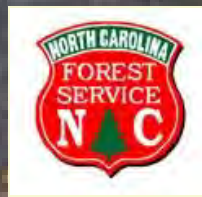


Fire Danger Rating of Organic Soils on the North Carolina Coastal Plain & Enhancement of NFDRS

James Reardon, RMRS Fire Science Laboratory, Missoula, MT
Gary Curcio, IPA Fire Environment Consultants, Kinston, NC



Primary Objectives

- Our ability to evaluate the potential for ground fire in organic soils is limited. Currently many of the guidelines used in fire planning and suppression are based largely on local experience.
- The Estimated Smoldering Potential or Probability (ESP) was determined through laboratory testing of the moisture limits of smoldering combustion in these soils. Prescribed burns were conducted under a range of conditions to field test the laboratory results.
- We would like to share details on the development and the use of ESP in fire danger rating on organic soils.

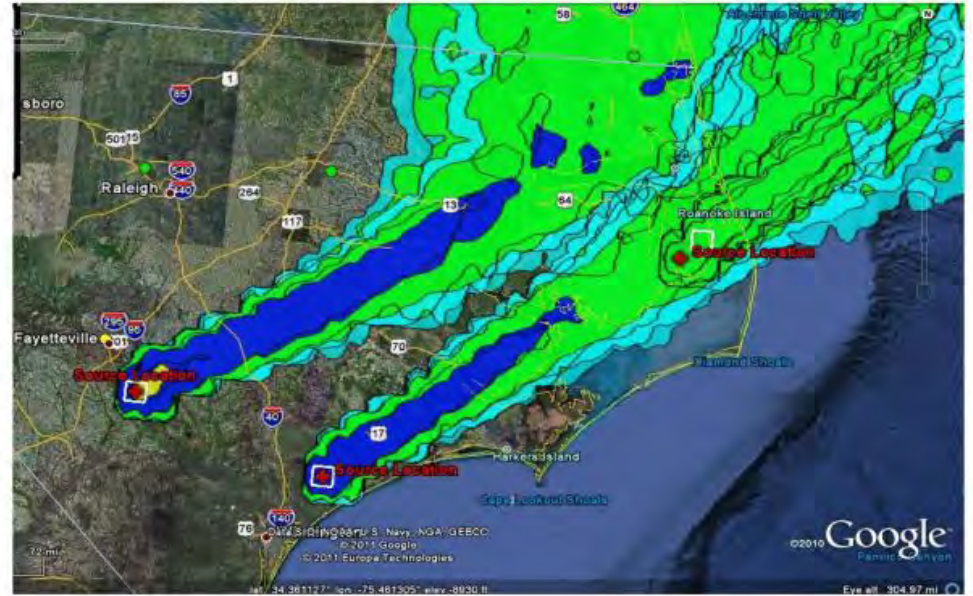
Flaming and Smoldering Combustion Phases



Emission production of ground fuels were quantified to be as much as 18 times greater than those produced from surface fuels on the Pains Bay Fire

Safety and Health Concerns are becoming more of a driving force in wildfire suppression

9:24 am 06/24/11 Friday



Pains Bay Fire :Dense Smoke on Highway 264 NC
Credit :Rob Shackelford, NCFS

Pains Bay Fire : Smoke Drift Map
6-24-2011

Safety and Health Concerns are becoming more of a driving force in wildfire suppression

9:24 am 06/24/11 Friday

Station ID	Dt	Tm	Tp	MSGC	WS	WDY	HRB	1H	10	HU	TH	XH	IC	SC	EC	BI	SL	R	KBDI
315201	050611	13	O	7O1P3	9	70	5	5	7	15	18	18	32	39	53	101	5	V	207
315201	050611	13	O	7G1P3	9	70	5	5	7	15	18	18	31	11	35	46	3	M	207
315406	050611	13	O	7O1P3	14	70	8	8	10	16	15	19	22	53	42	104	4	H	313
315406	050611	13	O	7N1P3	14	70	8	8	10	16	19	19	23	96	18	93			313
315406	050611	13	O	7G1P3	14	70	8	8	10	16	19	19	22	16	28	49			313
317901	050611	13	O	7G1P3	8	70	6	6	7	14	18	18	30	9	35	44			252
317901	050611	13	O	7O1P3	8	70	6	6	7	14	18	18	32	35	54	96	5	V	252
317901	050611	13	O	7N1P3	8	70	6	6	7	14	18	18	30	54	23	79			252
317901	050611	13	O	7D1P3	8	70	6	6	7	14	18	18	34	27	49	82			252

Pains Bay Fire :Dense Smoke on Highway 264 NC

Credit :Rob Shackelford, NCFS

Pains Bay Fire : Smoke Drift Map 6-24-2011

Suppression Activities are costly and labor intensive



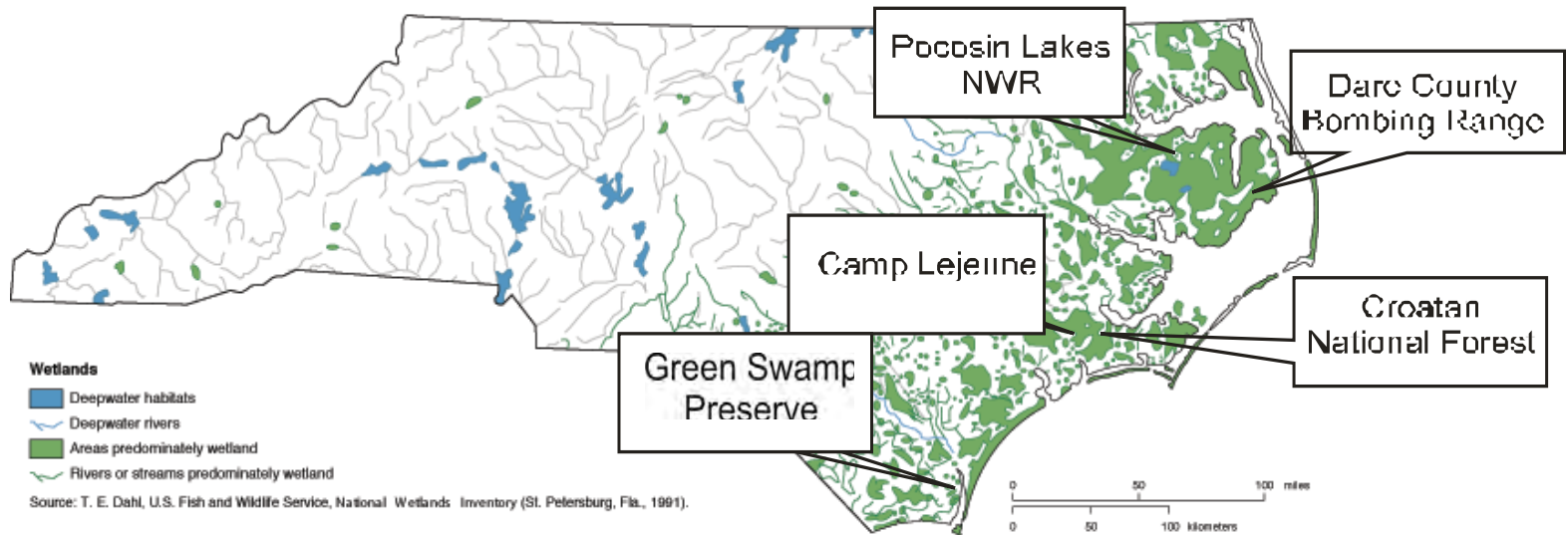
Potato patching



Fire Break and Sprinkler line

North Carolina Wetlands and Study Sites

Figure 4. Wetlands



Pocosin Swamp on a hill



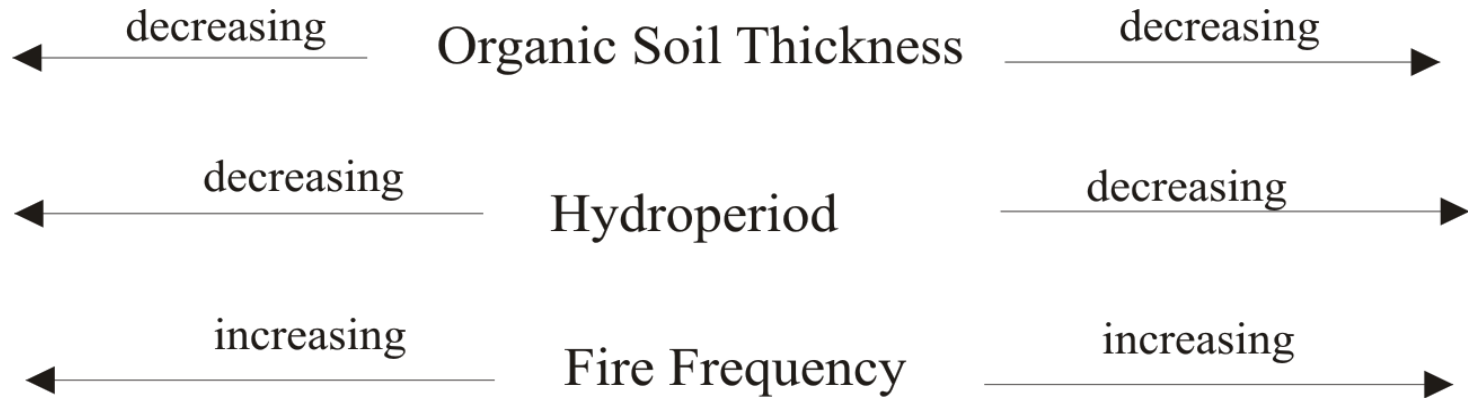
*Pond Pine
Woodlands*

*High
Pocosin*

*Low
Pocosin*

*High
Pocosin*

*Pond Pine
Woodlands*



Soil Horizons



Root mat

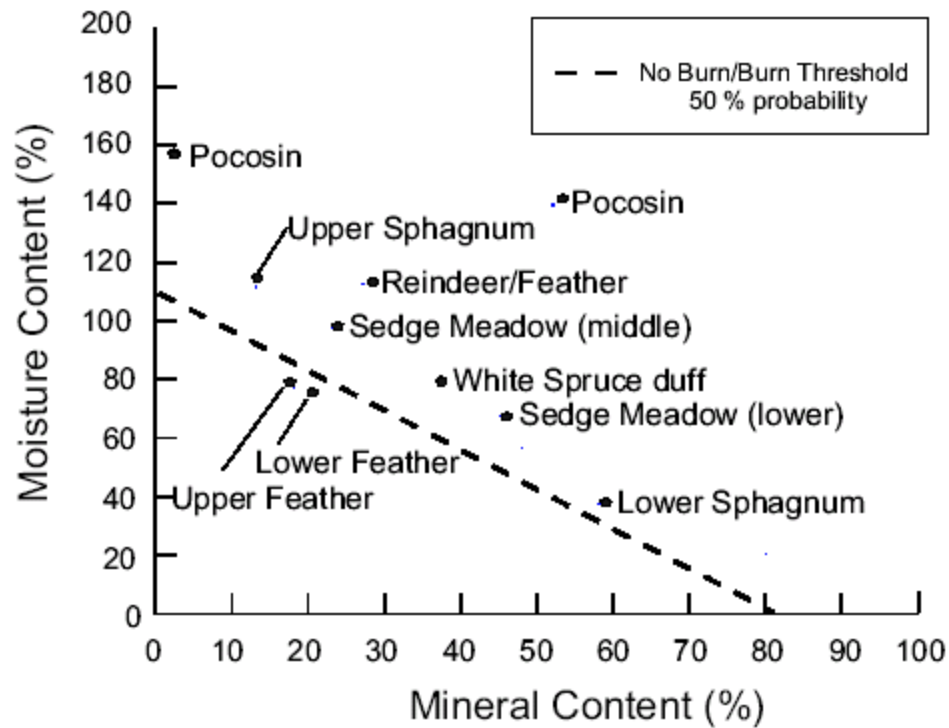


Muck/Sapric

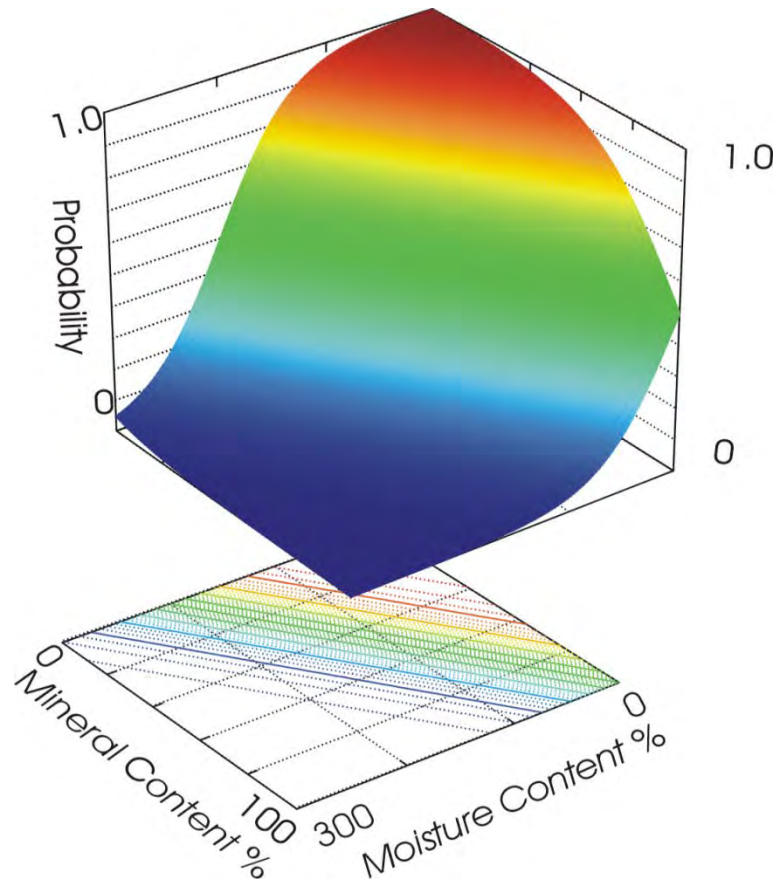
Laboratory Testing



No Burn/ Burn Threshold

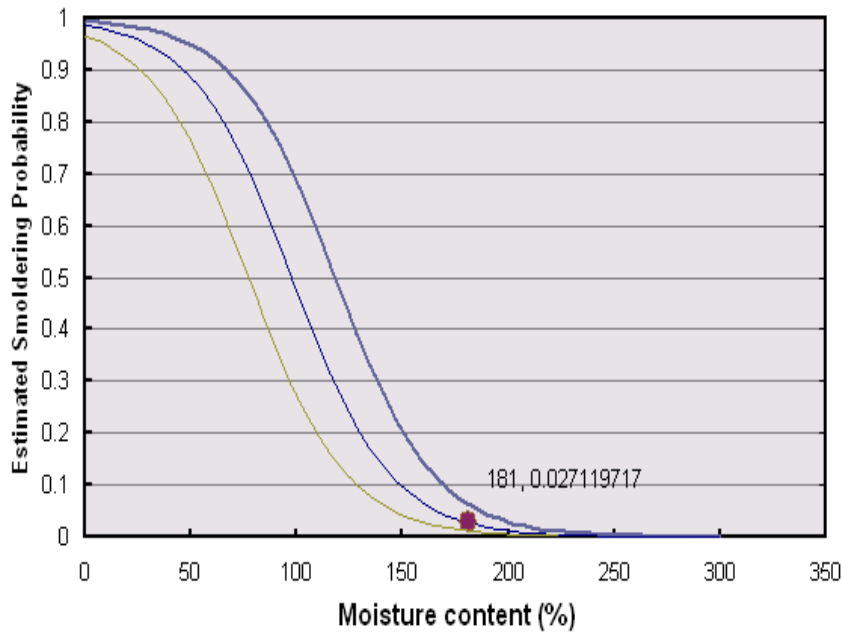


Estimated Smoldering Probability



Moisture Limits of Root Mat Soils

North Carolina Root Mat

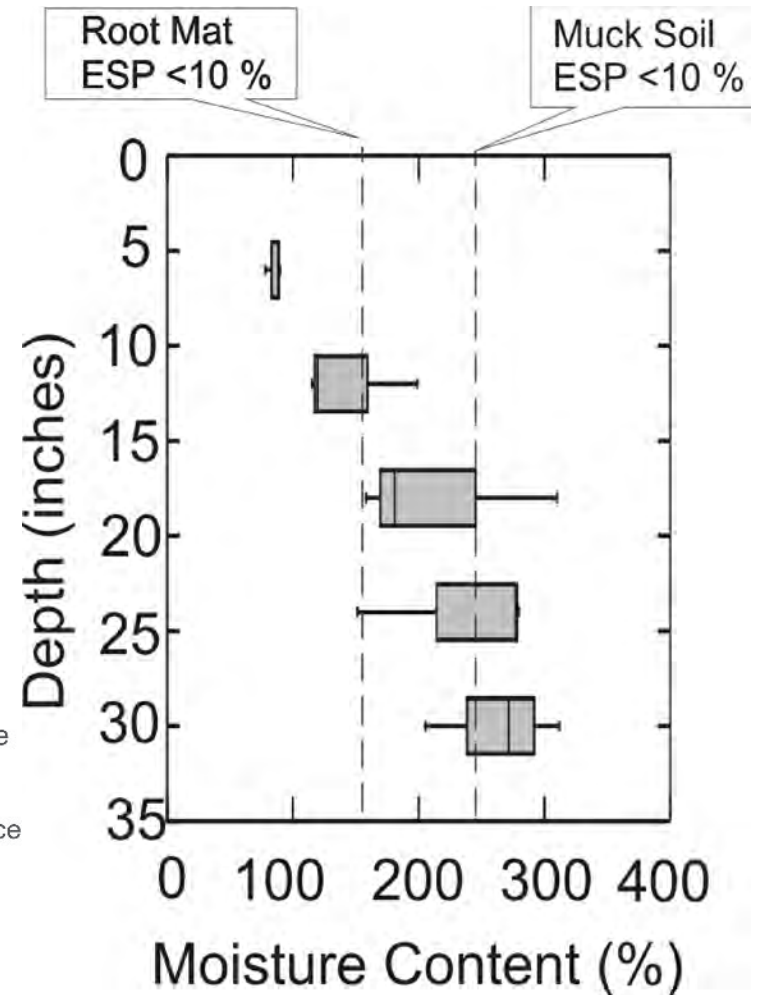
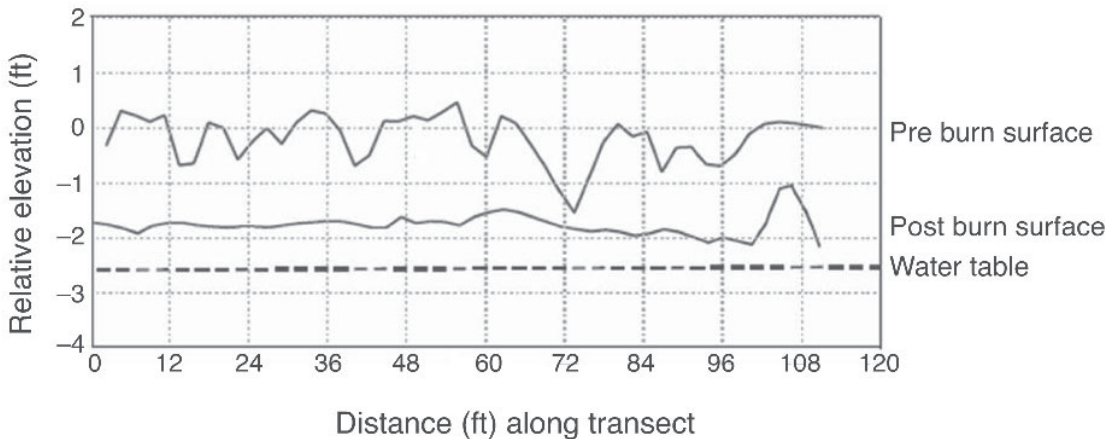


Soil Type
North Carolina Root Mat
North Carolina Sapric
Alaska Feather moss

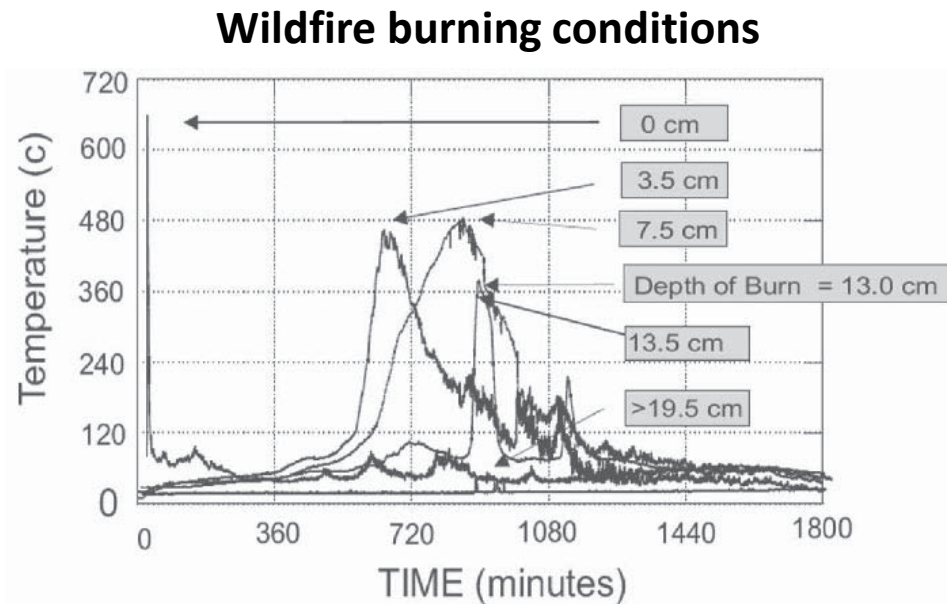
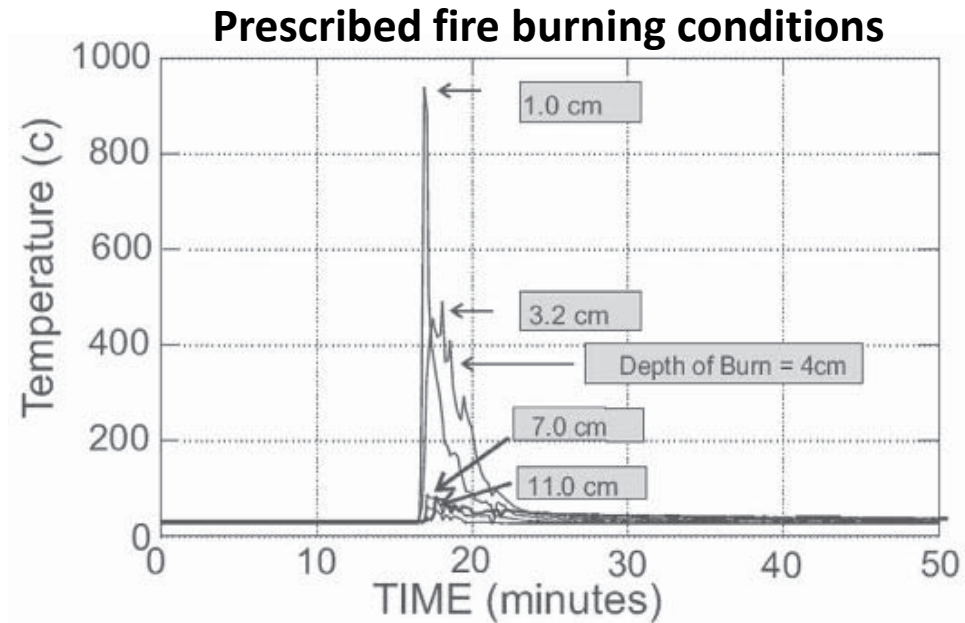
Moisture Content	181		
Mineral Content	3	5	7
Estimated Smoldering Potential	1.1%	2.7%	6.3%



Research Prescribed Burn Green Swamp, Brunswick County NC



Heating of ground fuels minutes vs. hours



Driving Creek Burn



Driving Creek Burn



Ver. 1.2.0 FastPath

Weather Information Management System

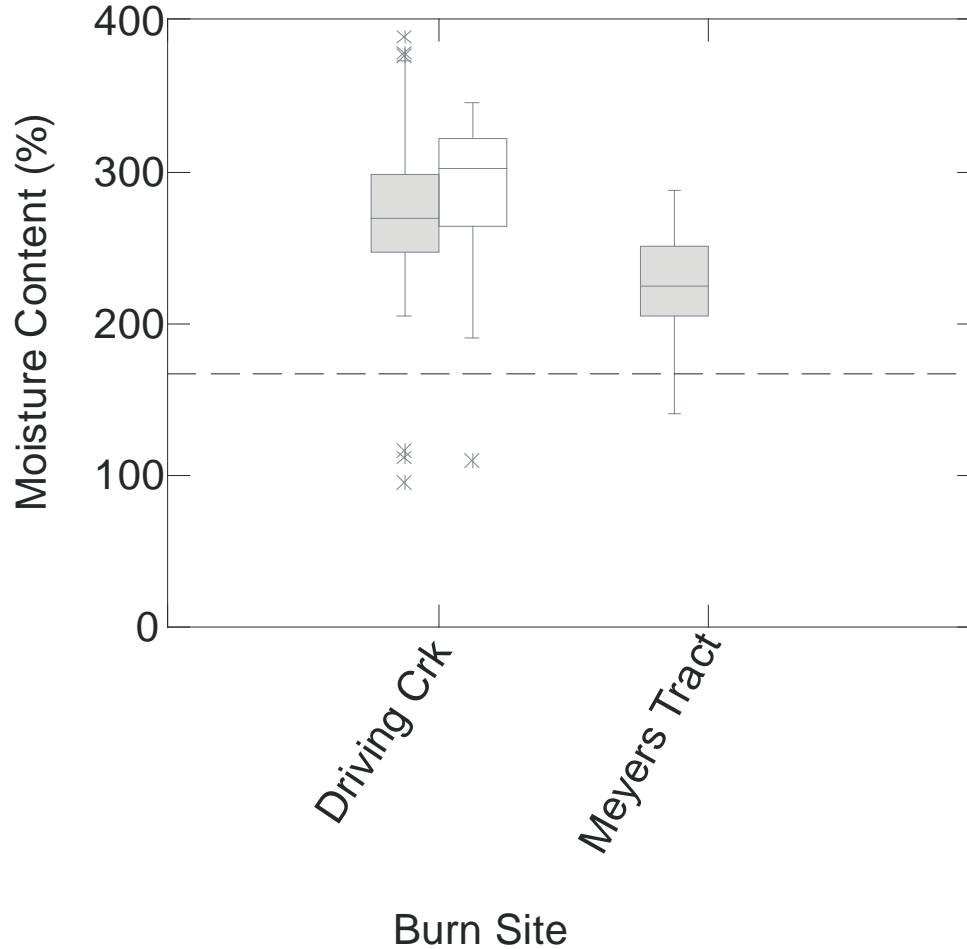
Display Index Format DIDX

Station ID: or Type: Date: Time:

Station ID	Obs Dt	Tm	O T	MSGC	WS	WDY	HRB	1H	10	HU	TH	XH	IC	SC	EC	BI	SL	R	KBDI
319802	021109	14	O	7O1P3	11	70	9	9	10	16	22	22	16	36	38	83	3	M	174
319802	021109	14	O	7G1P3	11	70	9	9	10	16	22	22	16	11	21	37	3	M	174
319803	021109	14	O	7O1P3	14	70	11	11	12	17	22	22	8	22	30	60	3	M	64
319803	021109	14	O	7G1P3	14	70	11	11	12	17	22	22	12	14	19	39	2	L	64



Root mat moisture content



Well above critical thresholds of:

UR \geq 170%

LR \geq 270%

■ Upper Rootmat

□ Lower Rootmat

Very Little Consumption of mat & smoldering

Head fire of Edna Buck Fire reaches DAQ monitors .



Edna Buck Fire burns organics with canal water present.

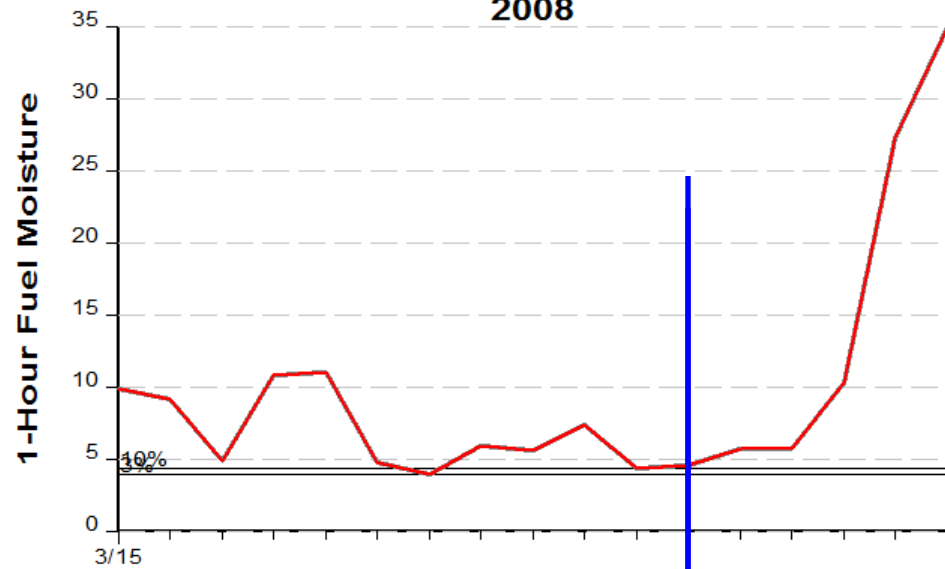


Commonly used indices such as the *Keetch-Byram* Drought Index are based only meteorological inputs and do not incorporate soil properties or hydrologic inputs that are major drivers of wetland processes.

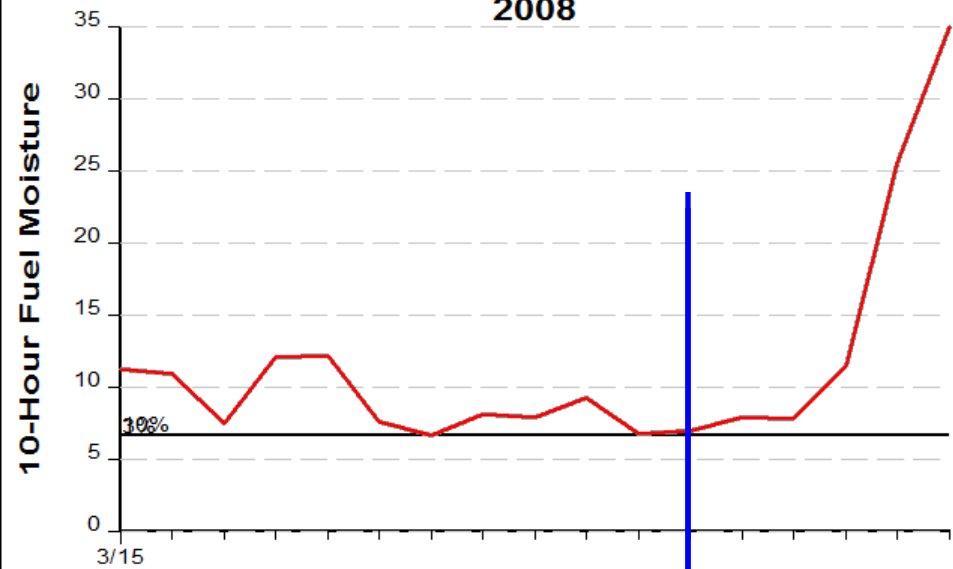
Generally when the “Root Mat” moisture content reaches “170 % or less”, the probability of sustained ignition dramatically increases & residual smoke becomes a serious issue



**SIG - Edna Buck
2008**



**SIG - Edna Buck
2008**



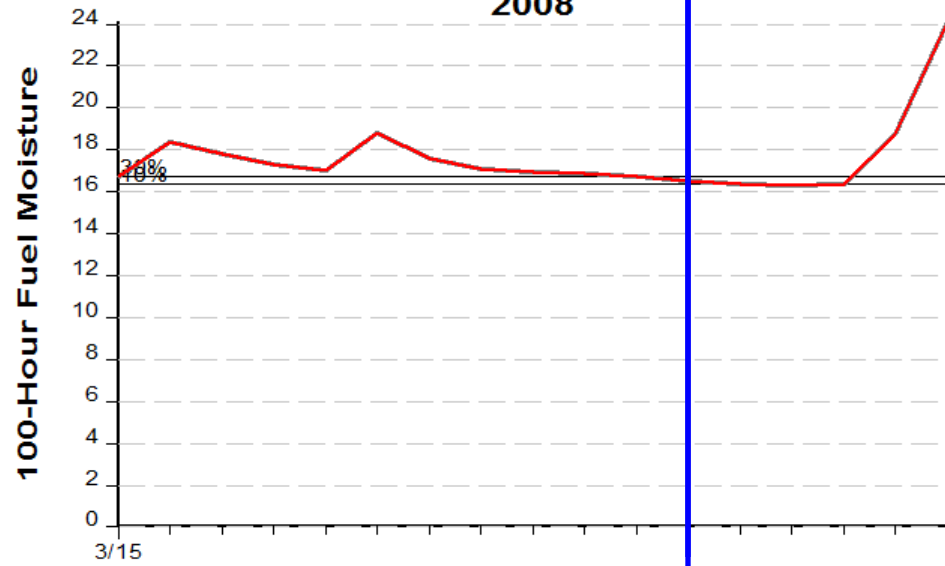
1 Day Periods

Model: 7G
17 Wx Observations
FF+4.0.2 11/18/2013-11:57

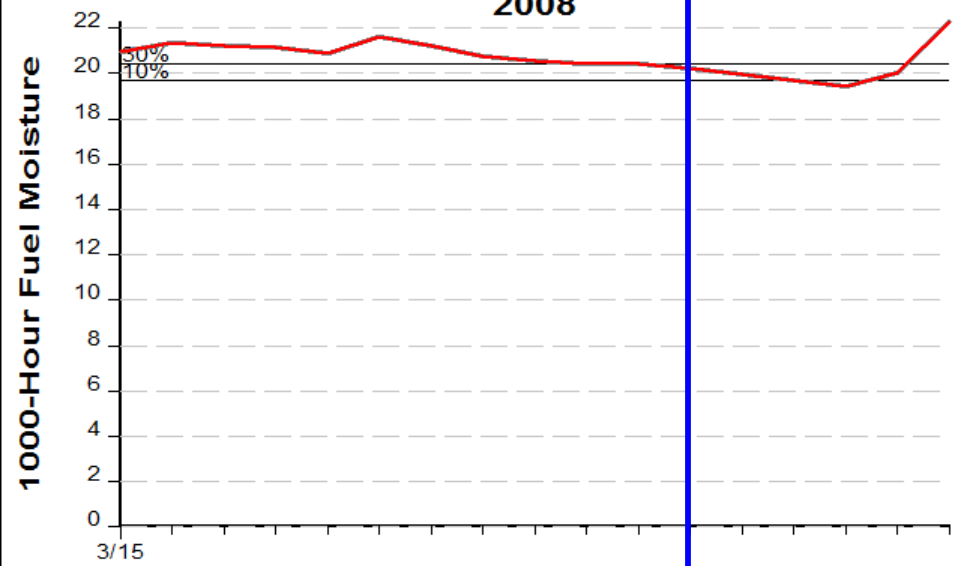
1 Day Periods

Model: 7G
17 Wx Observations
FF+4.0.2 11/18/2013-11:57

**SIG - Edna Buck
2008**



**SIG - Edna Buck
2008**



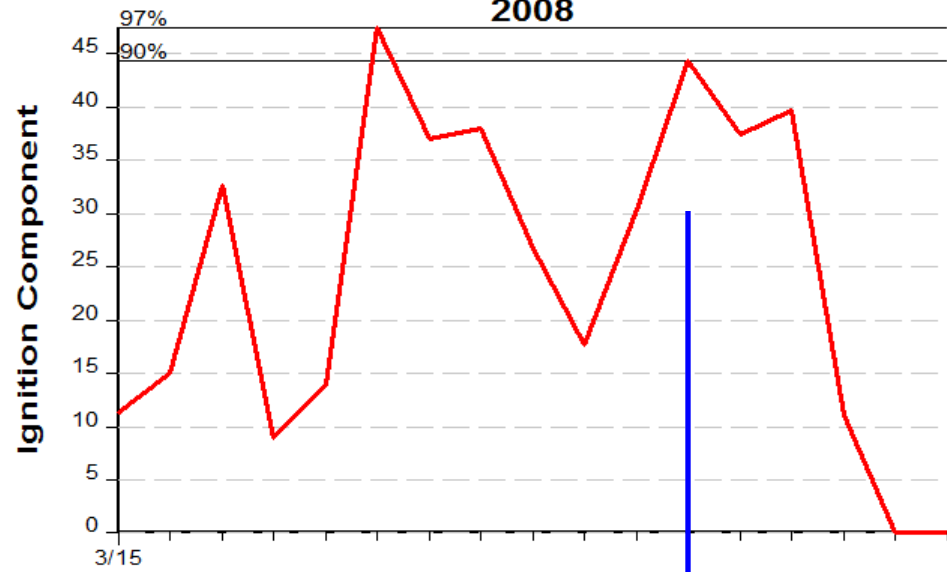
1 Day Periods

Model: 7G
17 Wx Observations
FF+4.0.2 11/18/2013-11:57

1 Day Periods

Model: 7G
17 Wx Observations
FF+4.0.2 11/18/2013-11:57

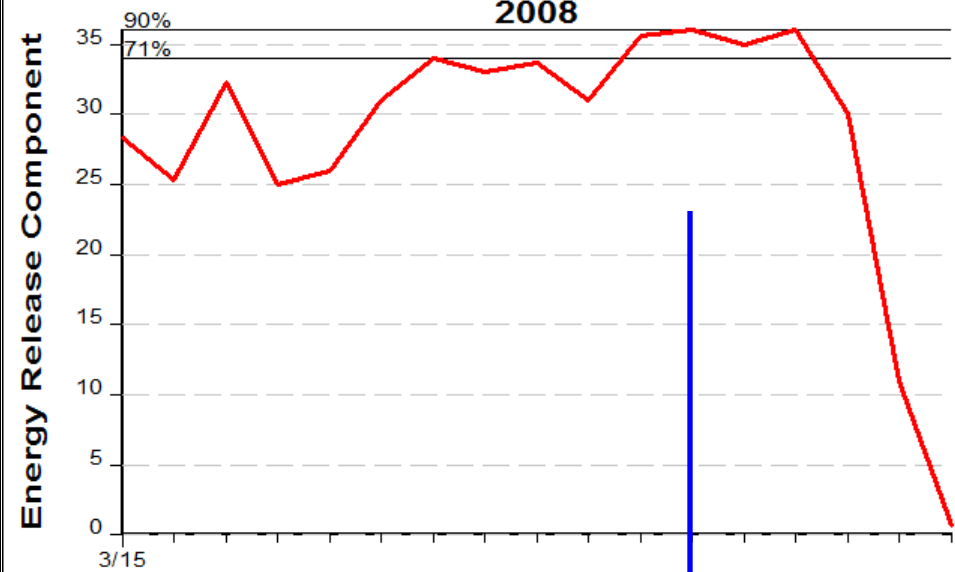
SIG - Edna Buck 2008



1 Day Periods

Model: 7G
17 Wx Observations
FF+4.0.2 11/18/2013-12:10

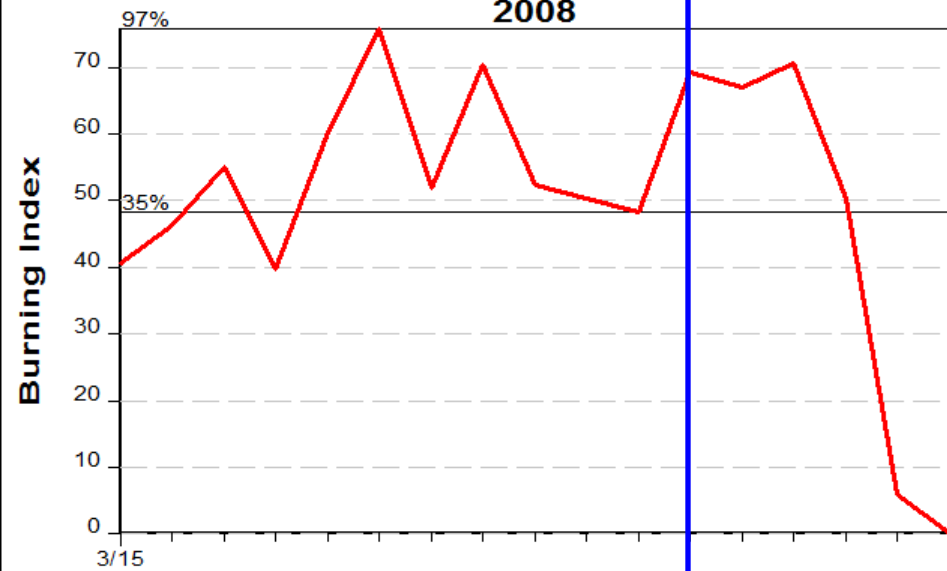
SIG - Edna Buck 2008



1 Day Periods

Model: 7G
17 Wx Observations
FF+4.0.2 11/18/2013-12:10

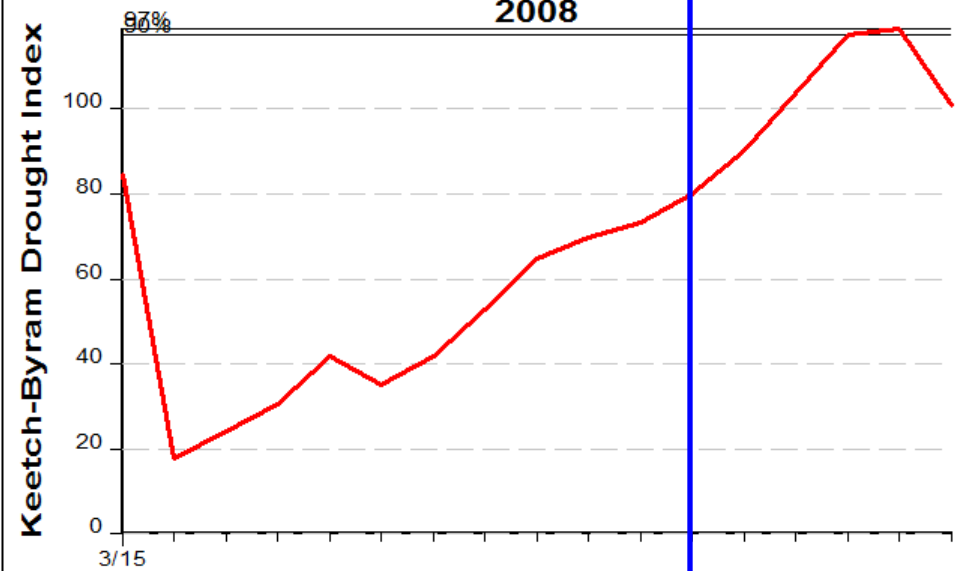
SIG - Edna Buck 2008



1 Day Periods

Model: 7G
17 Wx Observations
FF+4.0.2 11/18/2013-12:10

SIG - Edna Buck 2008



1 Day Periods

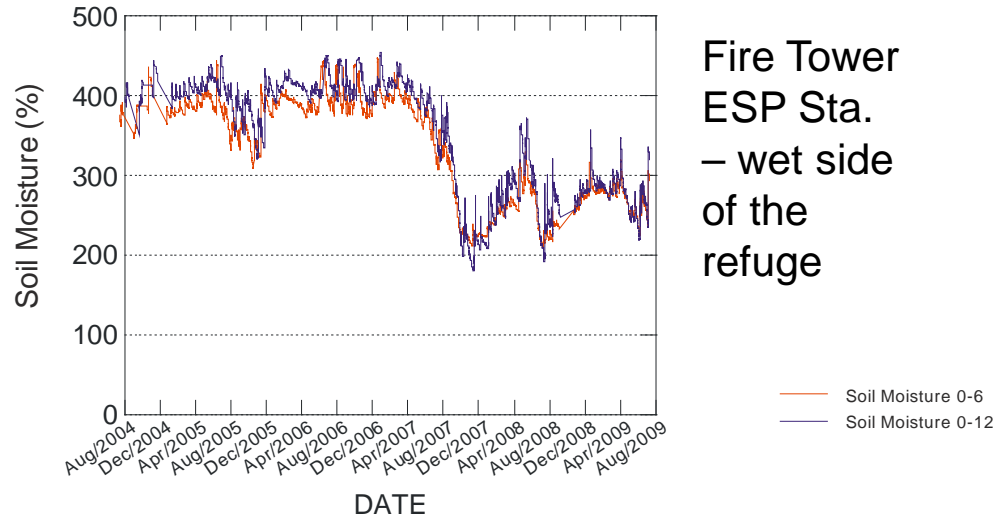
Model: 7G
17 Wx Observations
FF+4.0.2 11/18/2013-12:10

Camp Lejeune Pocosin Burn

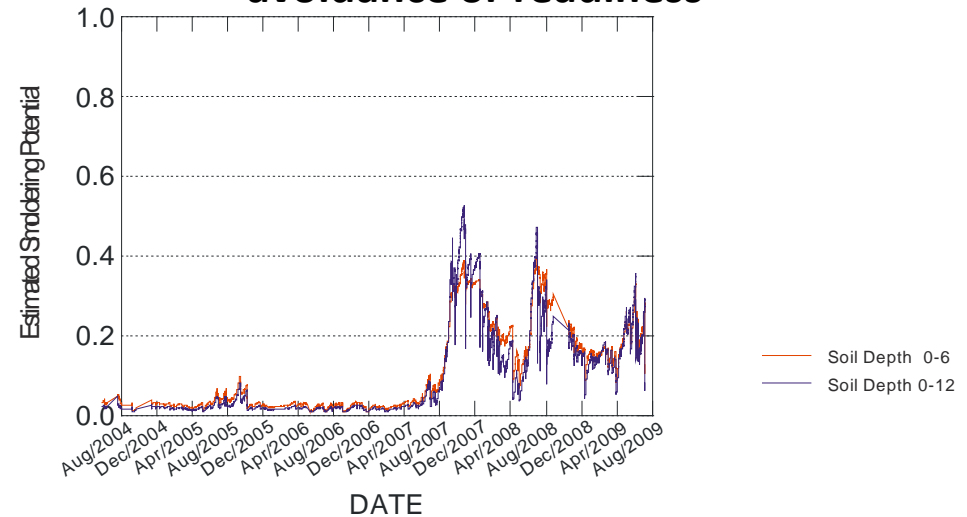
Station ID	Obs Dt	Tm	O T	MSGC	WS	WDY	HRB	1H	10	HU	TH	XH	IC	SC	EC	BI	SL	R	KBDI
319505	040710	13	F	701P3	11	70	7	7	11	15	18	18	29	43	44	97	4	H	171
319505	040710	13	F	7G1P3	11	70	7	7	11	15	18	18	28	12	30	46	3	M	171
319505	040610	13	O	701P3	7	70	6	7	8	15	19	19	24	28	47	82	4	H	154
319505	040610	13	O	7G1P3	7	70	6	7	8	15	19	19	23	8	31	37	3	M	154



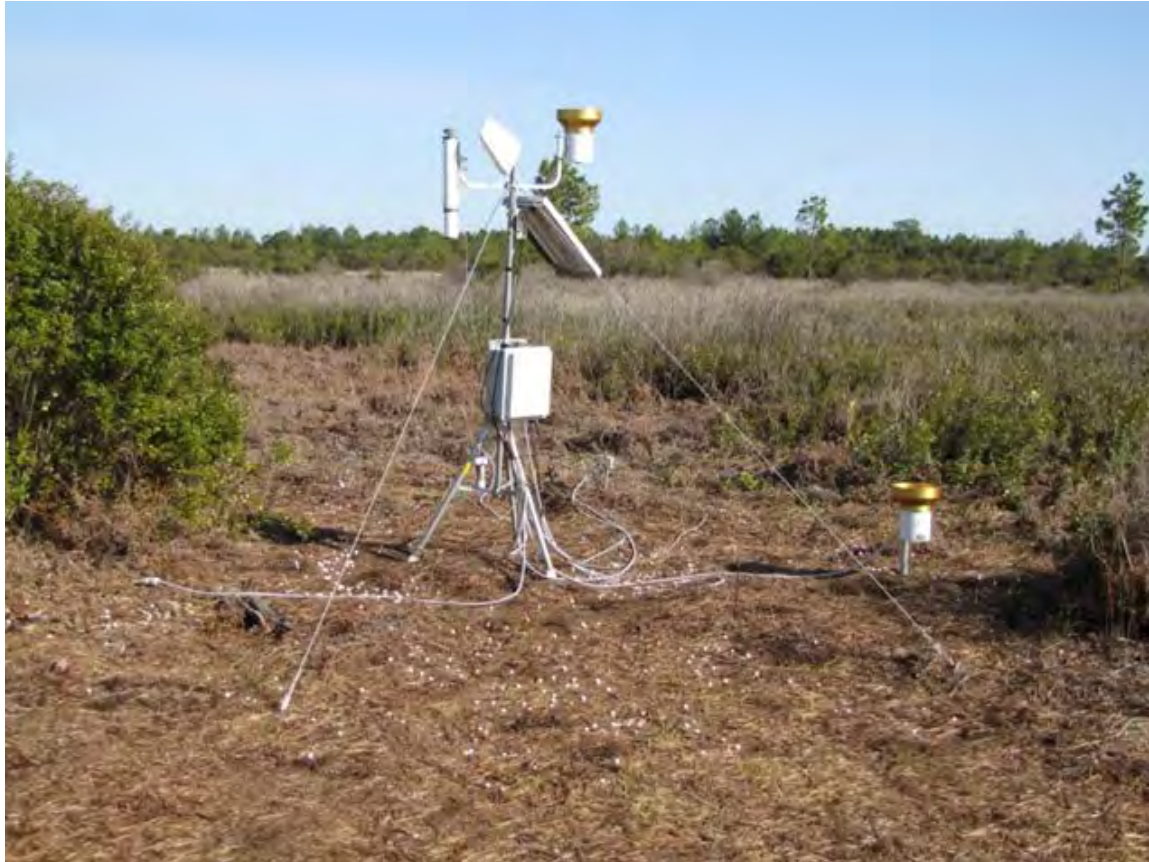
Soil moisture and estimated smoldering potential at Pocosin Lakes NWR



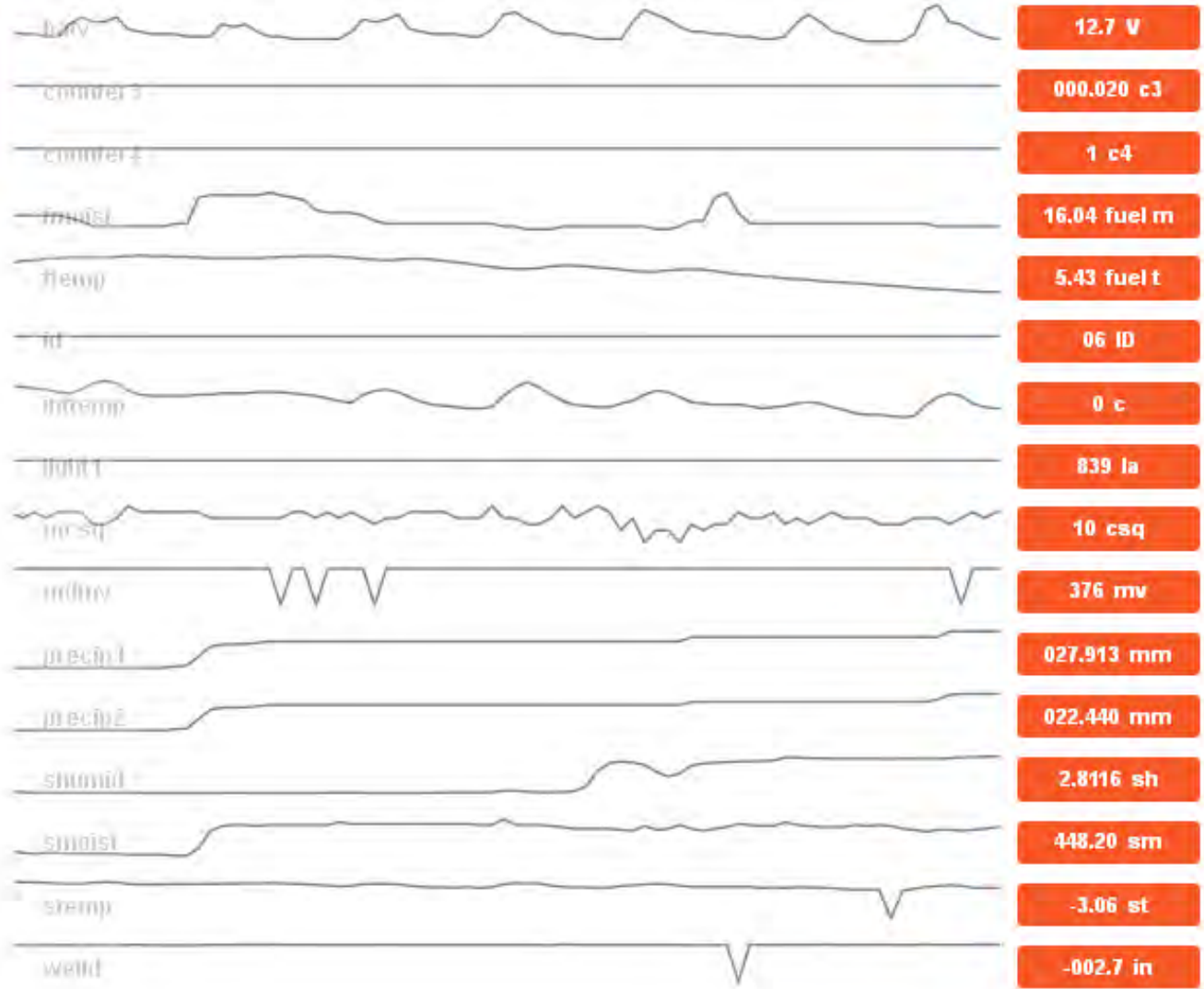
Trends identify windows of opportunity & avoidance or readiness



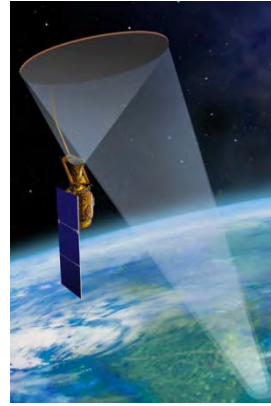
Remote Measurements



Pocosin Lakes ESP Array - Fire Tower Site

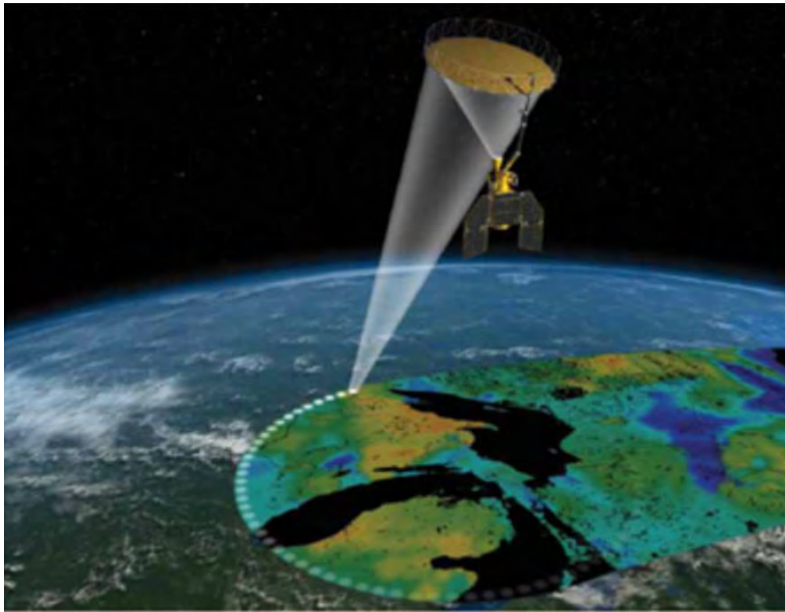
1 week


Soil Moisture Active Passive Satellite offers the possibility of assessing ground soil moisture remotely



The next project phase is to determine can we correlate remote ground data with remote satellite data

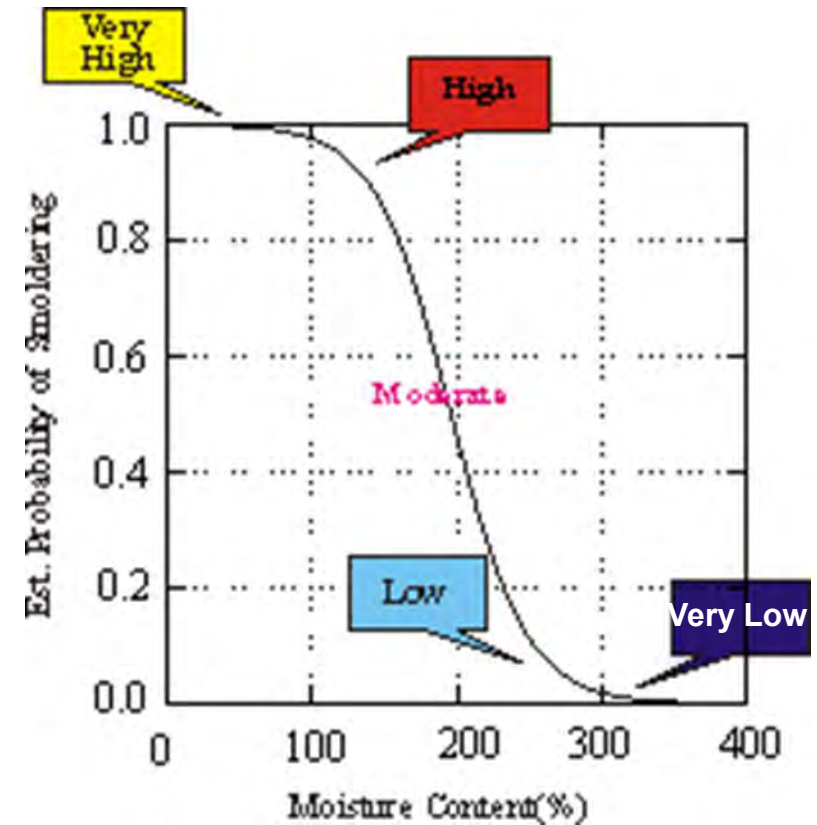
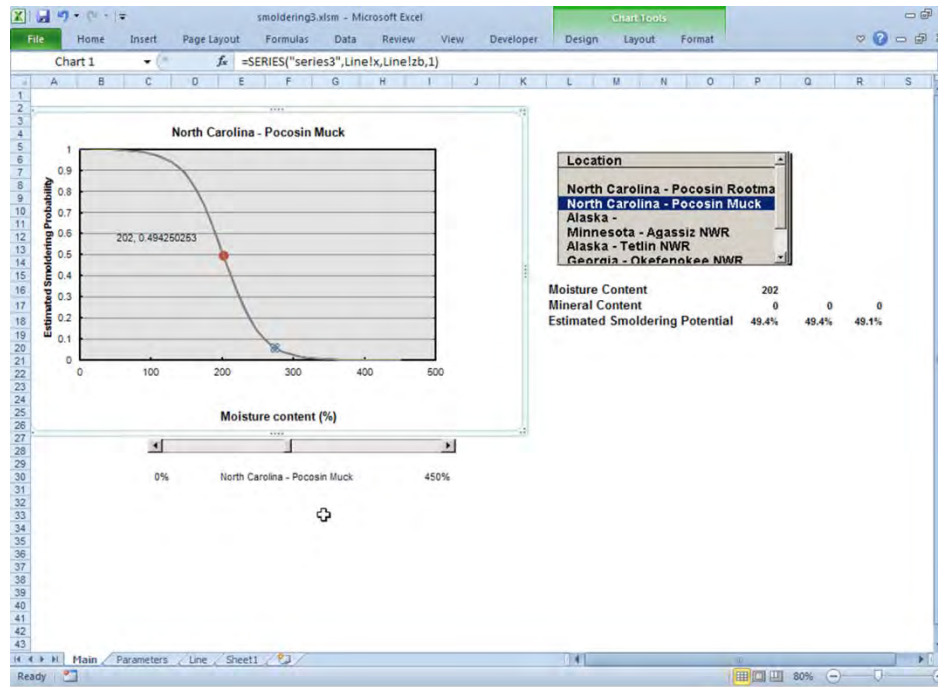
Will the satellite relay the necessary
information relative to what ESP
requires at an acceptable resolution?



Cell telemetry
2 tipping buckets
Fuel temp
10hr fuel moist
Soil Temp
Root Mat ESP
Muck ESP
ET Gauge
Well
Solar Panel



There are 4 geographic fire danger areas for ground fuels which will require different algorithms



Very High High Moderate Low Very Low

With improved soil moisture information coming from SMAP & fire danger remotely sensed, will the user community apply the information to assist in prescribed fire and wildfire management decisions?



Summary

- *ESP has been a reliable predictor on the lack of organic soil consumption for research burns which was consistent with laboratory work and other burns conducted on similar sites.*
- *Acknowledgements*
- *We would like to thank the Nature Conservancy , USFWS, DOD at Camp Lejeune, and NCFS for their collaboration on the ESP project.*