Mapping headwater streams using LiDAR: Finding streams beyond the blue lines

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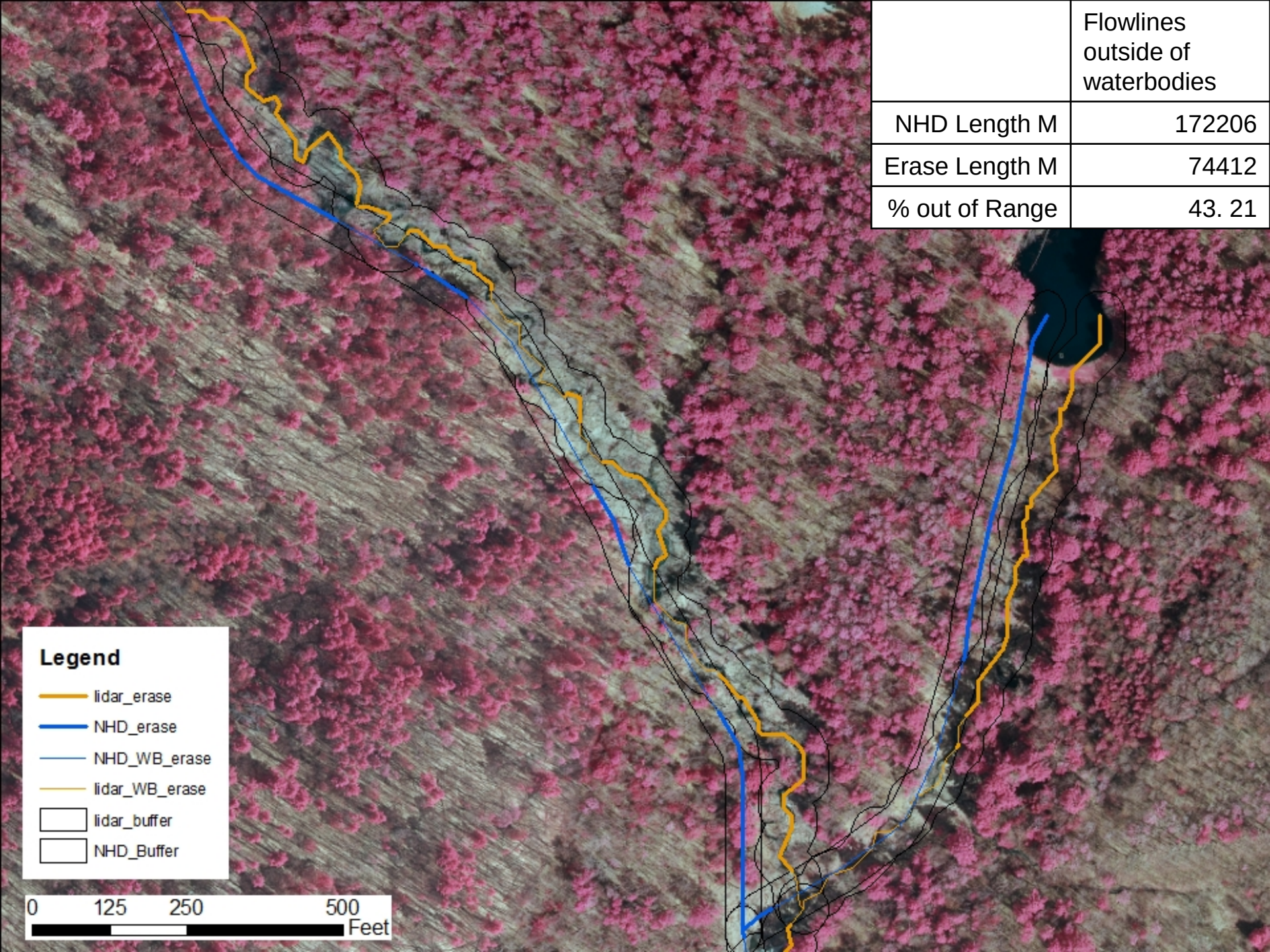
Headwater streams underrepresented in the maps

- North Carolina: National Hydrography Dataset (NHD) underestimates by 64% Benstead and Leigh (2012)
- Massachusetts: NHD underestimates 21% of the field-verified steams Brooks and Colburn (2011)
- North Carolina: NHD underestimates by 56% Colson et al. (2008)

Difficulties with photo-interpretation

- New Hampshire is the most forested state in the contiguous US (88.9%) (Nowak and Greenfield 2012)
- You can’t map what you can’t see

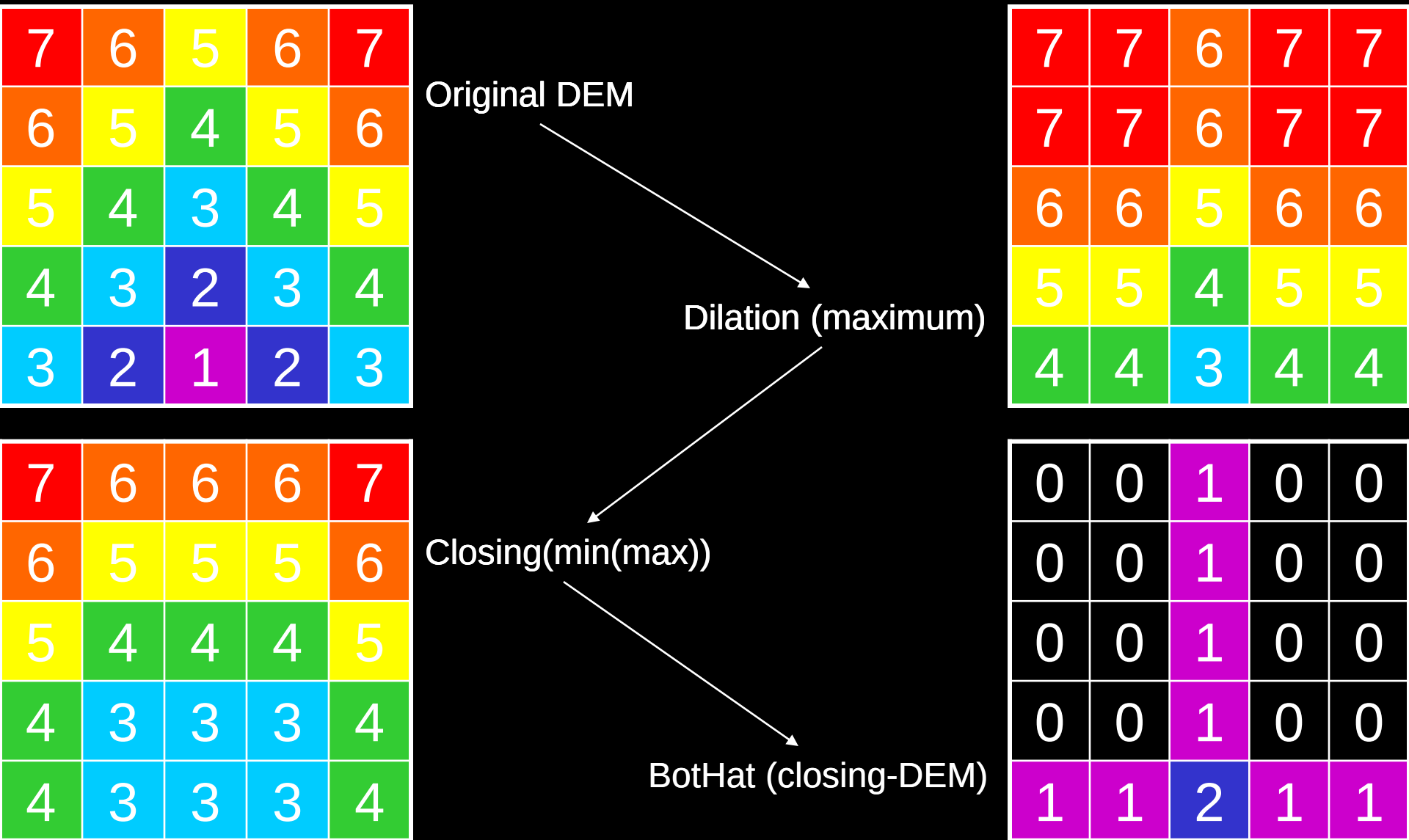
National Map standard:
Horizontal accuracy of 40 ft for 90% of streams
0
125
250
500
Feet



	Flowlines outside of waterbodies
NHD Length M	172206
Erase Length M	74412
% out of Range	43. 21

Morphological Filters

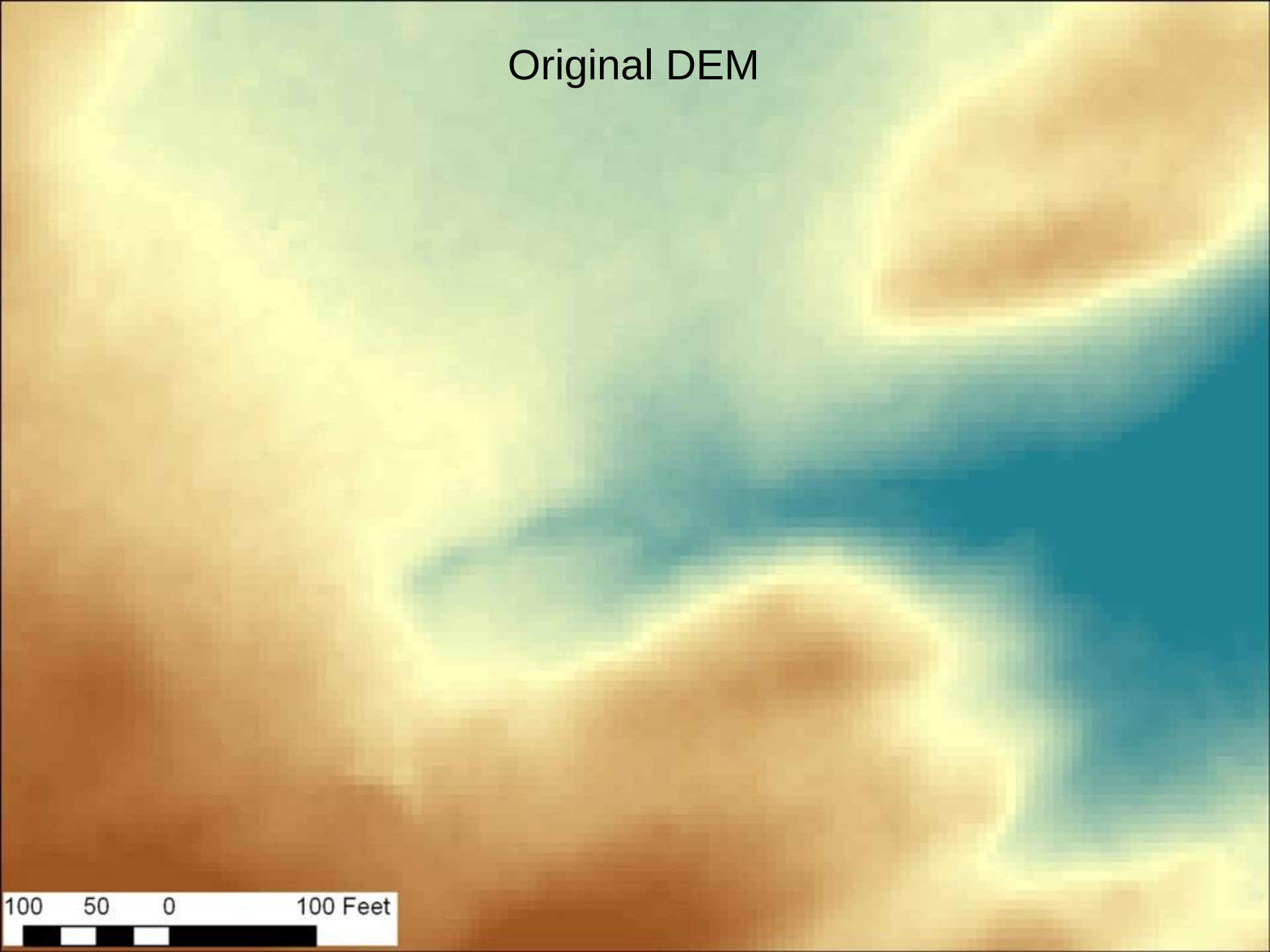
From Cho et al 2010 and Rodriguez 2007



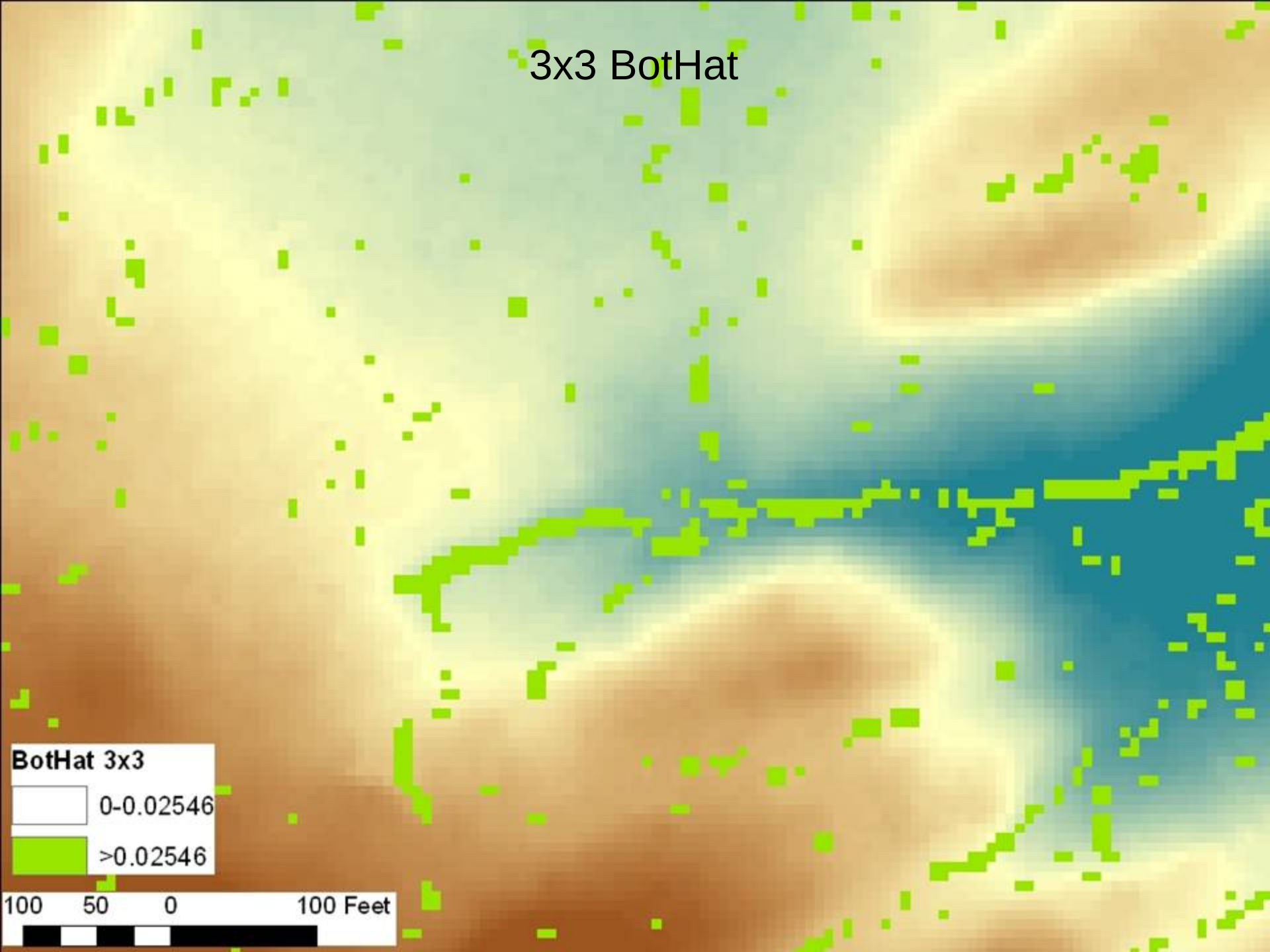
Methods

- Find channelized areas
- Find valley areas
- Find areas where water would accumulate
- Find areas where these coincide and represent a large area
- Use these as seed points
- Accumulate the seed points and convert to lines

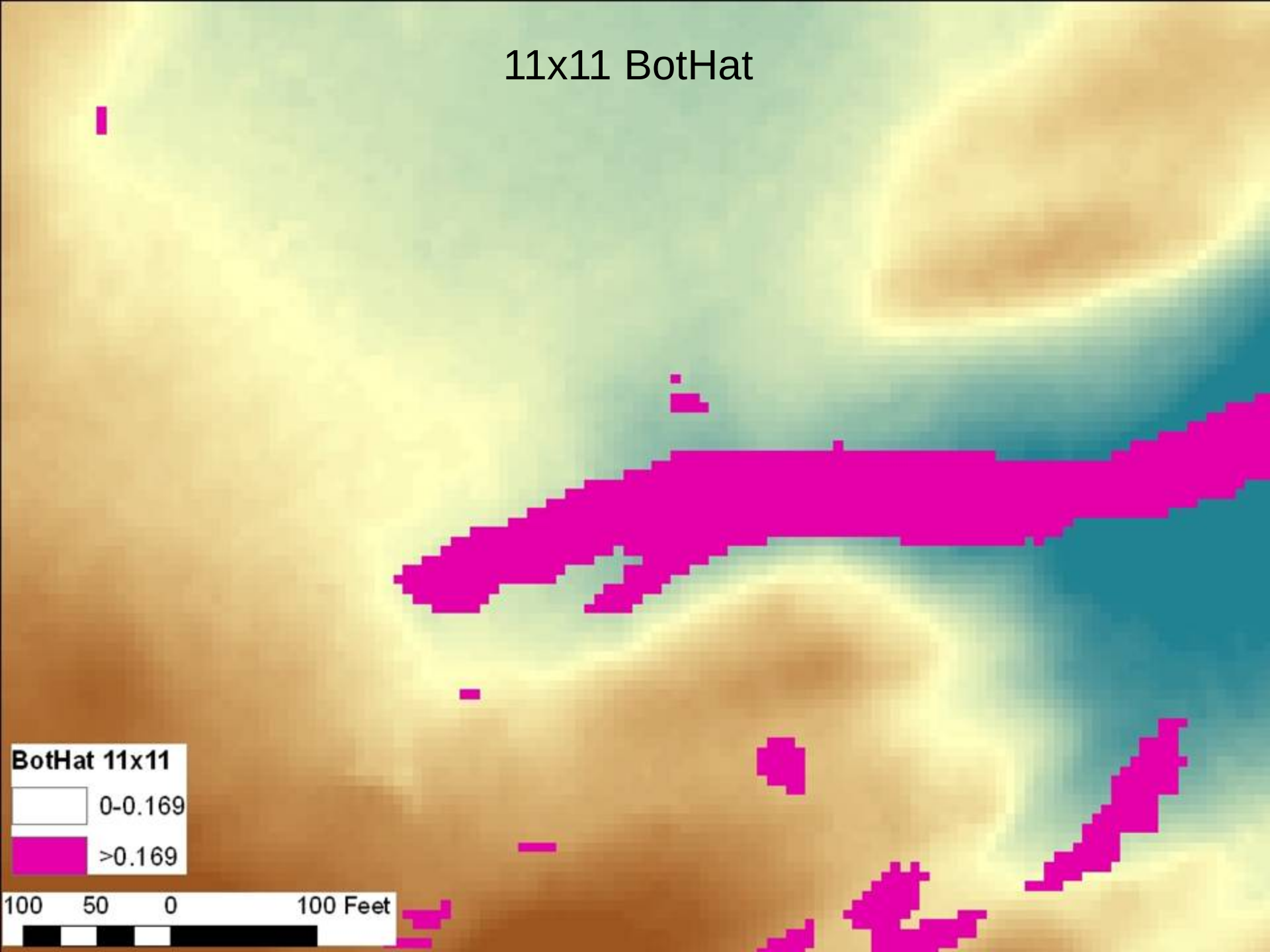
Original DEM



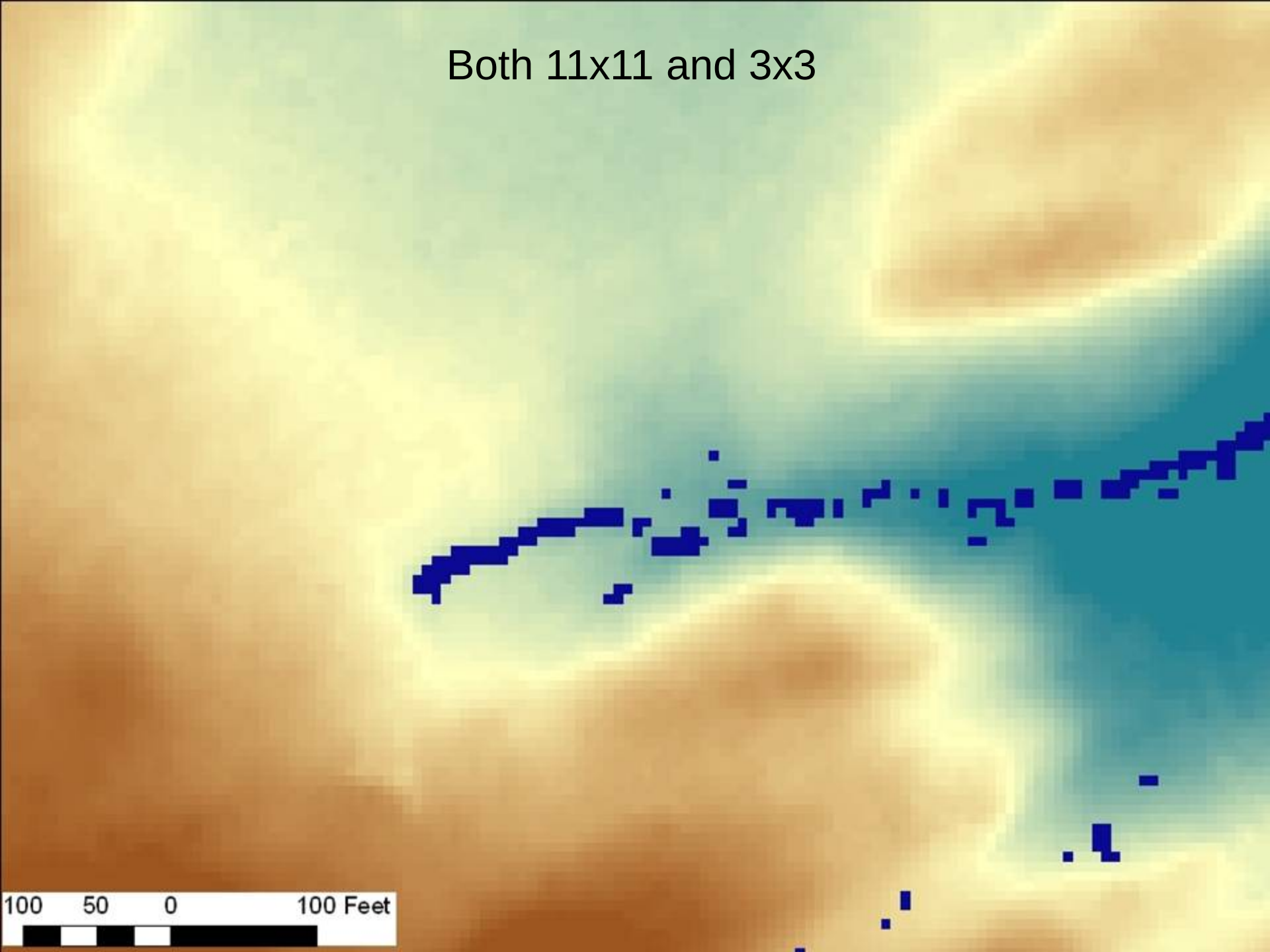
3x3 BotHat



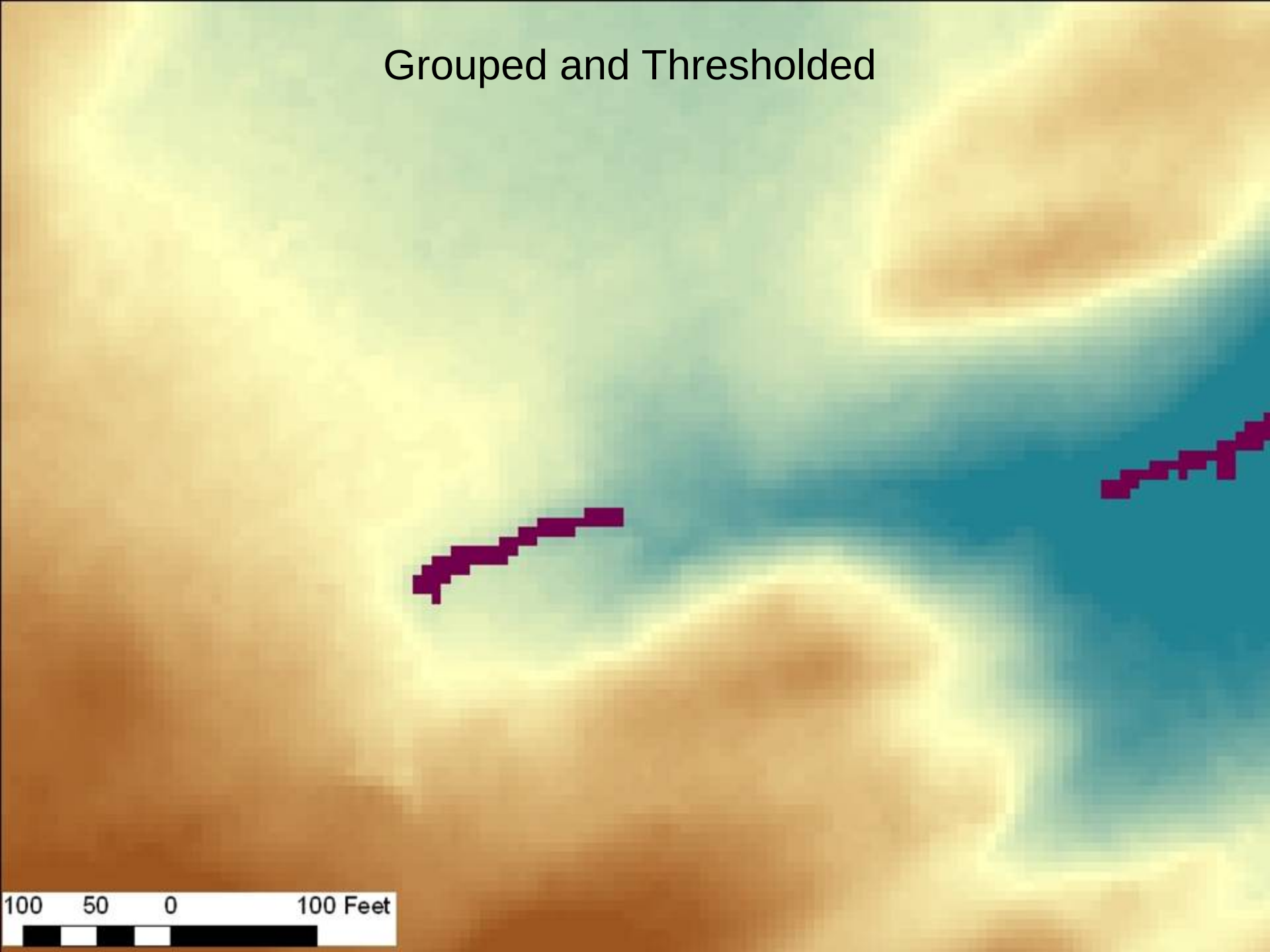
11x11 BotHat



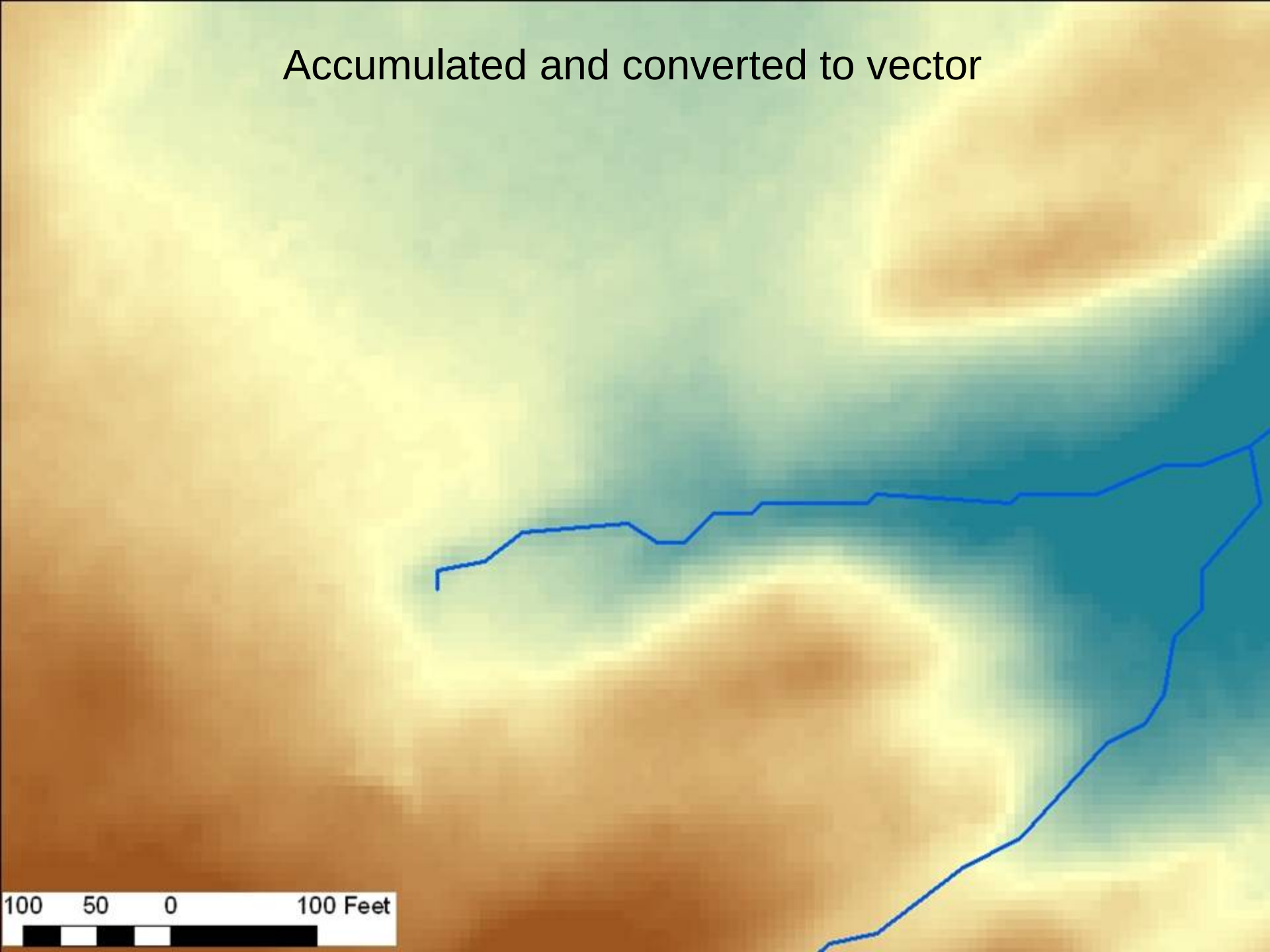
Both 11x11 and 3x3

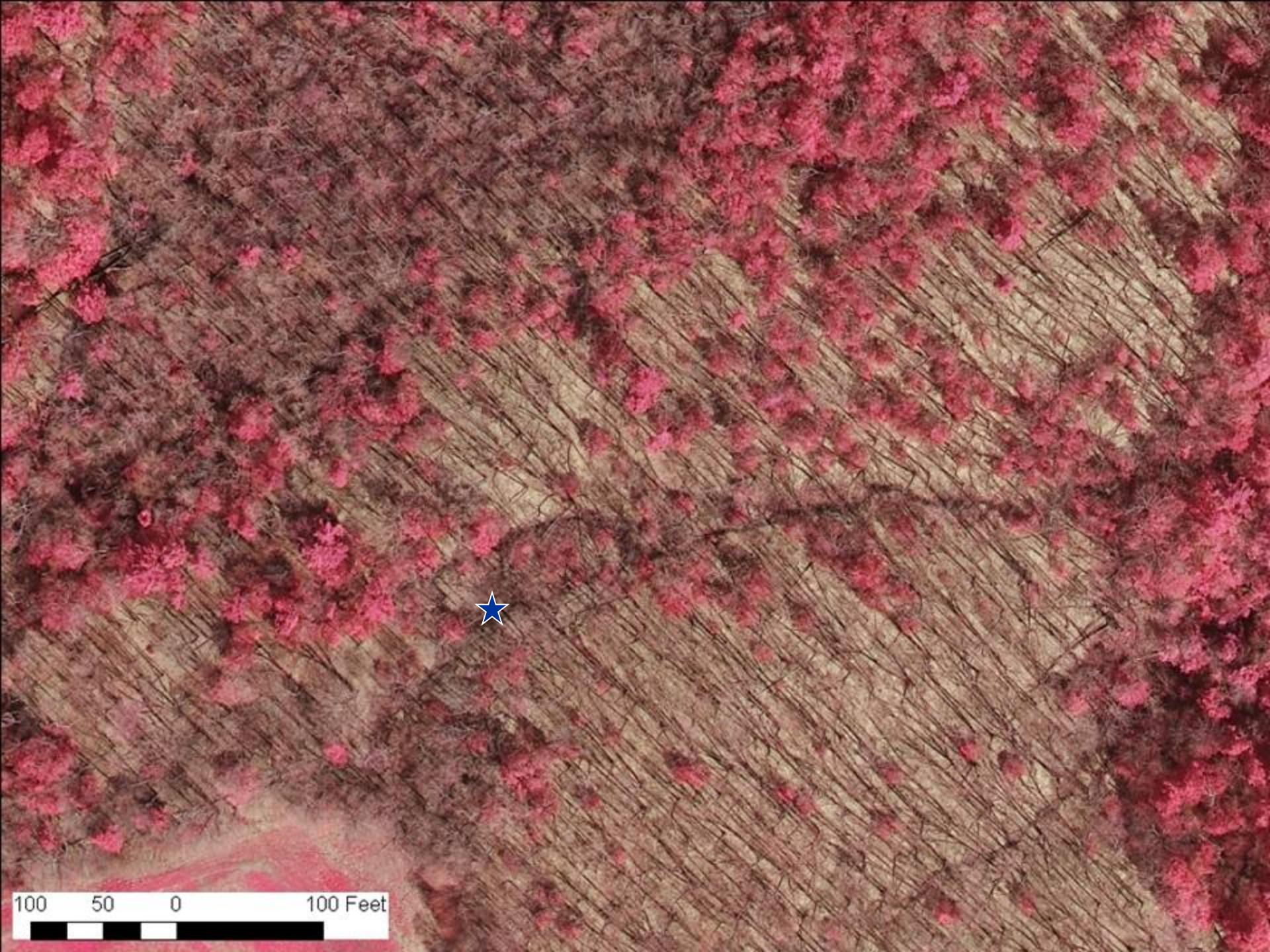


Grouped and Thresholded



Accumulated and converted to vector

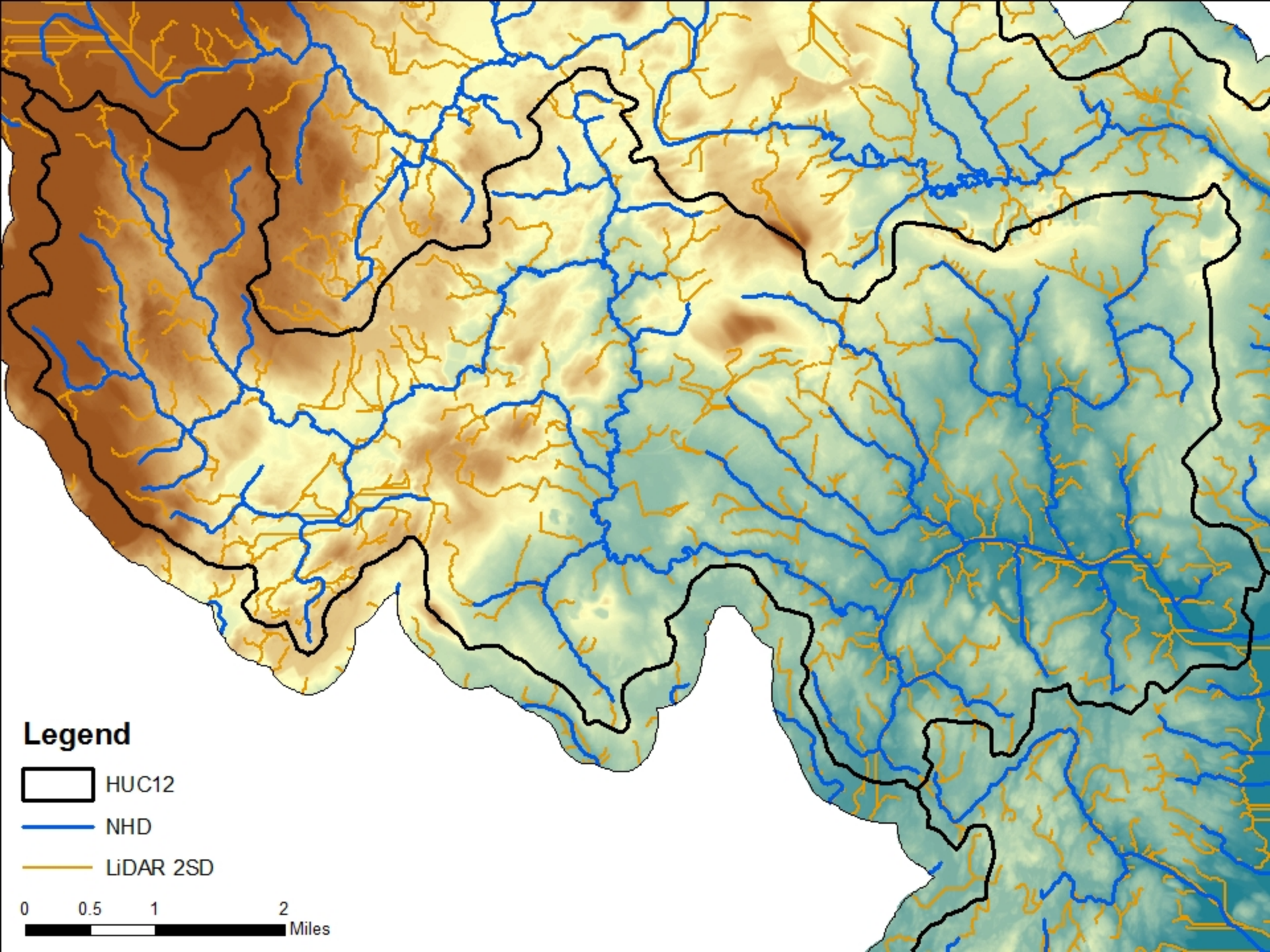


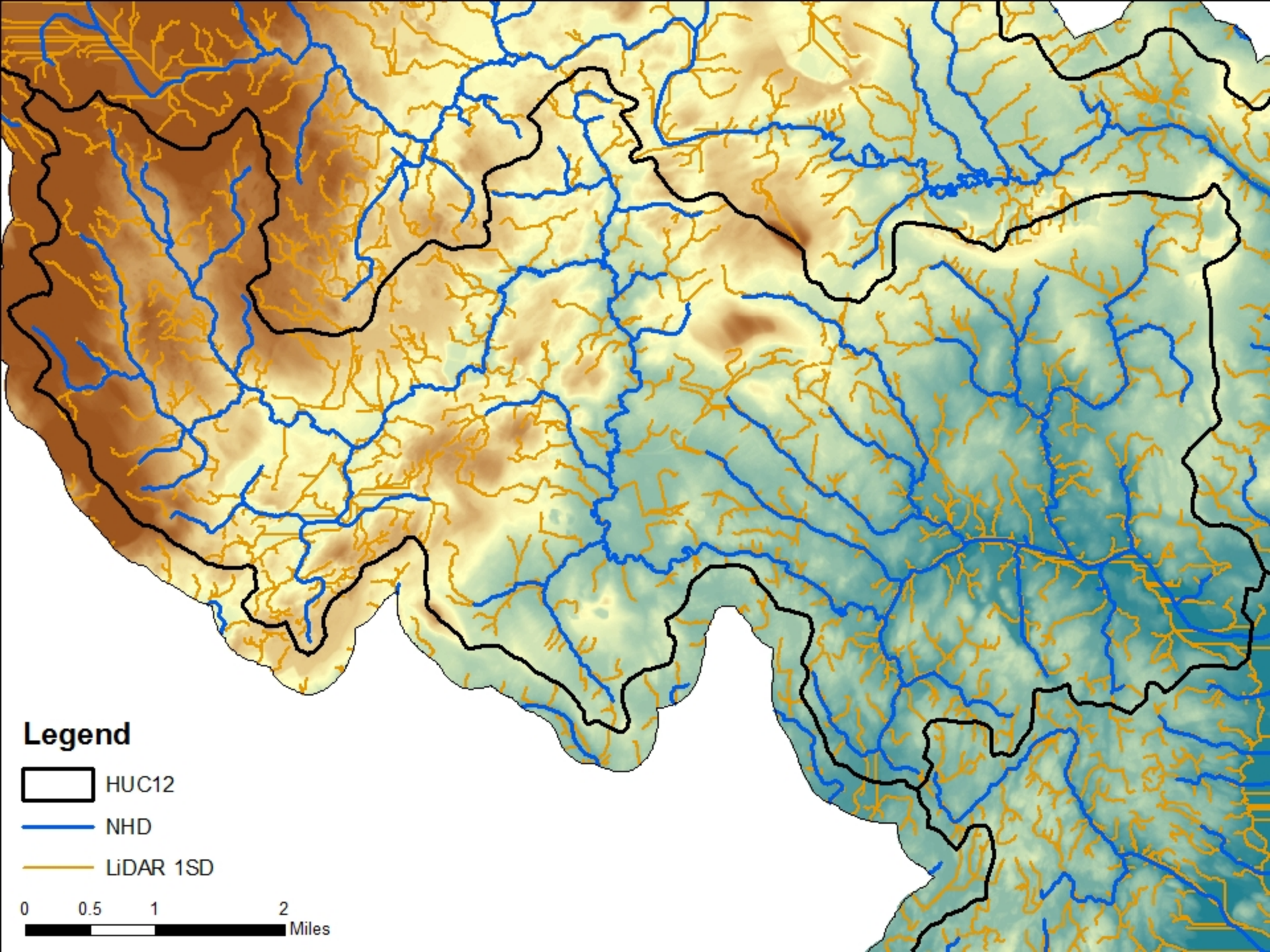

100 50 0 100 Feet

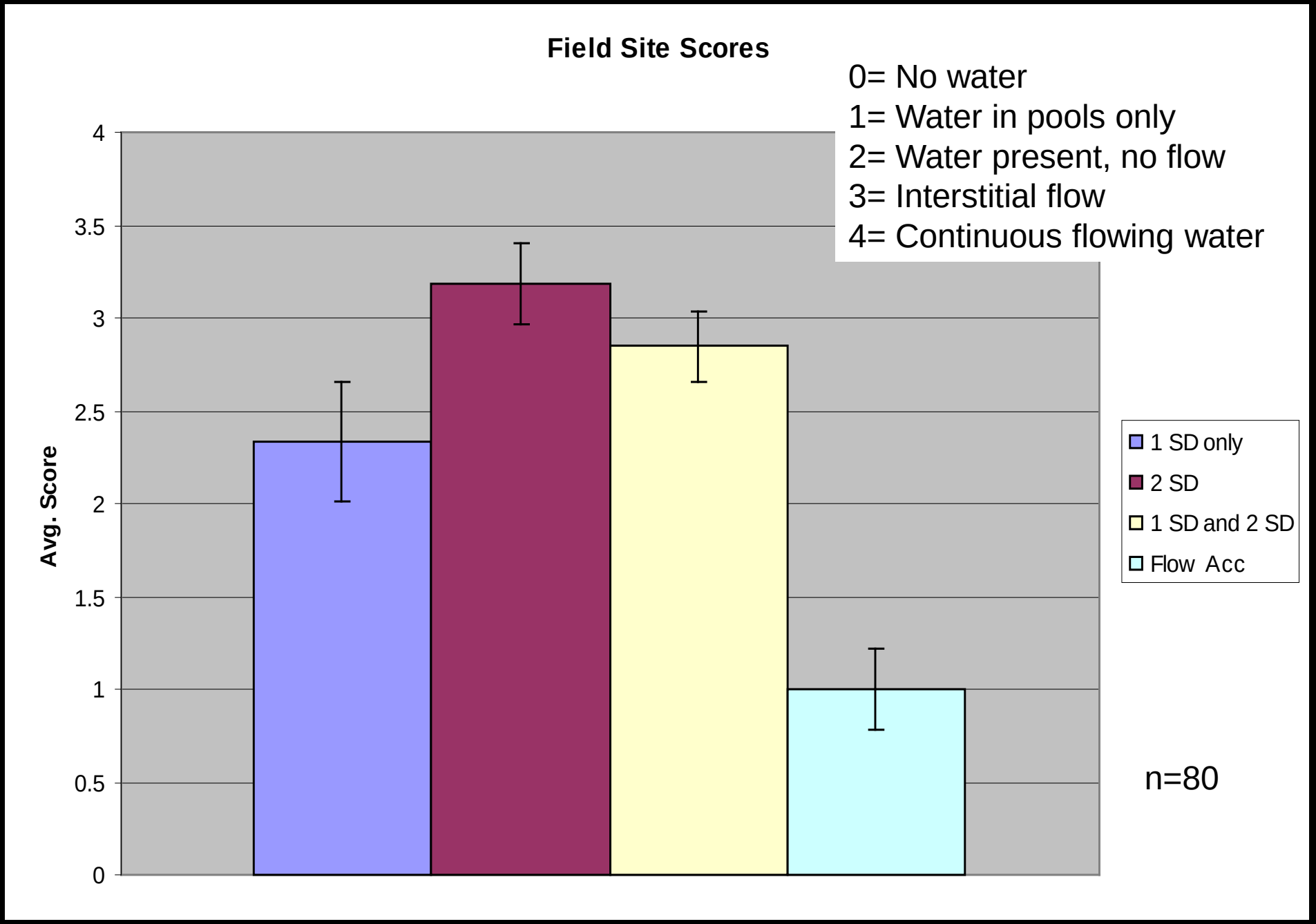
Seacoast Results

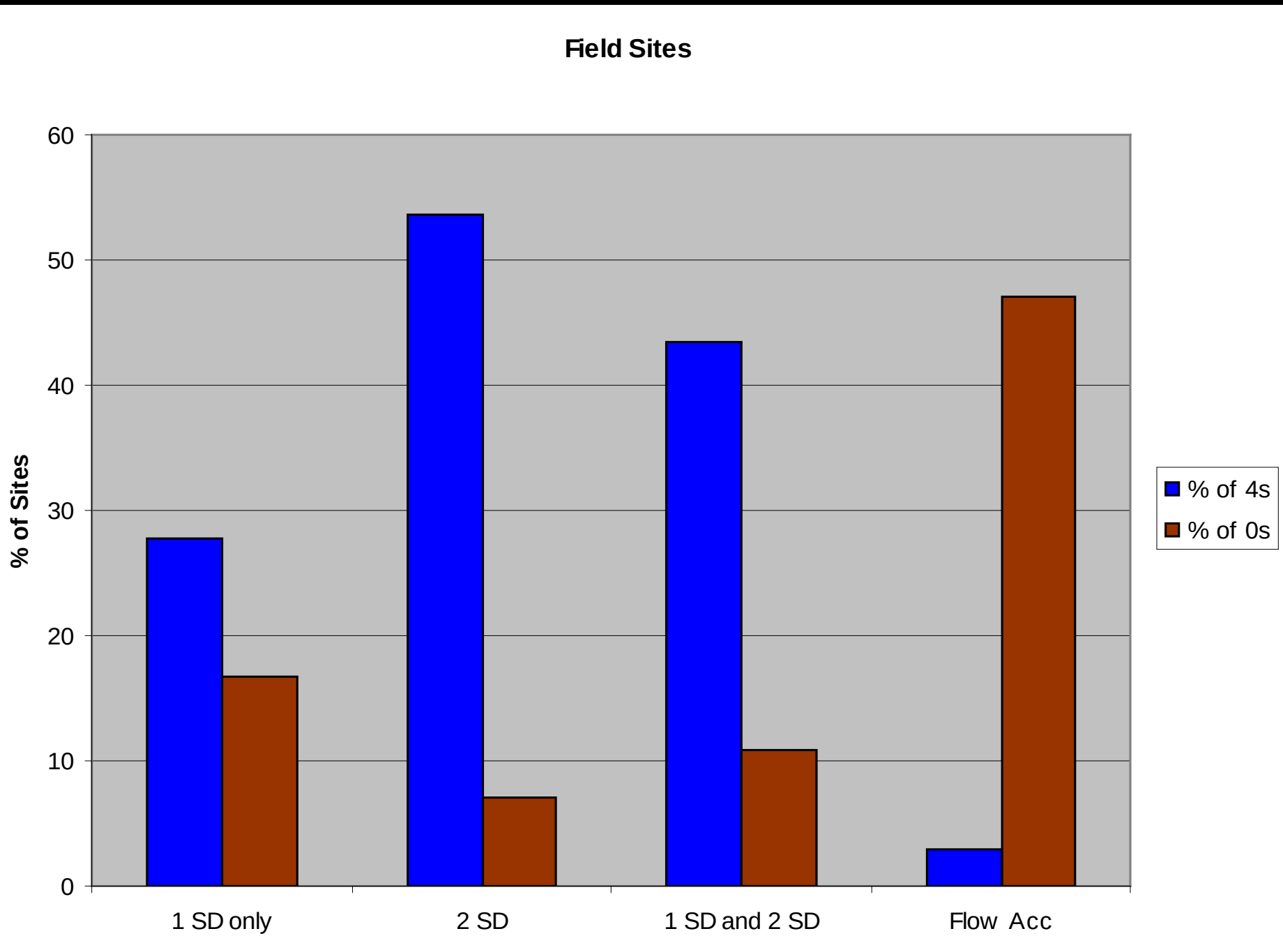
	NHD+	NHD	NHDlidar	1918	2 SD	1 SD
Drainage Density(mi/mi^2)	1.24	1.84	2.09	2.82	4.88	6.58
% increase	-32	--	13	53	164	256
sites	--	--	--	--	28	18

*An additional 34 sites not on an extracted flowline were visited.


Legend
HUC12
NHD
LiDAR 2SD
0
0.5
1
2
Miles

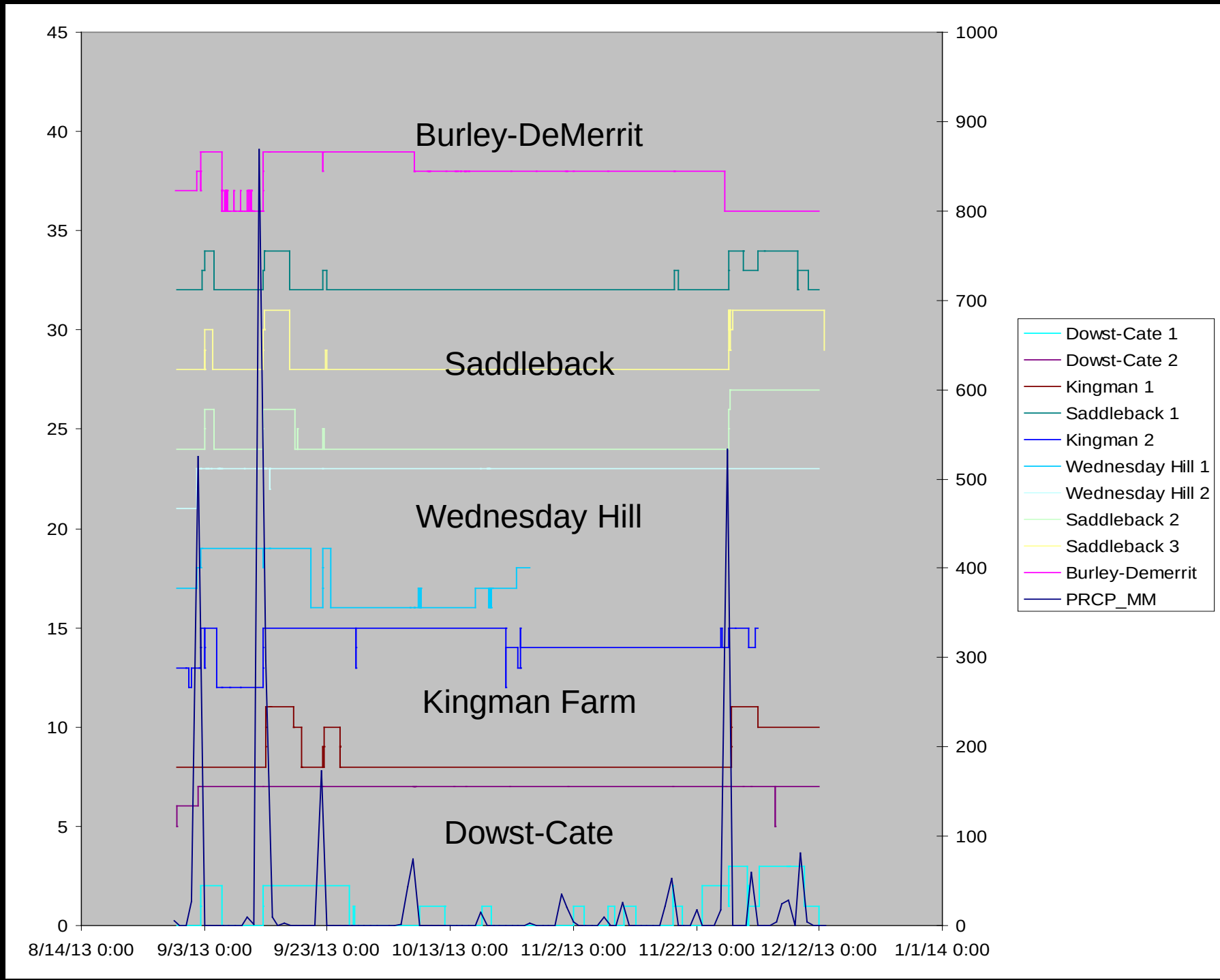

Legend
HUC12
NHD
LiDAR 1SD
0
0.5
1
2
Miles

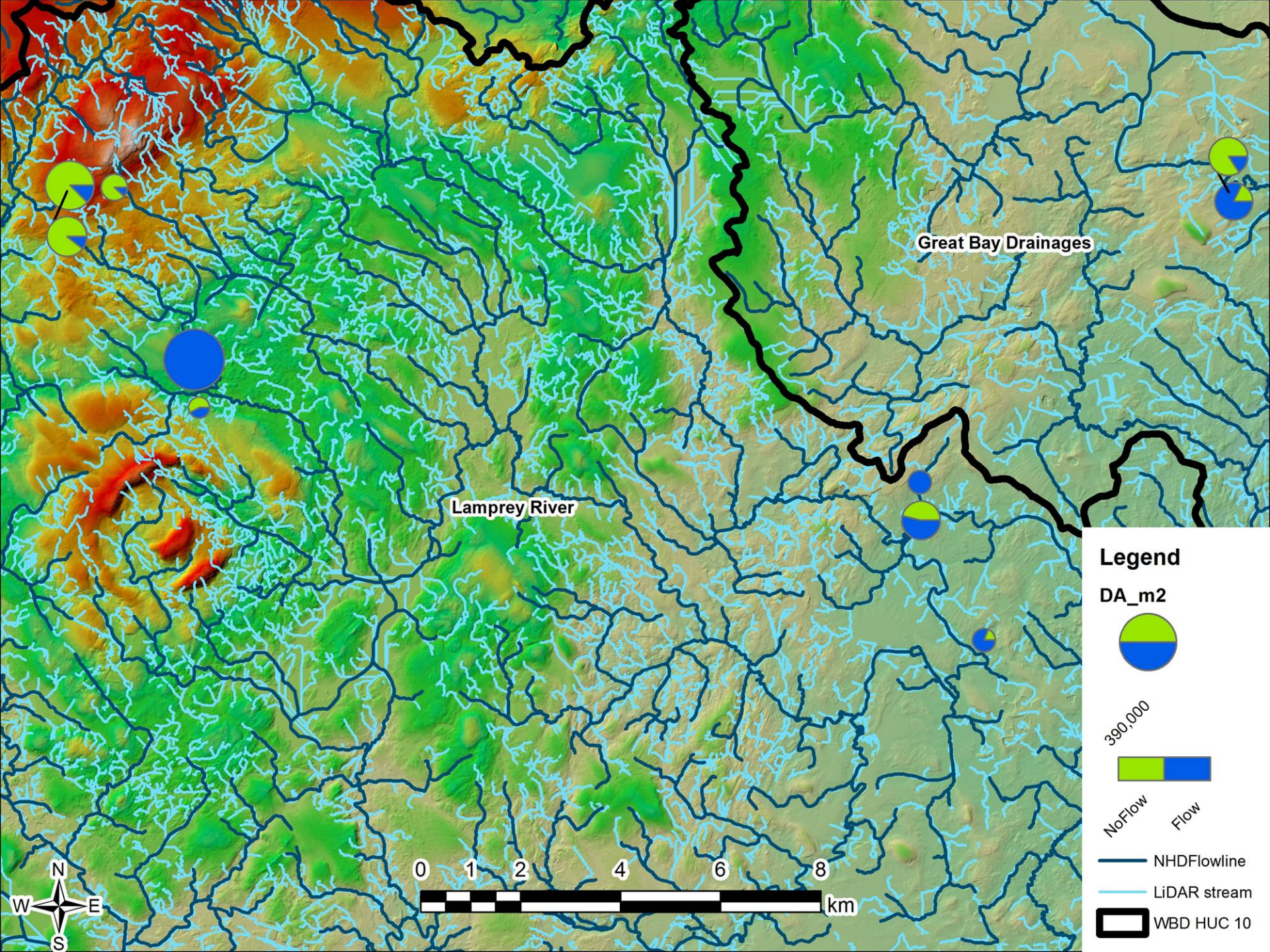

Field Site Scores
0= No water
1= Water in pools only
2= Water present, no flow
3= Interstitial flow
4= Continuous flowing water
Avg. Score
4
3.5
3
2.5
2
1.5
1
0.5
0
1 SD only
2 SD
1 SD and 2 SD
Flow Acc
n=80

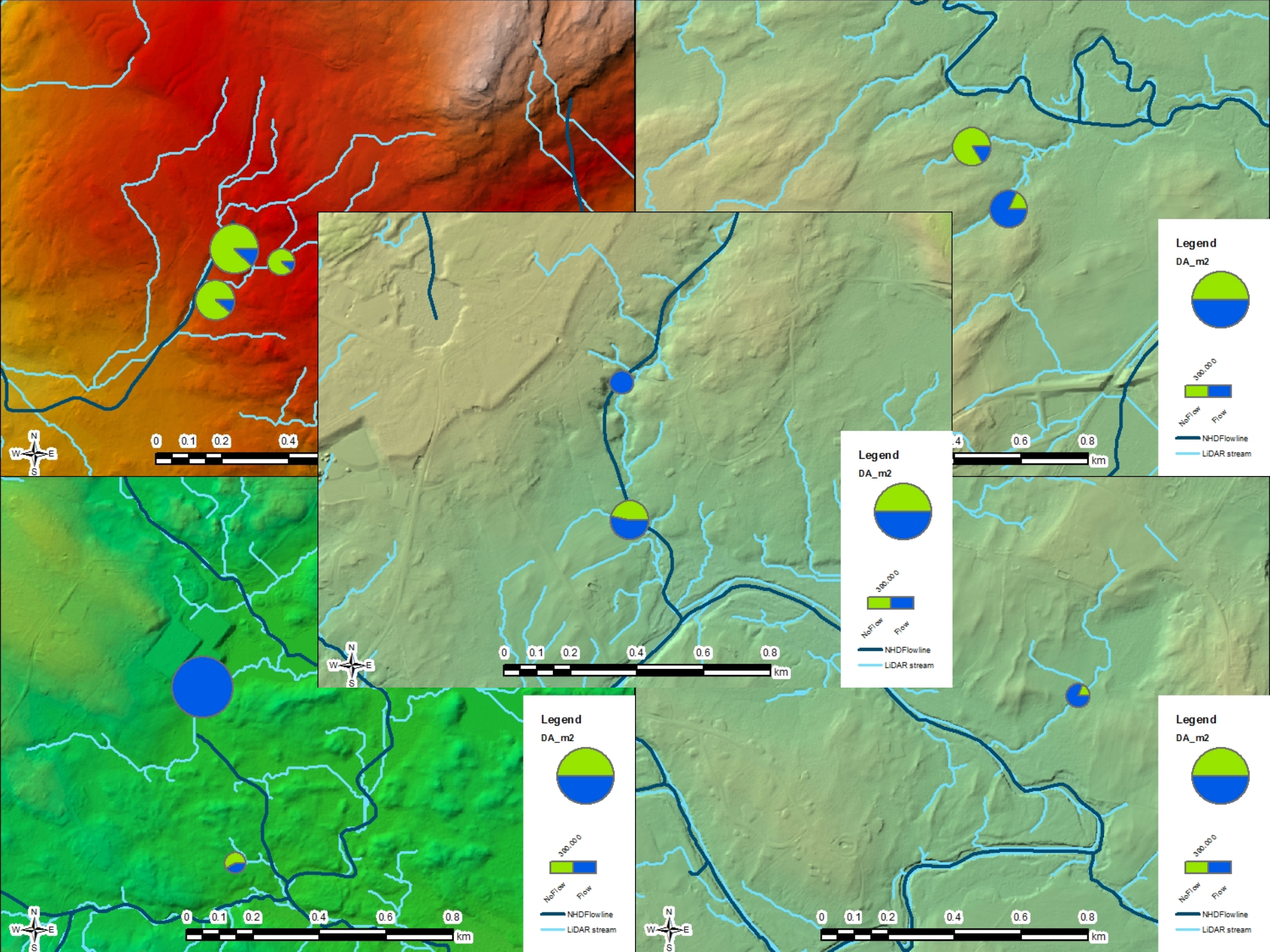

Field Sites
% of Sites
60
50
40
30
20
10
0
1 SD only
2 SD
1 SD and 2 SD
Flow Acc
% of 4s
% of 0s

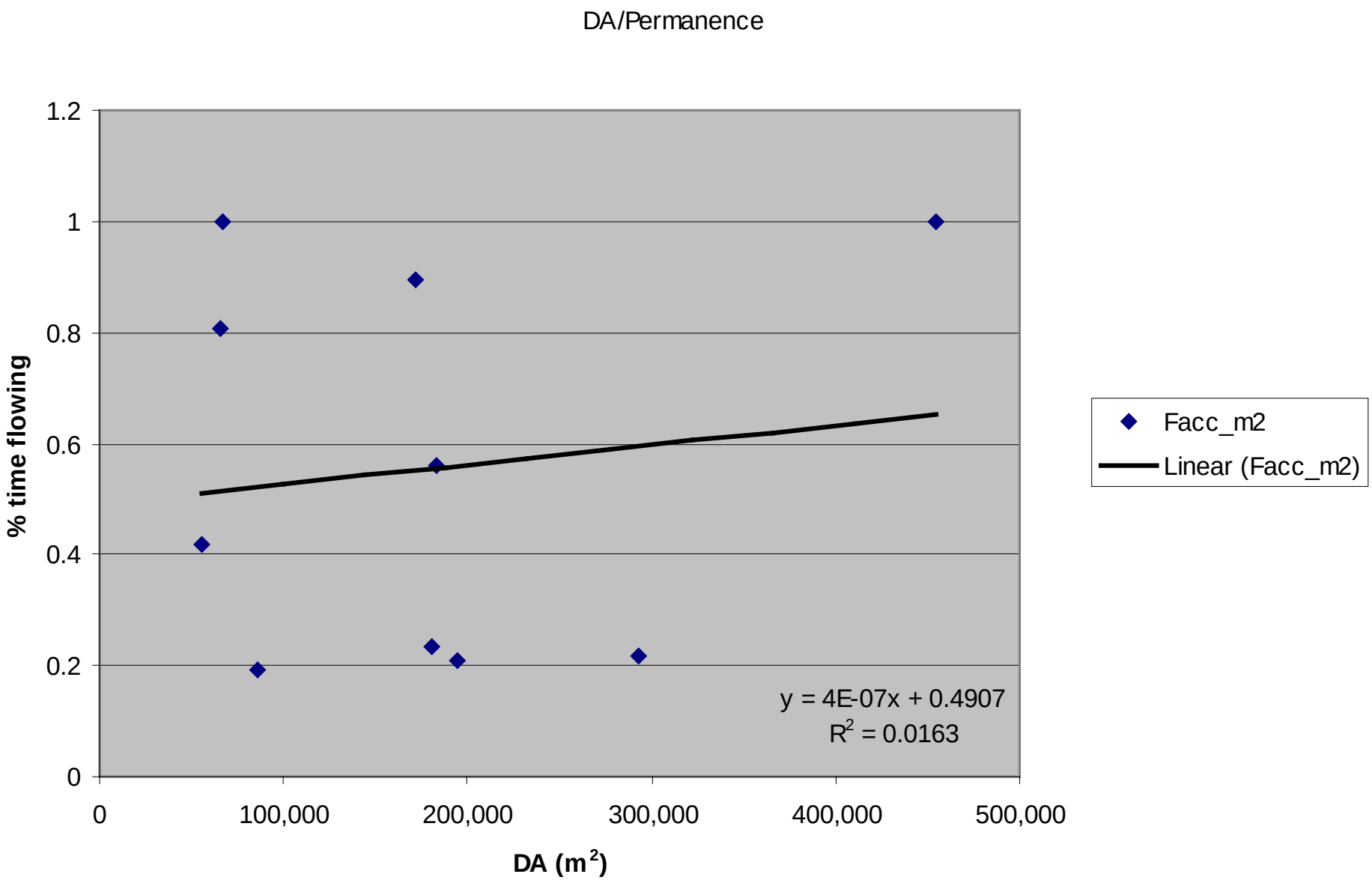
Permanance

- Ten streams in the seacoast region were fitted with simple state sensors following the design of Bhamjee and Lindsay 2011
- Streams were unmapped tributaries to 1st order NHD streams


Burley-DeMerrit
Saddleback
Wednesday Hill
Kingman Farm
Dowst-Cate
45
40
35
30
25
20
15
10
5
0
1000
900
800
700
600
500
400
300
200
100
0
8/14/13 0:00
9/3/13 0:00
9/23/13 0:00
10/13/13 0:00
11/2/13 0:00
11/22/13 0:00
12/12/13 0:00
1/1/14 0:00
Dowst-Cate 1
Dowst-Cate 2
Kingman 1
Saddleback 1
Kingman 2
Wednesday Hill 1
Wednesday Hill 2
Saddleback 2
Saddleback 3
Burley-Demerrit
PRCP_MM


Great Bay Drainages
Lamprey River
Legend
DA_m2
390,000
NoFlow
Flow
NHDFlowline
LiDAR stream
WBD HUC 10
0
1
2
4
6
8
km
N
W
E
S


Legend
DA_m2
300,000
NoFlow
Flow
NHDFlowline
LiDAR stream
0
0.1
0.2
0.4
0.6
0.8
km
N
W
E
S


DA/Permanence
% time flowing
DA (m2)
1.2
1
0.8
0.6
0.4
0.2
0
0
100,000
200,000
300,000
400,000
500,000
y = 4E-07x + 0.4907
R2 = 0.0163
Facc_m2
Linear (Facc_m2)

Questions?

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References

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