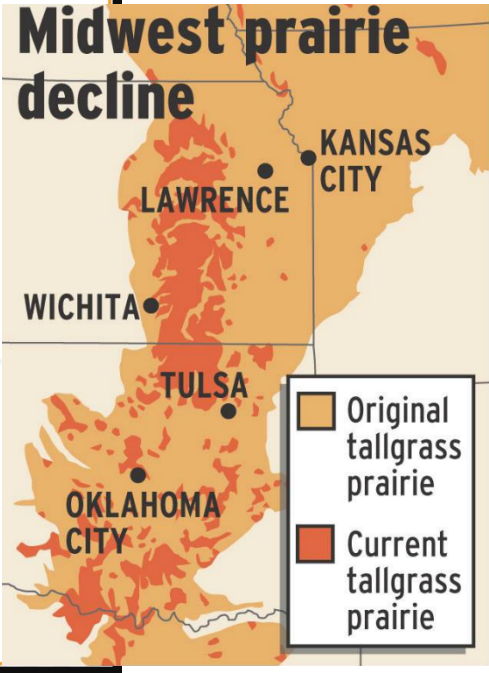
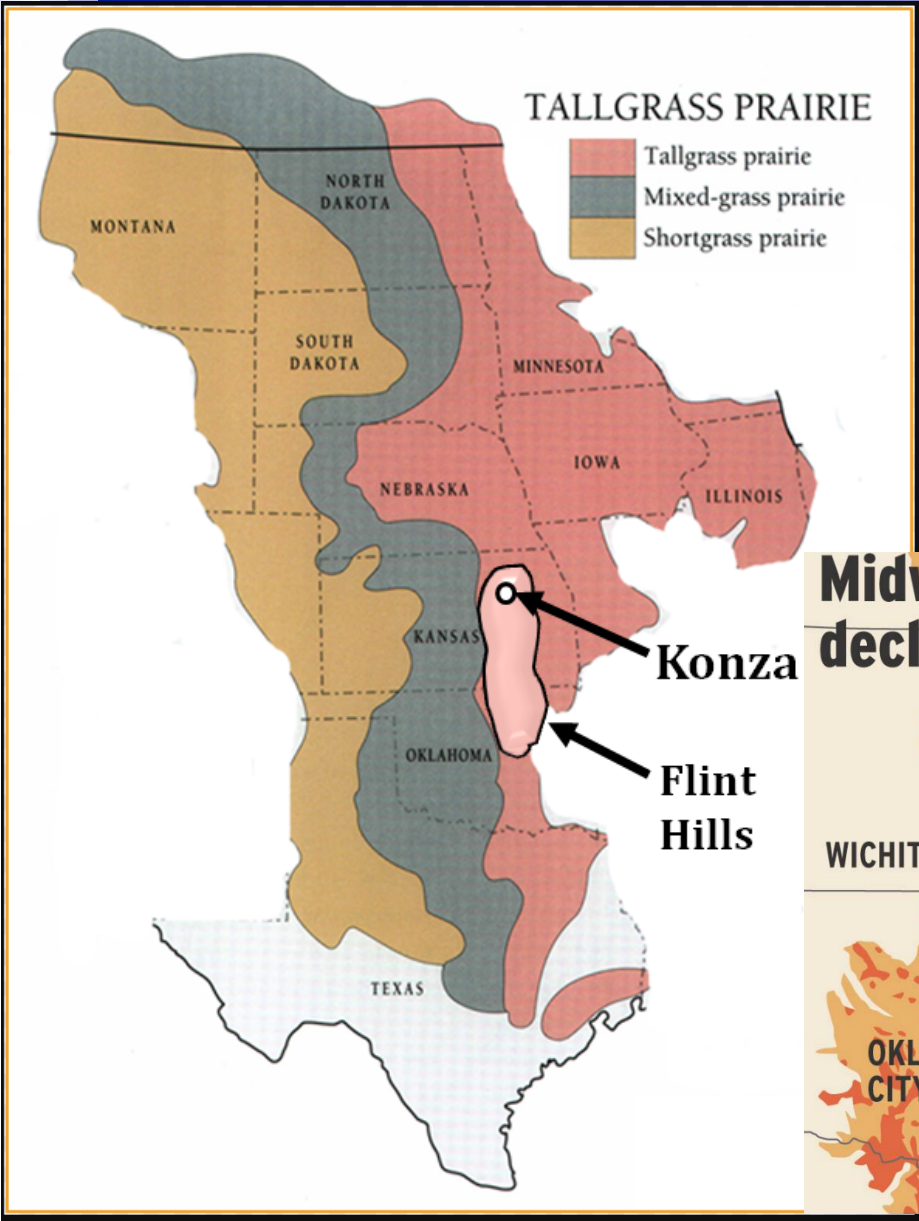




# 2017 Kansas Flint Hills Update

CenSARA Fall 2017 Business Meeting  
St. Louis , MO  
October 10, 2017

Douglas Watson, Meteorologist  
Chief, Monitoring and Planning Section  
Bureau of Air  
Kansas Department of Health and Environment



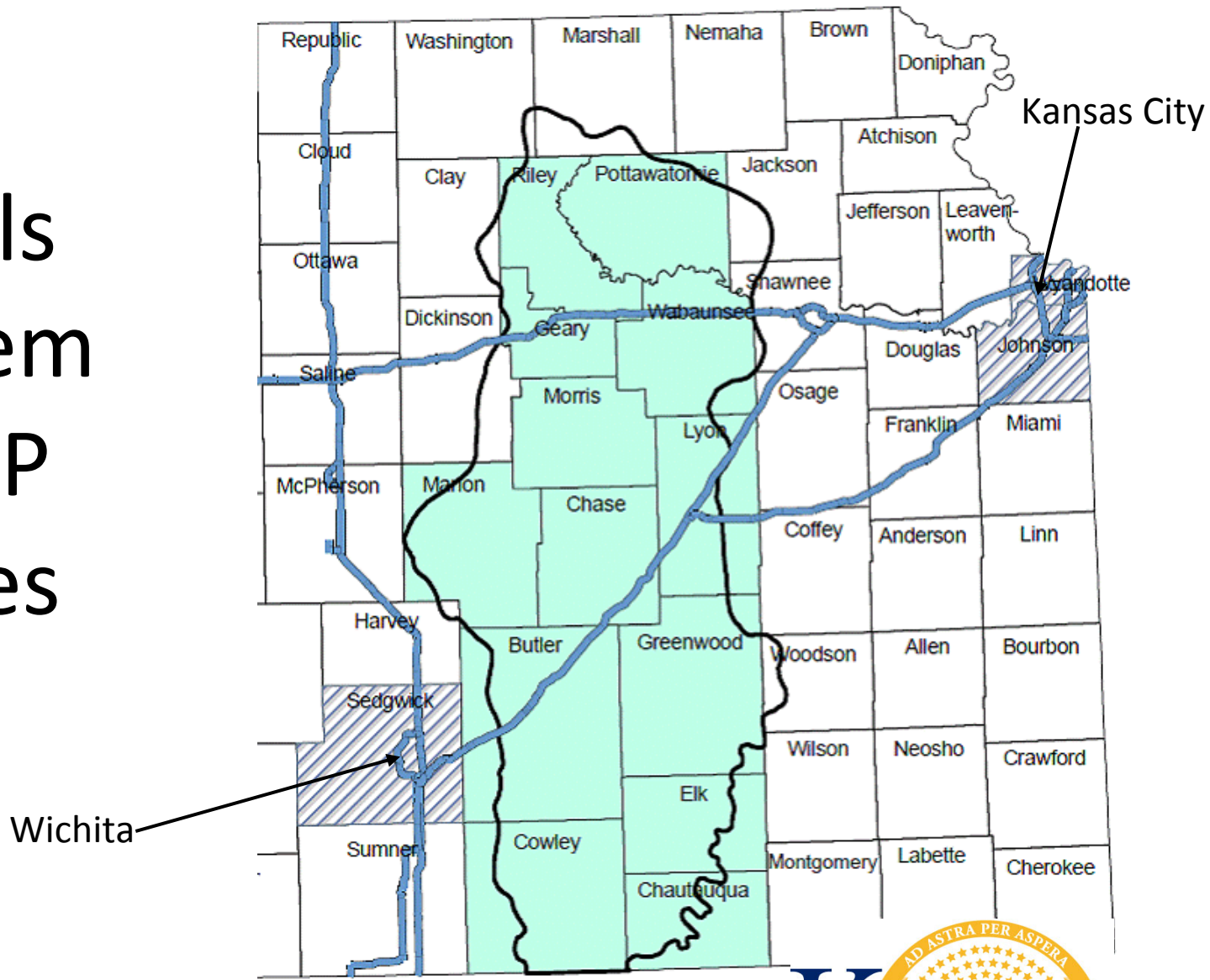
- ❑ Of the 170 million acres of historic tallgrass prairie that once covered N. America, less than 4% remain, primarily in the Flint Hills.
- ❑ One of the rarest and most endangered ecosystems in the world

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# Flint Hills ecosystem and SMP Counties

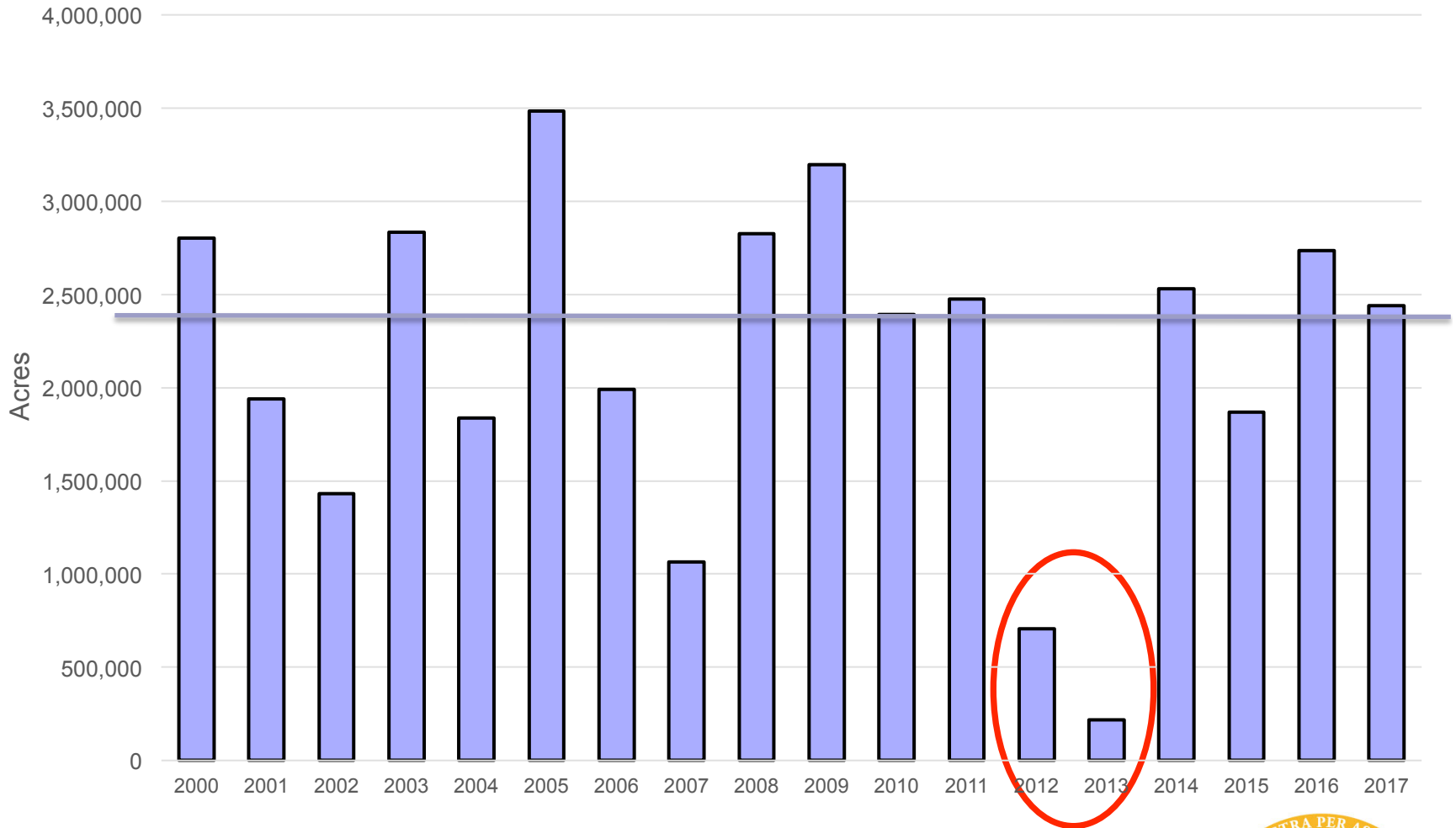


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# Flint Hills Burning Background

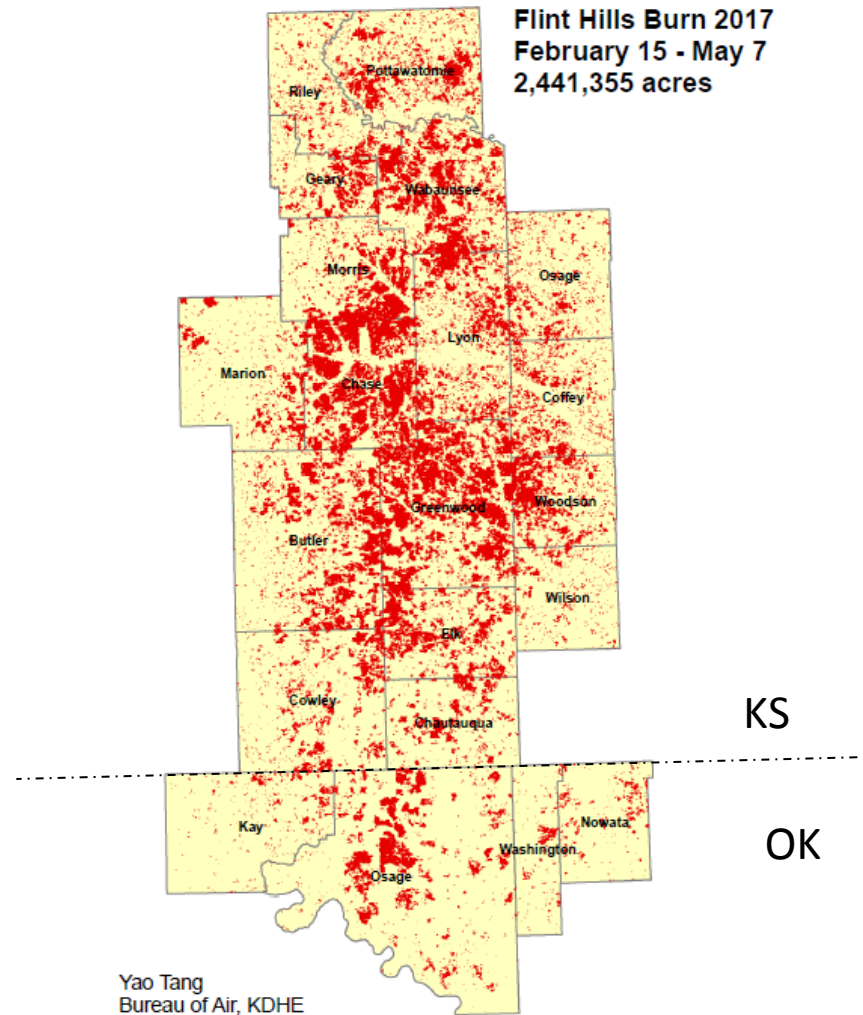
- Flint Hills ecosystem covers all or parts of 13 Kansas counties
- Prairie burned in March/April to preserve the ecosystem by controlling invasive trees, shrubs and plants and to improve cattle weight gain
- Safety conditions limit number of days that are suitable for burning
- 2,441,355 acres burned in 2017
- Burning caused ozone exceedances in 2003, 2009, 2010, 2011, 2014, 2015 and 2016
- Burning caused PM<sub>2.5</sub> exceedances in 2014, 2016 and 2017

## Flint Hills Prescribed Fire Total Acres Burned by Year



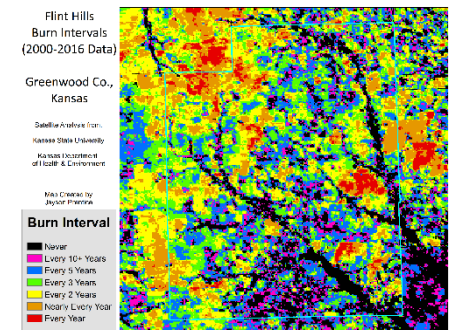
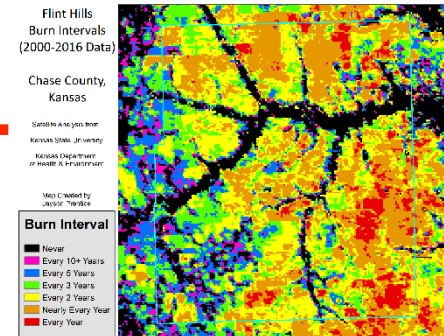
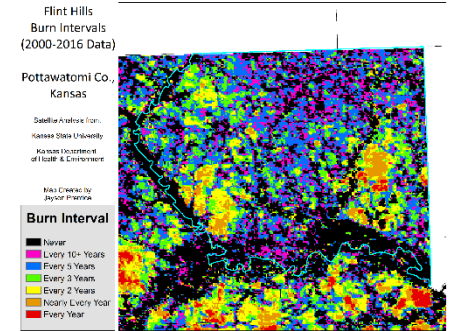
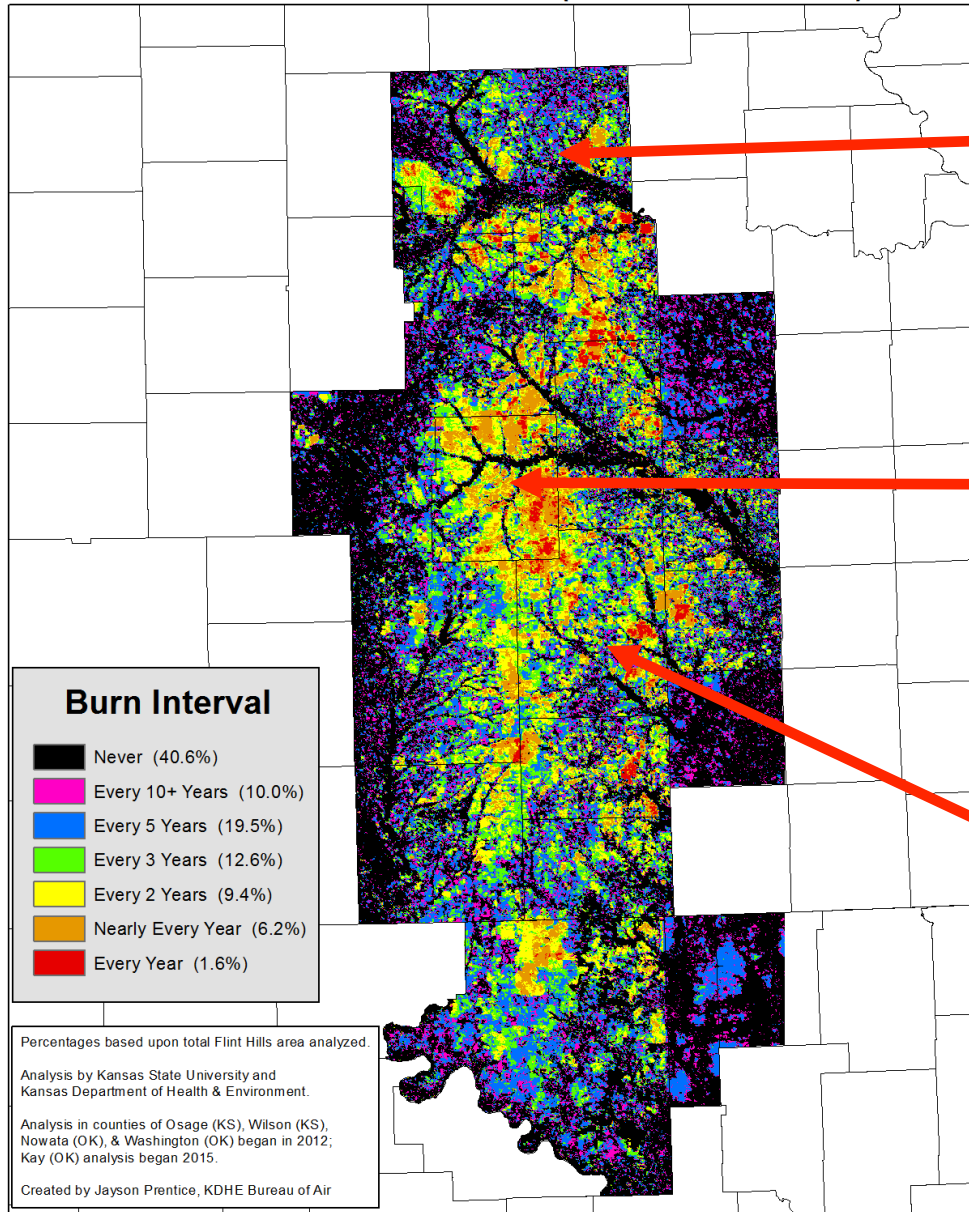
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# Satellite Derived Acres Burned in Flint Hills – (Feb. 15 – May 7, 2017)



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# Flint Hills Burn Intervals (2000-2016 Data)





**Flint Hills Prescribed Fire Acreage Burned by Year**

County	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Butler	297,653	177,390	74,487	259,012	126,162	309,962	91,182	121,838	268,031	293,761	241,189	213,883	45,004	13,097	166,442	94,349	245,921	220,221
Chase	318,718	184,340	168,541	278,487	186,857	340,772	197,467	54,425	286,610	310,487	280,124	255,240	28,912	5,174	288,529	218,860	318,679	273,258
Chautauqua	91,506	47,660	26,857	123,460	75,120	115,197	65,112	21,575	85,390	123,043	38,919	79,226	12,819	3,985	113,499	71,321	94,473	59,353
Coffey	68,649	28,216	94,996	88,525	41,683	112,402	101,081	61,282	75,460	122,857	42,255	77,612	26,162	11,166	77,298	81,978	76,450	84,697
Cowley	171,614	110,842	21,915	199,444	112,834	194,162	63,737	65,021	189,128	149,128	127,212	134,002	18,193	3,907	92,804	61,036	158,984	99,786
Elk	128,927	114,857	58,564	157,514	105,050	159,537	66,595	60,341	148,062	177,807	126,718	124,363	35,027	8,680	167,647	92,990	171,757	126,613
Geary	46,332	41,359	30,116	30,487	44,355	103,444	59,166	23,104	68,185	75,846	61,915	56,120	52,418	6,039	47,769	15,583	51,492	62,195
Greenwood	302,487	150,888	178,487	333,823	152,278	356,278	182,703	137,252	307,182	353,745	271,861	258,973	29,993	18,873	250,042	247,741	284,624	351,467
Lyon	165,282	84,371	144,402	188,865	104,016	214,286	221,128	61,838	158,610	203,382	121,699	160,604	43,336	14,471	143,075	156,975	174,213	151,865
Marion	64,958	26,317	12,000	53,931	26,672	80,896	15,985	10,378	52,788	62,131	60,649	45,632	8,324	3,228	44,402	28,124	75,647	68,357
Morris	134,363	76,880	81,050	106,734	68,757	171,599	138,054	18,533	125,205	111,938	126,595	114,117	16,155	2,162	107,600	64,433	149,780	118,721
Osage (KS)	92,030	63,692	46,933	93,107	60,315	114,361	65,419	33,152	92,782	104,903	78,559	81,210	42,657	10,008	77,901	66,070	64,974	67,229
Pottawatomie	107,660	131,645	70,471	42,224	103,629	169,884	92,803	58,502	124,247	126,178	119,784	108,853	124,480	5,961	120,882	63,229	89,114	125,671
Riley	90,749	77,714	71,413	63,073	71,073	128,046	97,143	70,457	92,479	116,510	86,703	89,490	85,561	36,201	84,032	50,039	64,110	63,723
Wabaunsee	195,444	128,741	136,664	173,591	157,359	281,467	273,684	91,723	240,880	261,838	183,521	203,319	64,047	23,552	240,173	102,349	199,804	194,954
Wilson	50,605	35,022	25,807	51,197	33,166	62,884	35,972	10,969	51,019	57,684	43,198	44,655	7,985	8,417	33,236	22,688	23,136	31,090
Woodson	73,838	73,266	48,386	85,375	62,100	99,043	52,664	54,981	86,301	97,622	59,954	73,855	19,599	12,124	82,271	82,596	79,276	100,759
Nowata (OK)	48,162	33,332	24,562	48,726	31,565	59,849	34,236	18,355	48,556	54,900	41,113	42,500	4,880	4,834	68,217	64,773	48,186	25,051
Osage (OK)	303,691	318,518	88,139	407,321	241,066	346,533	102,595	78,579	274,255	333,962	237,792	265,387	36,155	22,147	275,278	206,504	301,258	173,703
Washington (OK)	50,295	34,808	25,649	50,884	32,963	62,499	35,752	14,504	50,706	57,331	42,933	44,382	4,309	3,351	48,371	45,669	32,387	14,904
Kay (OK)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	32,711	32,526	27,738
	<b>2,802,963</b>	<b>1,939,859</b>	<b>1,429,438</b>	<b>2,835,778</b>	<b>1,837,021</b>	<b>3,483,101</b>	<b>1,992,477</b>	<b>1,066,809</b>	<b>2,825,876</b>	<b>3,195,053</b>	<b>2,392,693</b>	<b>2,473,423</b>	<b>706,016</b>	<b>217,377</b>	<b>2,529,468</b>	<b>1,870,018</b>	<b>2,736,791</b>	<b>2,441,355</b>

*No burn scar data available; Estimated based on year's overall average burn rate multiplied by county's grassland acreage*

Average Acres Burned 2000-2017

2,154,195

Average Acres Burned 2000-2017 w/o 2012-2013 drought years

2,365,758

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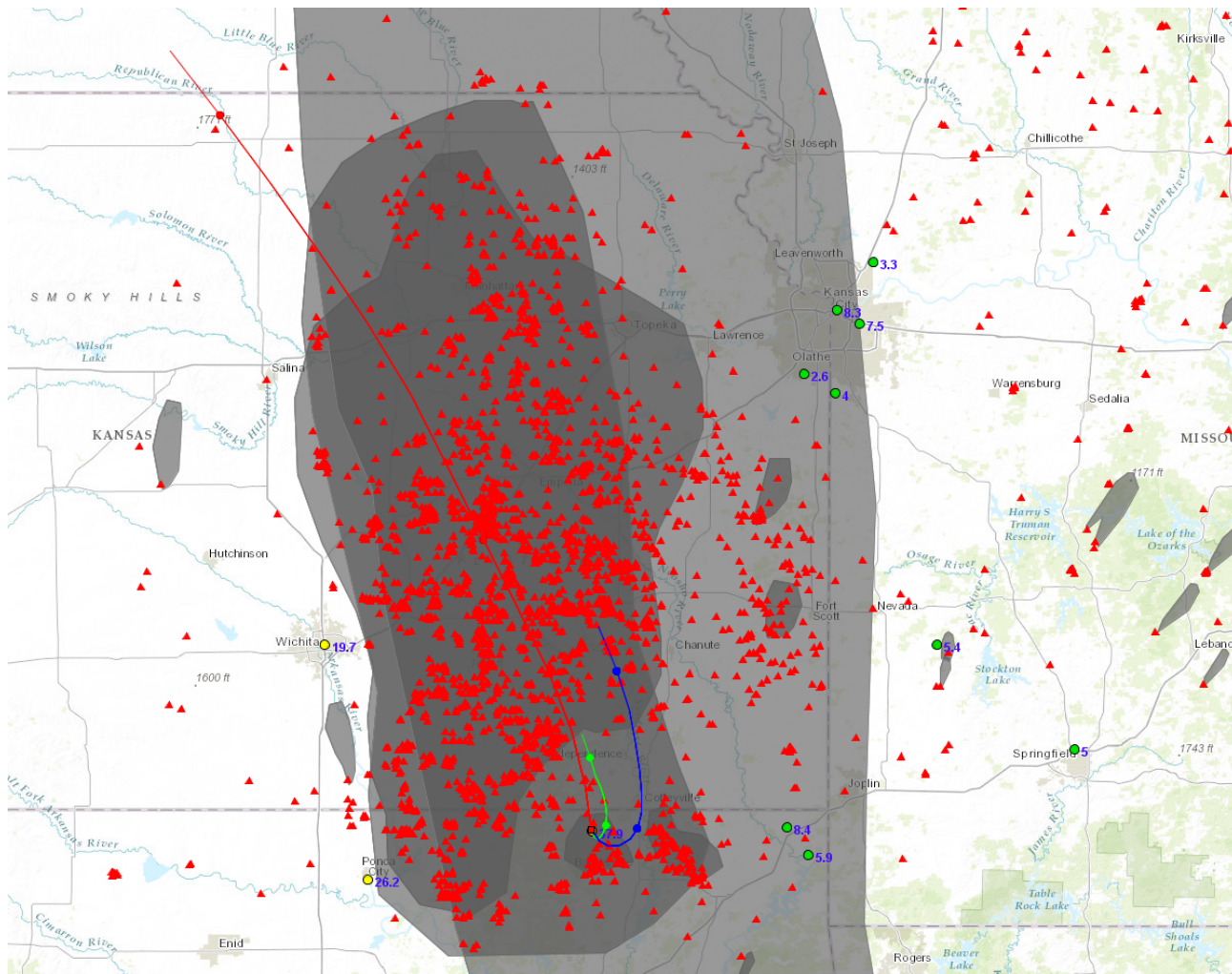


April 7, 2017  
Copan, OK  
PM<sub>2.5</sub> Exceedance

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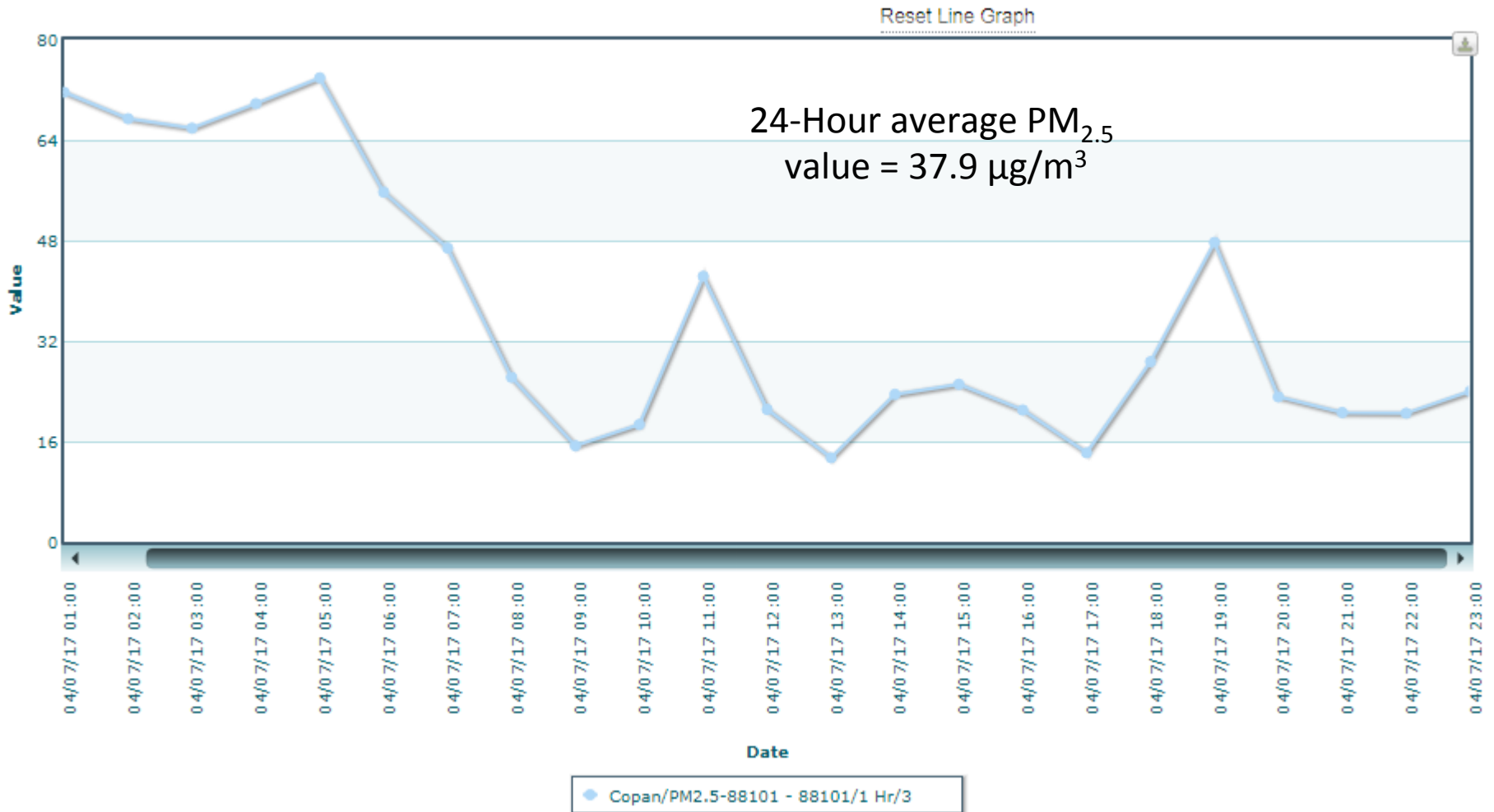
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HYSPLIT backward air trajectories for previous 12 hours at heights of 10 meters (green), 100 meters (blue), and 1000 meters (red), valid at 6am CDT, April 7, 2017. Hourly PM<sub>2.5</sub> values shown.

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Hourly PM<sub>2.5</sub> Values on April 7, 2017 at Copan, OK

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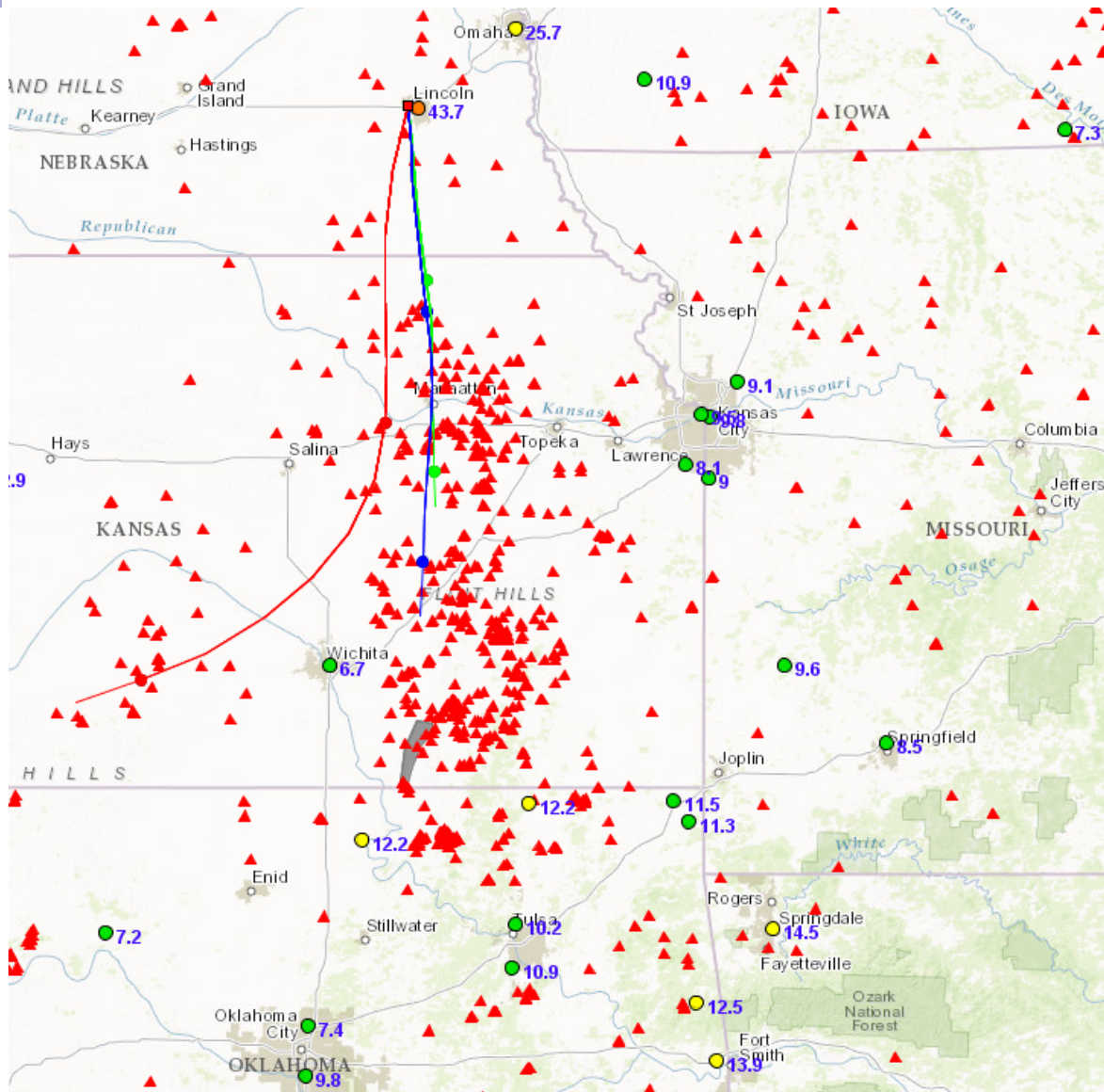
# April 8, 2017 Lincoln, NE PM<sub>2.5</sub> Event\*

\* - PM<sub>2.5</sub> continuous instrument in Lincoln is not used as reference or equivalent method monitor and has a known high bias

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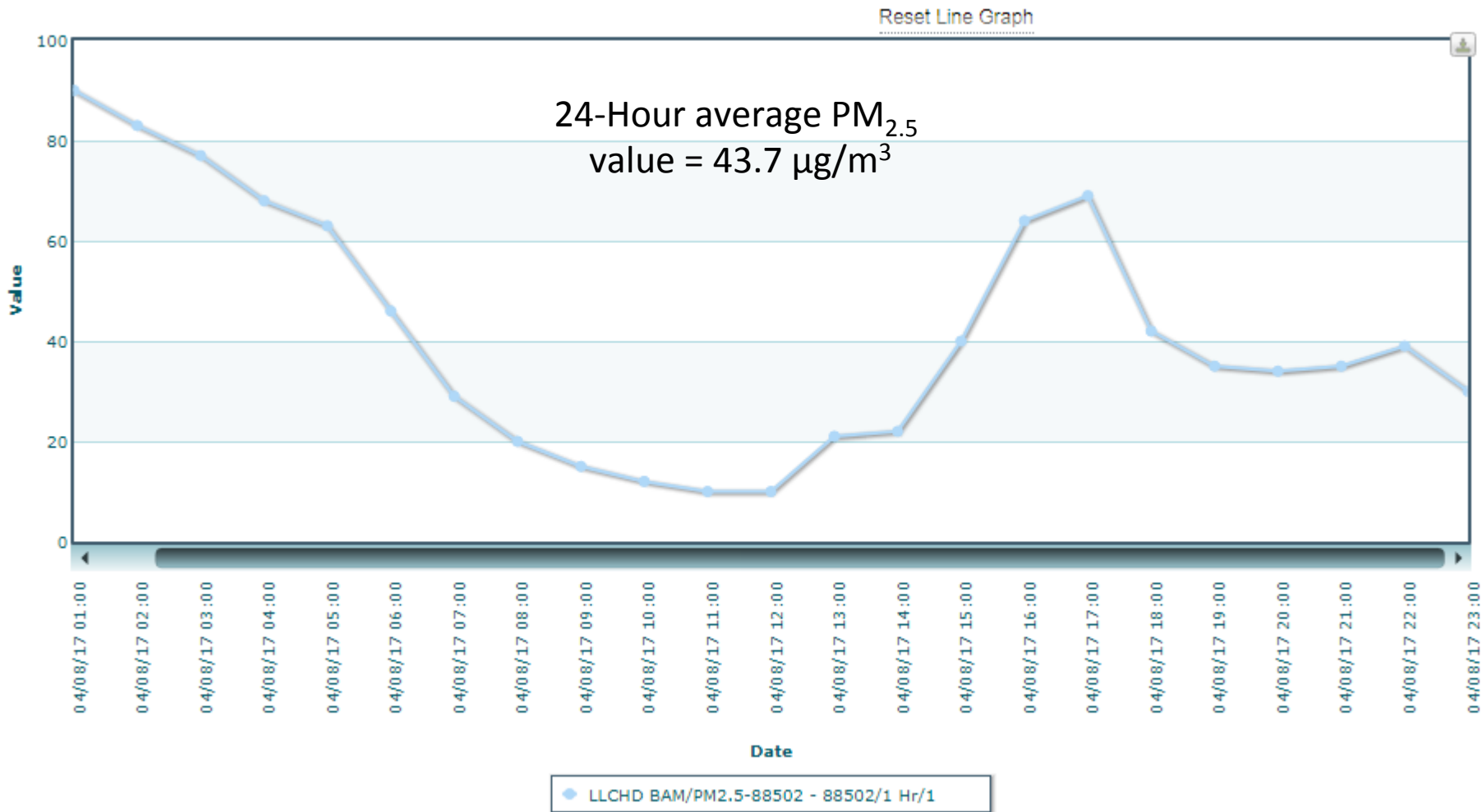




HYSPLIT backward air trajectories for previous 12 hours at heights of 10 meters (green), 100 meters (blue), and 1000 meters (red), valid at 5pm CDT, April 8, 2017.

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Hourly PM<sub>2.5</sub> Values on April 8, 2017 at Lincoln-Lancaster County Health Department

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# April 12, 2017 Lincoln, NE PM<sub>2.5</sub> Event\*

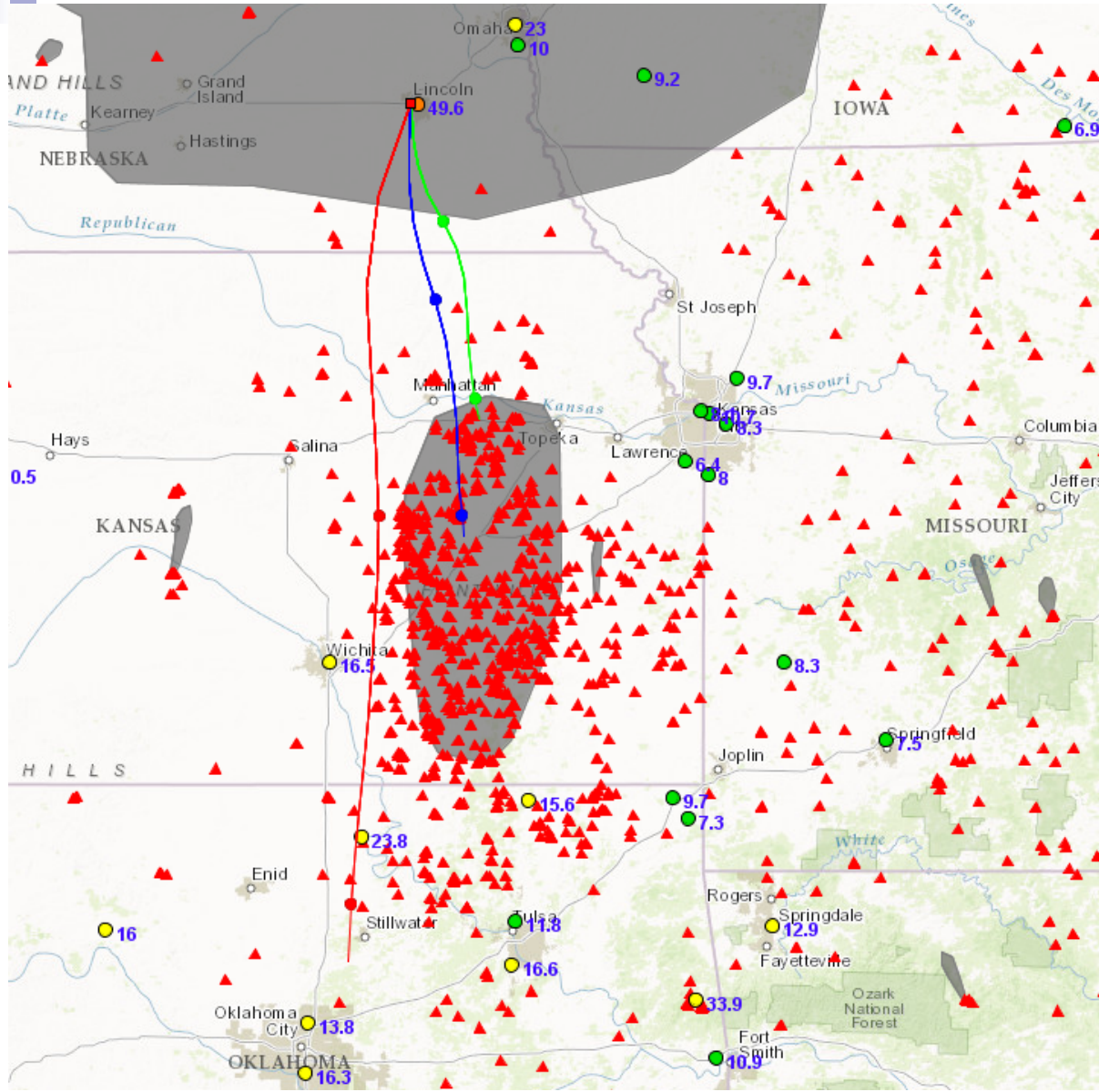
\* - PM<sub>2.5</sub> continuous instrument in Lincoln is not used as reference or equivalent method monitor and has a known high bias

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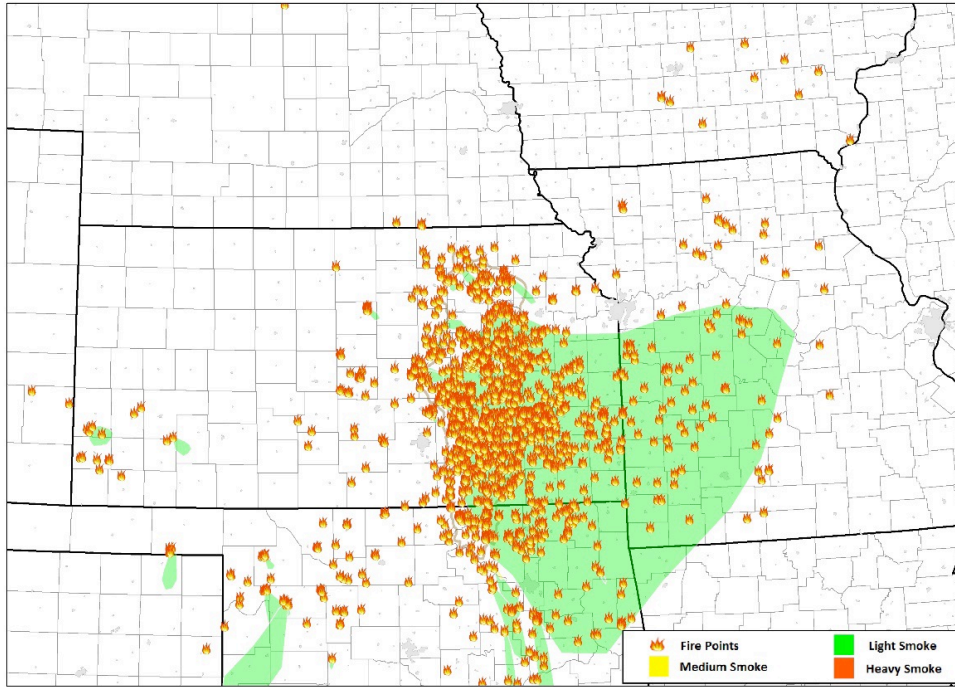




HYSPLIT backward air trajectories for previous 12 hours at heights of 10 meters (green), 100 meters (blue), and 1000 meters (red), valid at 8pm CDT, April 12, 2017.

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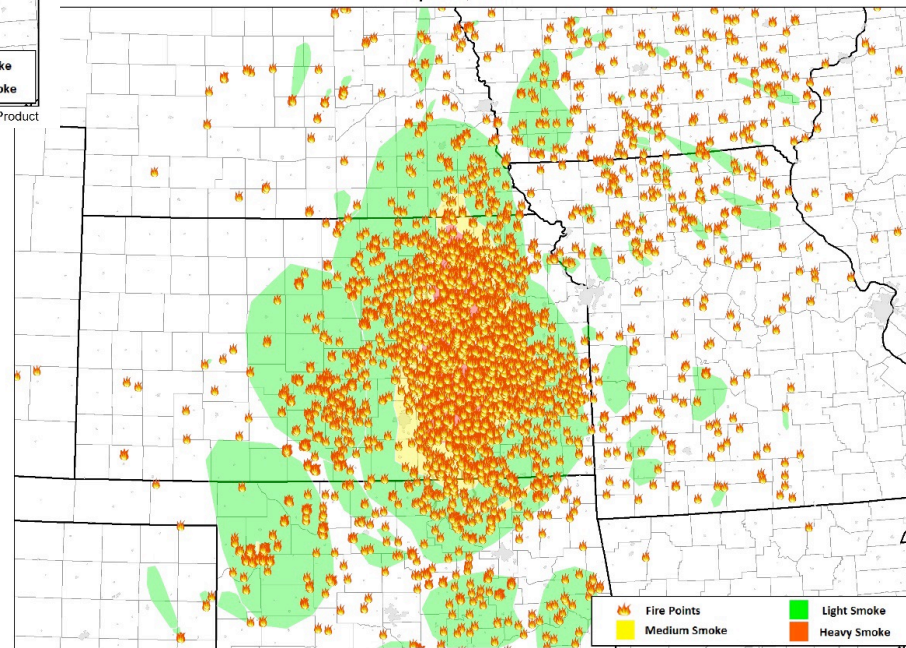
### HMS Fire & Smoke Analysis April 10, 2017



Map: Jayson Prentice, KDHE Bureau of Air

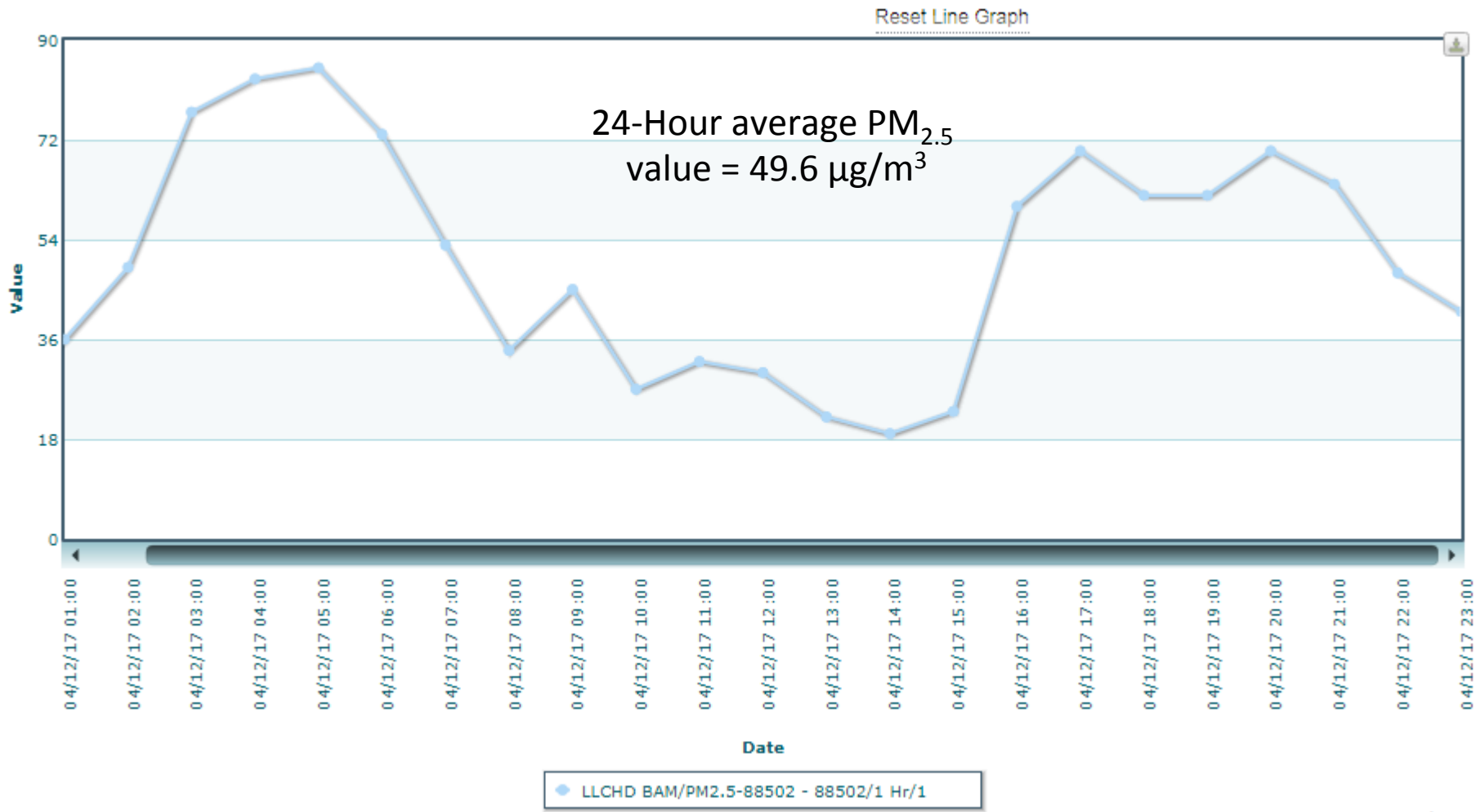
Data: NOAA NESDIS OSPO Hazard Mapping System Fire and Smoke Product

### HMS Fire & Smoke Analysis April 11, 2017



Map: Jayson Prentice, KDHE Bureau of Air

Data: NOAA NESDIS OSPO Hazard Mapping System Fire and Smoke Product



Hourly PM<sub>2.5</sub> Values on April 12, 2017 at Lincoln-Lancaster County Health Department

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# www.ksfire.org Website Home Page

- Developed as part of SMP
- One stop shop for land managers
- Smoke Modeling tool

The screenshot shows the homepage of the Kansas Flint Hills Smoke Management website. At the top is a navigation menu with links for Home, About Us, Environment, Regulations, Education, Health, Events, Weather, and Smoke Models. Below the menu is a large banner image of a prescribed burn in a field with a tractor. To the right of the banner is a sidebar with sections: 'AT A GLANCE' (listing various reports and permits), 'IN THE NEWS' (with a 'Videos' section and 'Burn Advisories'), and 'WEATHER' (with 'Access Weather' and 'CONNECT WITH US' including social media icons). The main content area features the title 'Kansas Flint Hills Smoke Management' and three paragraphs of introductory text. A 'Click Here to Access Smoke Model' button is positioned to the right of the text. At the bottom of the main content area is a video player for 'Preserving the Tallgrass Prairie'.

**Kansas Flint Hills Smoke Management**

Welcome to the Kansas Flint Hills Smoke Management Website. This site has been developed to provide one location for land managers conducting prescribed burns in the Flint Hills to obtain information and access tools to assist them in making burn decisions.

The website is the result of the development of the Flint Hills Smoke Management Plan. It provides training, regulations, policies, publications, a modeling tool and other links to guide people looking for information on smoke management.

The development of the Flint Hills Smoke Management Plan is an attempt to balance the need for prescribed fire in the Flint Hills with the need for clean air in downwind communities. The plan does not include any provisions that restrict the burning of grasslands in the Flint Hills.

Instead, the plan takes a voluntary approach toward improving air quality during the burn season. The plan's voluntary approach leaves flexibility in the hands of the land manager but also puts the responsibility on him or her to make wise decisions.

The plan and website are cooperative efforts of countless persons with many perspectives on Flint Hills burning. We encourage land managers to use the site and to provide us feedback on organization, content, ease of use, and ways in which the site can be improved for the next burn season.

[Click Here to Access Smoke Model](#)

**Preserving the Tallgrass Prairie**

00:00 / 29:43

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# KDHE Pre-burn/Burn Season Activities

- Meeting with SMP stakeholder group in January to discuss 2016 season and air quality impacts
- Newsletter briefings prior to burn seasons
- Numerous presentations to land managers
- Health alert press release to public prior to burn season and mid-season as warranted
- Held a pre-season call with Flint Hills county extension agents to talk about potential air quality impacts and mitigation strategies.
- Held several calls/e-mails with NDEQ staff on development of their fire/smoke notification/education webpage
- Daily/Weekly discussions/notifications to downwind states/health departments in 2017 to potential downwind smoke effects
- Weekly updates to all stakeholders on season burn progression and any air quality impacts

## KDHE Pre-burn/Burn Season Activities (con't)

- Daily radio announcements of modeling tool results for potential air quality impacts
- Reviewed, updated, reprinted and distributed smoke management brochure throughout the Flint Hills through county agents, other agency staff, and at burn workshops
- KSU participated and take lead on Biomass Estimation research project to determine the feasibility of estimating fuel loads with low altitude aerial imagery and software (drone flights) to improve modeling tool
- **Continue great cooperation with KSU on education/outreach**

# Post 2017 Burn Season Activities

- Working with EPA on additional modeling tools to assist KDHE and ranchers to limit downwind impacts of smoke
- Collaborating with EPA on research project using balloon mounted instrumentation to better characterize smoke emissions and improve inputs to modeling tools
- Intensify outreach and education to Flint Hills Stakeholders on smoke impacts and existing tools and practices available to mitigate impacts including alternate burn seasons (i.e Summer/Fall Burns)
- Meeting with SMP Subcommittee November 27 to discuss season and path forward.
- Meeting with Kansas Farm Bureau to discuss KFB policy, AG-13 Controlled Prescribed Burning.....

**AND**

Collaborating with KSU, T&B Systems and NASA to investigate the use of UASs (drones) and small instrumentation packages to characterize smoke emissions and improve inputs to modeling tools.

Goal is to be ready by Spring 2018 season to fly smoke plumes in Flint Hills.





# Questions



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[www.kdheks.gov](http://www.kdheks.gov)

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# Weather History & Observations

# Emporia, KS Municipal Airport

2017	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Mar	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
20	86	72	58	60	54	46	100	65	30	30.01	29.91	29.85	10	10	6	22	10	29	0.00	
21	62	55	48	45	39	28	71	54	36	30.29	30.14	30.01	10	10	10	28	17	34	0.00	
22	57	49	41	39	29	25	61	47	32	30.34	30.24	30.12	10	10	10	26	15	31	0.00	
23	77	65	53	54	48	41	77	59	40	30.10	29.90	29.71	10	10	10	33	21	42	T	
24	73	61	48	56	50	45	68	57	45	29.85	29.78	29.70	10	9	1	35	16	45	0.44	Rain , Thund
25	49	46	42	49	44	42	100	96	92	29.95	29.88	29.79	10	6	1	25	13	31	0.33	Rain
26	56	50	43	52	46	43	100	92	83	29.96	29.89	29.81	10	5	1	18	7	28	0.67	Rain , Thund
27	56	51	45	49	47	45	100	86	72	30.01	29.91	29.83	10	8	4	15	8	19	0.05	Rain
28	55	52	49	52	49	46	100	92	83	30.07	29.97	29.86	10	8	2	30	12	37	0.85	Rain
29	68	58	48	62	52	46	100	84	67	29.87	29.70	29.57	10	5	1	28	15	35	1.53	Rain , Thund
30	49	46	43	49	45	43	100	96	92	29.83	29.62	29.51	10	6	2	22	13	28	0.07	Rain
31	53	48	43	44	42	41	100	86	71	30.09	29.95	29.81	10	10	7	15	9	18	0.00	
2017	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Apr	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	55	50	44	47	44	40	100	86	71	30.17	30.11	30.05	10	8	2	23	13	29	0.14	Rain
2	62	55	47	57	52	47	100	92	84	30.06	29.87	29.67	10	5	0	13	5	15	0.19	Fog , Rain
3	67	60	53	56	53	49	100	78	56	29.72	29.57	29.50	10	6	2	20	11	25	1.06	Rain , Thund
4	53	49	44	49	46	41	100	92	83	29.86	29.74	29.65	10	7	2	26	13	31	0.73	Rain , Thund
5	61	51	40	46	42	35	100	72	43	30.08	29.83	29.66	10	8	2	31	16	42	0.65	Rain , Thund
6	61	50	38	40	35	31	92	62	32	30.27	30.20	30.09	10	10	10	18	9	30	0.00	
7	67	50	33	42	37	32	96	64	32	30.25	30.10	29.90	10	7	2	22	10	27	0.00	
8	80	66	52	59	52	42	83	63	43	29.88	29.70	29.61	10	9	6	28	19	38	0.00	