



# NATIONAL WEATHER SERVICE

## Building a Weather-Ready Nation

# Science to Service

## Collaborative Research to Operations in Southern Plains Fire Meteorology

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**Workshop on Fire Weather Forecasting - CIWRO**  
**Norman, Oklahoma – 13 February 2024**

Howdy and welcome!

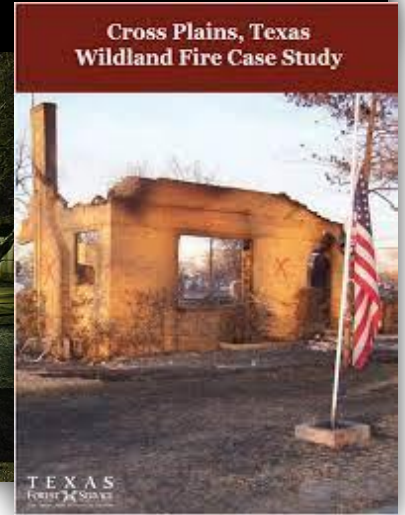
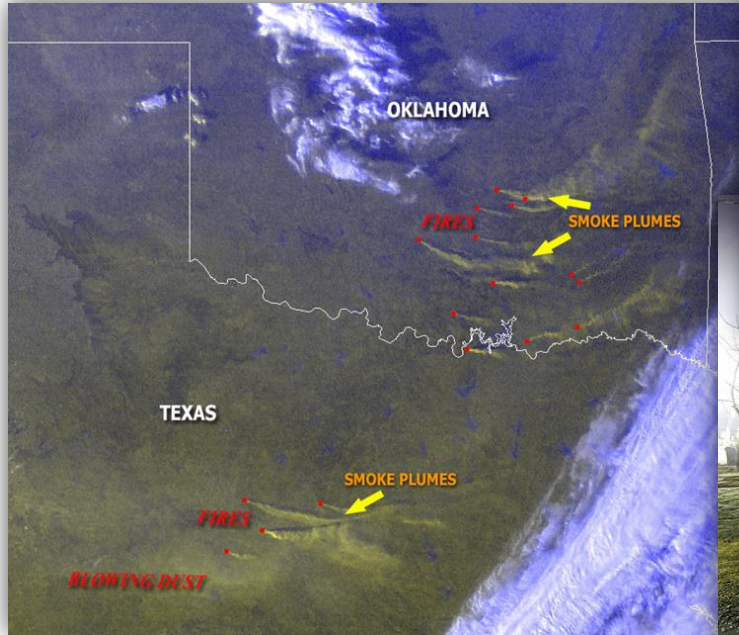
# Oklahoma

Where the wind comes  
sweepin' down the plain.



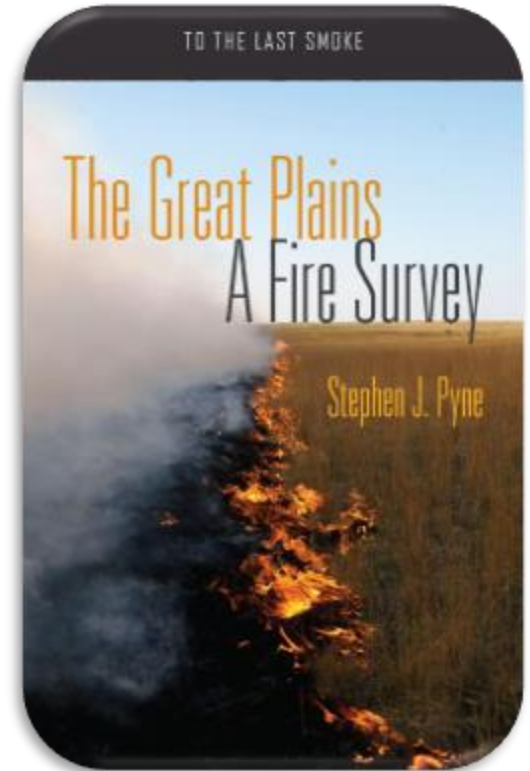
*Where the wind comes  
sweepin' down the plain.*

# This Story Begins on 27 December 2005



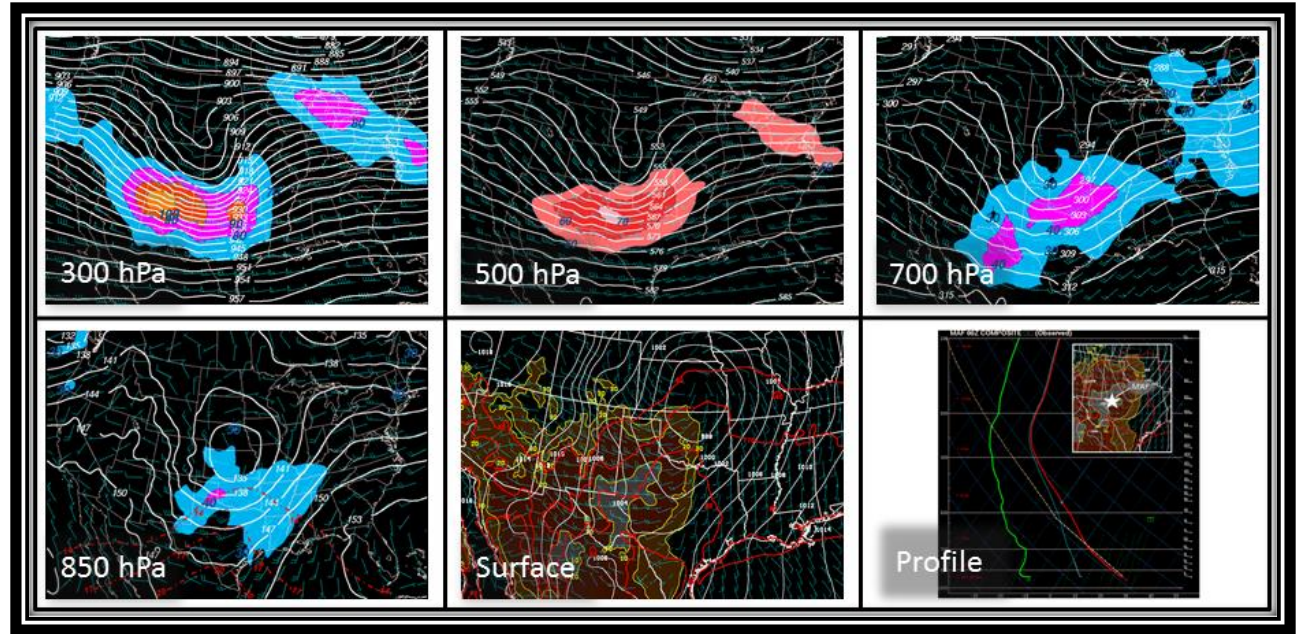
“TFS conducted careful studies of “firestorms” to determine why they had been so damaging and how effectively to intervene; strengthened linkages with its federal partners...claimed the special attention of fire science in Texas and produced a world-class literature.” – Stephen J. Pyne – The Great Plains: A Fire Survey.

**This is that story...**



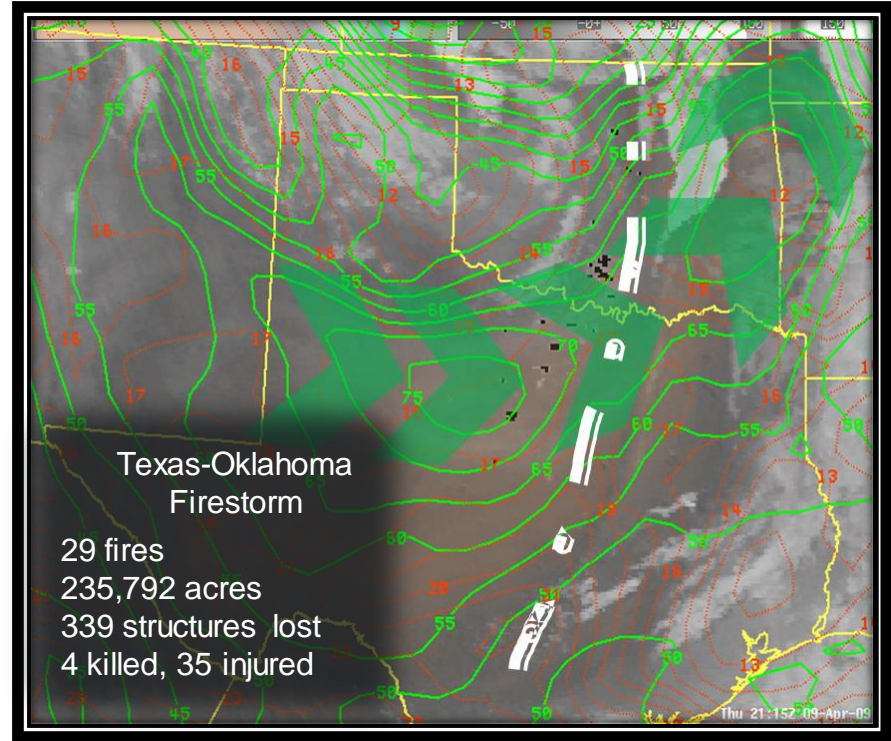
# Predictable Synoptic Pattern for Fire

Application of rudimentary science to Plains fire outbreaks analogous to severe storm forecasting in the 1950s.





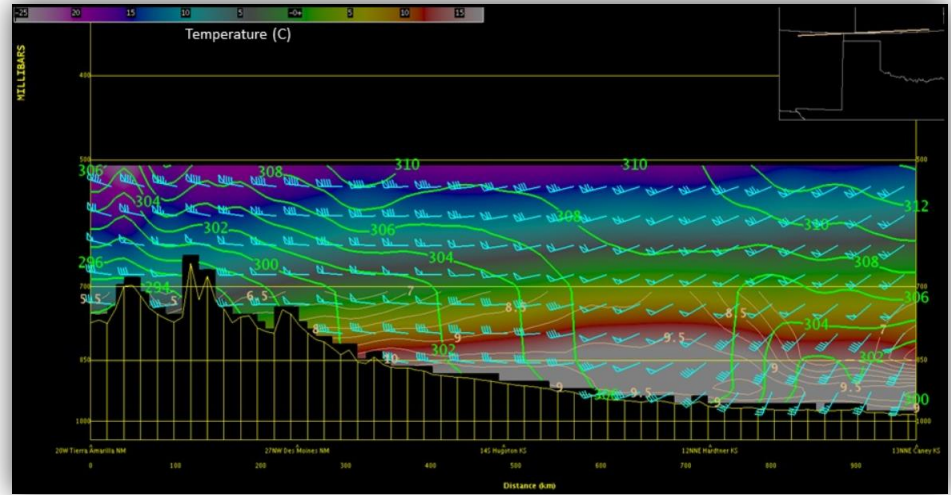
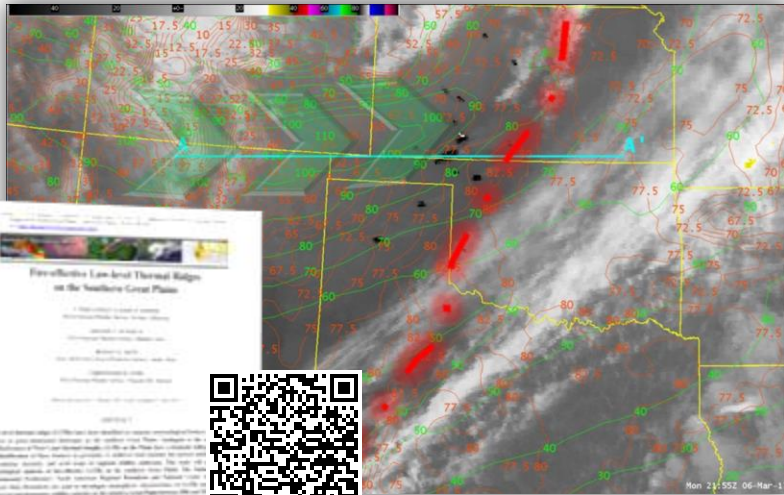
# 9 April 2009 – A Pivotal Plains Fire Disaster





# Mesoscale Fire Process/Predictor

## Fire-effective Low-Level Thermal Ridge



*“Fires are atmospheric events, as much as dust devils or hurricanes which also organize heat release from the surface”* Dr. Stephen J. Pyne – *Between Two Fires* (2012)

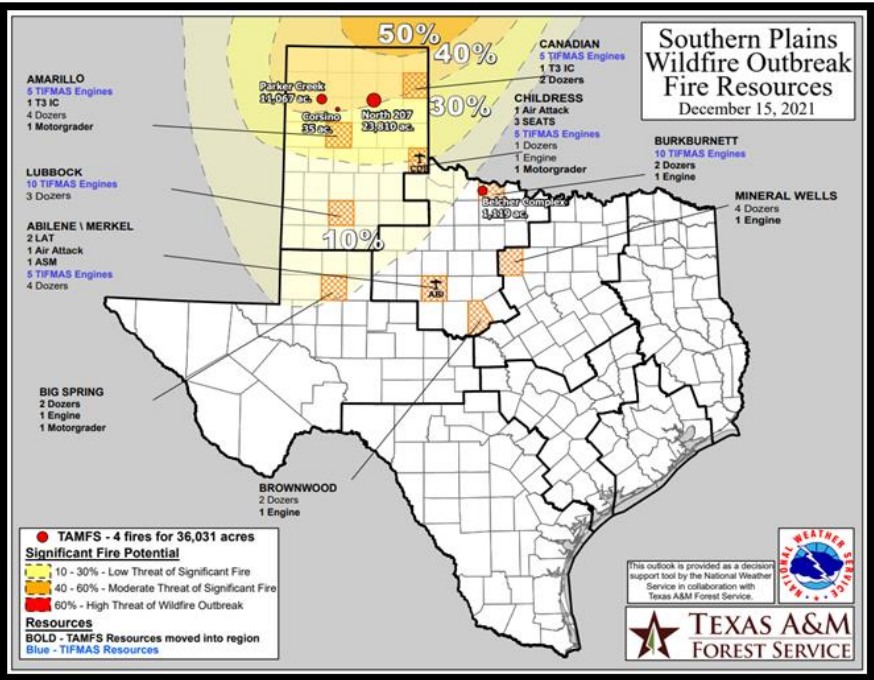
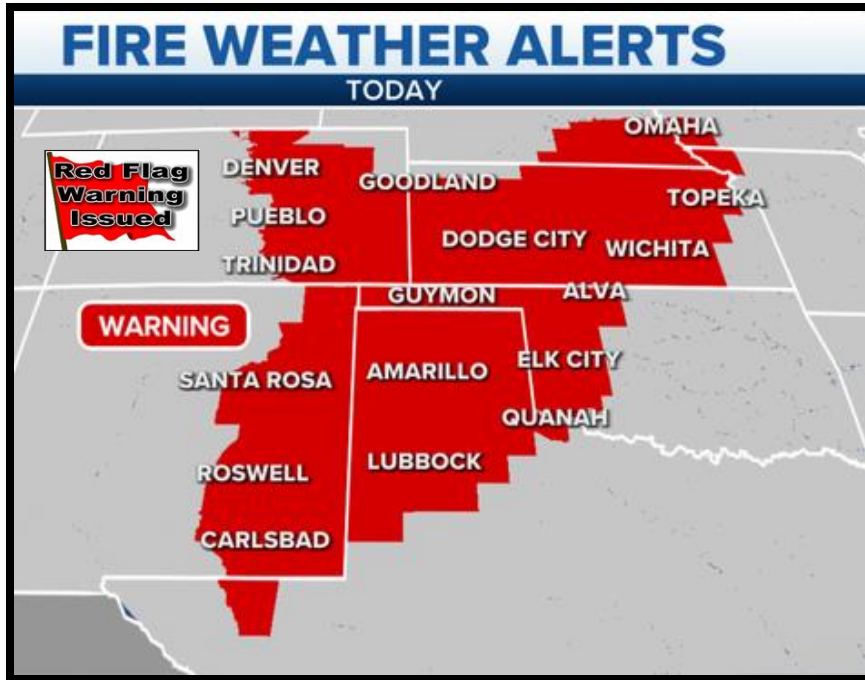


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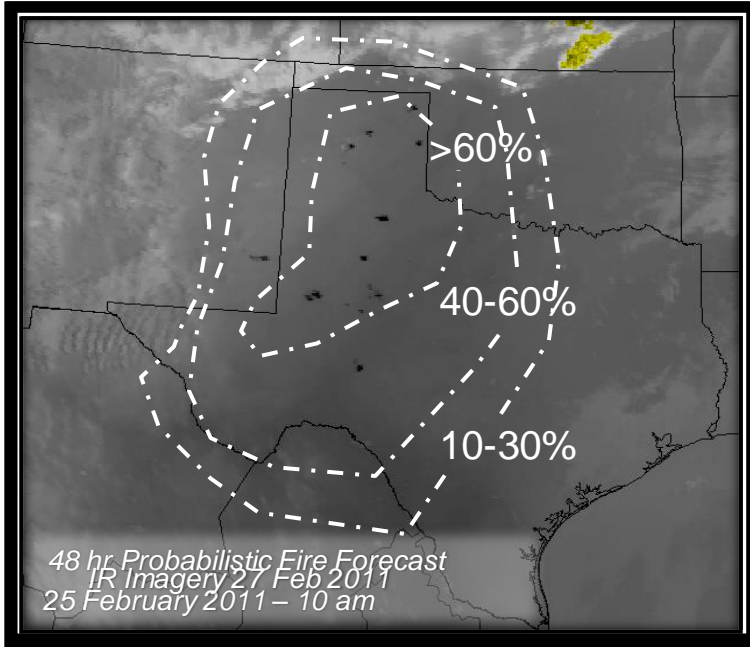
***“Fire behavior deals with statistical ensembles...Wildland fire does not merely resemble a climatic or meteorological phenomenon; it results from them and is thus another order removed from simple determinism.”***

Dr. Stephen Pyne – Fire in America: A Cultural History of Wildland & Rural Fire (1982)



# First Collaborated Probabilistic Outlook

## 27 February 2011



- 6 single engine air tankers
- 1 heavy air tanker
- 25 dozers
- 4 wildland fire strike teams
- 27 fire supervisors
- 6 fire prevention
- NWS deployed to ICPs in Midland, Lubbock, and Amarillo

*"It is crucial that we take steps to prepare for and respond to extreme wildfires"...* Governor Rick Perry 2/25/11



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# Southern Great Plains Wildfire Outbreaks (SGPWO)/Plains Firestorms



*“A ‘perfect storm’ for  
extreme fire.”*

*Texas A&M Forest Service*

**Dec 2005-Feb 2024**

37 SGPWOs

7.03 million acres

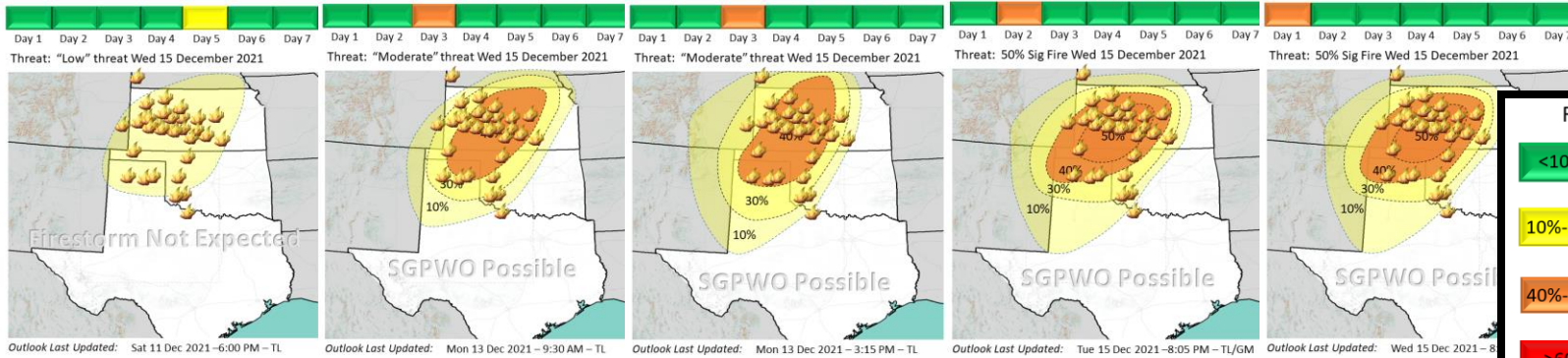
3,454 structures lost

44 killed, 305 injured

84% of SGPWOs result in human casualties

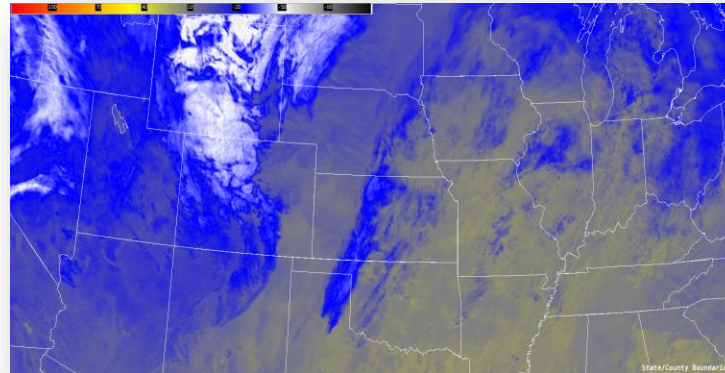
# Summary of Probabilistic Outlooks

Probability of Significant Wildfire Occurrence – 15 December 2021



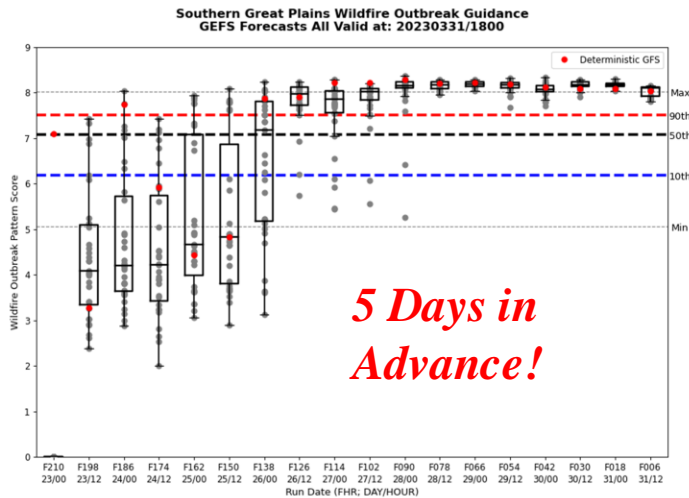
**Risk Potential Legend**

- <10%** Nil and/or Routine Fire Wx with Initial Attack & Large Fire
- 10%-30%** Low-Moderate Significant Fire
- 40%-60%** High Significant Fire Potential - Outbreak Possible
- >60%** Significant Wildfire & Outbreak Likely

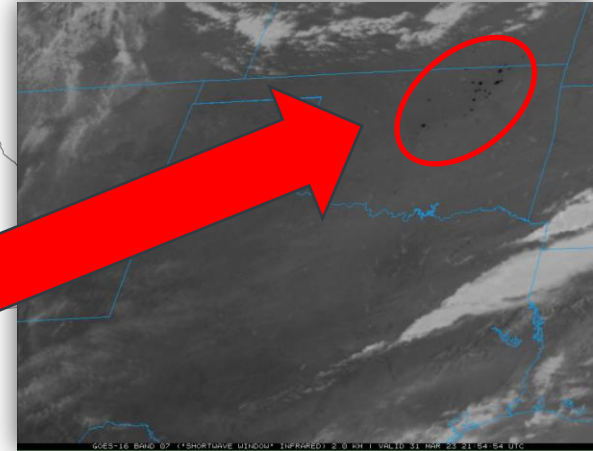
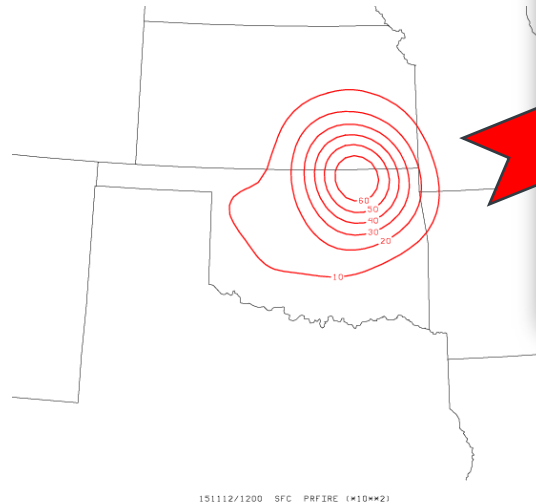


# The Probabilistic Puzzle

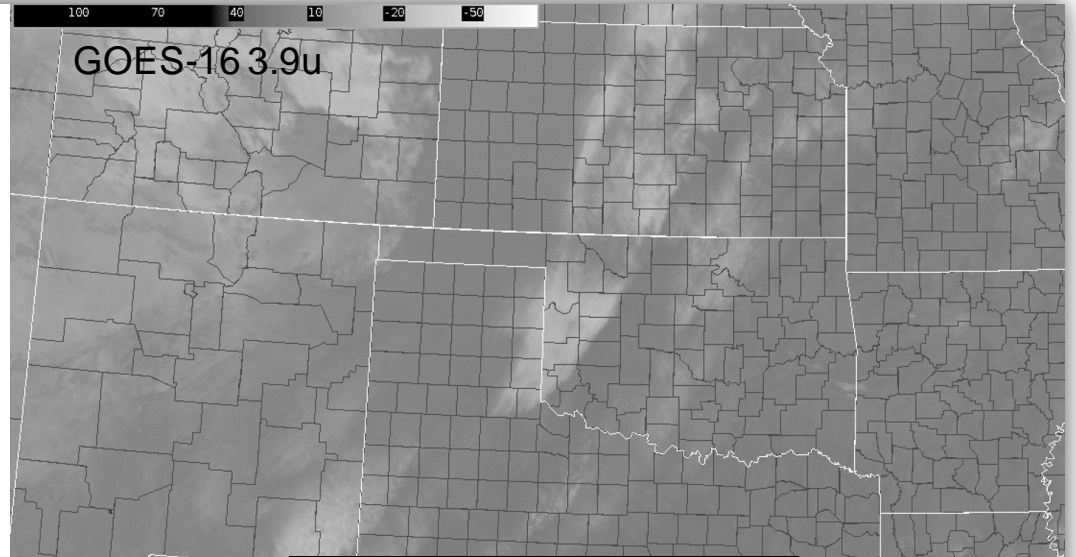
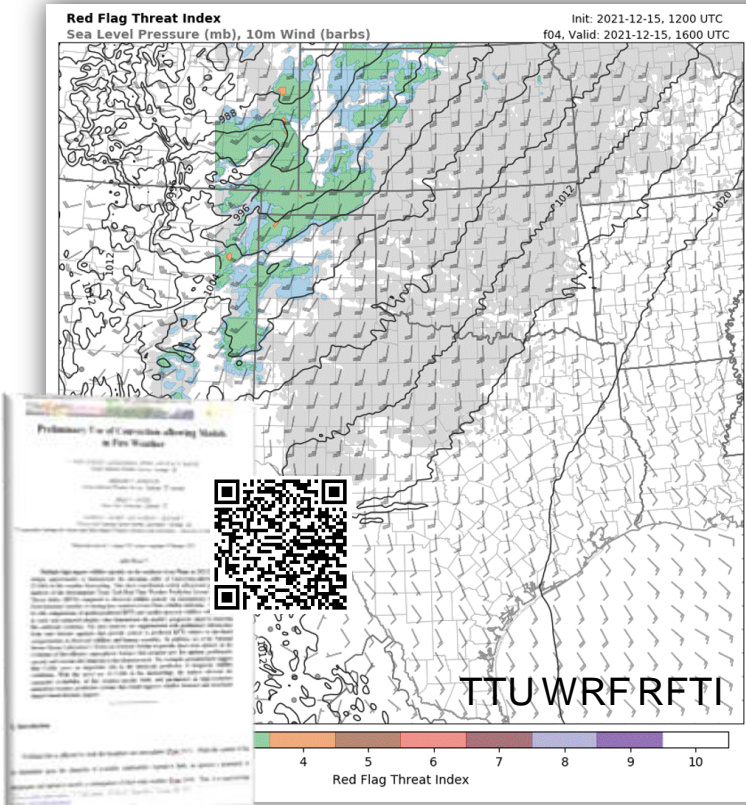
- Energy Release Component
- Red Flag Threat Index
- Wildland Fire Assessment System
- CIPS Analog Guidance



**Prototype probability of  $\geq 5,000$  acre fire 1<sup>st</sup> guess**

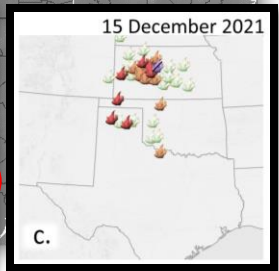


# Red Flag Threat Index in Hi-Res Weather Models



Fire Categorization (Fire Size km <sup>2</sup> )	Fires Occurring Within Predicted TTU WRF RFTI by Category (%)					
	Nil (0)	Elevated (1-2)	Near-critical (3-4)	Critical (5-6)	Extremely Critical (7-8)	Historically Critical (9-10)
Initial Attack (n=94*) 0-1.2	1	11	33	31	19	5
Large Fire (n=21) 1.2-20.2	-	-	24	29	14	33
Significant Fire (n=22) >20.2-404.7	-	-	5	41	36	18
Megaline Fire (n=1) >404.7	-	-	-	-	-	100
Casualty Fire (n=4)	-	-	-	-	75	25
Unknown (n=4)	100	-	-	-	-	-

\*2 known Initial Attack fires were excluded due to occurrence outside of the TTU WRF RFTI domain.

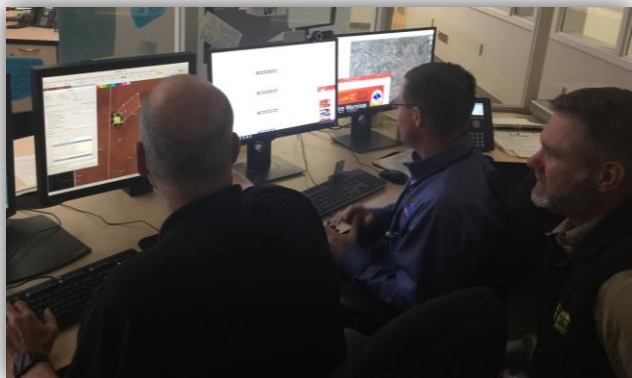






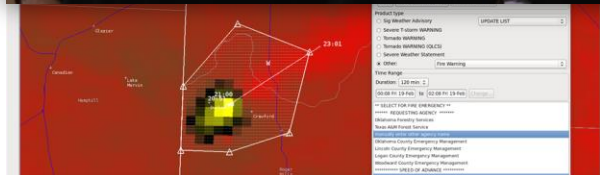


# Environment + Detection = Warnings?



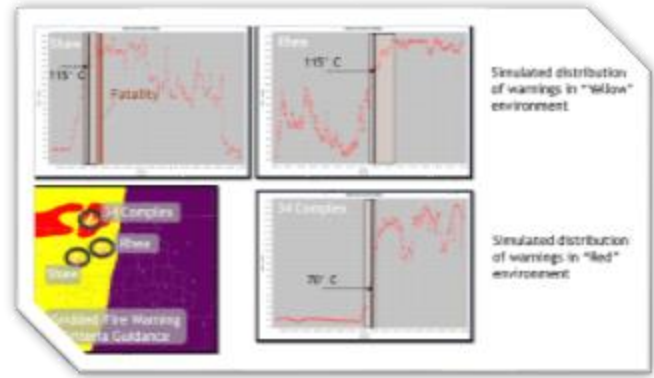
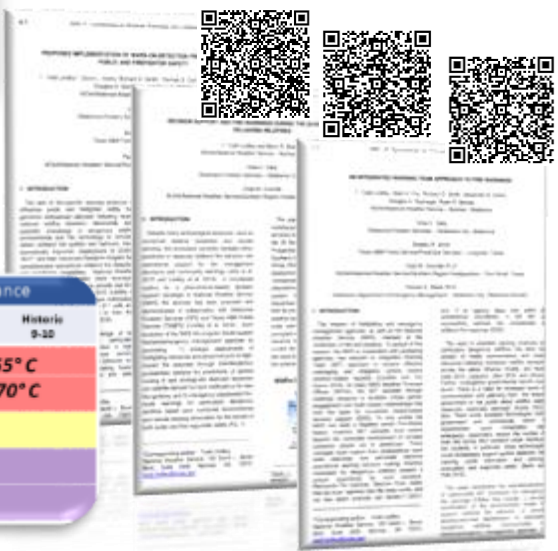
The scientific guidance for Fire Warnings was co-developed between meteorologists and fire analysts through simulations & analyses, and includes:

- ❑ Gridded environmental information (ERC percentiles & Red Flag Threat Index).
- ❑ Remote sensing (GOES-16/17) signals related to past extreme fire behavior in various fire environments.



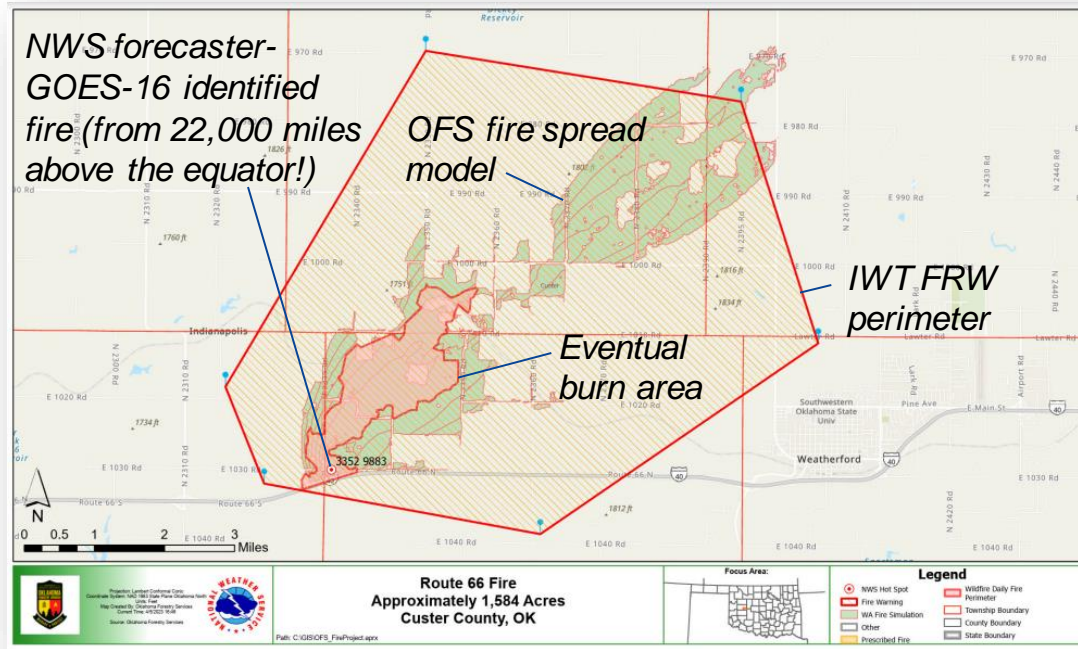
Combined Fire Environment & SWIR FRW Coordination Decisional Guidance

Weather (RFTI)	REL 0	Elevated 1-2	near Critical 3-4	Critical 5-6	Extreme 7-8	Historic 9-10
>90 <sup>th</sup>				(2)	(3) BT <sub>min</sub> =55° C	
70 <sup>th</sup> -90 <sup>th</sup>				BT <sub>min</sub> =95° C	BT <sub>med</sub> =70° C	
50 <sup>th</sup> -70 <sup>th</sup>				BT <sub>med</sub> =115° C		
25 <sup>th</sup> -50 <sup>th</sup>	(1) Local EM Request Only					
<25 <sup>th</sup>						

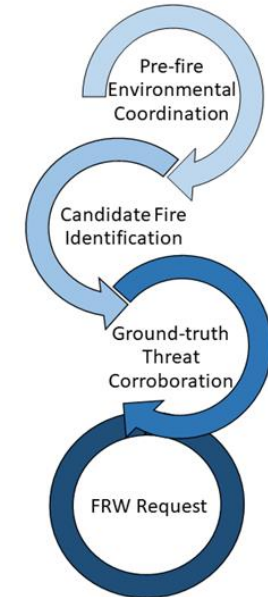


# Integrated Team Fire Warnings

At the request of State Foresters, WFO Norman conducted collaborative science with OFS/TAMFS Fire Analysts to produce a science-based methodology for proactive coordinated interdisciplinary Fire Warnings for public & first responder safety – issued at the request of land/fire agencies.

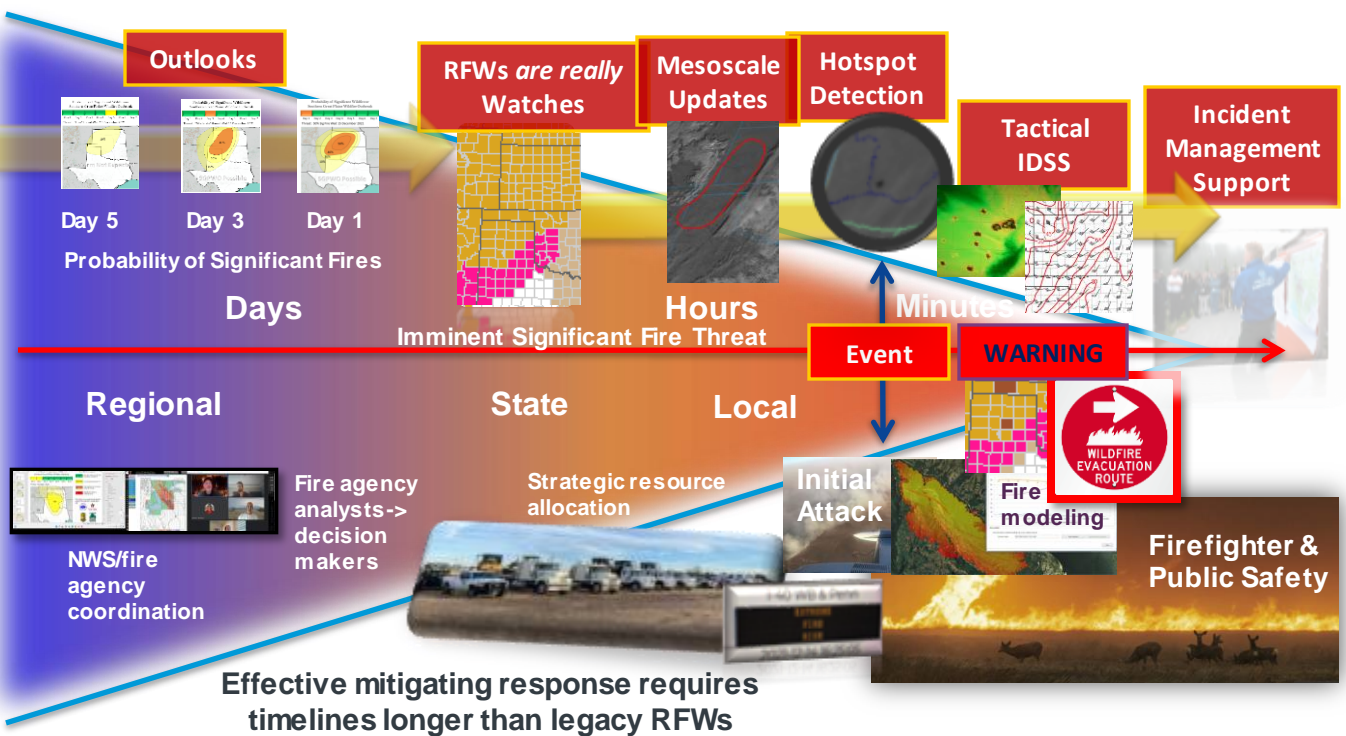


## IWT FRW Workflow

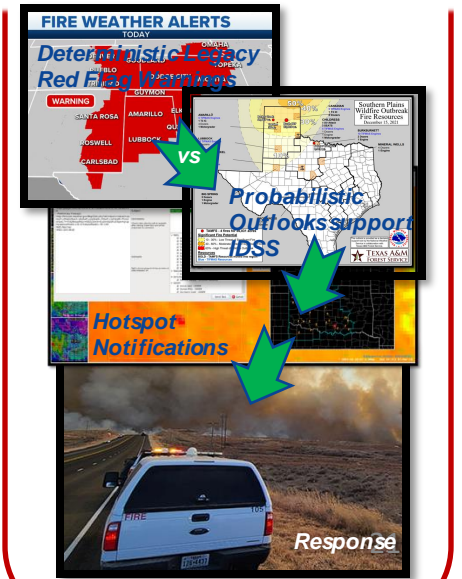


# Science to Service Approach for Fire

A “seminal approach” to “meteorology paired tightly with skilled operational decision making”...Matt Jeglum, NOAA/NWS/WRH.



The power of this process is informing strategic pre-deployments that are tactically routed to emerging incidents.



Adapted for fire from Dr. Heather Lazrus (NCAR) & NSSL FACETS



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**Comments & Questions**

