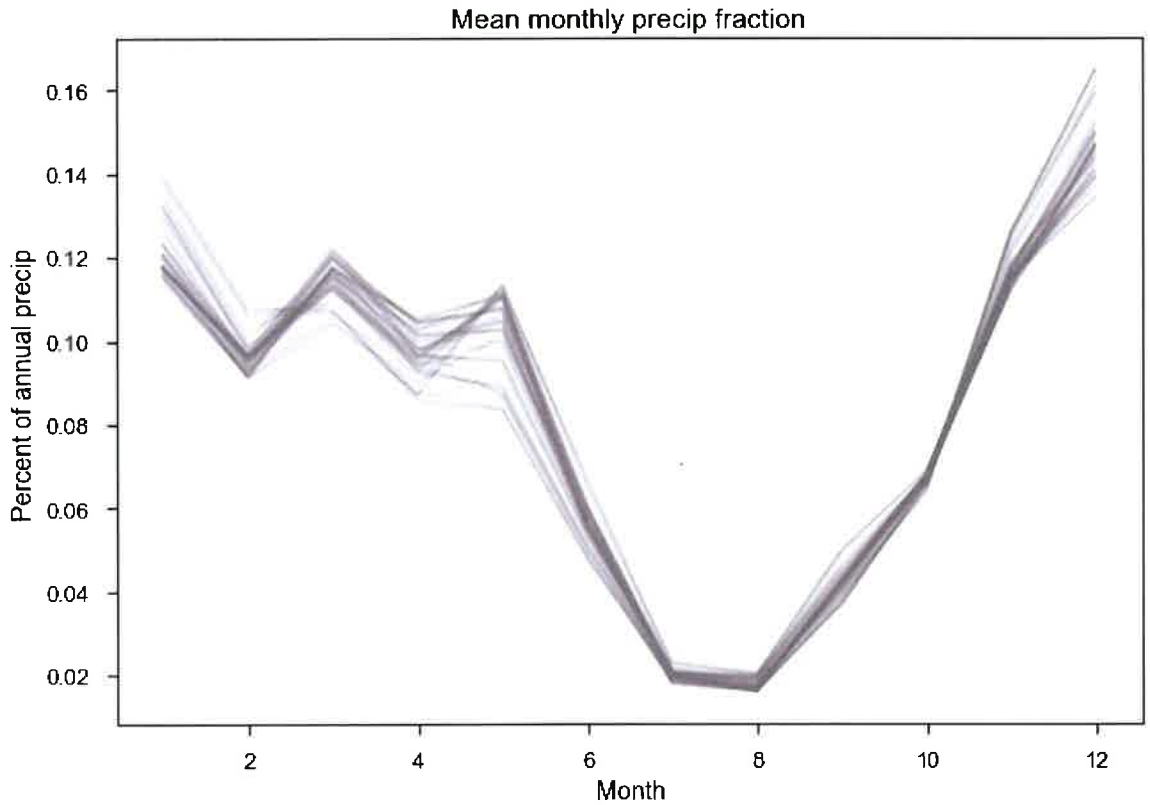


	Boise	Payette
Mean annual underflow (AF)	9151	18834


Total annual underflow by basin
boise
payette
AF
30000
25000
20000
15000
10000
5000
0
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

Temporal distribution

- Calculate monthly proportion of annual precip in each trib from PRISM
- Scale annual underflow for each month



Small Basin Contributions

- Do small tributary basins contribute to underflow?
- Dry Creek / Reynolds Creek conceptual models
  - Chauvin et al, 2011; McNamara et al., 2005
  - Winter precip replenishes soil water and ground water deficit before delivery to stream.
  - Streamflow/groundwater fluxes decoupled after snow ablation. Subsequent precip does not contribute to streamflow

Source	Boise Front Recharge (AF)	% of Annual Total Budget*
This analysis	9,100	.89
(Payette)	18,834	1.8
Wylie 2018	515	.05
Petrich and Urban (2004)	905	.09
Urban (2004)	4300	.42
Newton (1991)	Small	
Welhan (2012)	9,000	.88
SPF (2007a)	3900	.38
SPF (2007b)	5580	.55

*1,020,300 AF (Urban, 2004)

Conclusions + Suggestions

- Higher estimates of recharge due to finer resolution sampling (30m vs 1 mile cells)
- Mean is near max value of prior estimates
- Only a few catchments will have significant underflow
  - Dry Creek, Indian Creek, Willow Creeks
- Use delineated subbasins to route underflow to cells
- Adjustable parameters
  - Monthly multiplier
  - Multiplier on annual recharge (0 – X% of average annual precip in basin)

Tributary basin delineation

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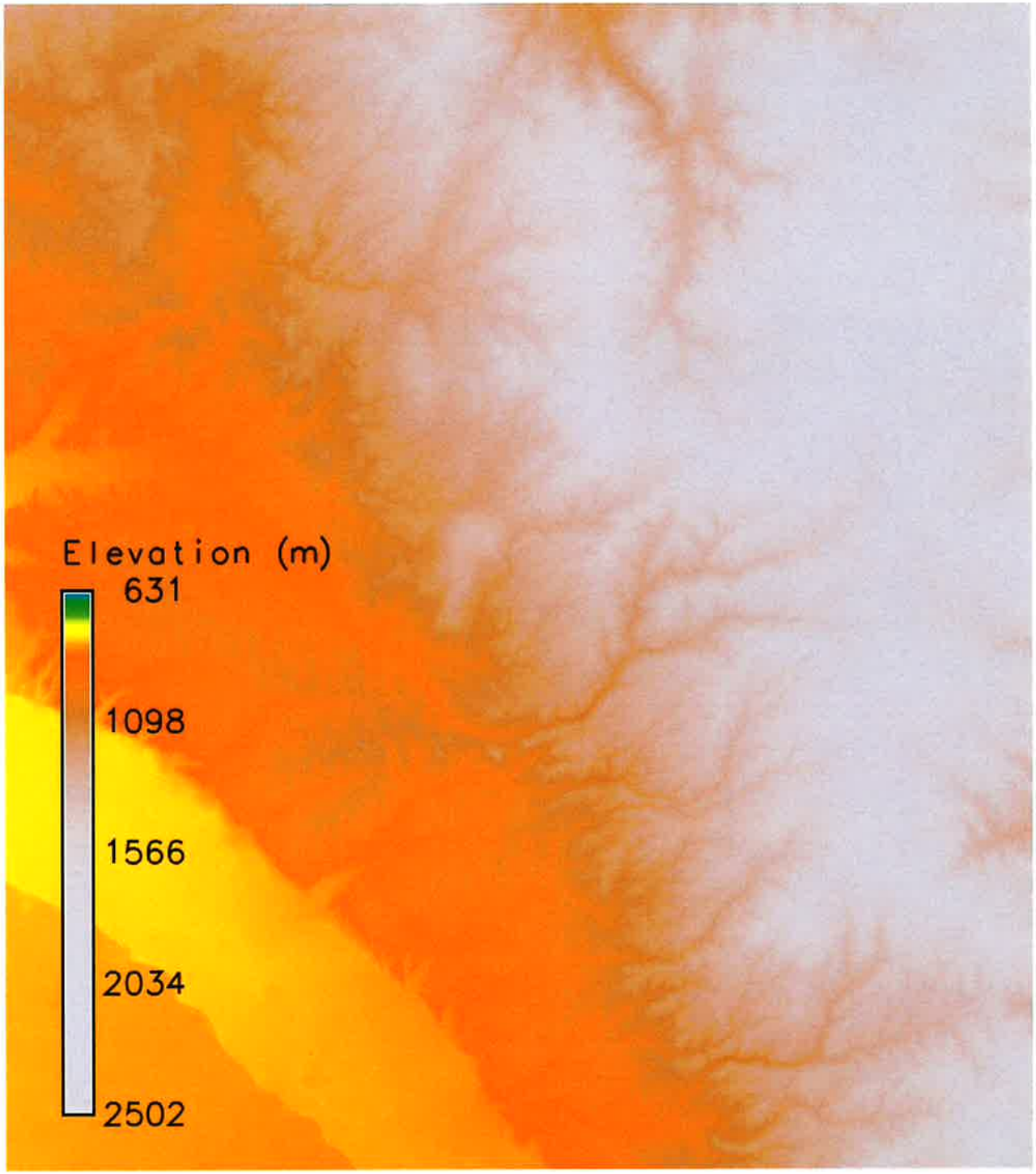

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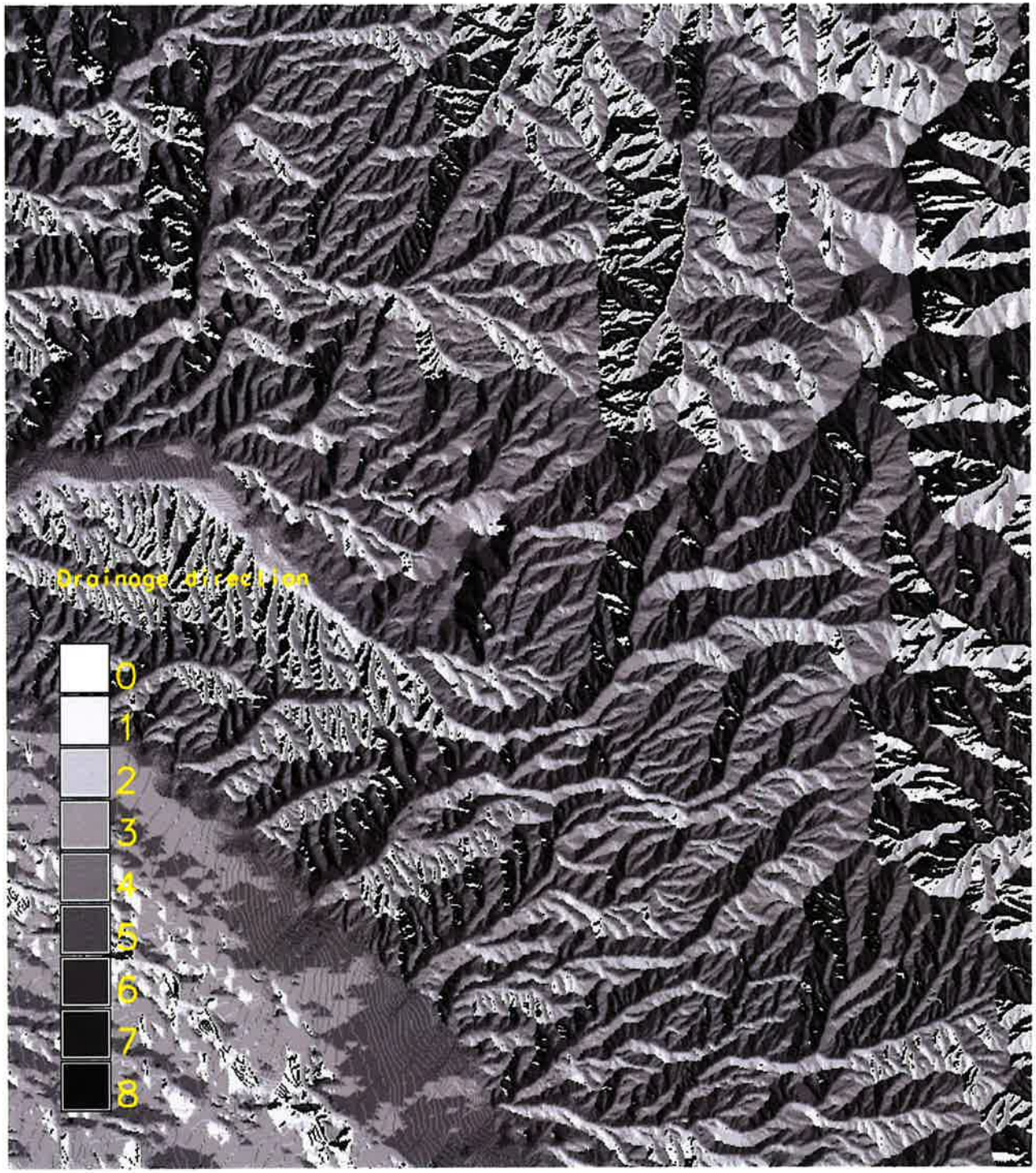

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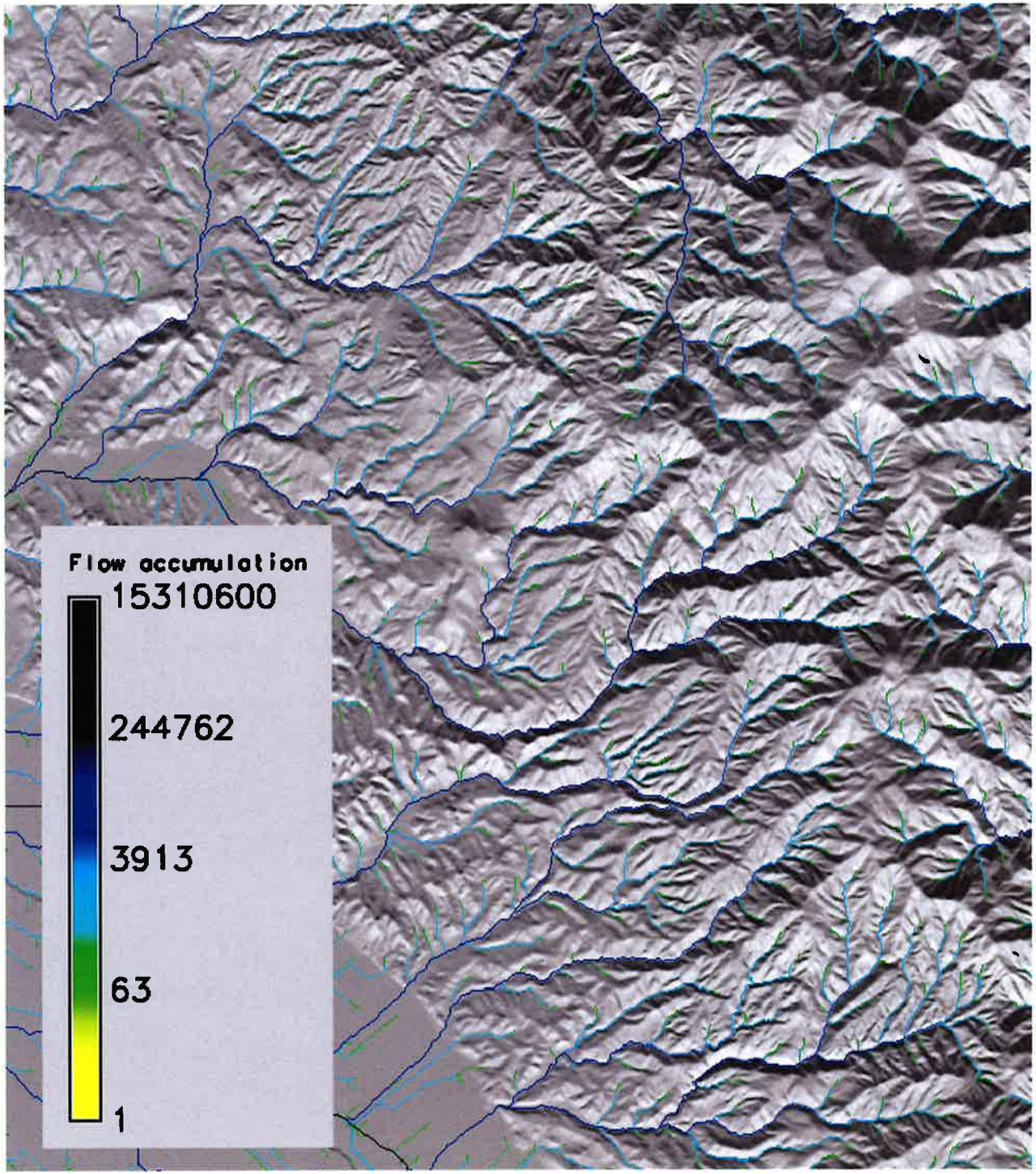

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