Mapping Headwater Streams in Southeastern New Hampshire from LiDAR using Morphological Filters

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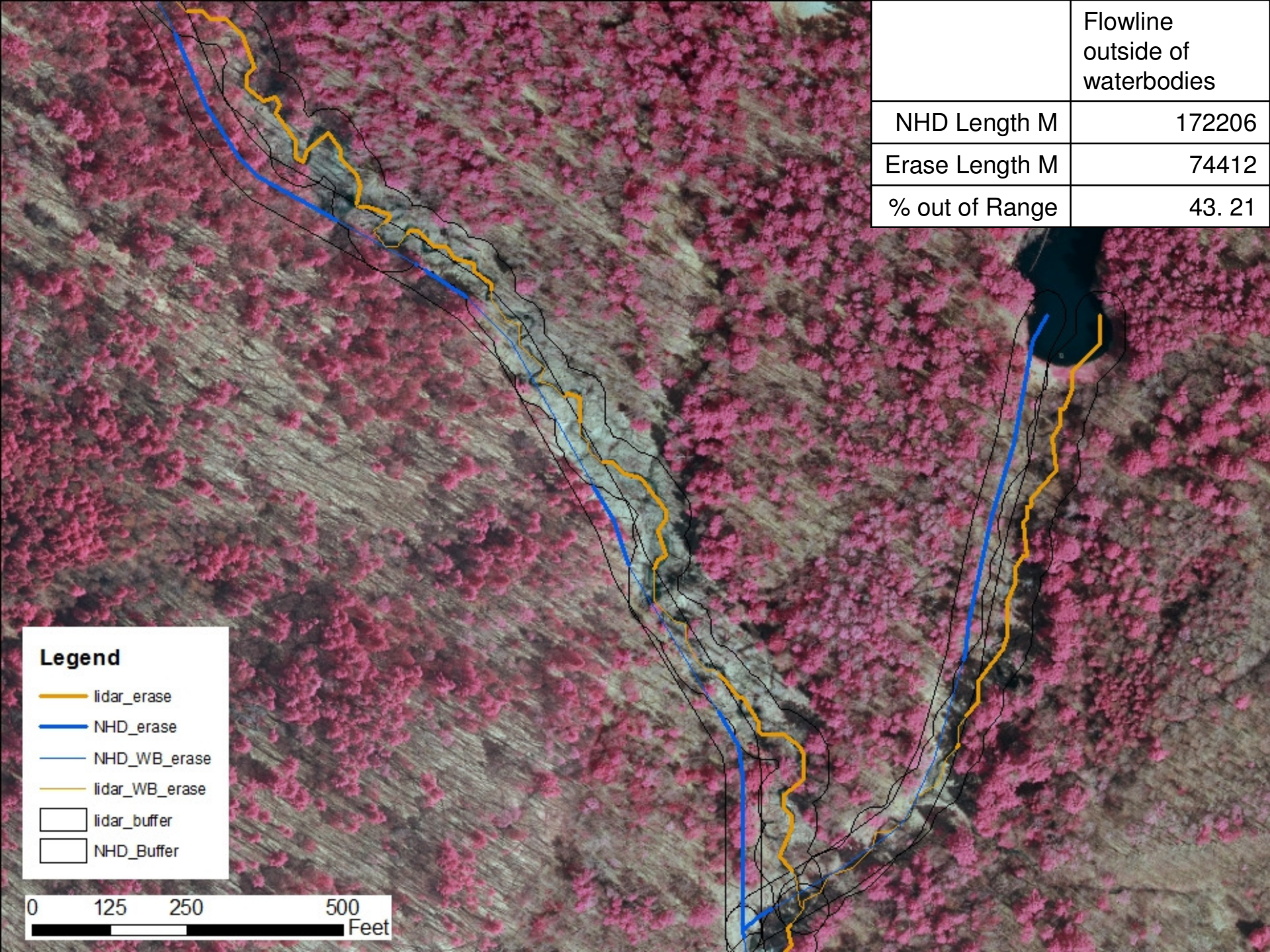
New Hampshire Geological Survey

Headwater streams underrepresented in the maps

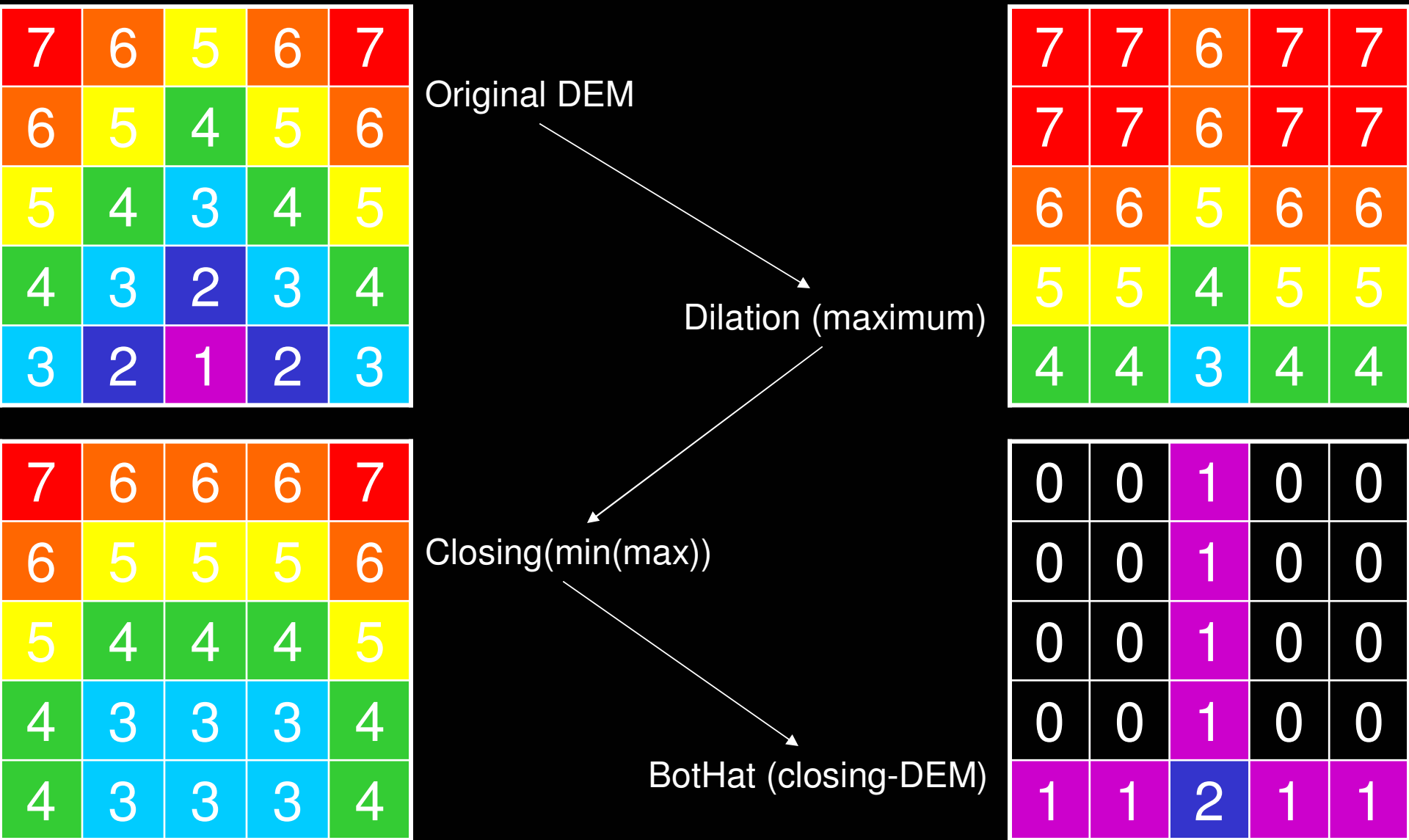
- Benstead and Leigh (2012) NHD underestimates by 64% in NC
- Colson et al. (2008) NHD underestimates by 56% in NC study
- Brooks and Colburn (2011) NHD underestimates 21% of the field-verified steams in MA study


National Map standard:
Horizontal accuracy of 40 ft for 90% of streams
0
125
250
500
Feet


Flowline outside of waterbodies
NHD Length M 172206
Erase Length M 74412
% out of Range 43. 21
Legend
lidar_erase
NHD_erase
NHD_WB_erase
lidar_WB_erase
lidar_buffer
NHD_Buffer
0 125 250 500
Feet

Morphological Filters

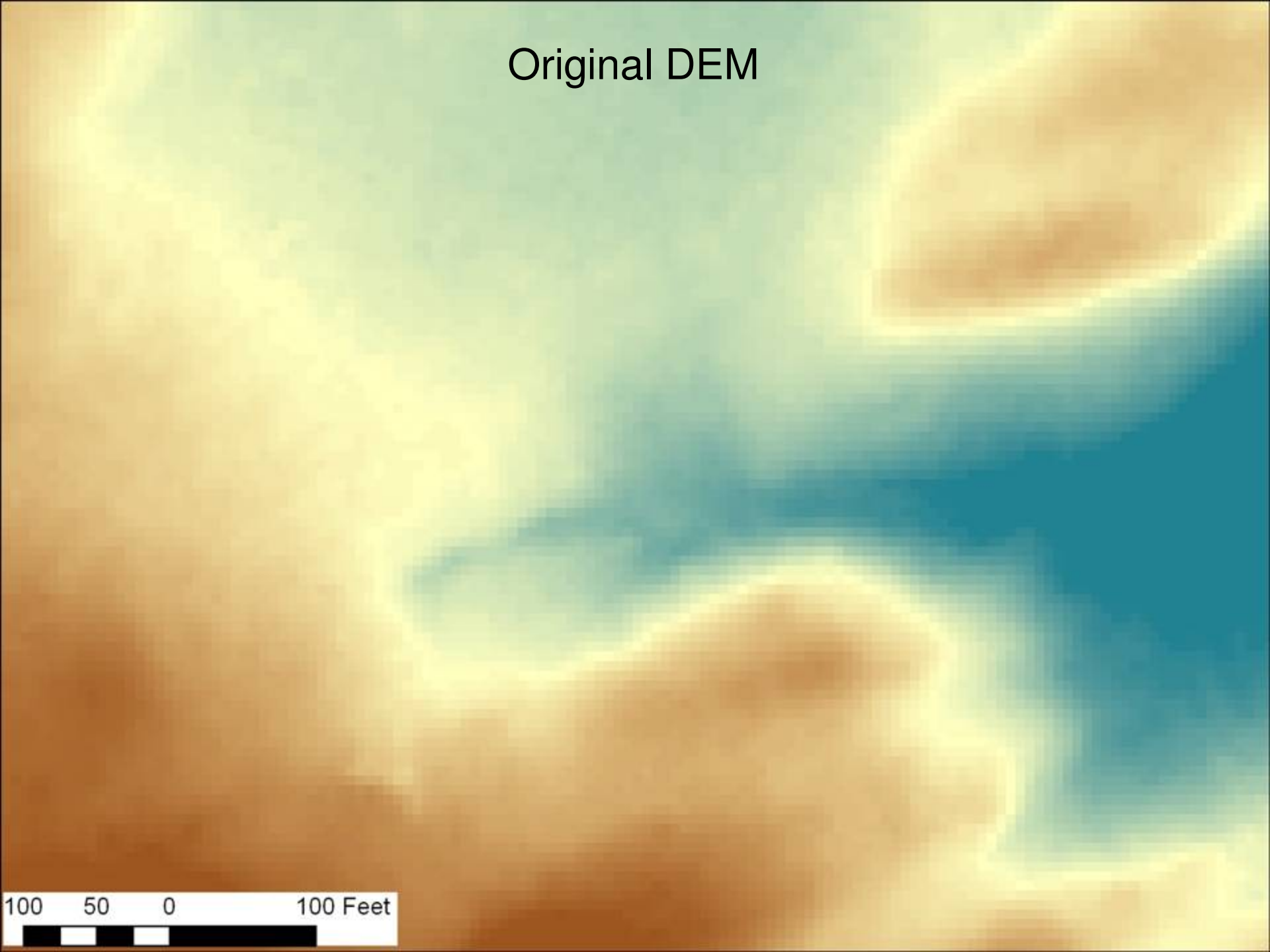
From Cho et al 2010 and Rodriguez 2007



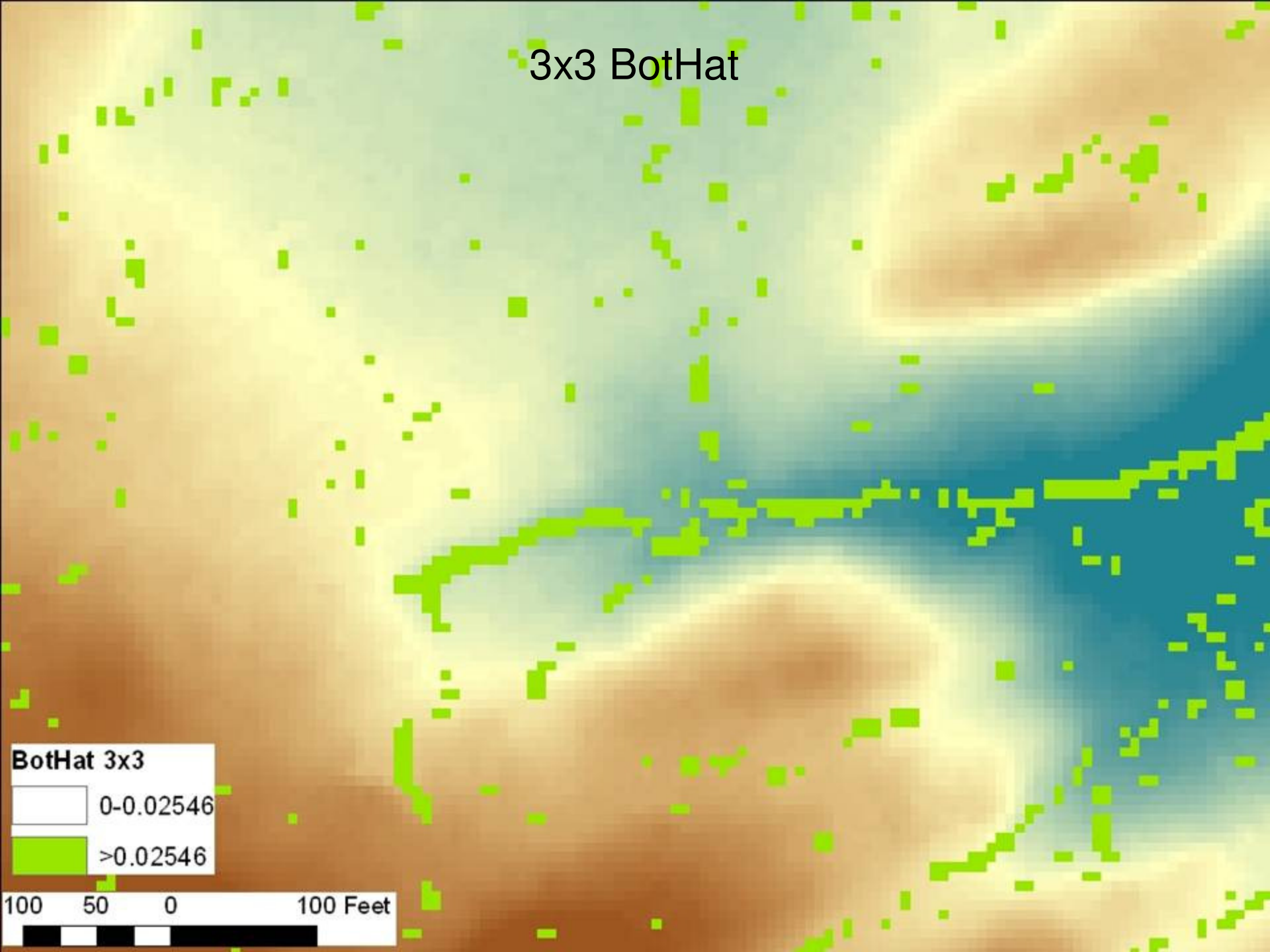
Methods

- BotHat 3x3, threshold
- BotHat 11x11, threshold
- Flow Accumulation >500
- Coincident from steps 1,2&3
- Group step 4, threshold
- Accumulate step 5, convert to vector

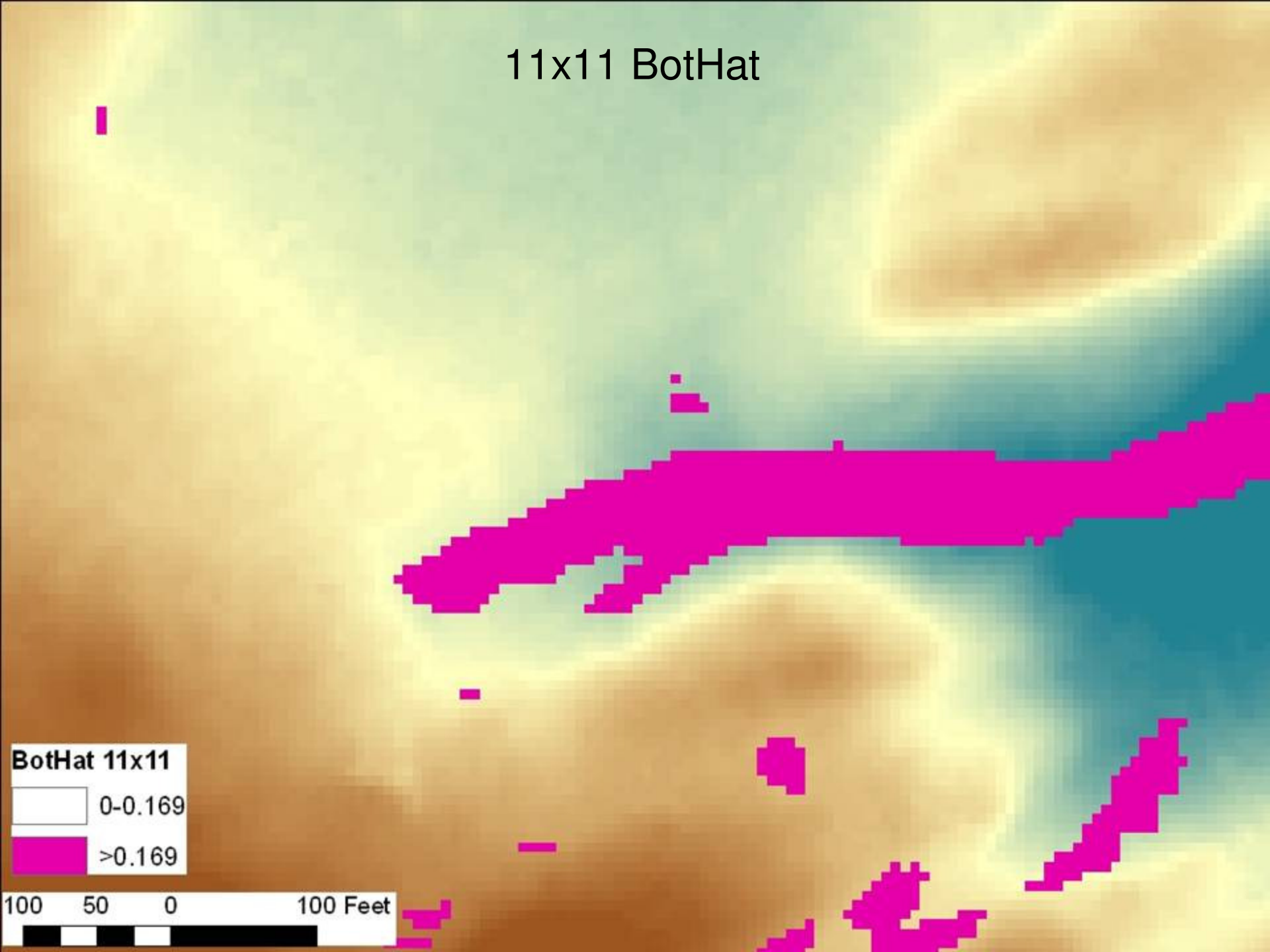
Original DEM



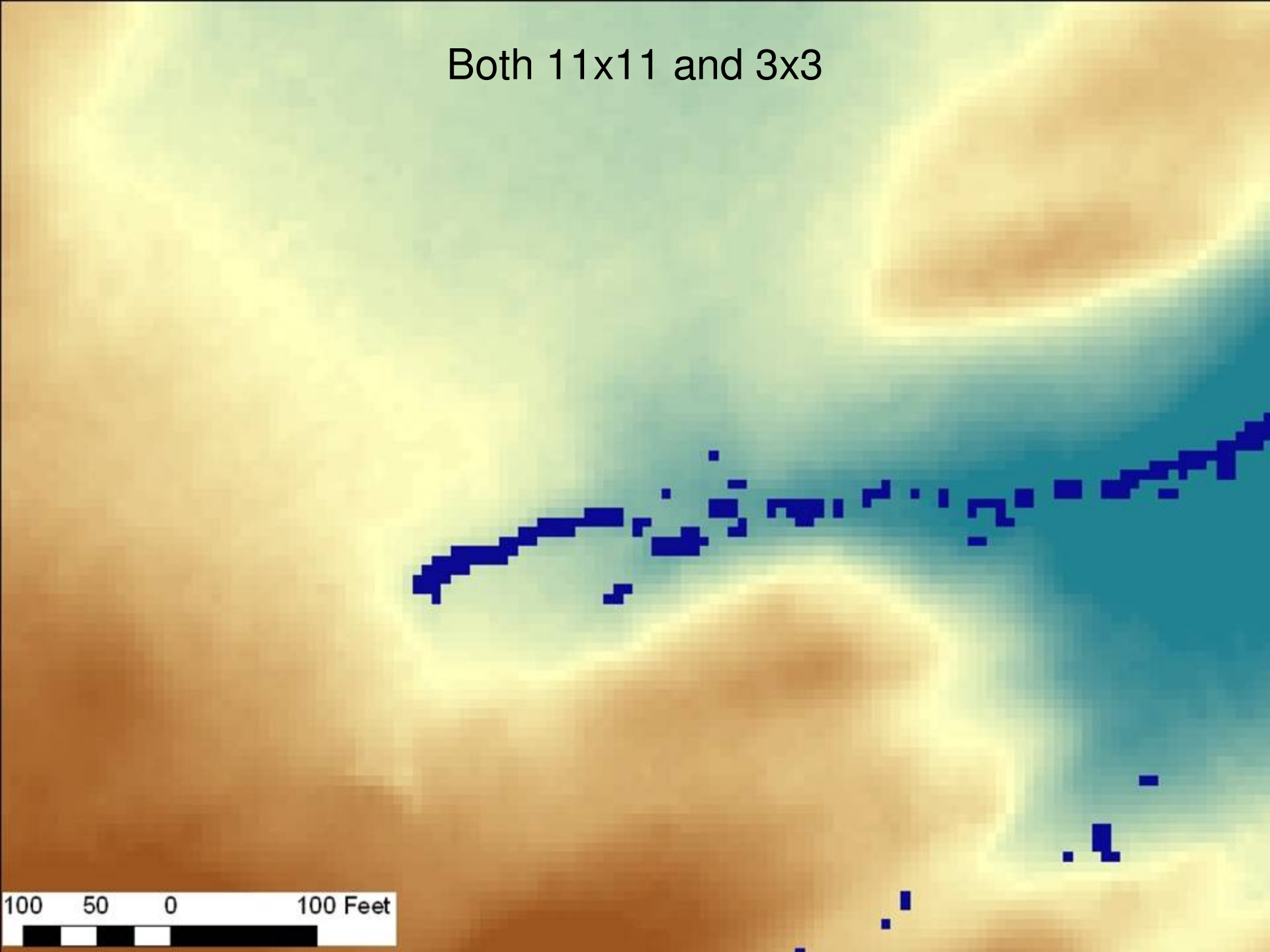
3x3 BotHat



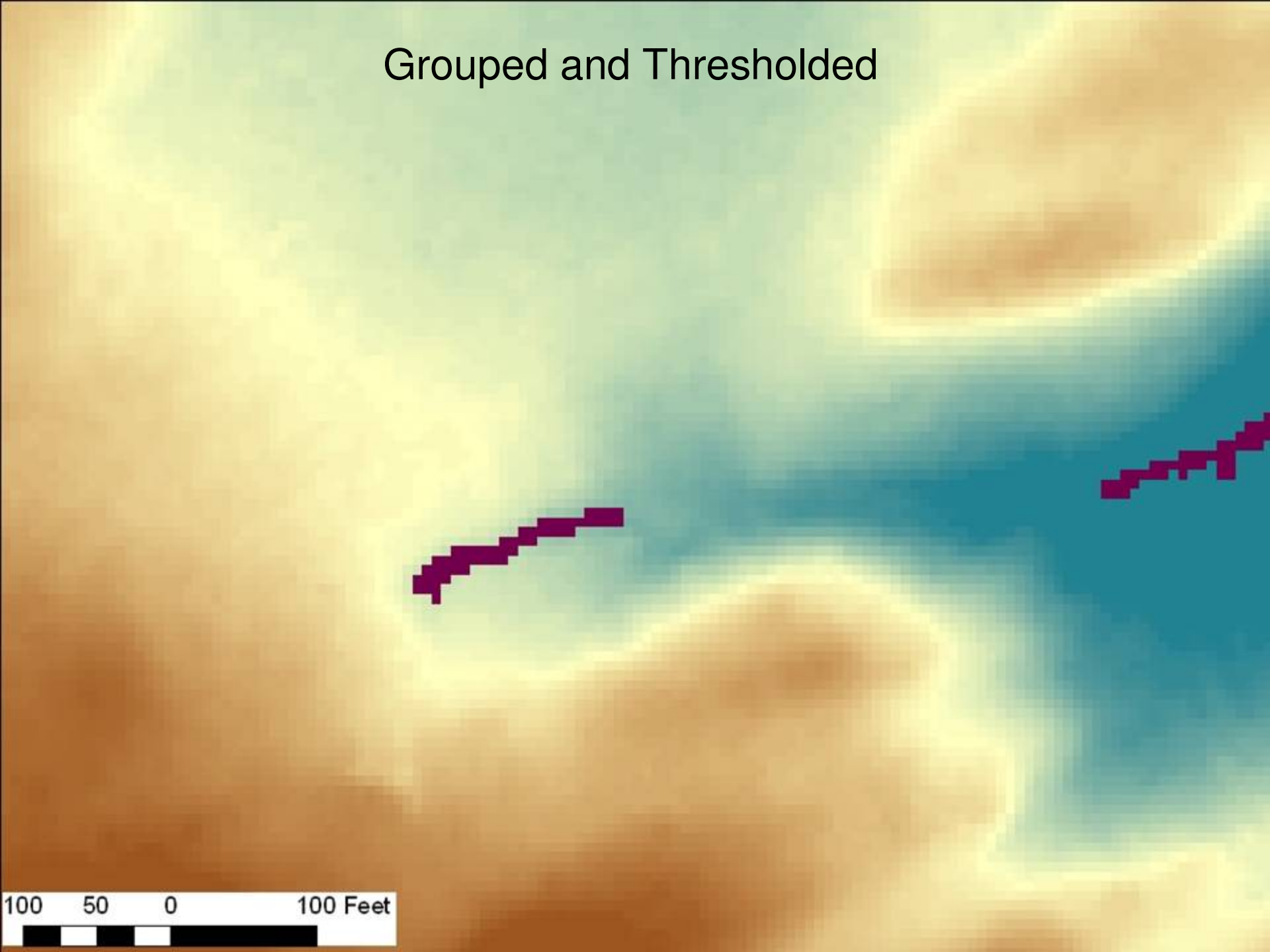
11x11 BotHat



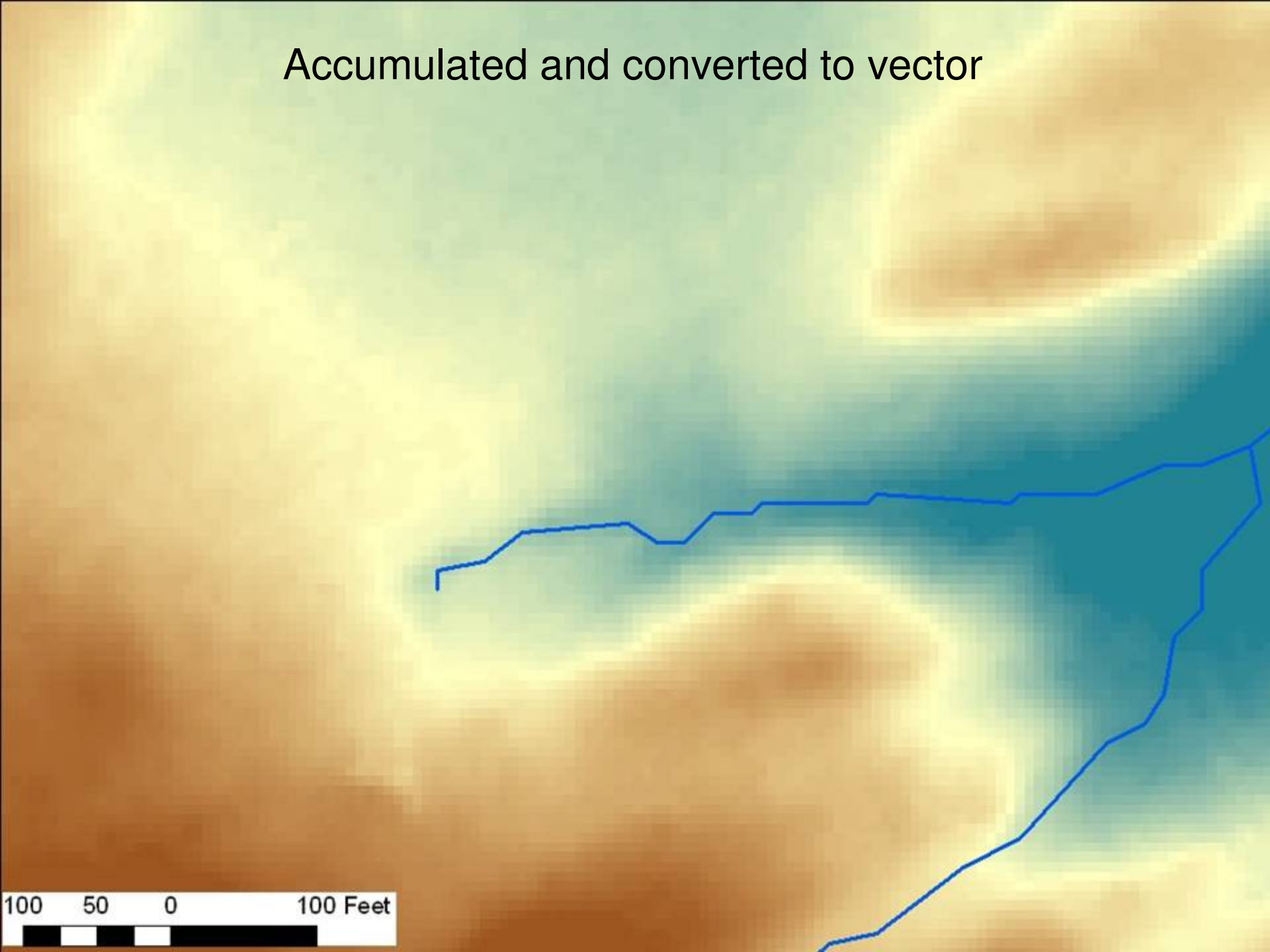
Both 11x11 and 3x3

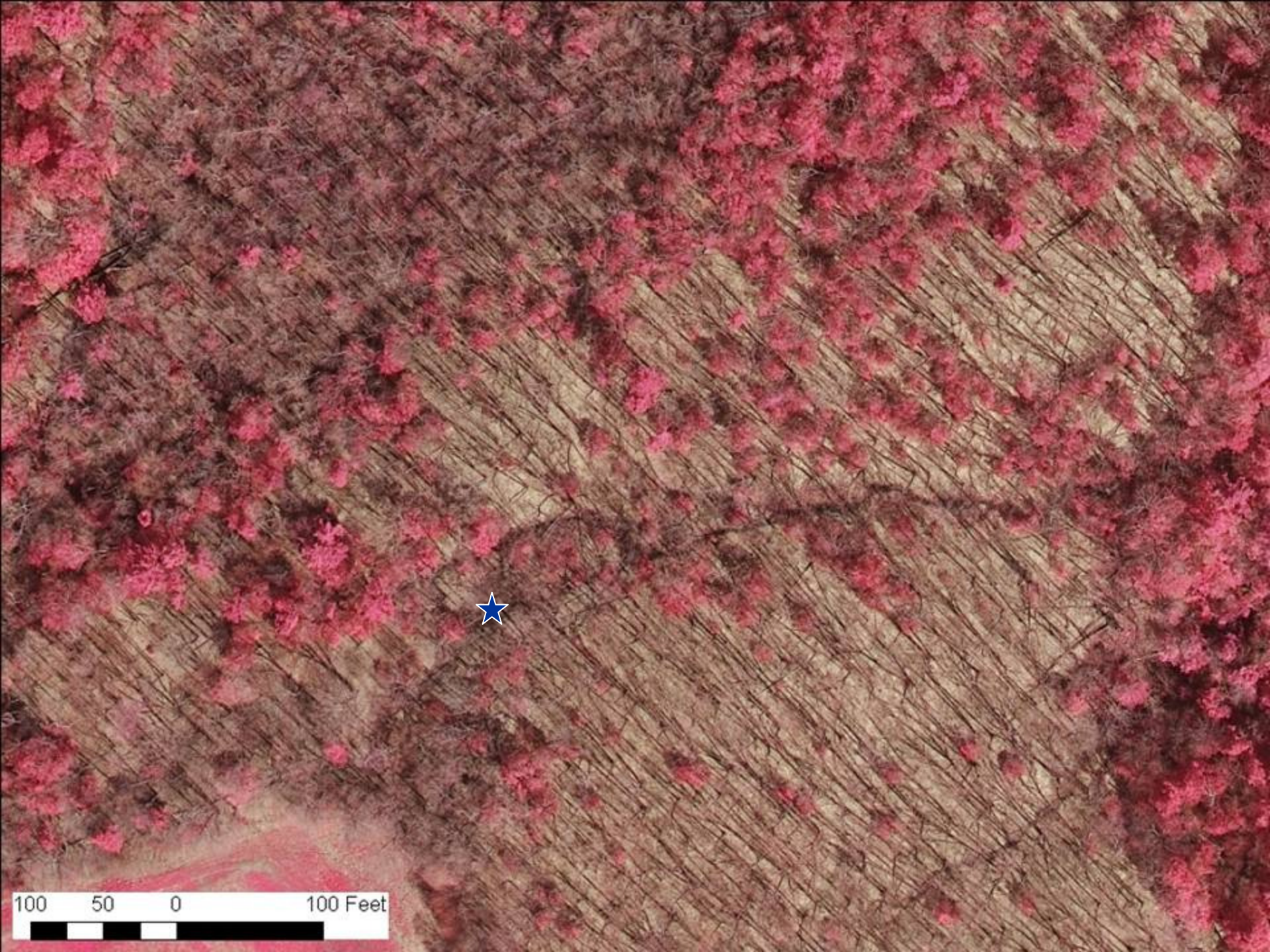


Grouped and Thresholded

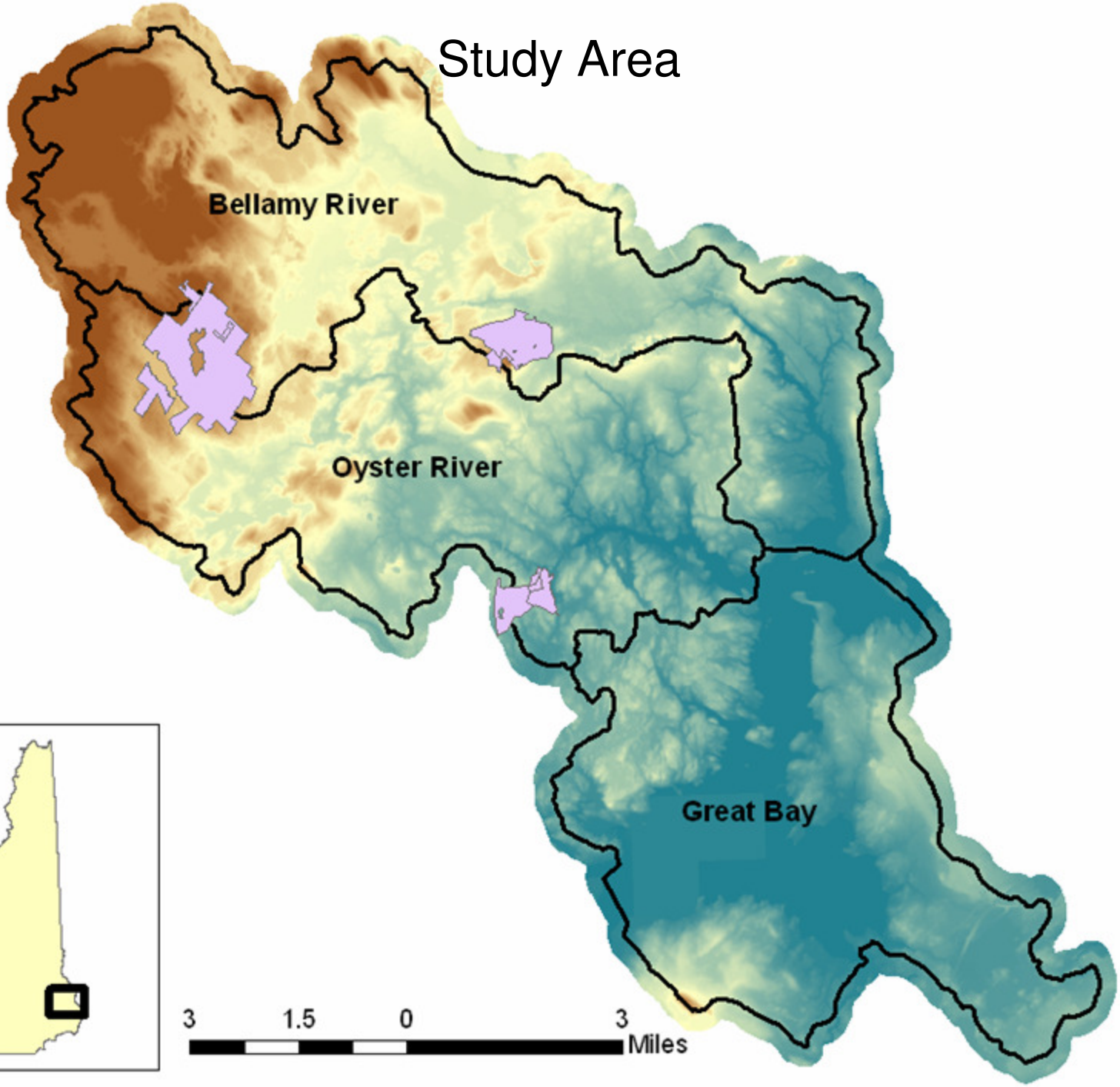


Accumulated and converted to vector

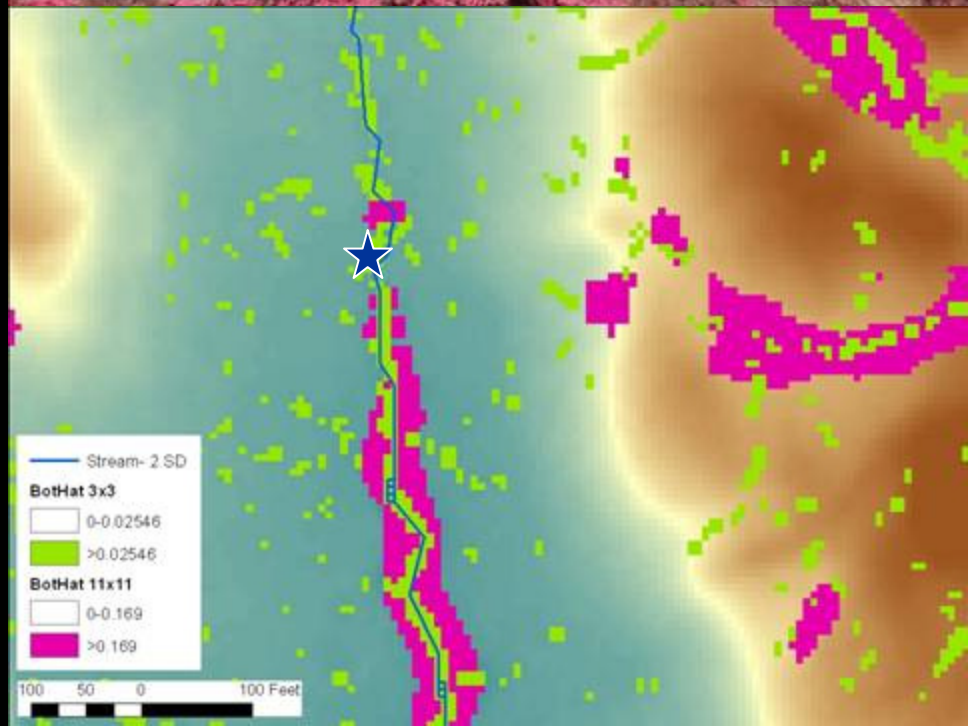



100 50 0 100 Feet

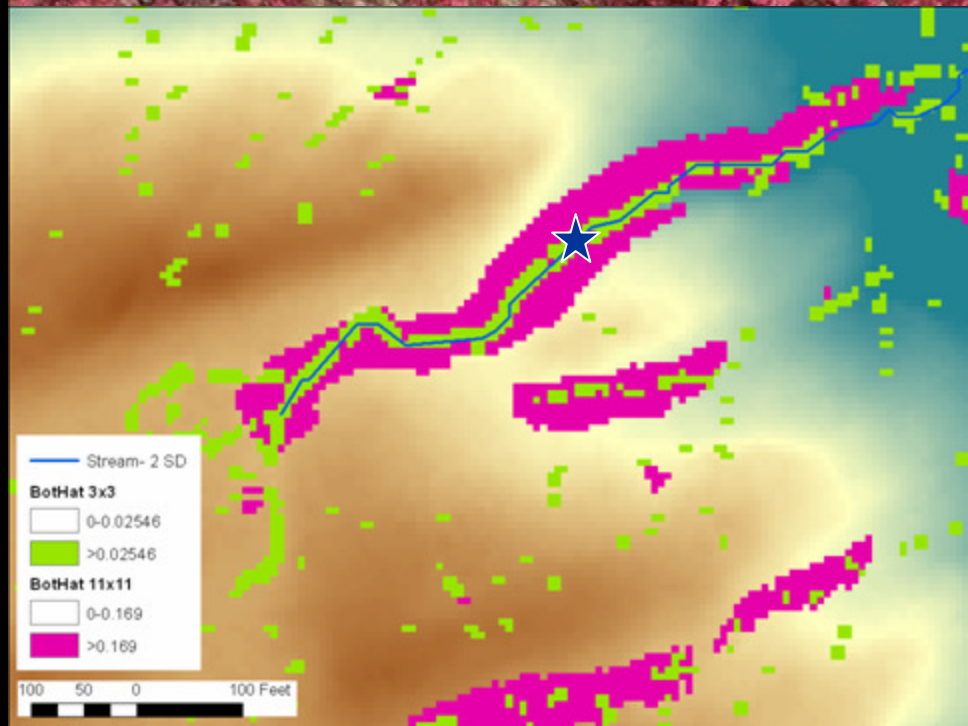
Study Area




100 50 0 100 Feet


Stream- 2 SD
BotHat 3x3
0-0.02546
>0.02546
BotHat 11x11
0-0.169
>0.169
100 50 0 100 Feet

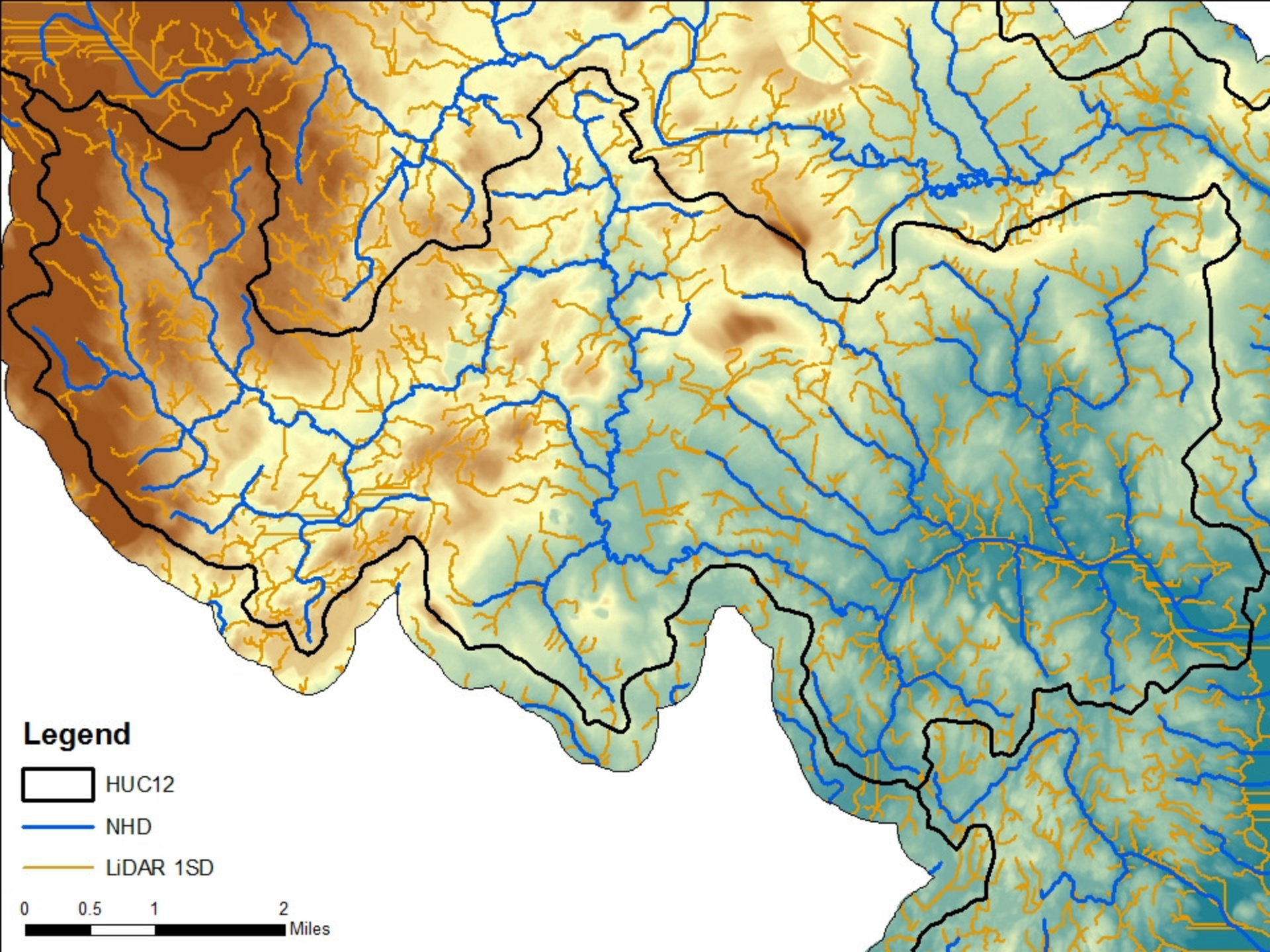

100 50 0 100 Feet

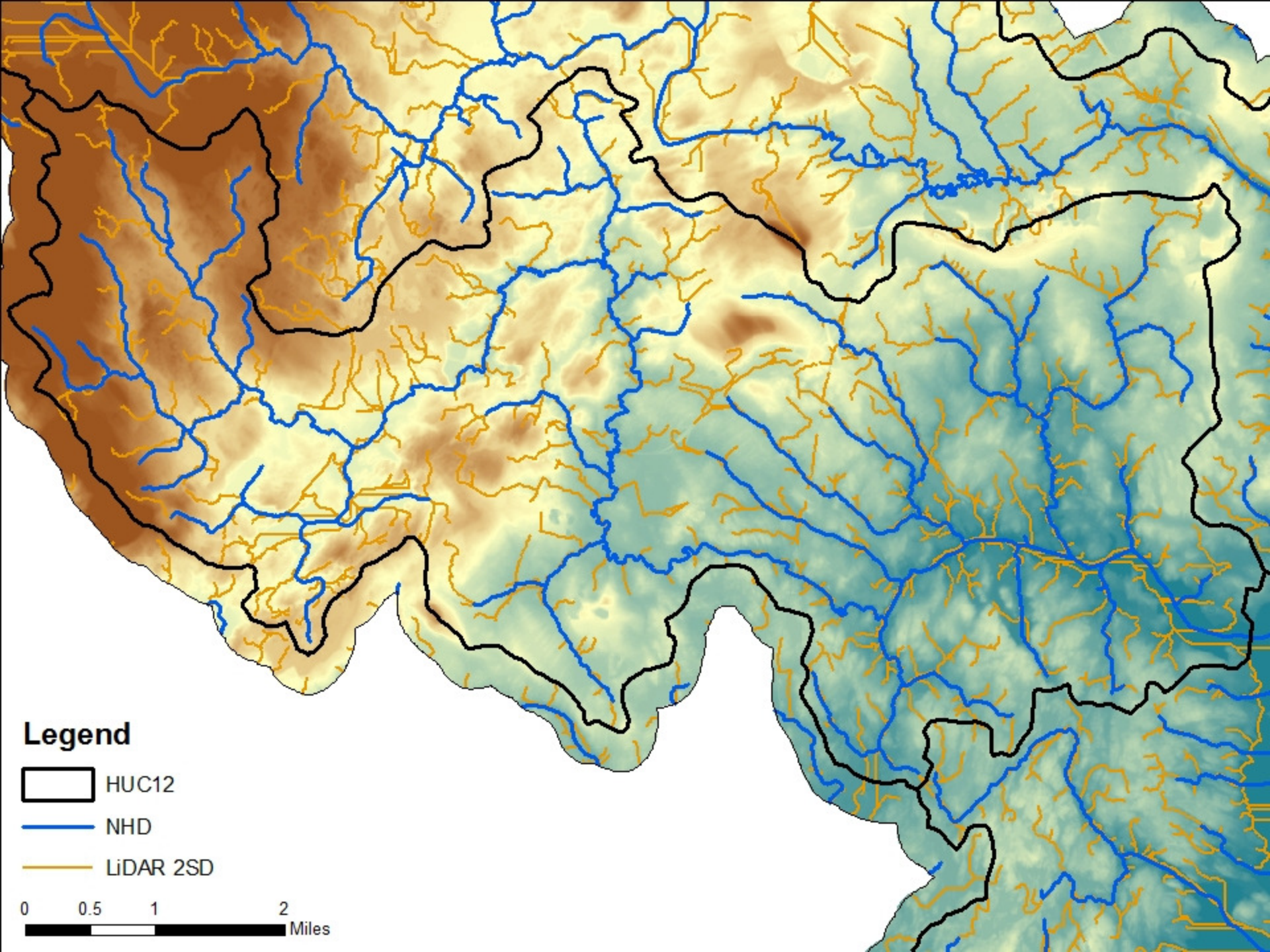

Stream- 2 SD
BotHat 3x3
0-0.02546
>0.02546
BotHat 11x11
0-0.169
>0.169
100 50 0 100 Feet

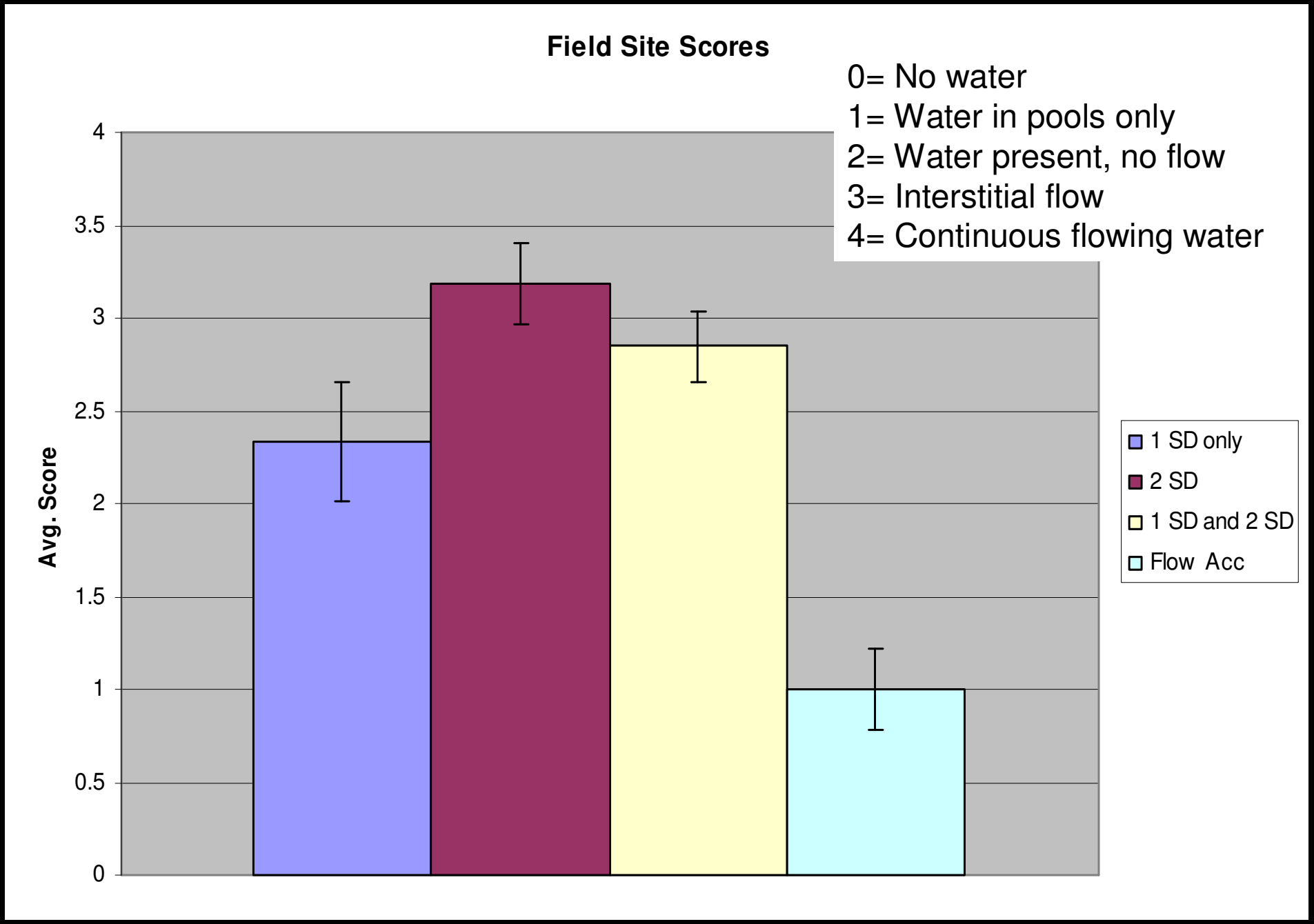
Preliminary Results

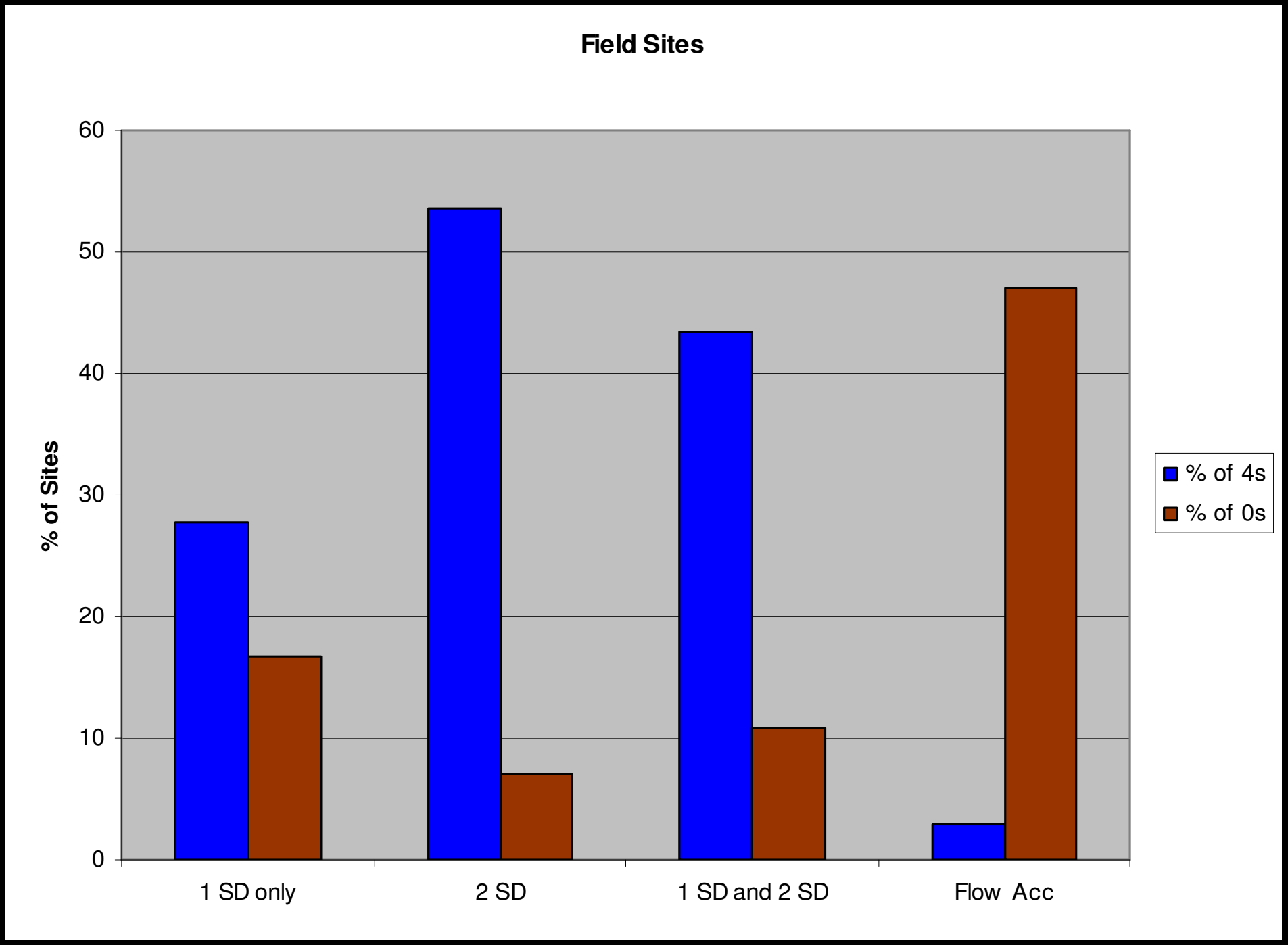
	NHD	1 SD	2 SD	Flow Acc
Drainage Density(mi/mi^2)	1.84	6.58	4.88	53.74
% increase or decrease*	-62	256	164	2816
sites	--	18	28	34

*relative to 2SD set


Legend
HUC12
NHD
LiDAR 1SD
0
0.5
1
2
Miles

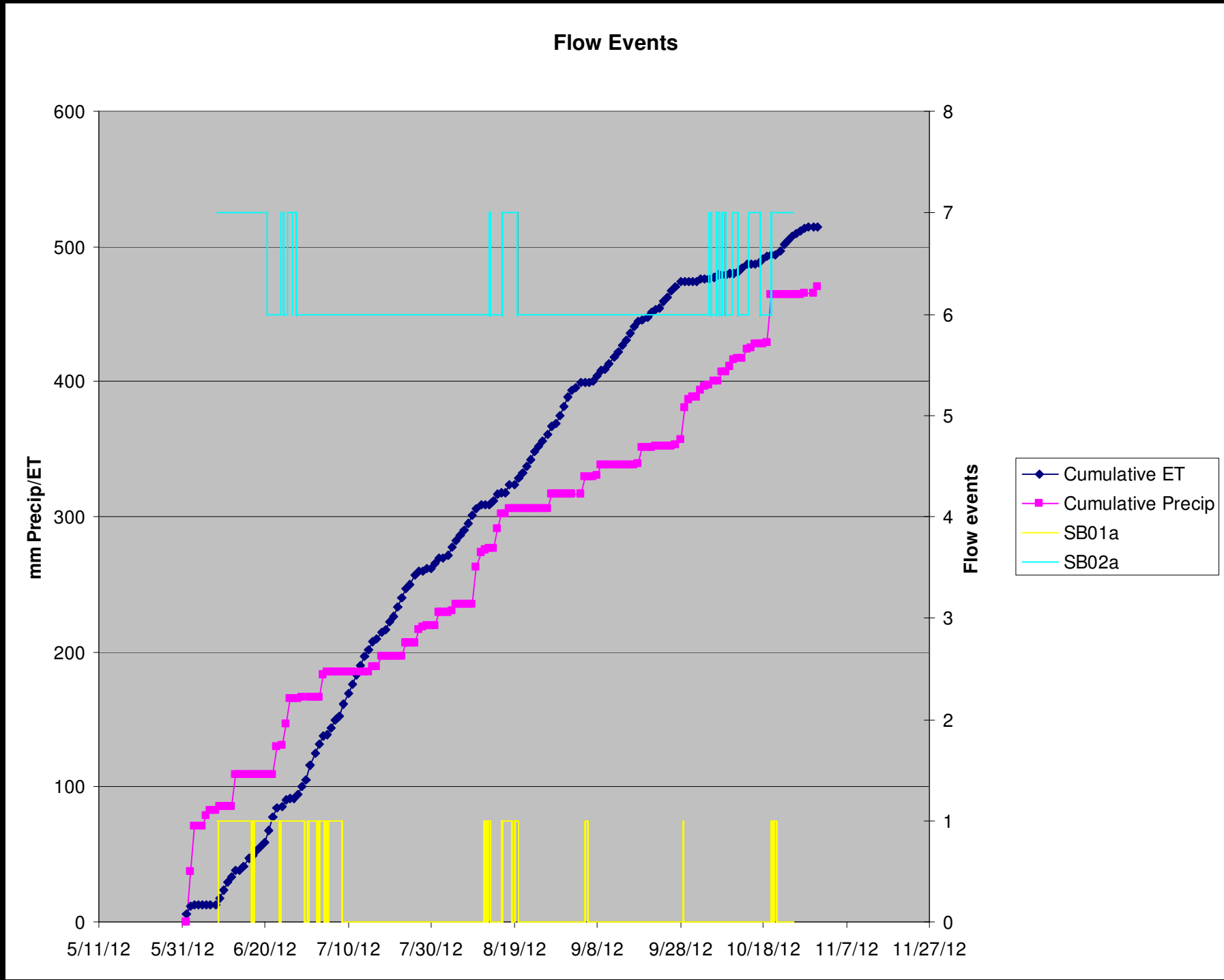

Legend
HUC12
NHD
LiDAR 2SD
0
0.5
1
2
Miles


Field Site Scores
0= No water
1= Water in pools only
2= Water present, no flow
3= Interstitial flow
4= Continuous flowing water
Avg. Score
4
3.5
3
2.5
2
1.5
1
0.5
0
1 SD only
2 SD
1 SD and 2 SD
Flow Acc

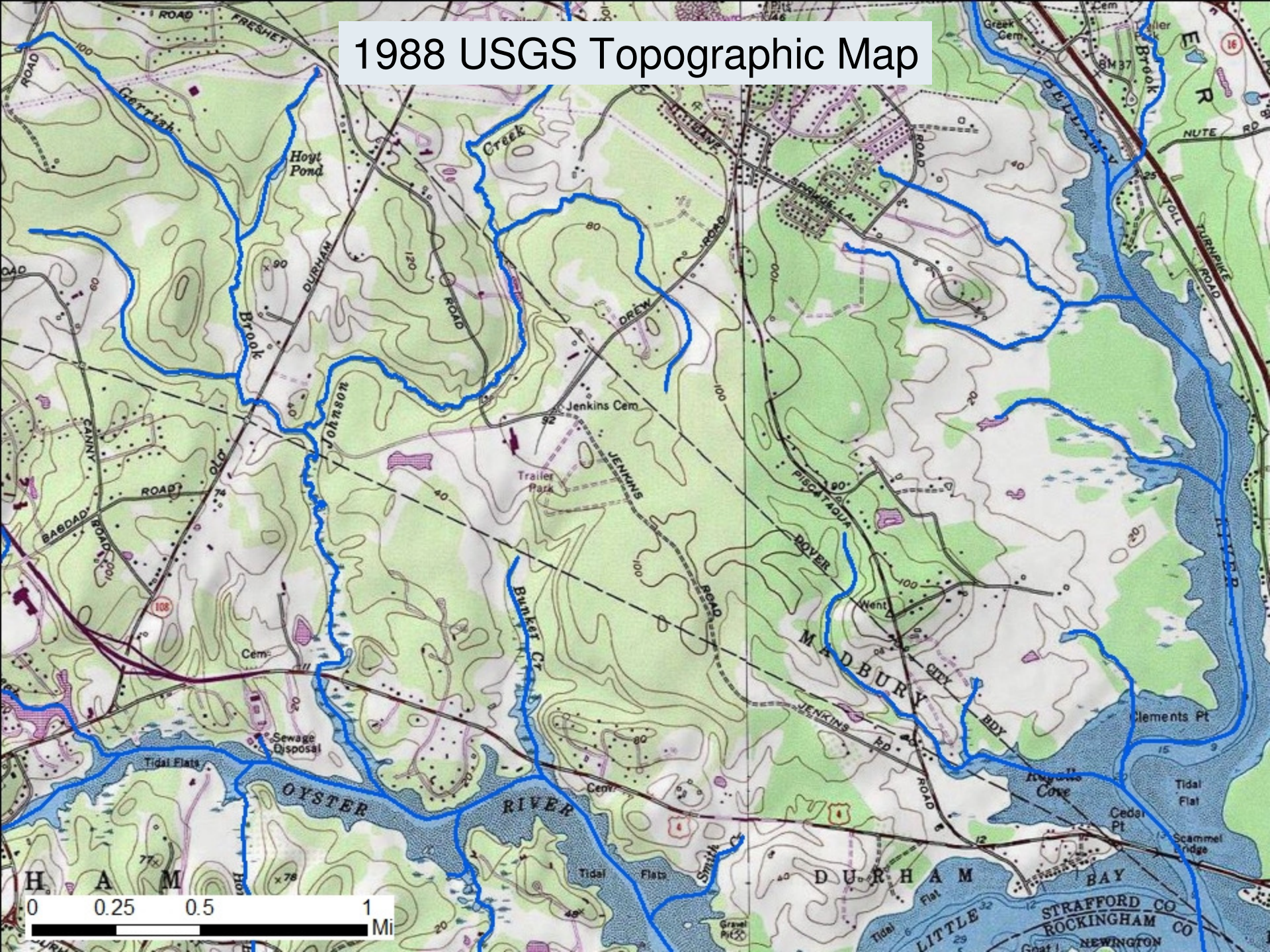

Field Sites
% of Sites
60
50
40
30
20
10
0
1 SD only
2 SD
1 SD and 2 SD
Flow Acc
% of 4s
% of 0s

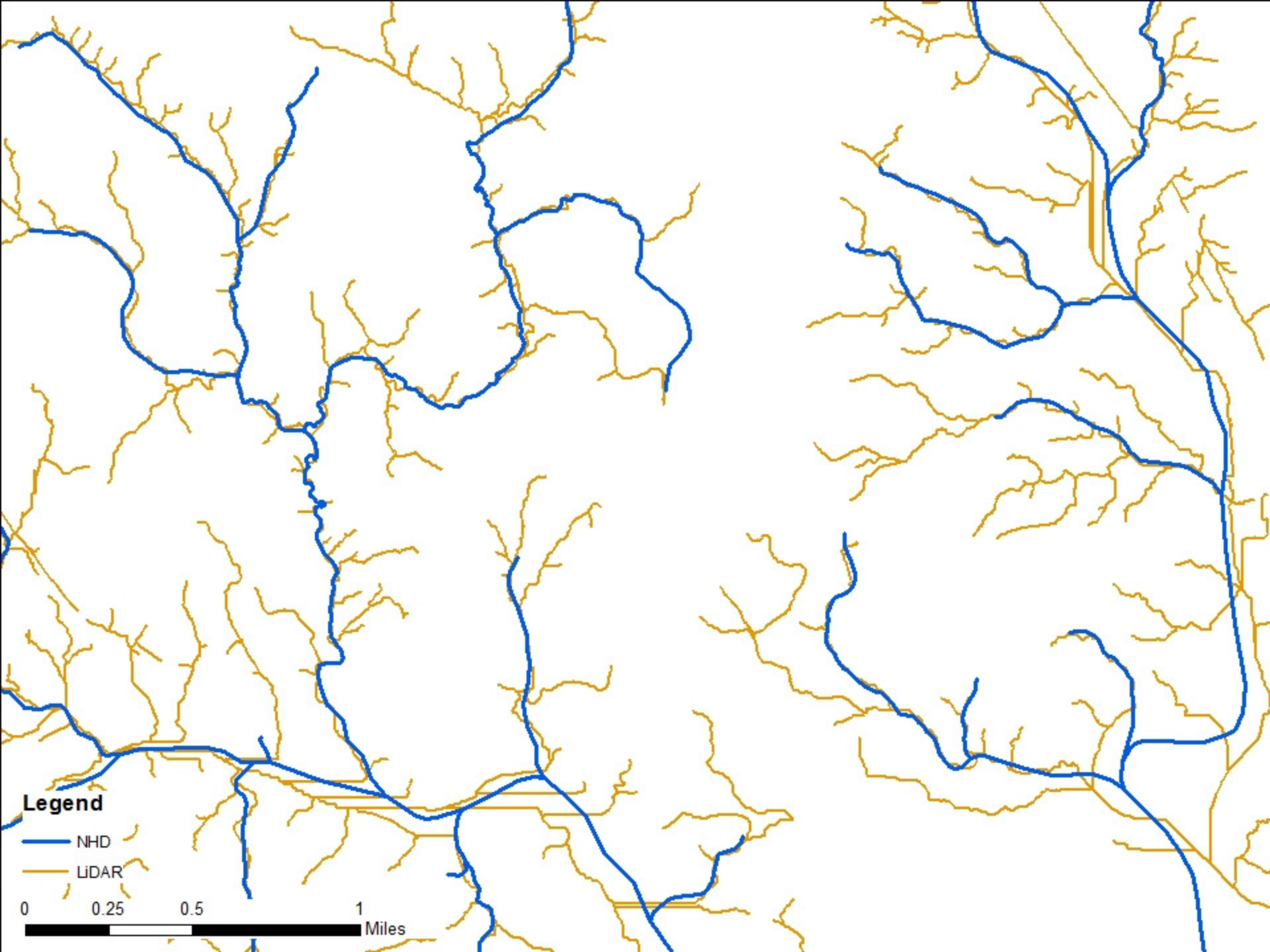
Permanance

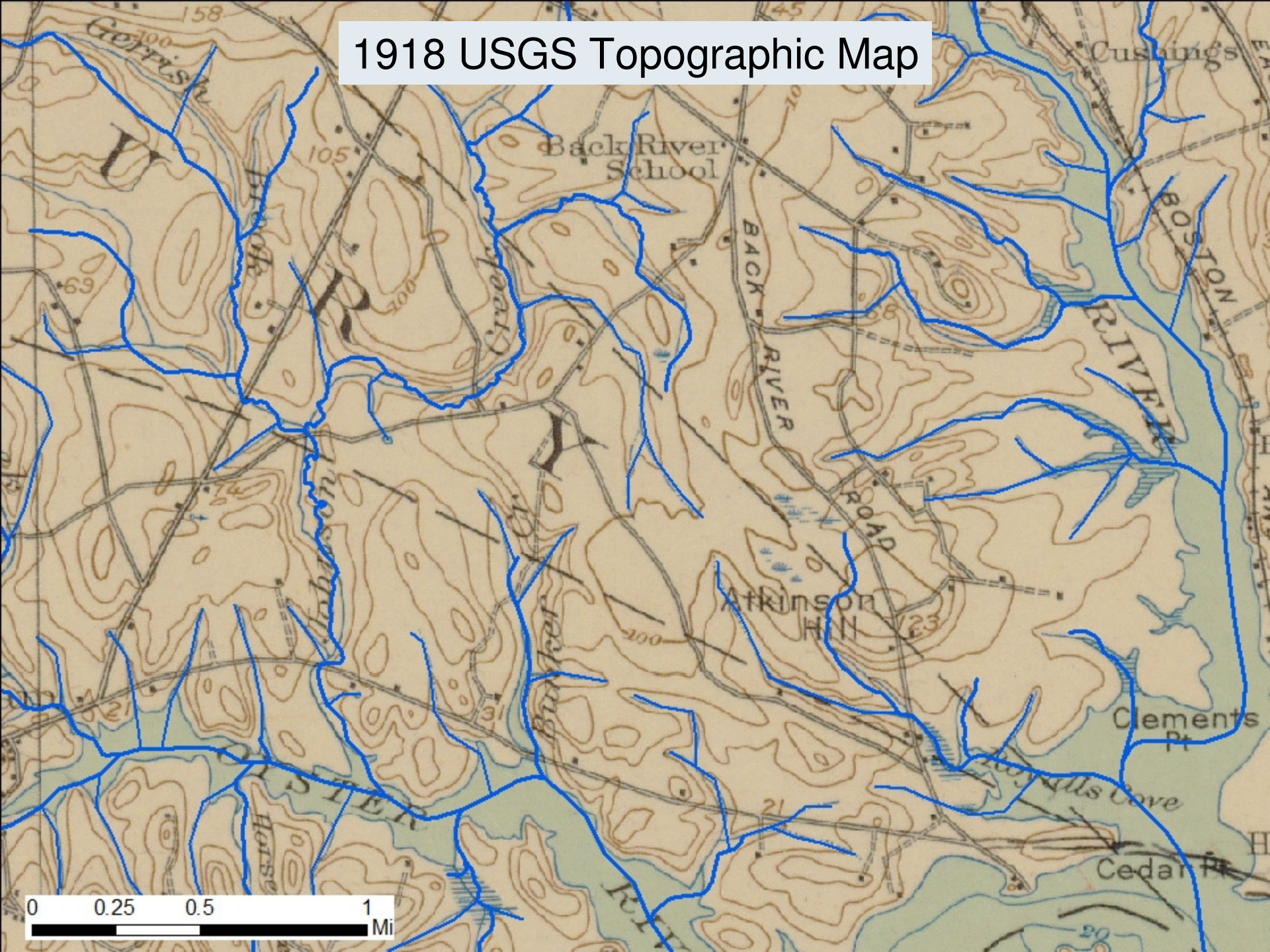
- Two streams were fitted with simple state sensors per Bhamjee and Lindsay 2011


Flow Events
mm Precip/ET
Flow events
600
500
400
300
200
100
0
8
7
6
5
4
3
2
1
0
5/11/12
5/31/12
6/20/12
7/10/12
7/30/12
8/19/12
9/8/12
9/28/12
10/18/12
11/7/12
11/27/12
Cumulative ET
Cumulative Precip
SB01a
SB02a

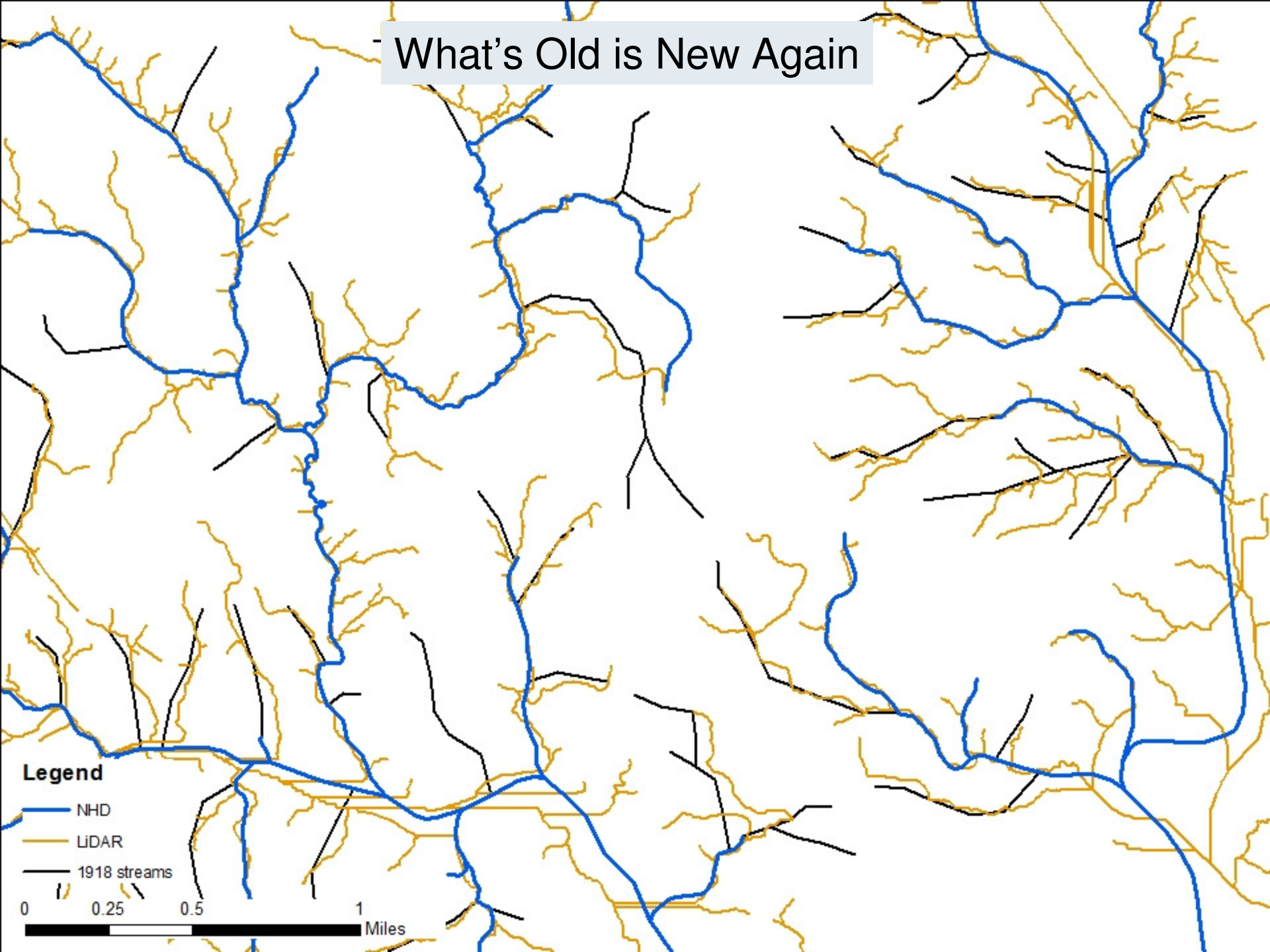
1988 USGS Topographic Map




Legend
NHD
LiDAR
0
0.25
0.5
1
Miles


1918 USGS Topographic Map
Back River School
BACK RIVER ROAD
BOSTON RIVER
Atkinson
Clements Pt
Cedar Pt
Cushings
0 0.25 0.5 1 Mi

What's Old is New Again



Questions?

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References

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