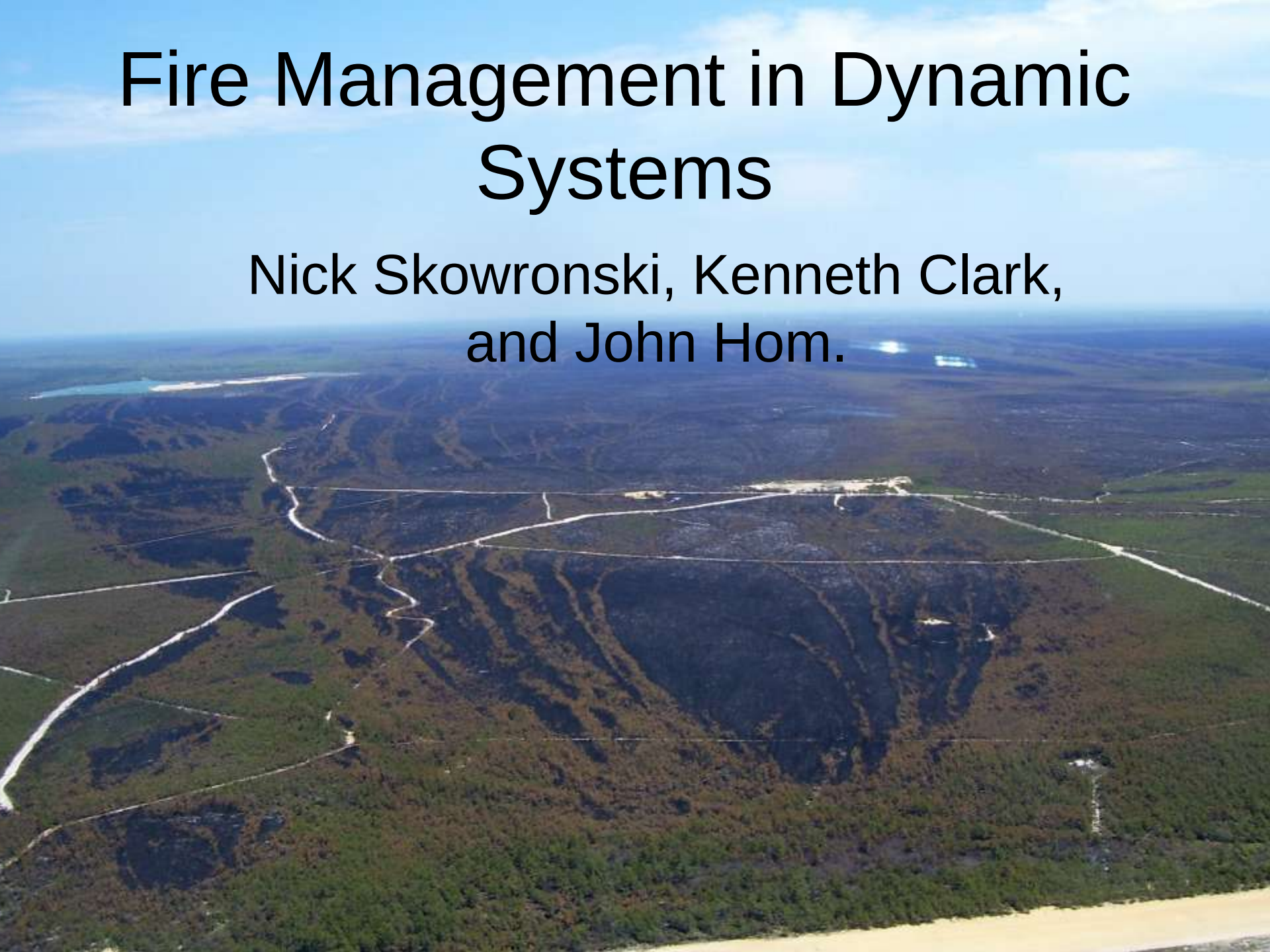
Fire Management in Dynamic Systems

Nick Skowronski, Kenneth Clark, and John Hom.



Silas Little Exp. Forest
Oak/Pine

Fort Dix
Pine/Oak

Manchester WMA
Pine/Scrub Oak

USFS

NJ Fire Danger Monitoring Console

Most recent information collected as of February 3, 2009, 11:44 am

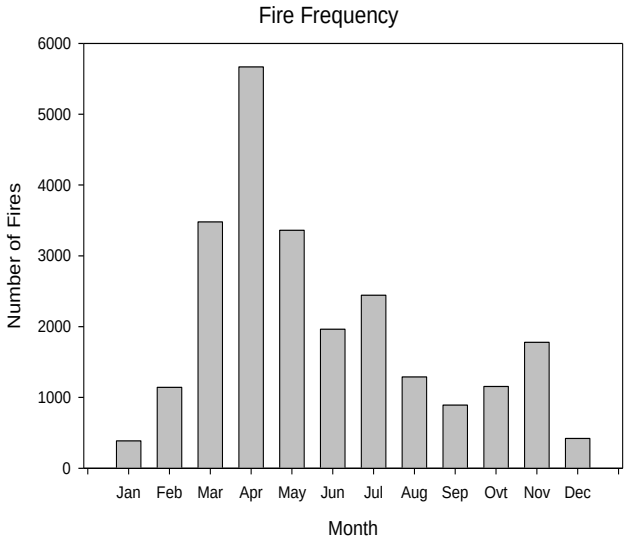
Site	Air Temp	RH	Wind Sp	Peak Gust	Wind Dir	10hr Fuel Moisture	10hr Fuel Temp	24hr Precip
Hammonton	33		5	11	N			0.05
Upper Deerfield	32	90	9	13	N			0.02
Cream Ridge	32	93	4	14	N	17	34	
Woodbine	33	95	10	15	N			0.07
Oswego Lake	32	94	6	12	NNW	24	33	0.05
Silas Little	32	92	5	11	NNW	27	33	0.00
Fort Dix I	32	91	6	14	N		33	0.00
Cedar Bridge	31	97	6	11	NNE	23	33	0.00
Fort Dix II	32	89	2	6	WNW	20		
Ancora Hospital	34	92	4	12	N	38	34	
Coyle Field			7	16	NNE	30	78	
Middlesex (RAWS)	32	100	0	7	NNE	27	64	
Forsythe	33		6	15	N	0	32	
Berkeley Twp.	32	94	10	14	N	16	34	0.03
Howell	33	99	4	10	NNE			0.01

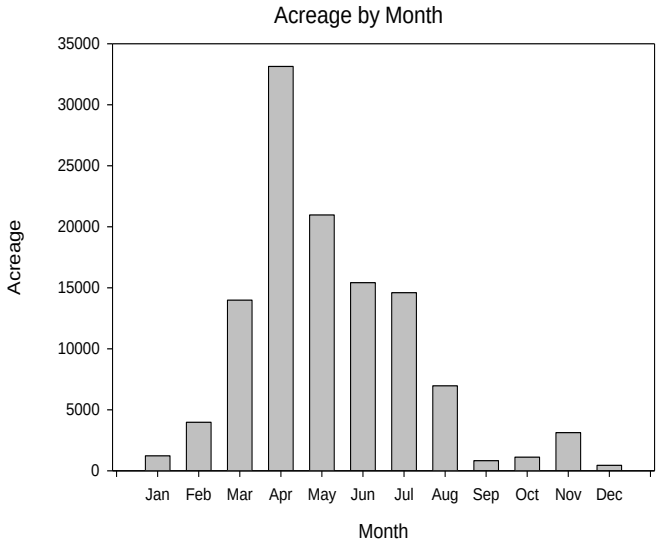
Legend:

Relative Humidity	< 40%	< 30%	< 20%
Wind Speed/Gust	> 15	> 20	> 25
Fuel Moisture	< 20	< 15	< 10

From: Office of the NJ State Climatologist.
http://climate.rutgers.edu/usfs/monitoring.php

Fire Frequency and Acreage



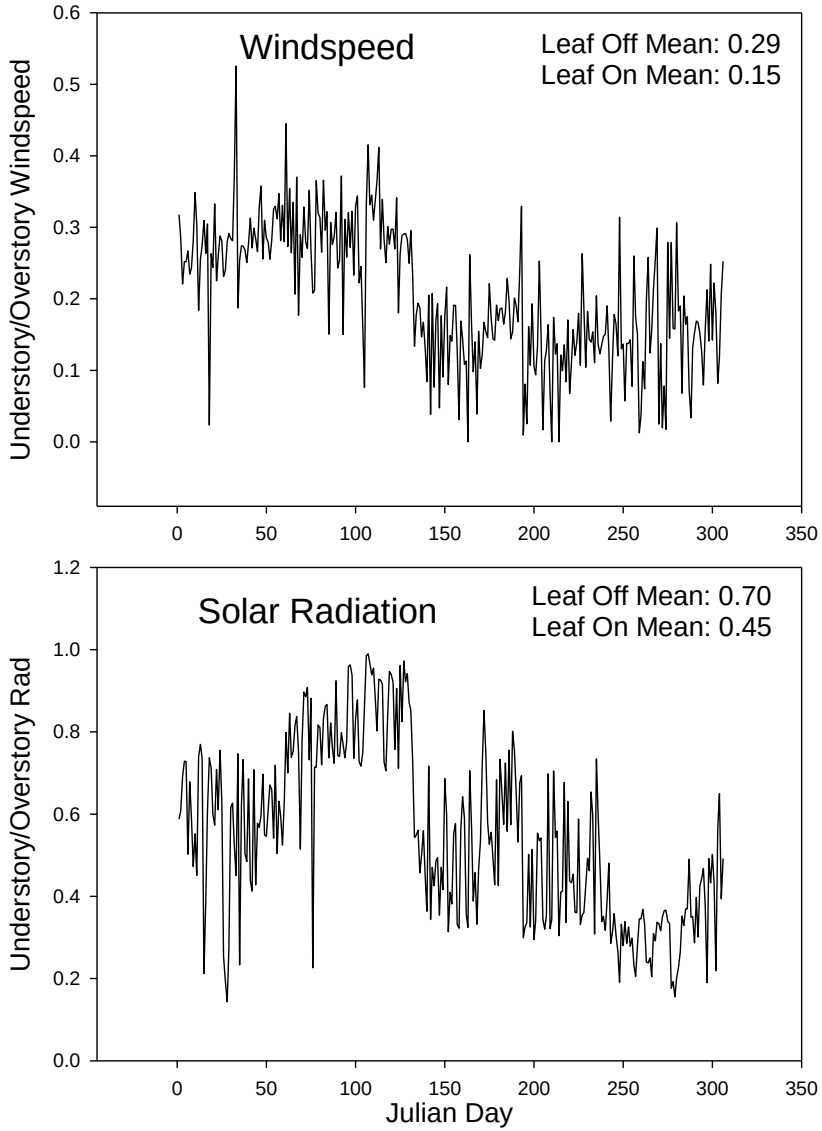


Large Fire Day (> 100 acres)

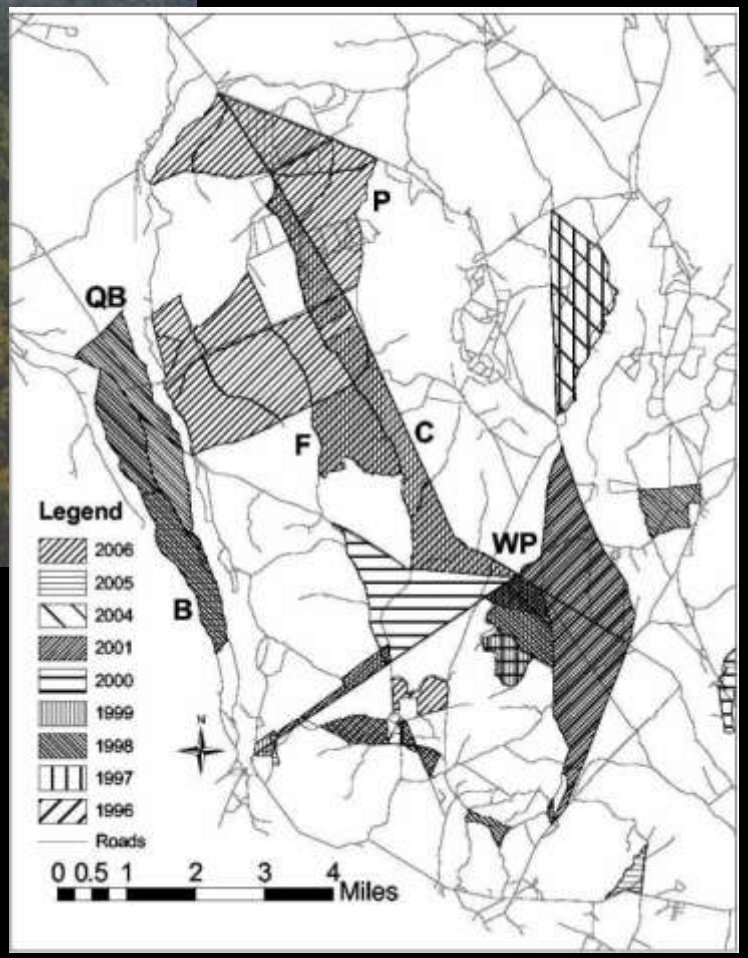
	Spring	Summer	Fall	All
BUI	0.24	0.96	0.77	0.14
KBDI	0.04	0.46	0.69	0.17
BI	0.93	0.91	0.83	0.89
SC	0.98	0.95	0.62	0.96
RH	0.92	0.68	0.69	0.85

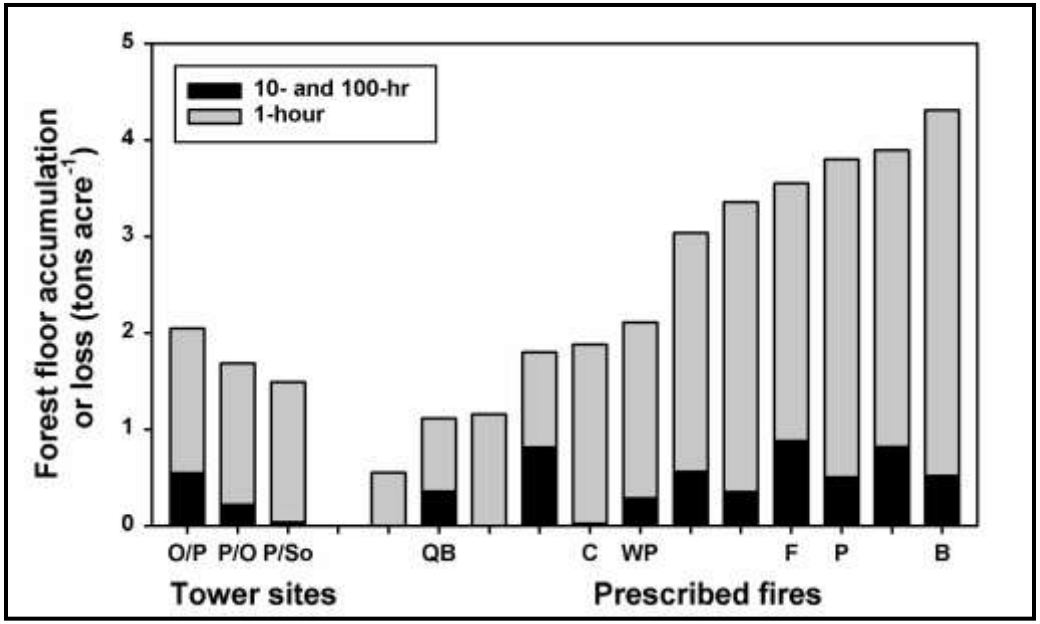
Data courtesy NJ Forest fire Service and US EPA

2004 Understory/Overstory Ratios At Slias Little Exp. Forest



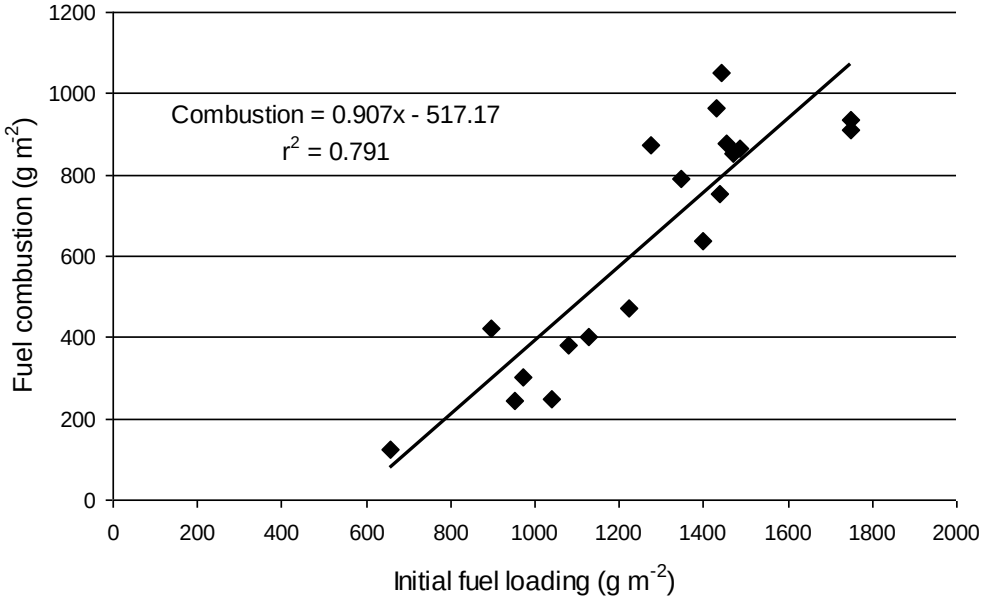
Evaluation of hazardous fuel reduction treatments conducted by NJFFS



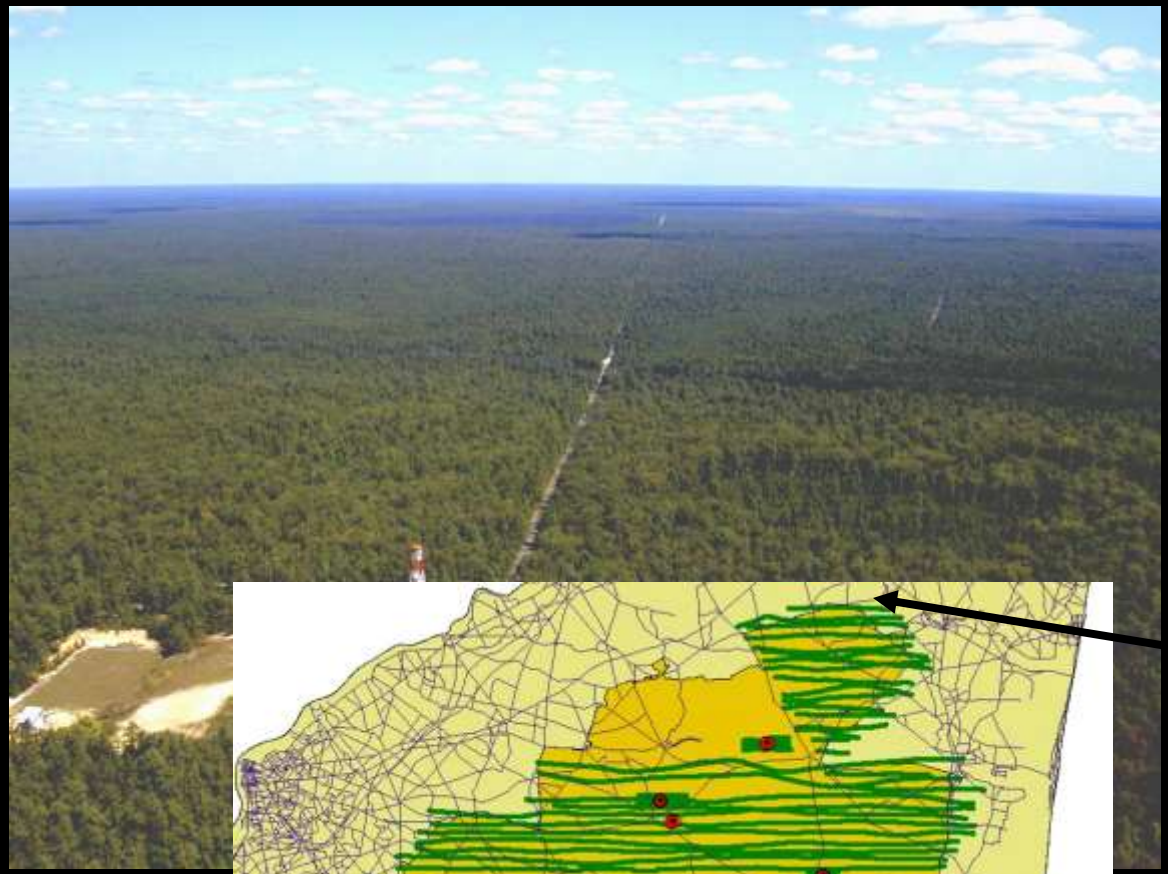


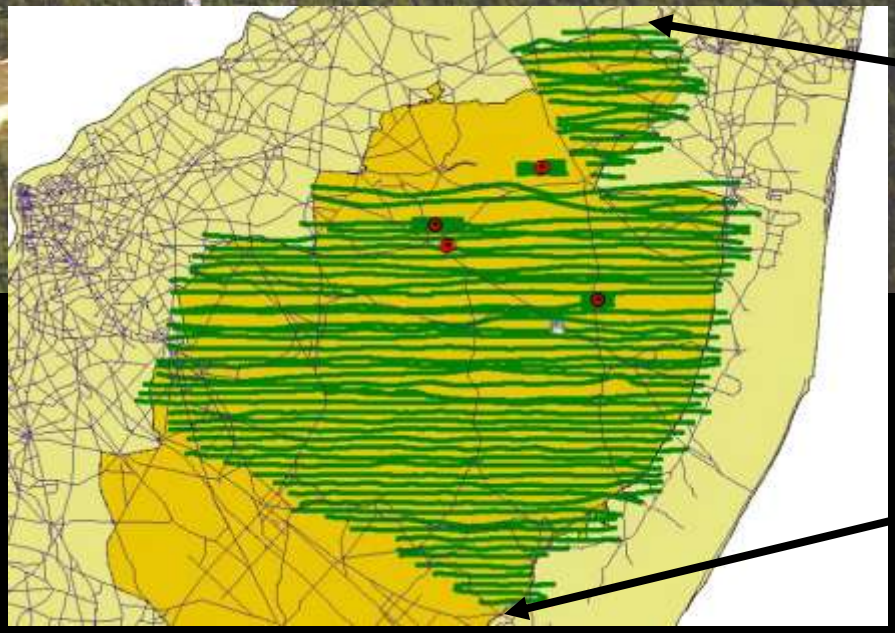
Fuel consumption from 12 prescribed fires in Wharton State Forest.

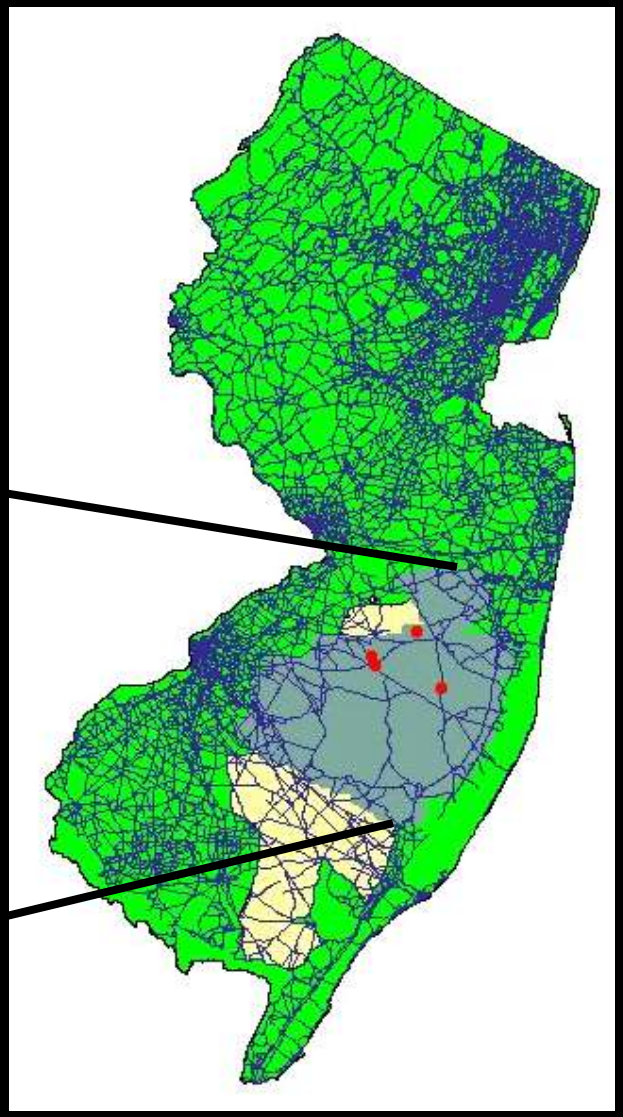
Relationship between initial fuel loading and fuel consumption at these fires.



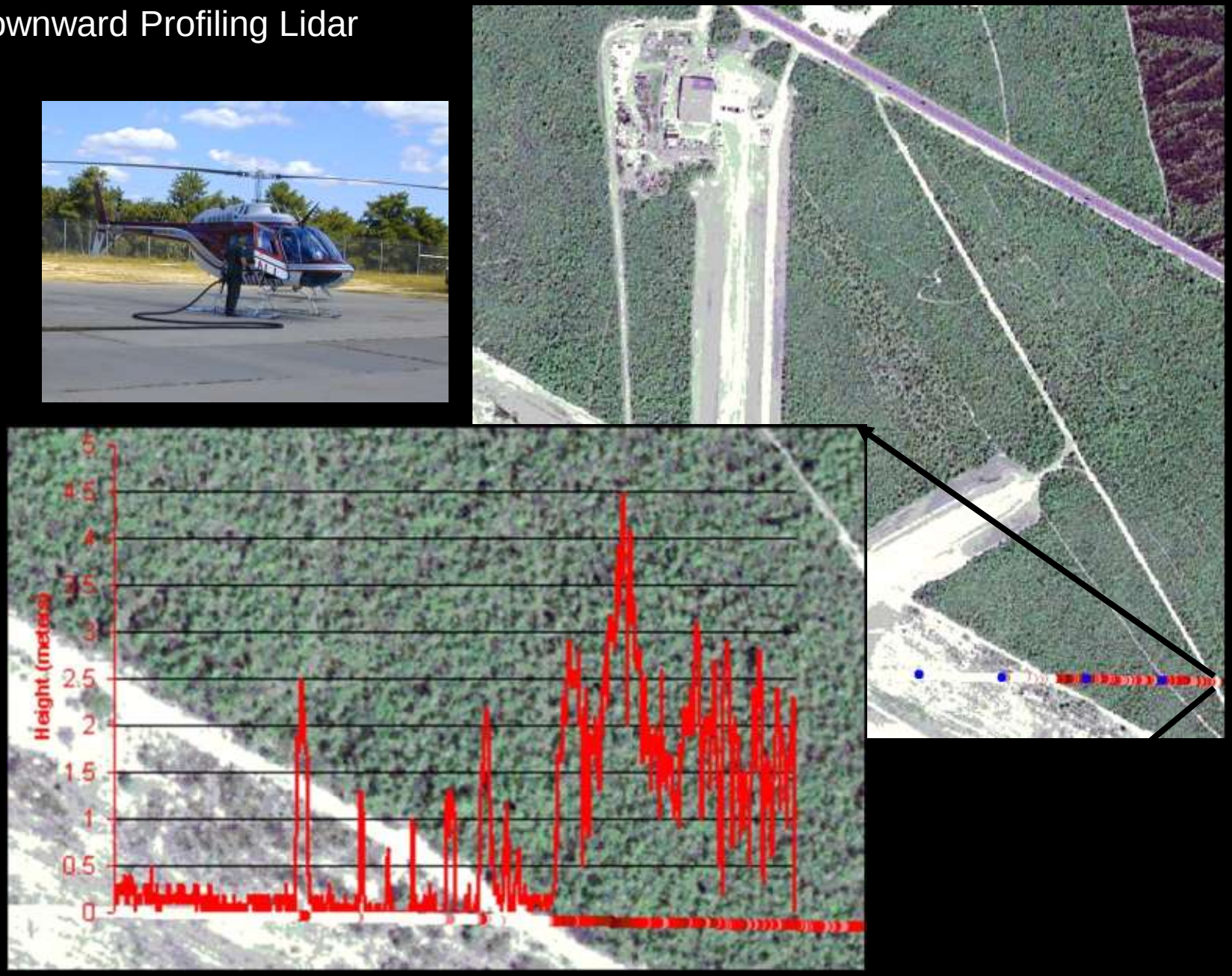
Landscape-level fuel assessment







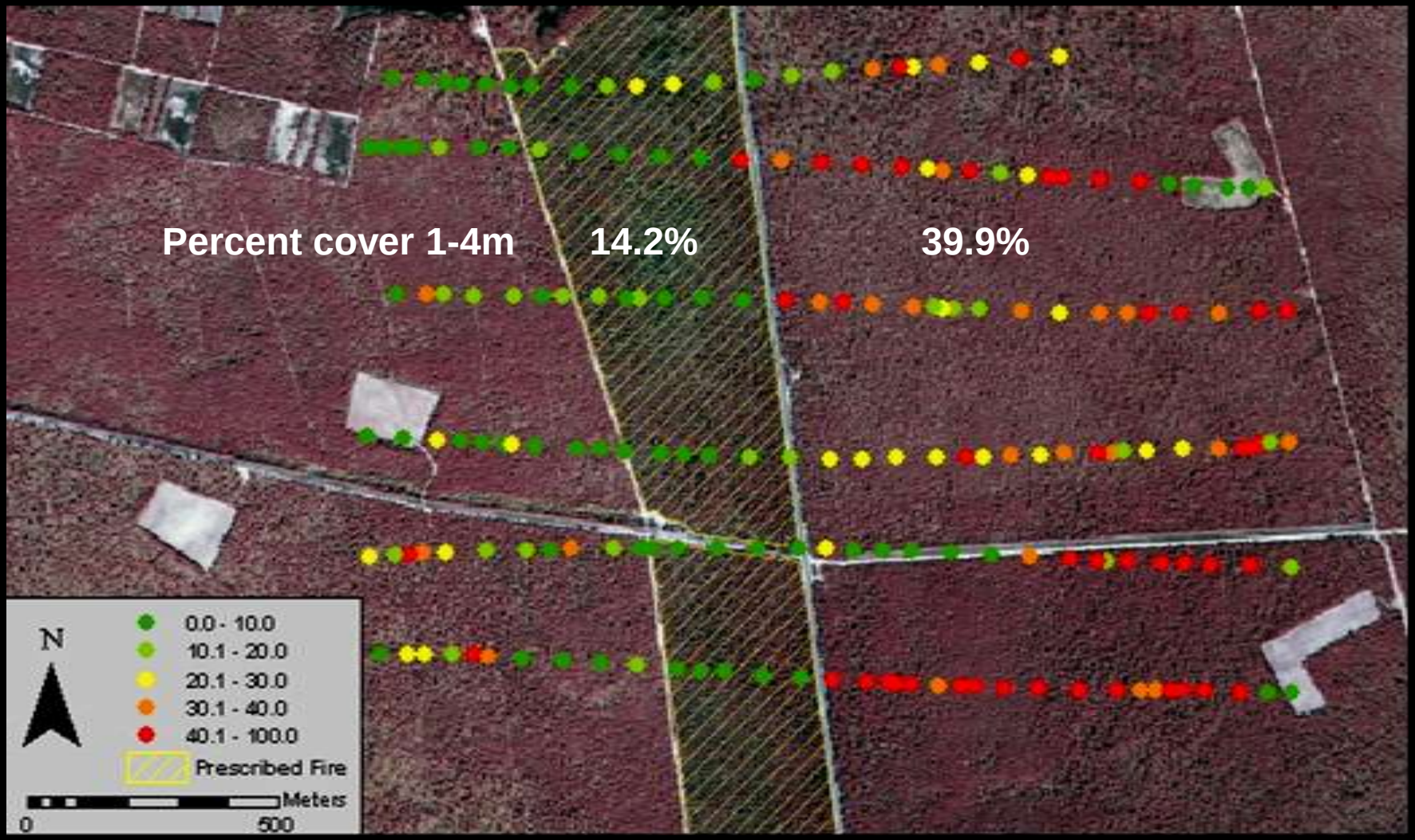
Downward Profiling Lidar



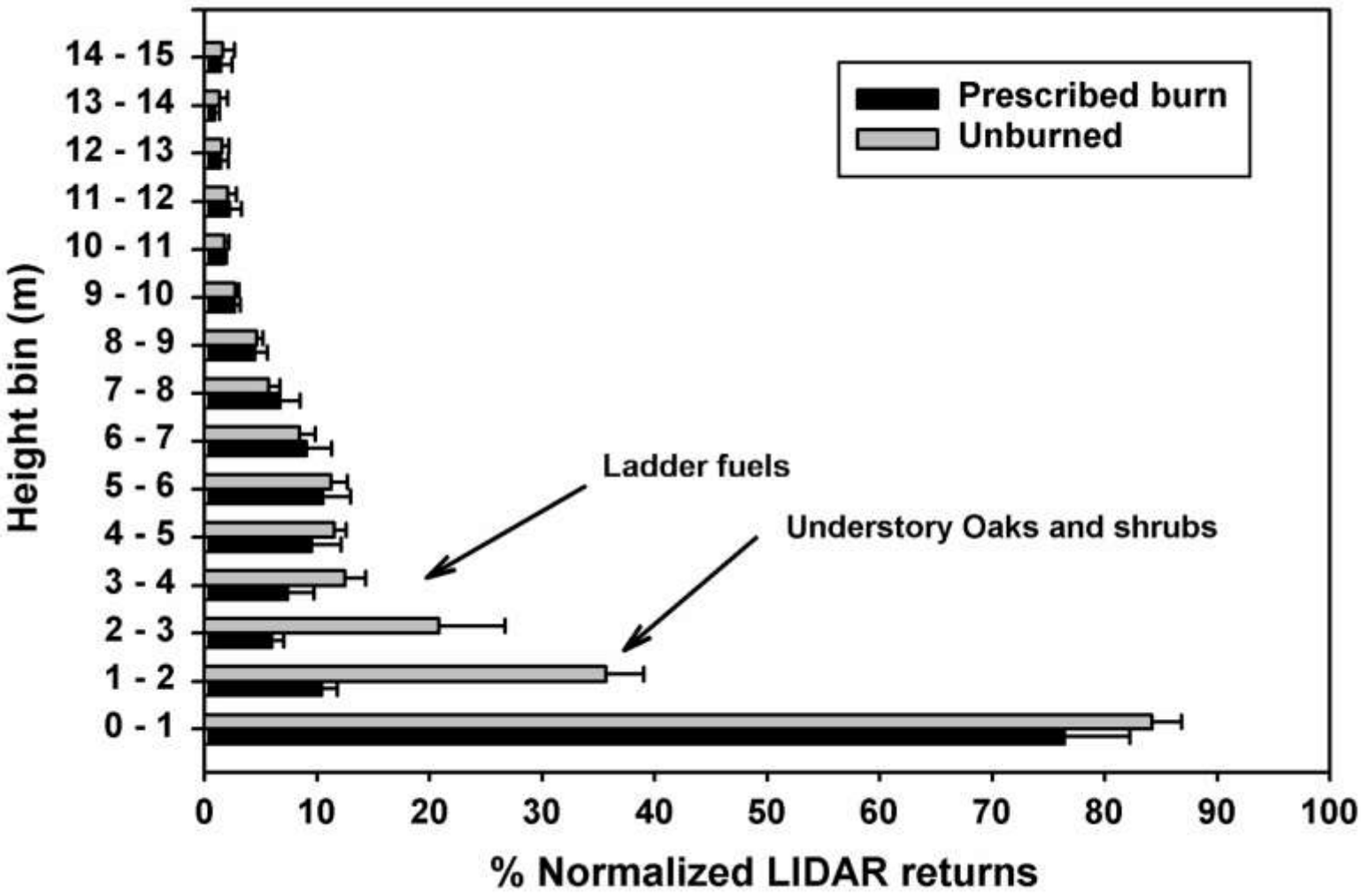
Cedar Bridge, Prescribed fire 2004

Cedar Bridge, Unburned

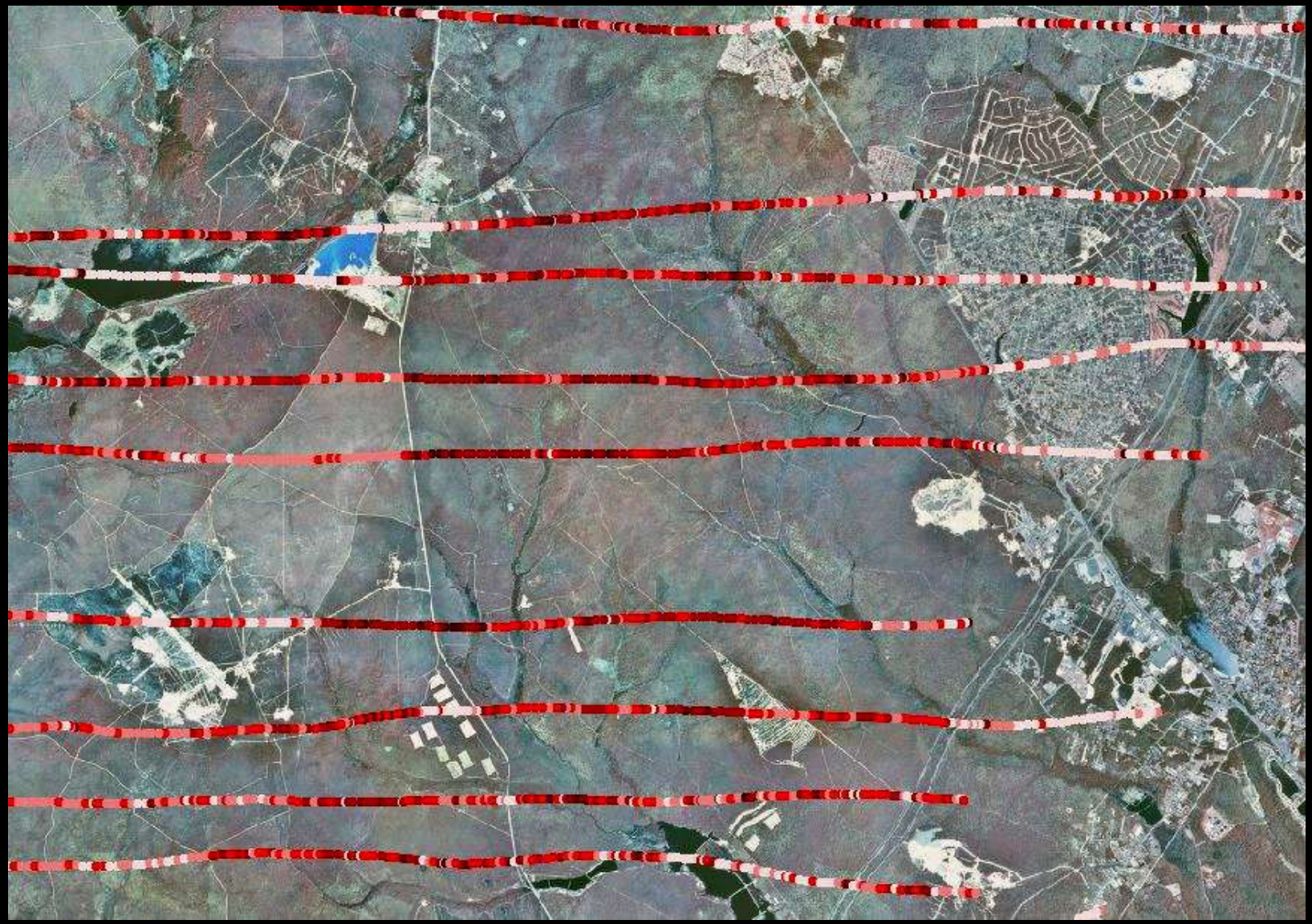
Height binned LIDAR data, “cover classes” color coded

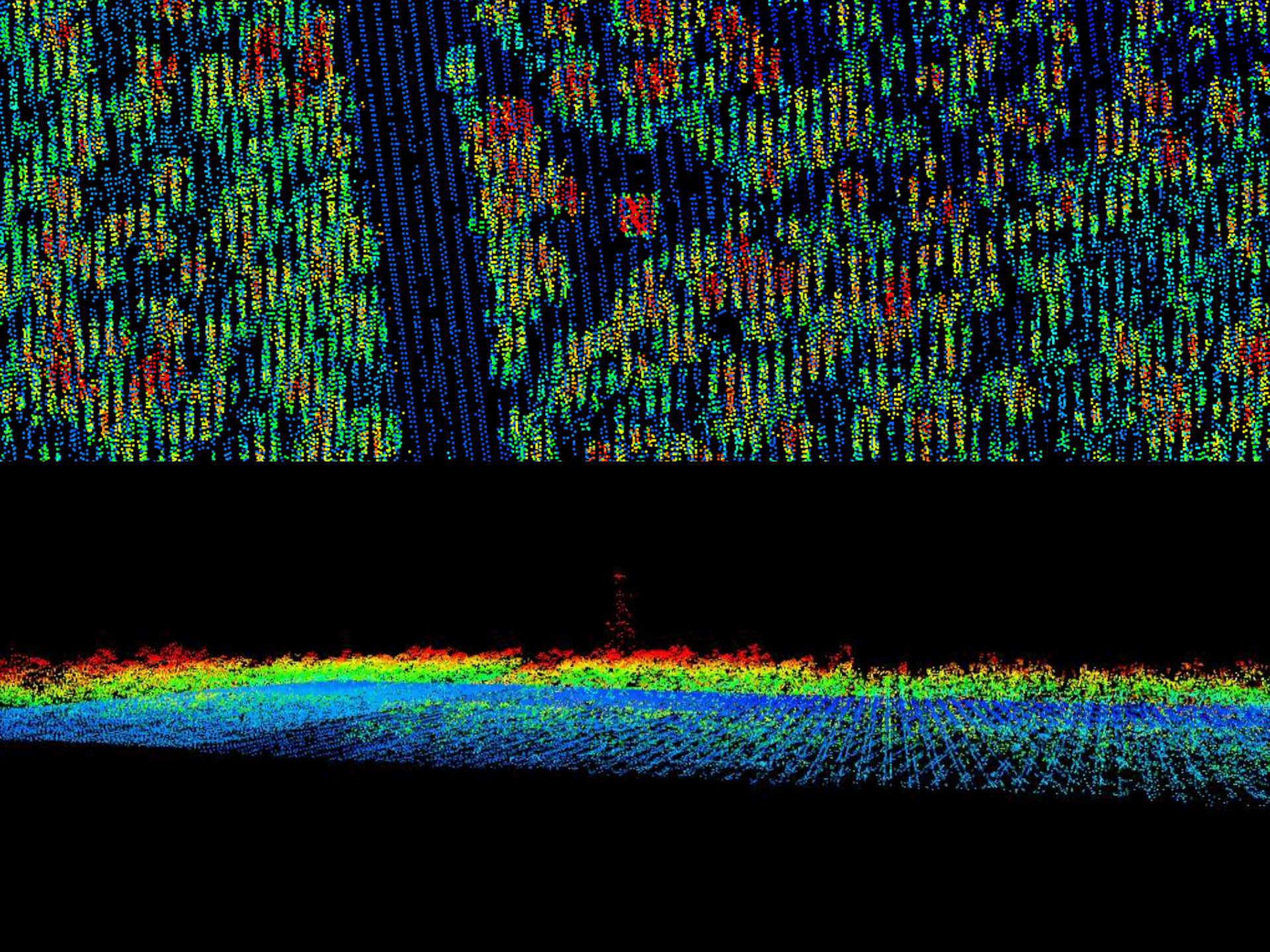


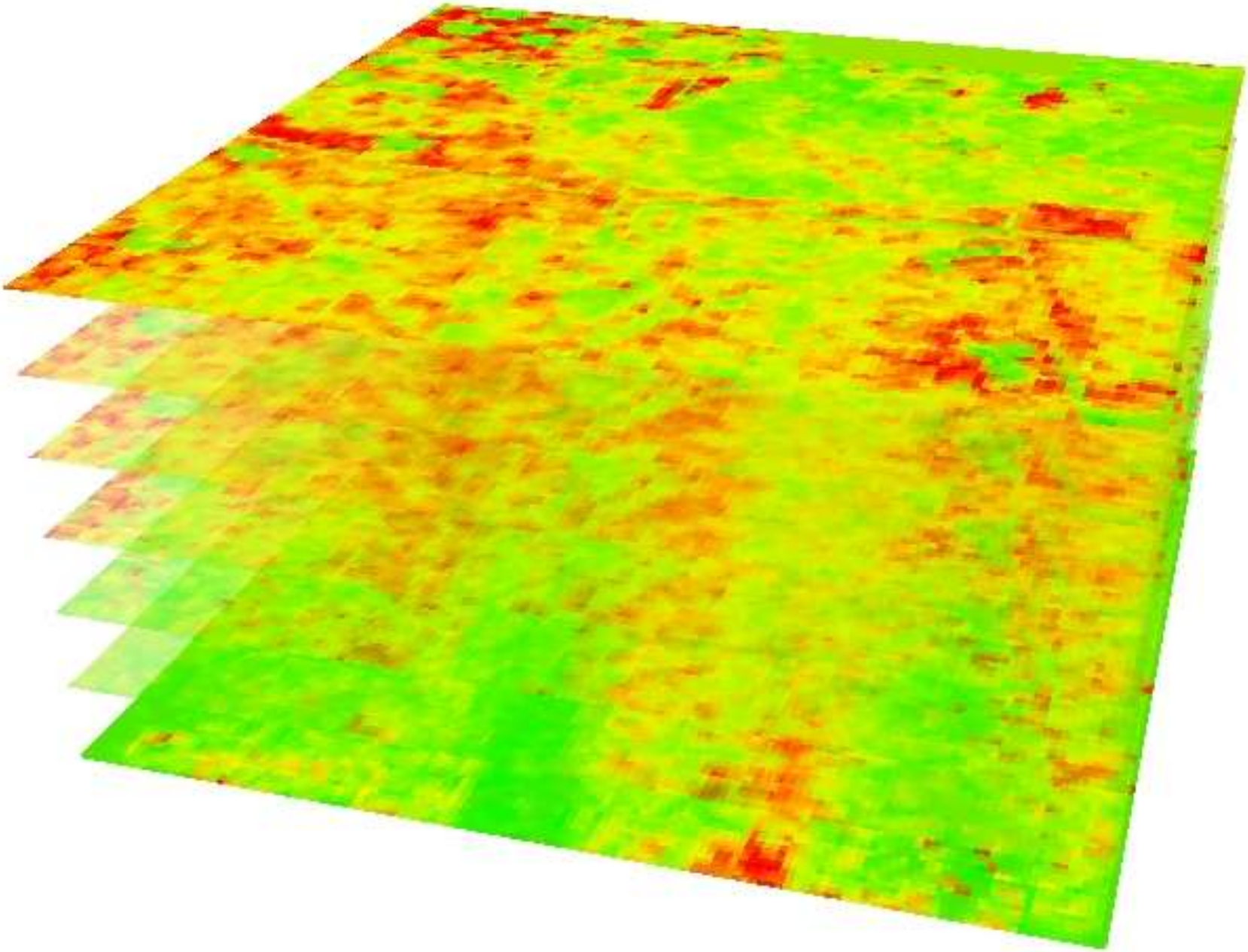
Skowronski et al. 2007


Prescribed burn
Unburned
Ladder fuels
Understory Oaks and shrubs
Height bin (m)
14 - 15
13 - 14
12 - 13
11 - 12
10 - 11
9 - 10
8 - 9
7 - 8
6 - 7
5 - 6
4 - 5
3 - 4
2 - 3
1 - 2
0 - 1
0
10
20
30
40
50
60
70
80
90
100
% Normalized LIDAR returns

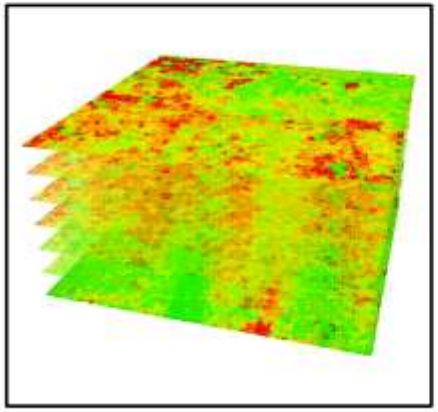
Heavy fuel loads in WUI, Stafford Township, NJ

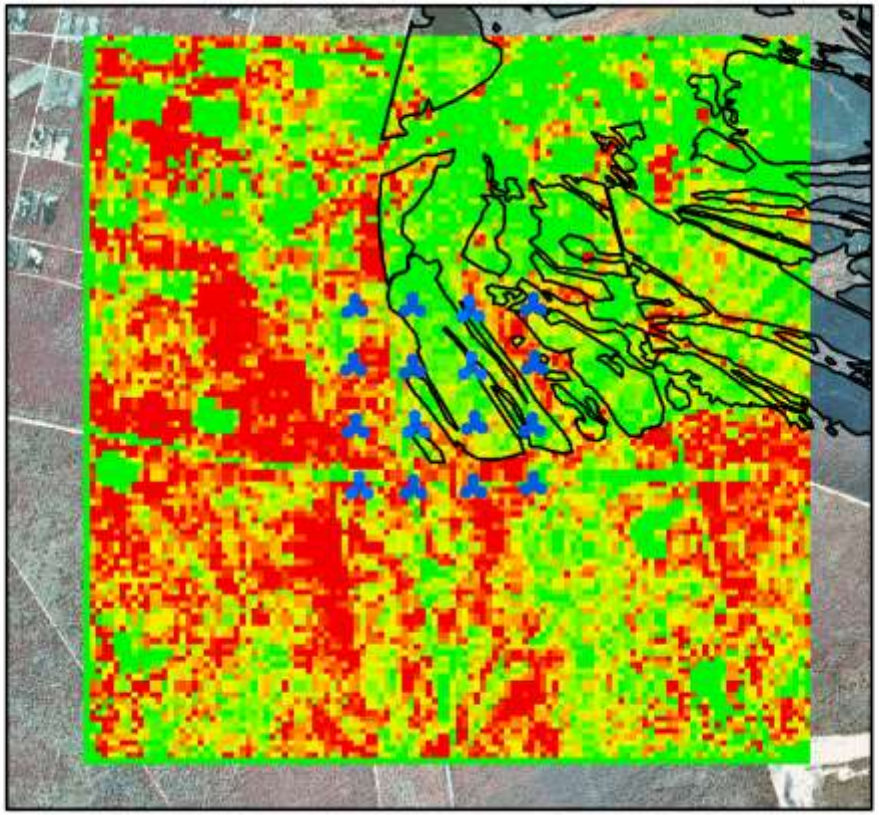


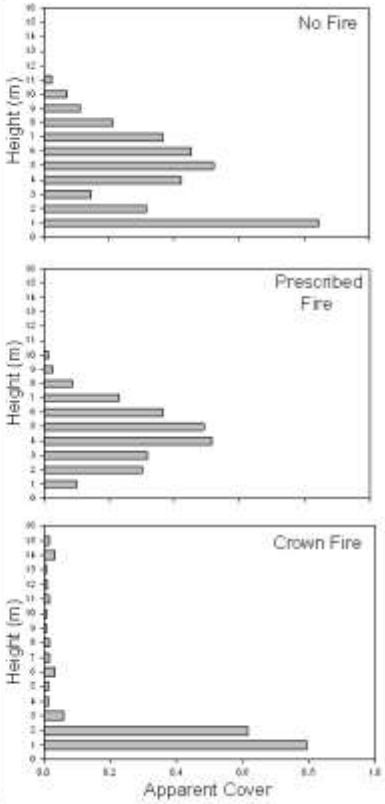




1995 Manchester WMA Major Wildfire

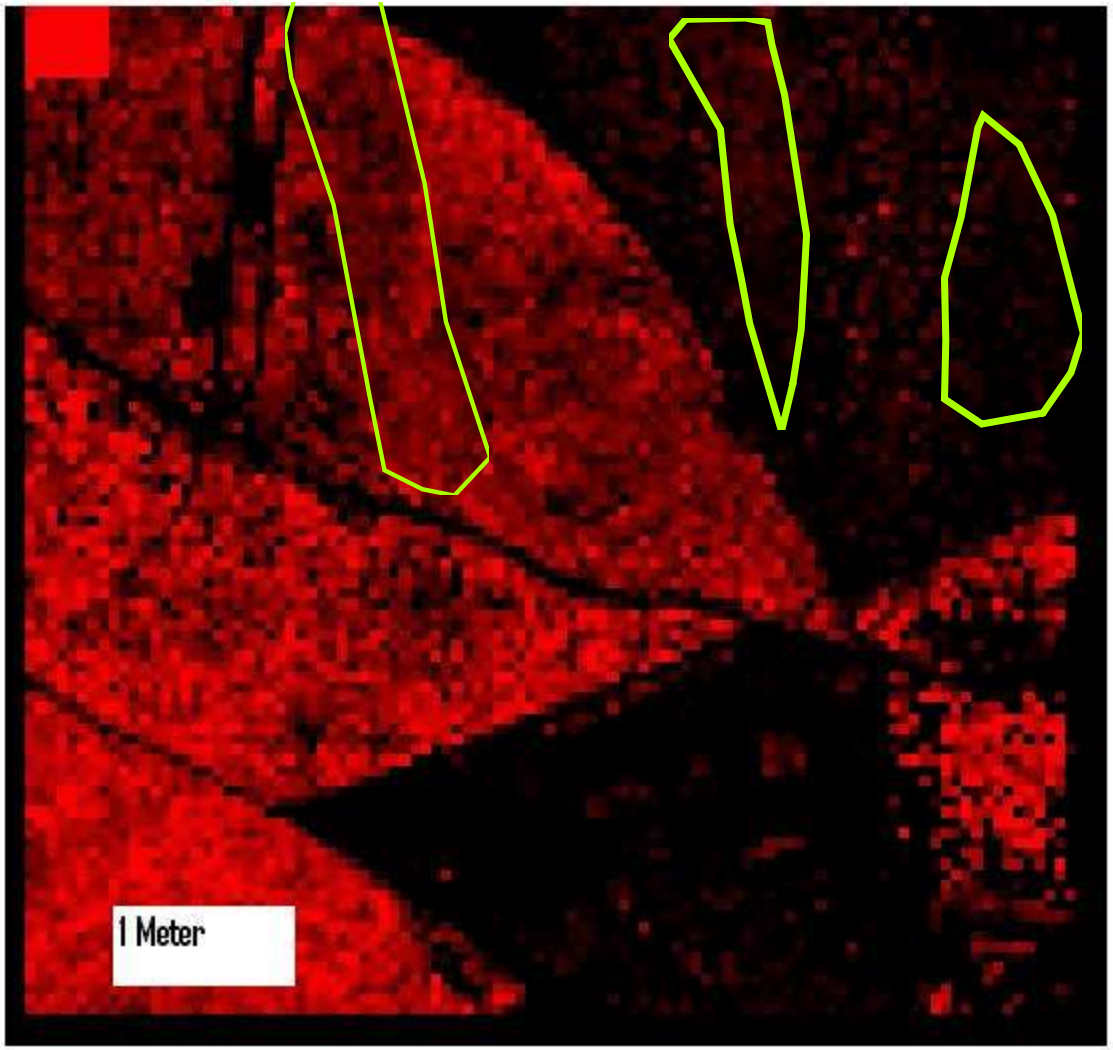






*LiDAR acquired summer, 2006

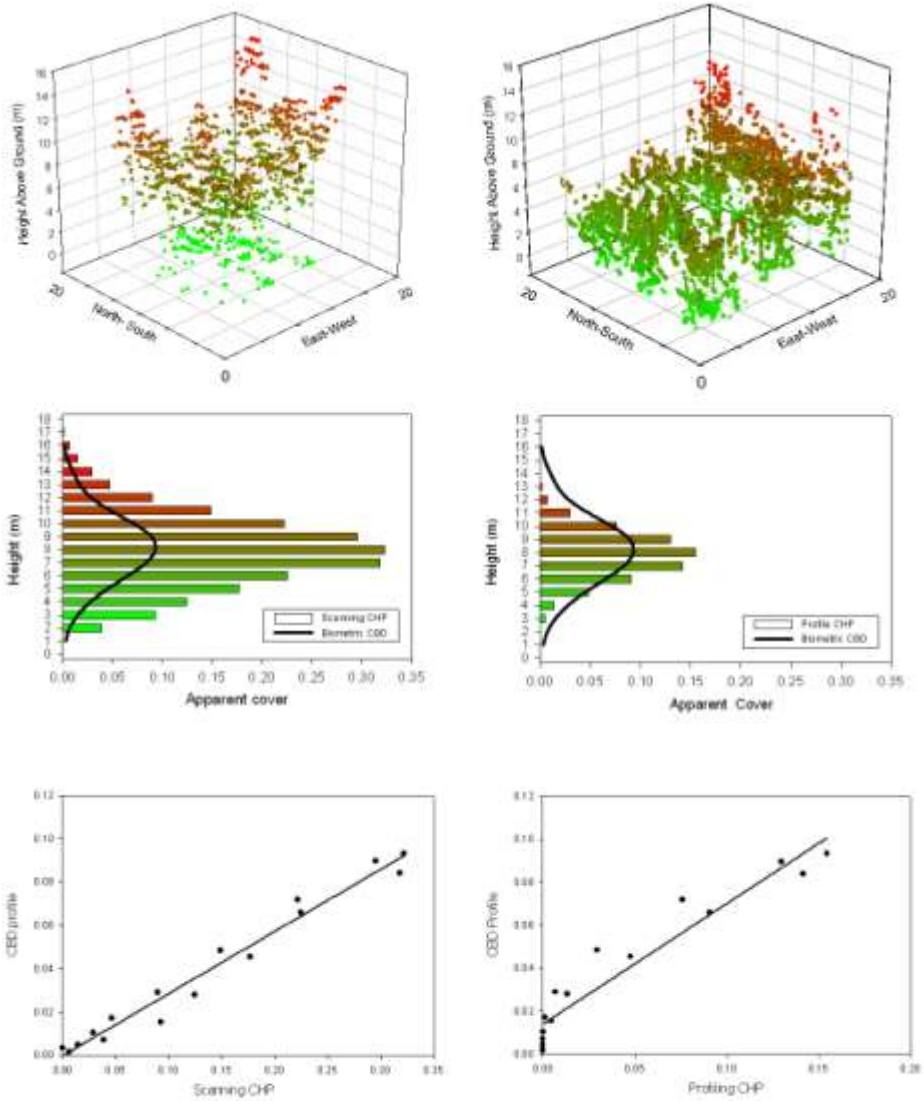
Derived Lidar Cover 1m through 20 meters



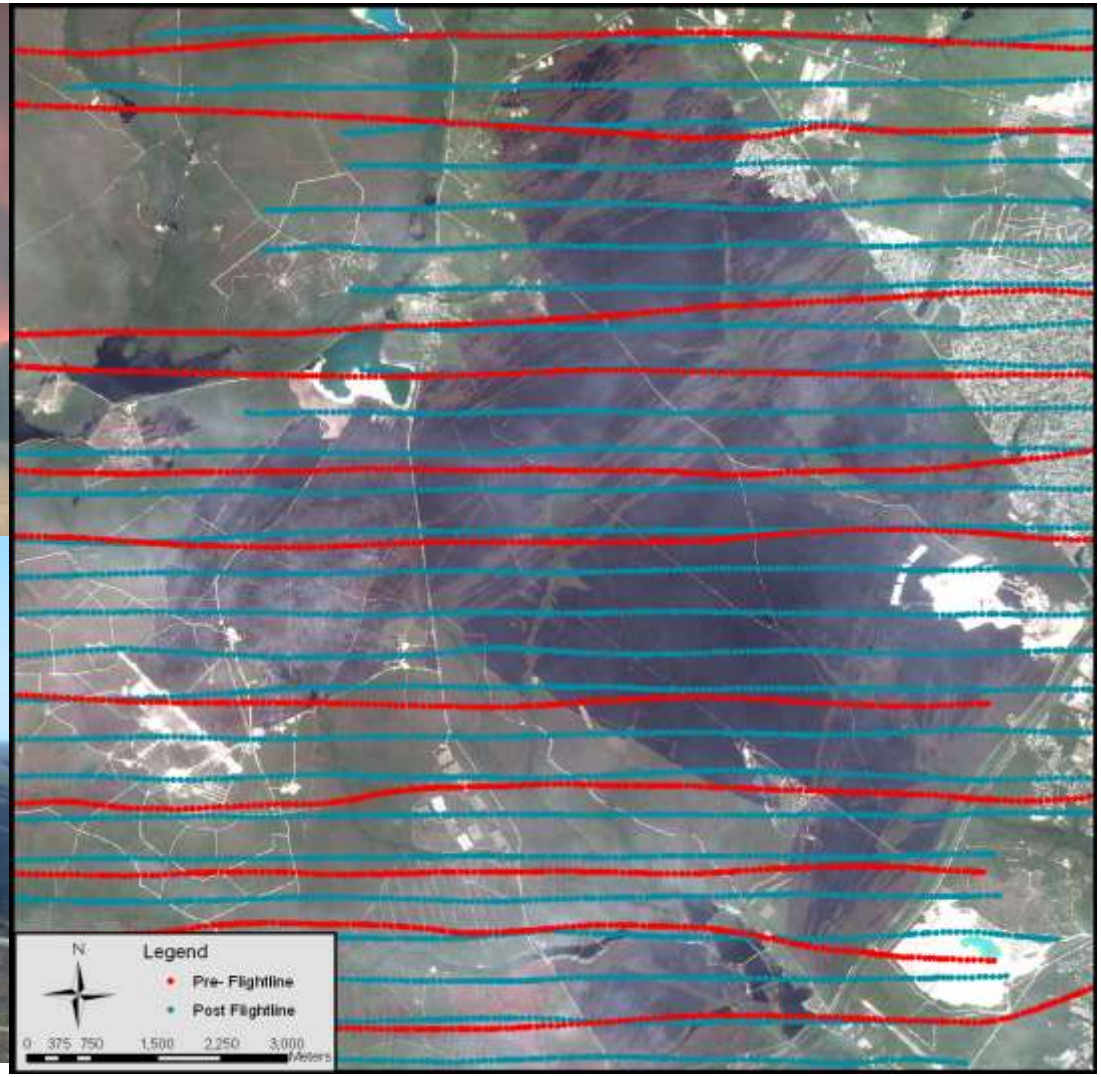
1995

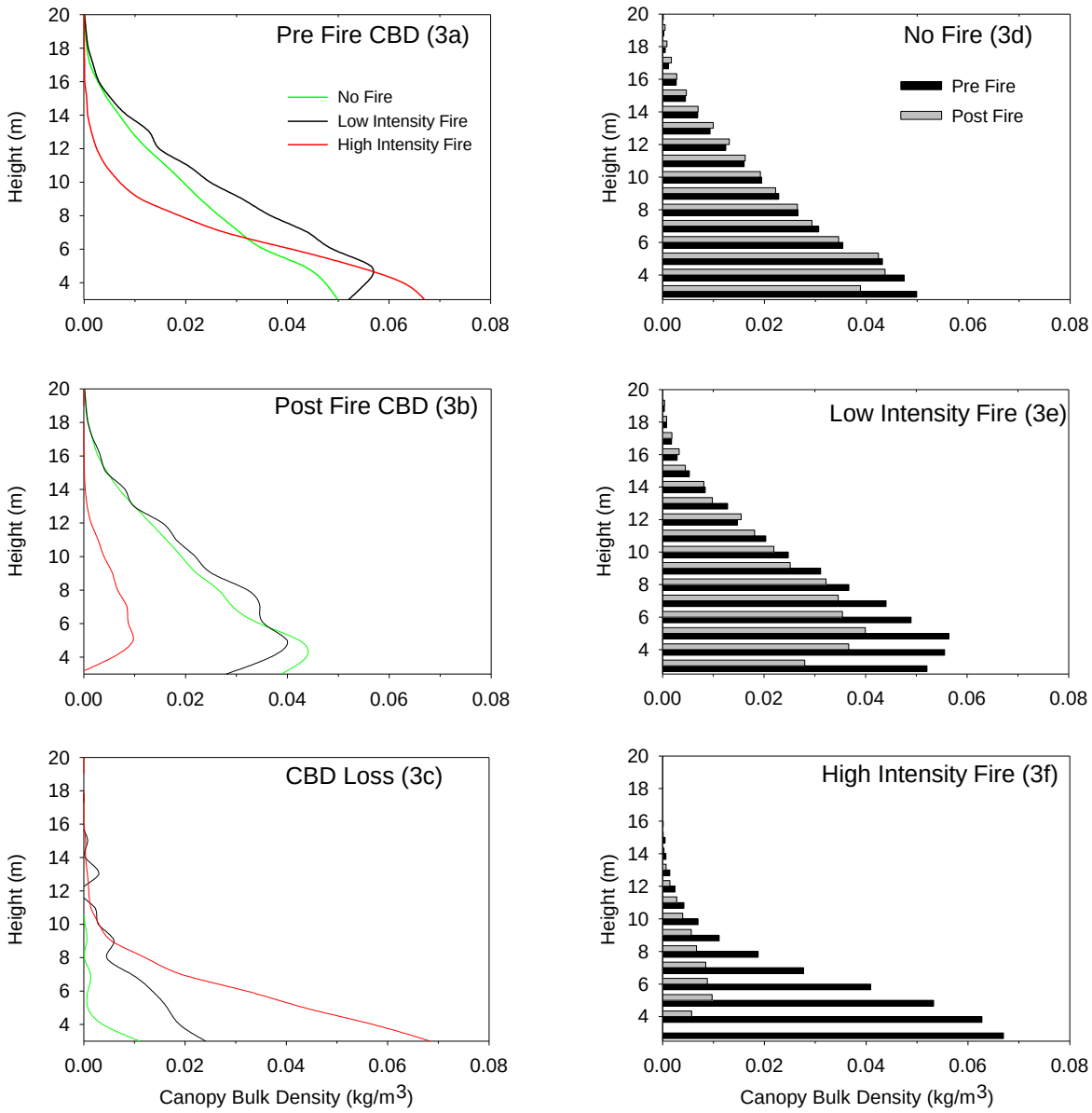
2006

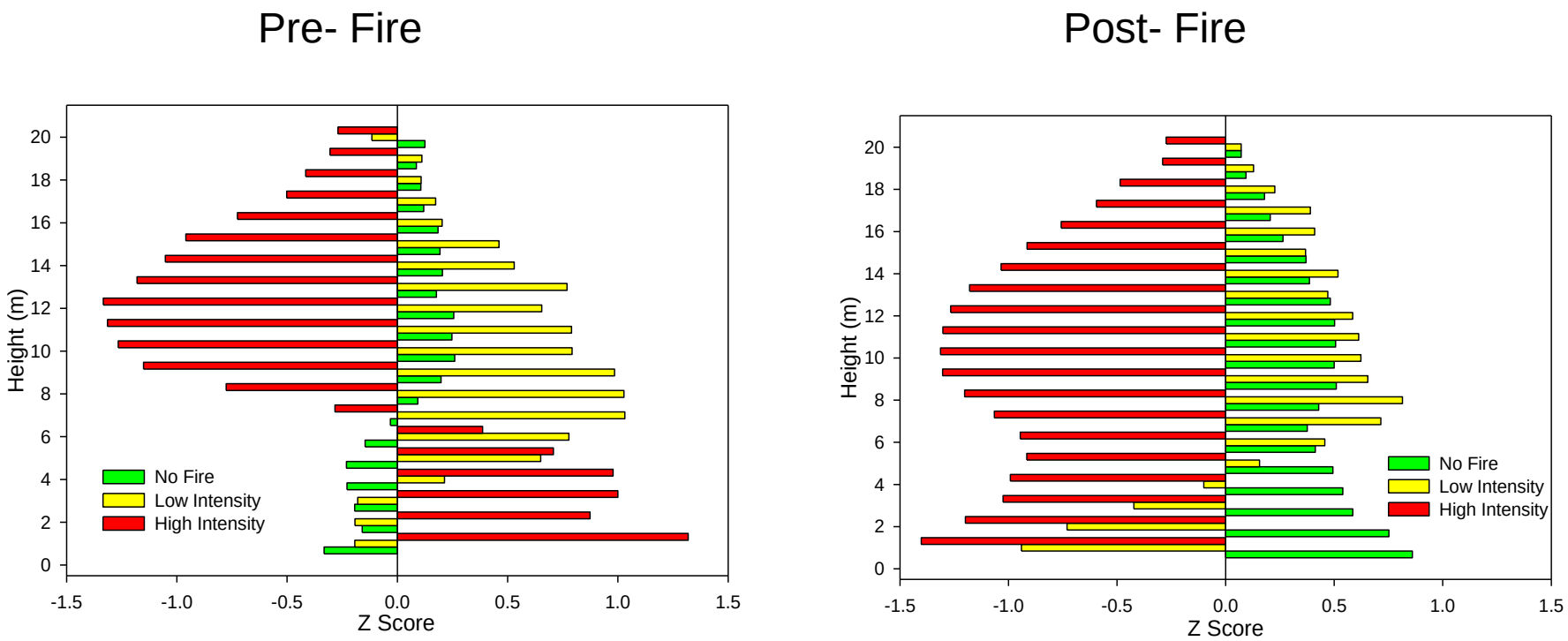
Biometric validation of two Lidar datasets to Canopy Bulk Density (kg/m^3)



Before and after profiling LiDAR sampling of the Warren Grove Fire

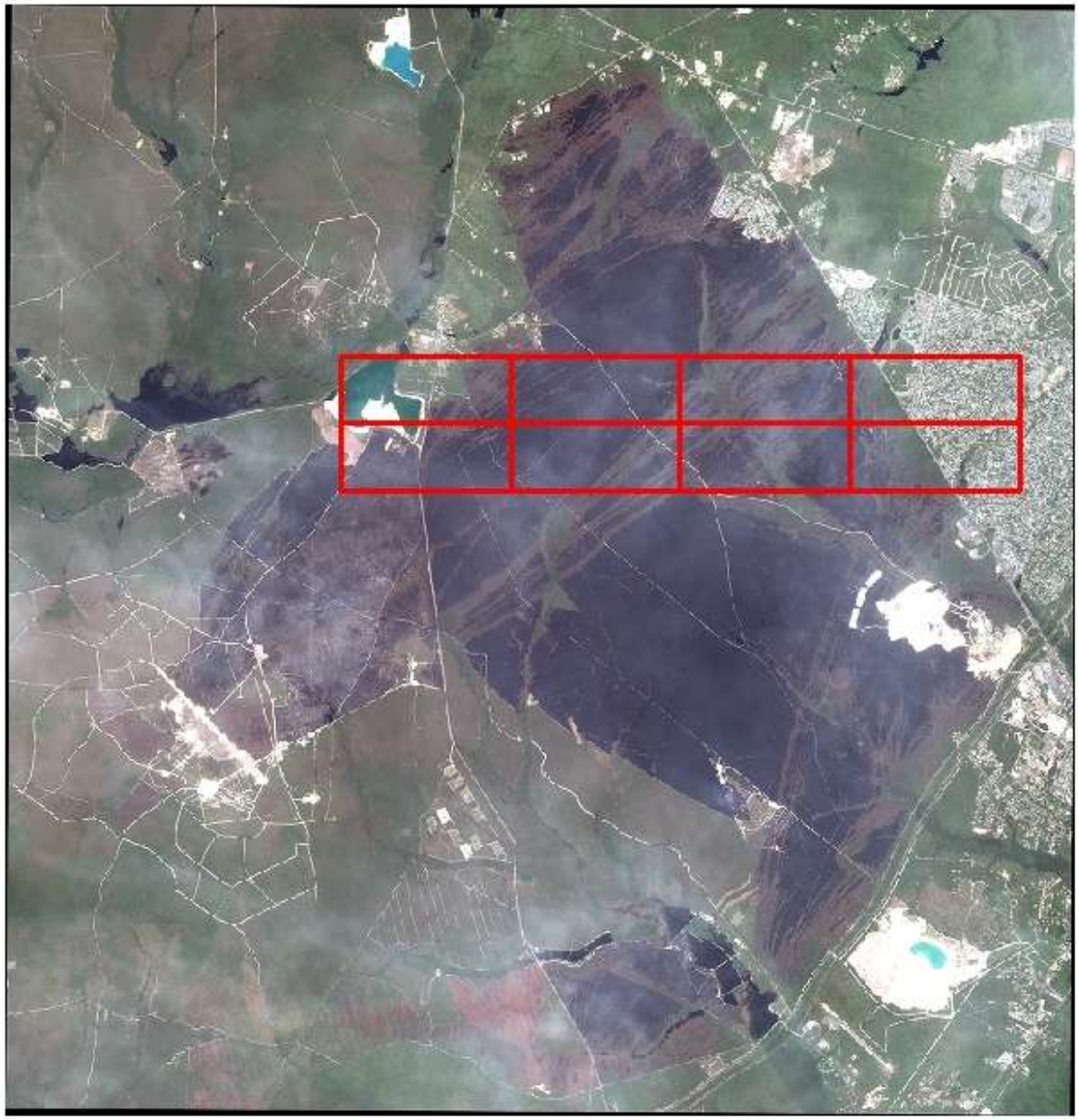



Pre Fire CBD (3a)
No Fire
Low Intensity Fire
High Intensity Fire
No Fire (3d)
Pre Fire
Post Fire
Post Fire CBD (3b)
Low Intensity Fire (3e)
CBD Loss (3c)
High Intensity Fire (3f)
Height (m)
Canopy Bulk Density (kg/m3)
0.00
0.02
0.04
0.06
0.08
4
6
8
10
12
14
16
18
20



Vertical distribution of the CBD Getis-Ord Gi* statistic Pre- and Post-Fire. This Z-score represents the patchiness and magnitude of values as compared to the Global mean. A high positive z-score indicates a clumped areas with high values while a high negative represents a highly clumped area with low values relative to the Global mean.

2007 Warren Grove Wildfire Extent



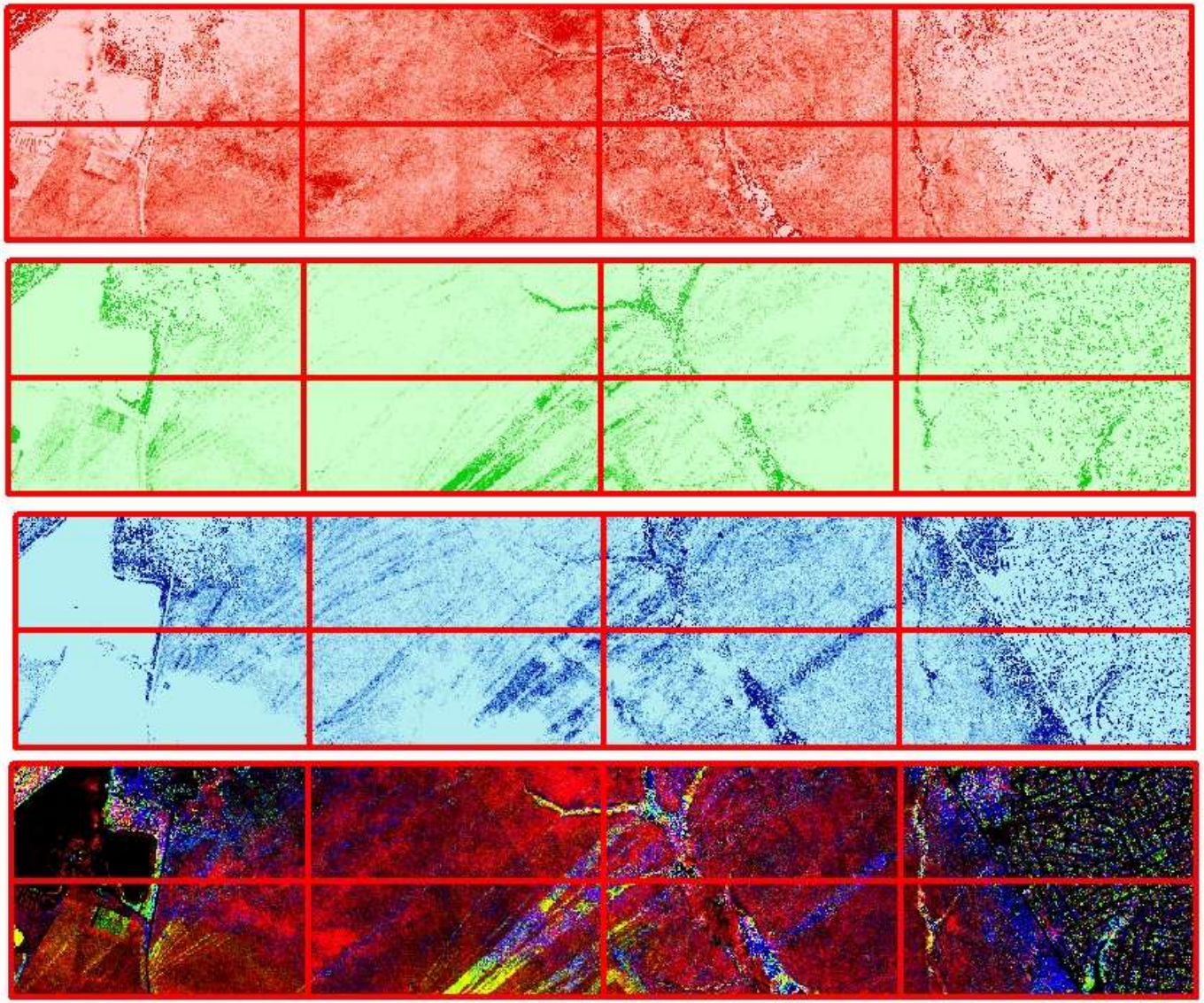
Height Bin (m)

New Warren Grove Dataset

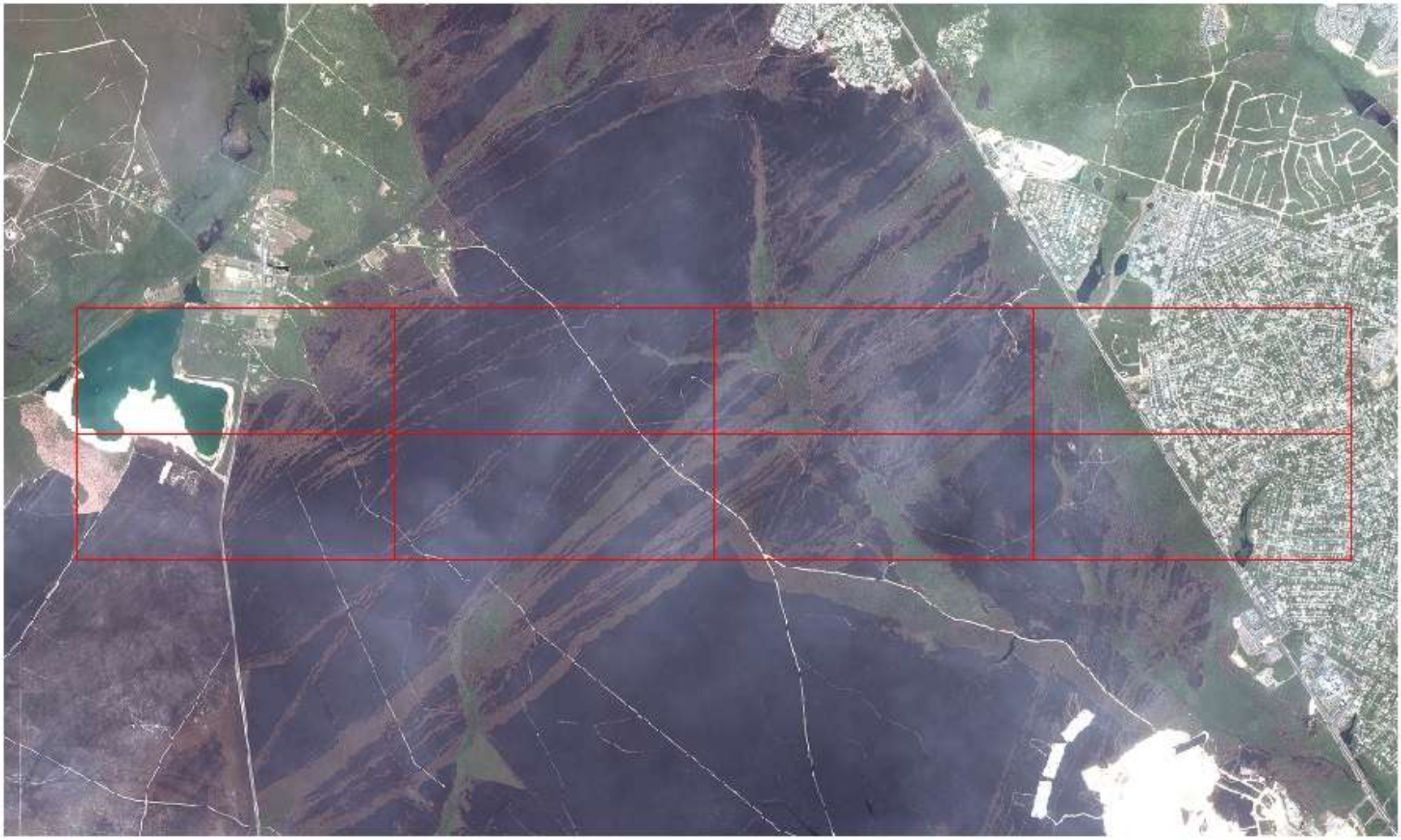
Bin 1

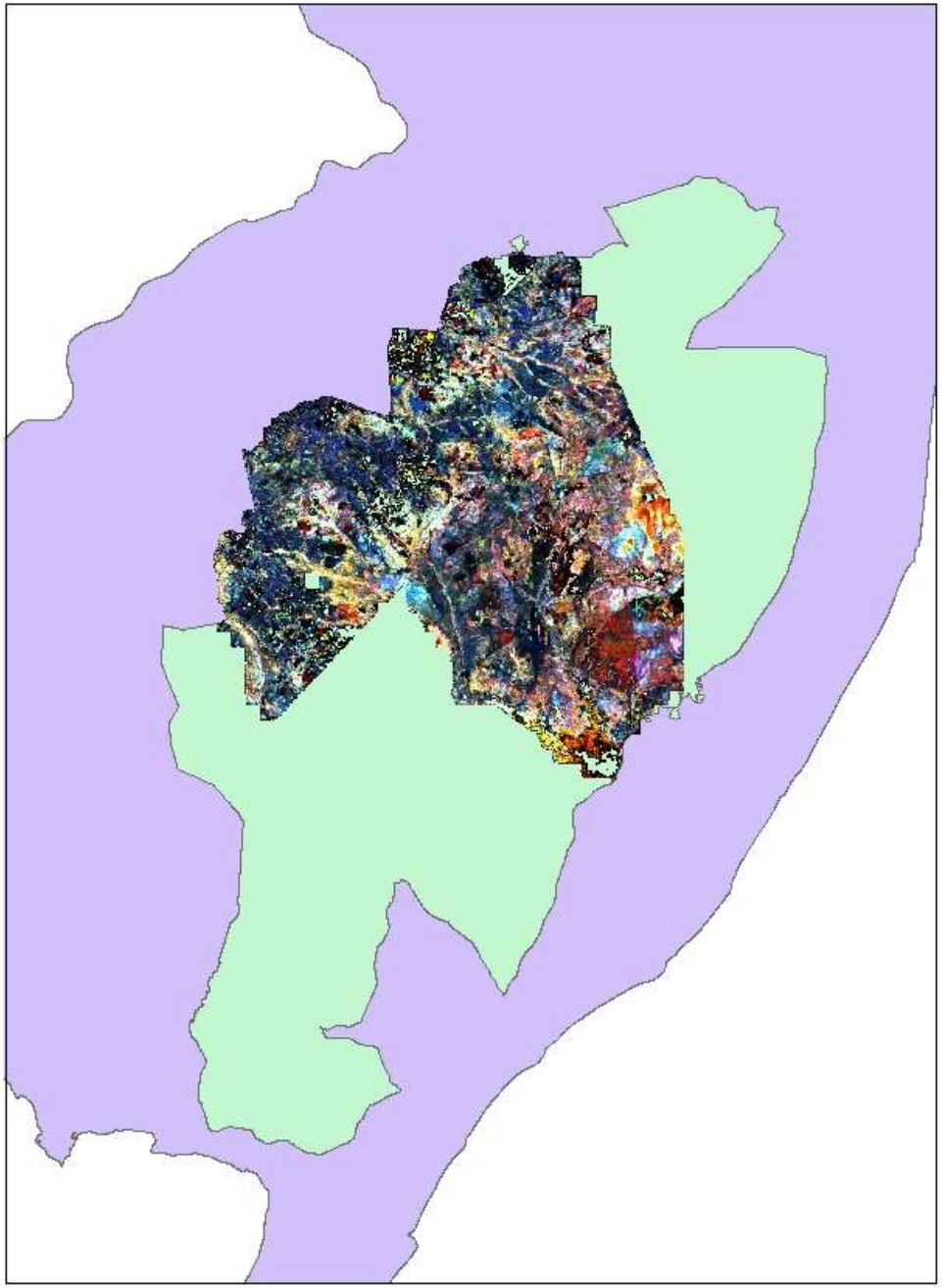
Bin 5

Bin 8

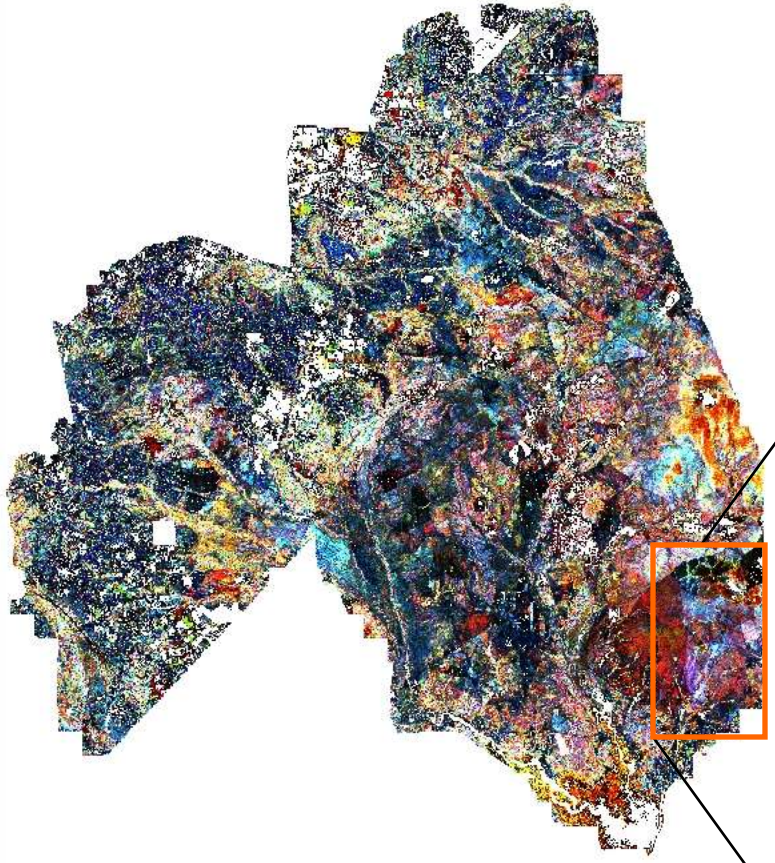


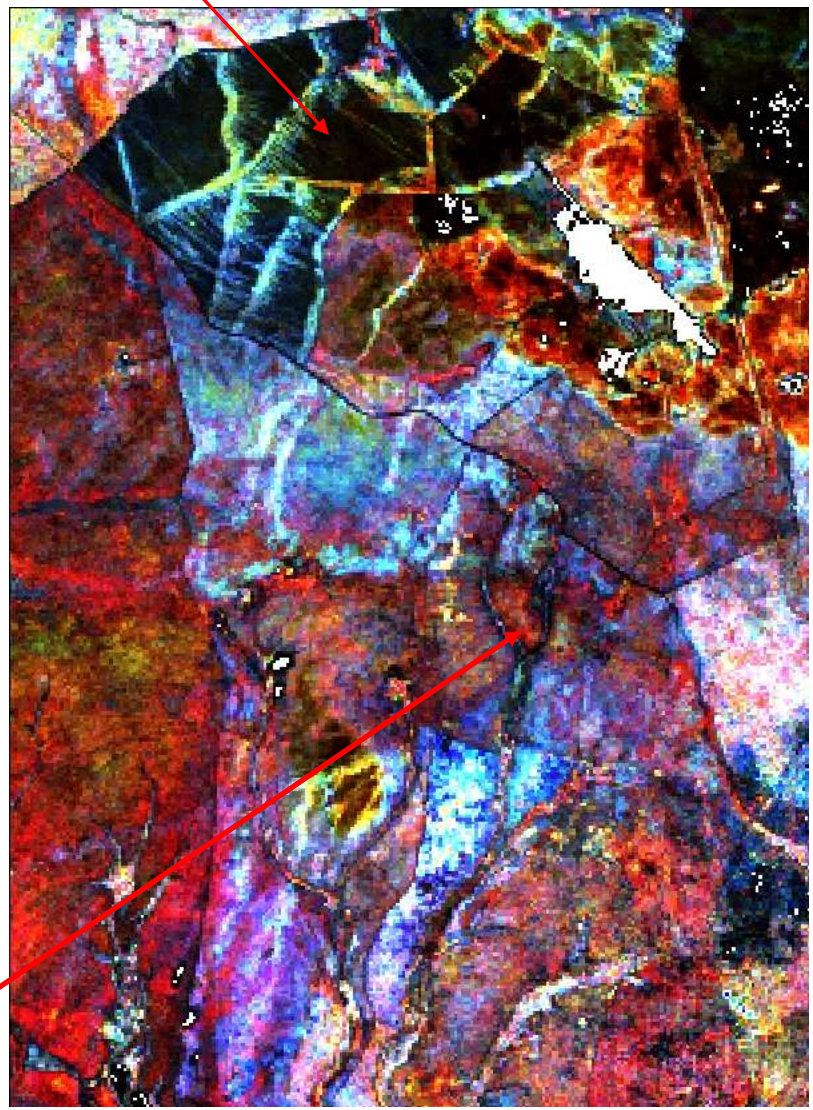
Red -Bin 1
Green -Bin 5
Blue -Bin 8





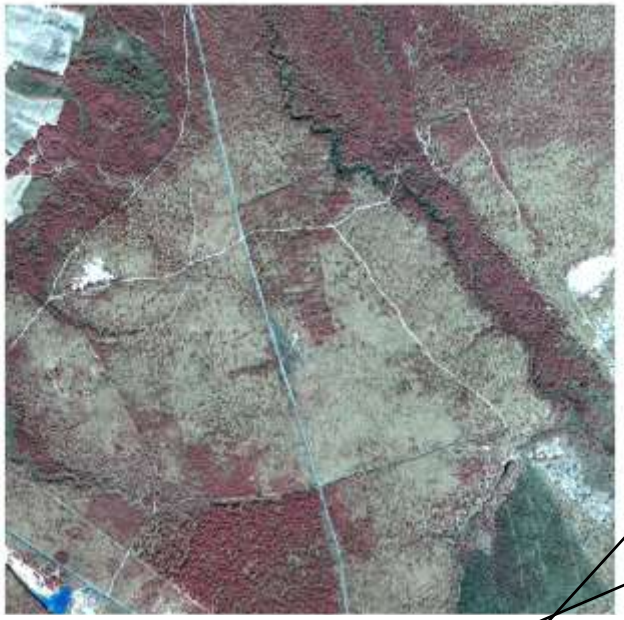
Warren Grove Fuel Reduction Treatments

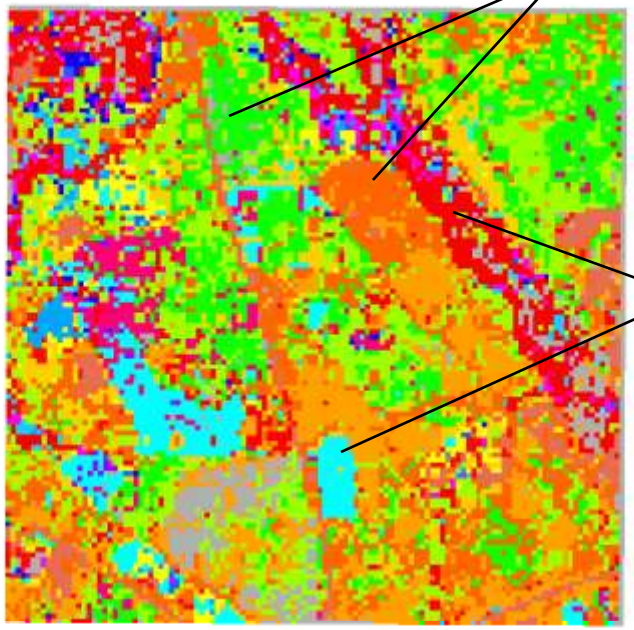


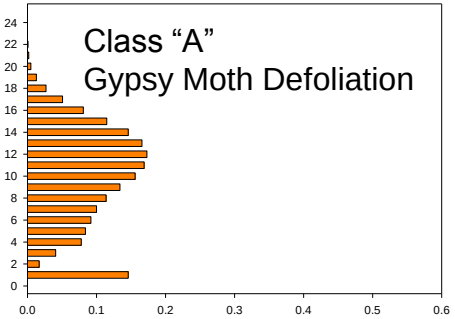


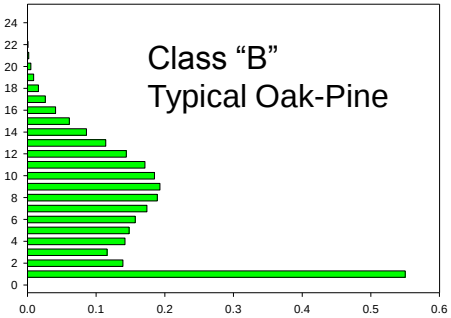
1999 Bass River Fire

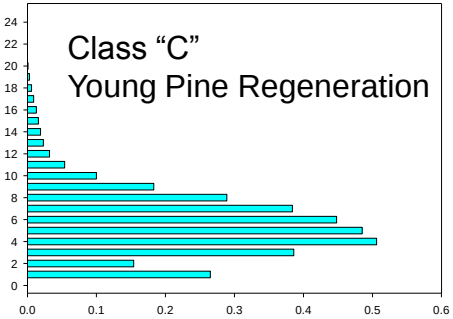
Unsupervised Classification for data reduction

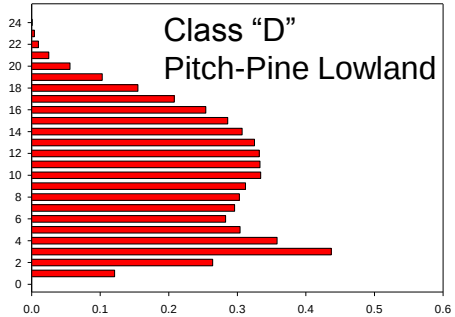




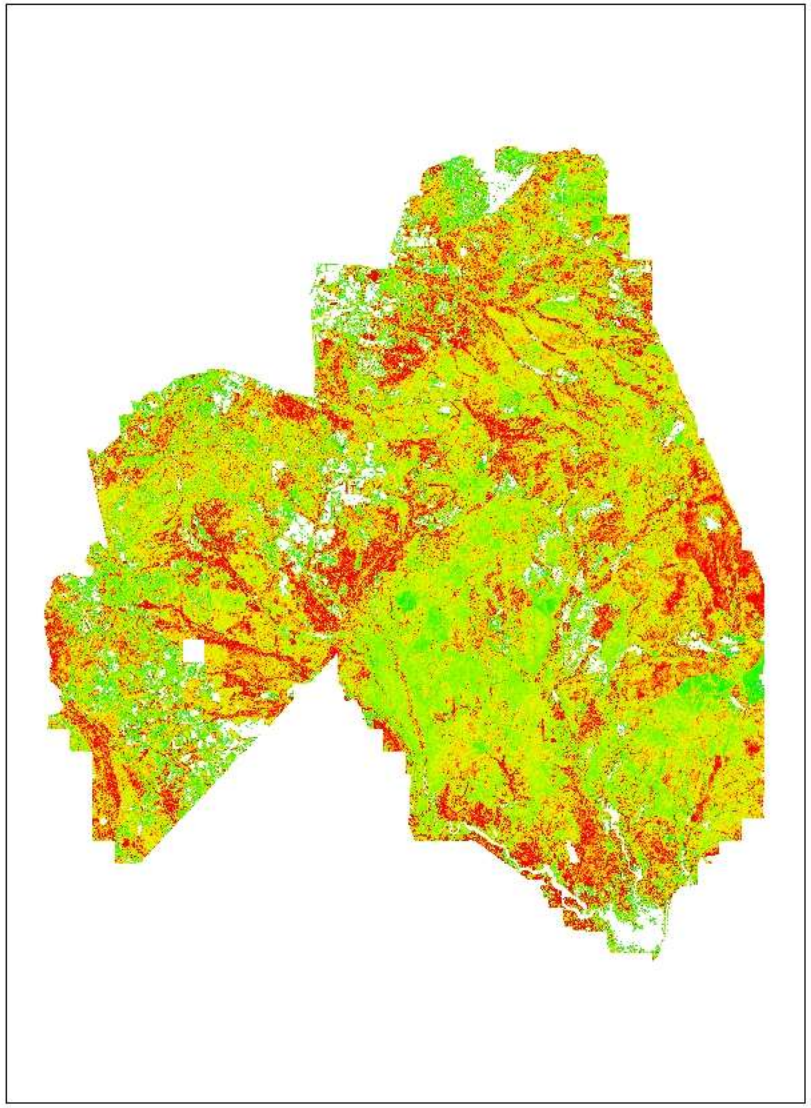
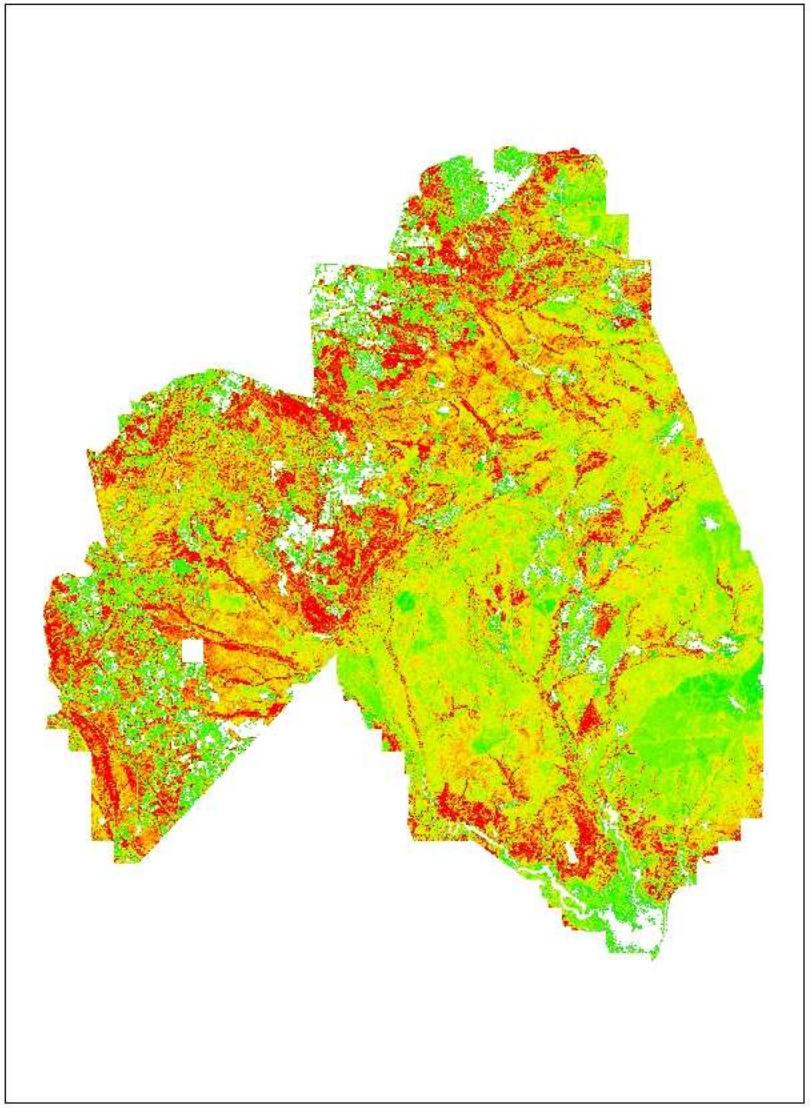








Maximum CBD (kg/m^3)



Canopy Fuel Weight (kg/m^2)