

Flint Hills Smoke Management Plan

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Denver, Colorado

Tom Gross
Bureau of Air
Kansas Department of Health and Environment

Flint Hills Burning Background

- Flint Hills is last large intact remnant of tall grass prairie ecosystem.
- 2 to 3 million acres are burned each spring in the Flint Hills.
- Burning helps reduce intrusion of invasive woody species and improves cattle weight gain.
- Land is privately held.
- Fires up to 10,000 acres.



Flint Hills Burning Background

- Under certain weather patterns, smoke impacts downwind cities
- Smoke has caused exceedances of the ozone and PM NAAQS in KC, Wichita and far beyond.
- KDHE met with ag reps from 2004 through 2009 to negotiate solutions.
- Commitment to develop Smoke Management Plan in 2010.
- Multiple meetings with multiple stakeholders during 2010 to develop SMP.
- Plan adopted by KDHE in December 2010.

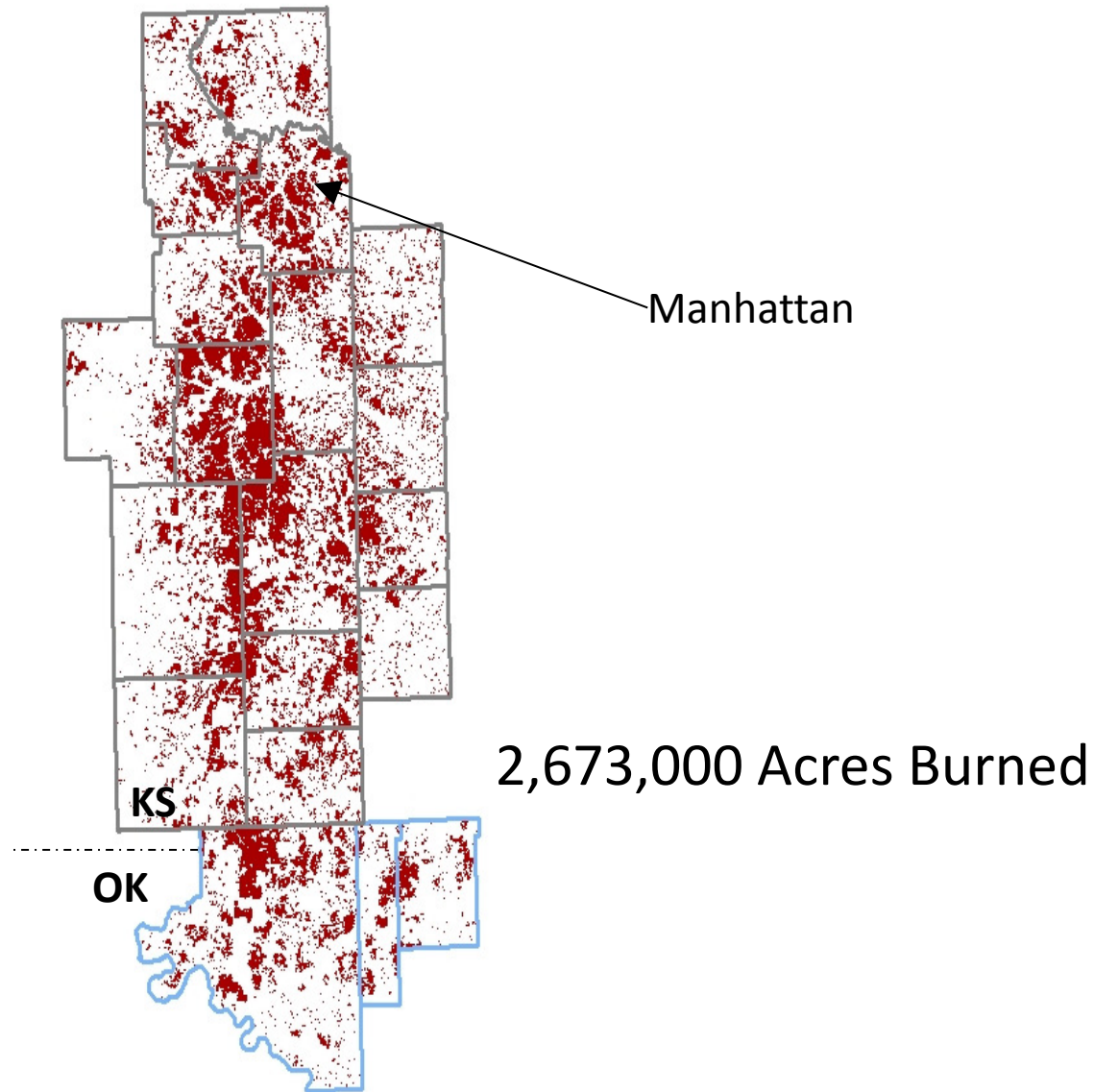
Safety Is a Primary Concern



The Smoke Management Plan

- Describes the Tall Grass Prairie ecosystem
- Reviews the balance between air quality concerns and the Flint Hills ag economy
- Is voluntary for prescribed burns of rangeland
- Includes restrictions on certain types of April burning
- Includes guidance and a modeling tool to assist land managers and fire officials in making burn decisions
- Spurred outreach activities by a host of state and federal agencies
- Included a voluntary burn data collection effort

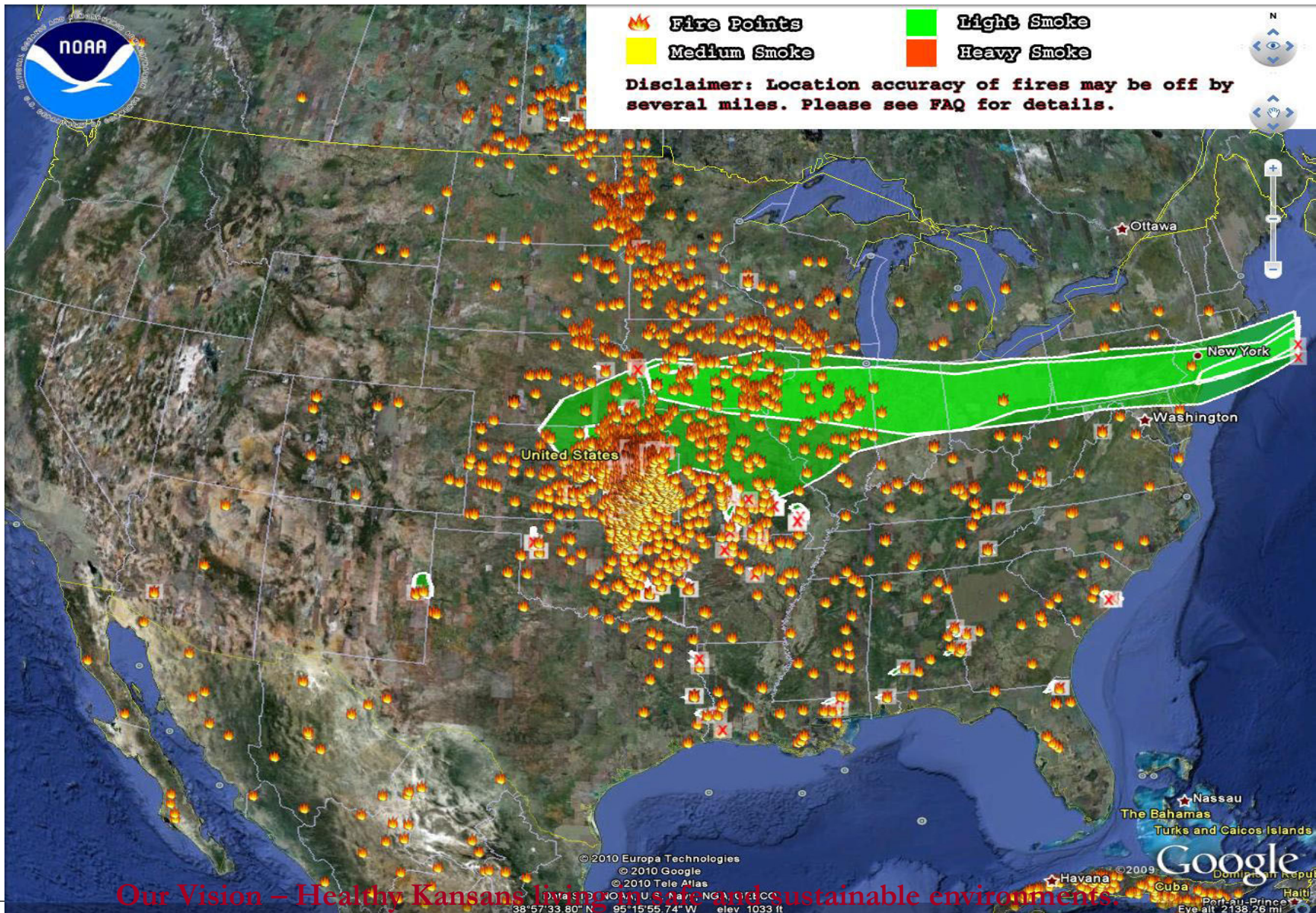
Acres Burned in Flint Hills in April 2011



Map generated using MODIS data downloaded from NASA website at <https://wist.echo.nasa.gov/api/>

ENVI and ArcGIS software used for image analysis.

April 11, 2010 Fire and Smoke Plumes



Our Vision – Healthy Kansans living in a safe, sustainable environment.

KsFire Website Modeling Home Page

http://ksfire.sonomatechdata.com/view/about

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Kansas Flint Hills SMOKE MANAGEMENT

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About Cumulative Fire Impacts Your Fire Impacts

Welcome to the Kansas Fire Modeling Page

The Flint Hills Smoke Management Plan encourages land managers to use model predictions in making the final decision to burn. Models have been developed specifically for use with the Smoke Management Plan. These models predict the potential contribution to urban area air quality problems. They do not provide information about whether conditions are safe to conduct a burn. Where required by local ordinance, check with your local public safety official regarding fire safety questions.

Cumulative Fire Impact

Two forecast models have been developed. The Cumulative Fire Impact map is generated by the first model. The map shows the predicted potential contributions of smoke from each county to air quality in urban areas. This information is based on the assumption that multiple fires will be occurring simultaneously across the Flint Hills. The model uses emission rates from burn days in prior years when air quality in downwind cities exceeded air quality standards. These data, coupled with currently predicted weather conditions, provide an overall look at air quality impacts for a two-day period. A map is generated for each day, with each county colored to represent the predicted contribution of fires in that county to air quality in Kansas City, Wichita, and Topeka:

Color	Potential Contribution
Green	Fires in the county are expected to have a small contribution
Yellow	Fires in the county are expected to have a medium contribution
Red	Fires in the county are expected to have a large contribution
White	The county is not included in the model

Your Fire Impacts

A second model (available under the Your Fire Impacts tab) shows the direction and extent of the predicted plume from a single burn. To use this model, select the county in which the burn is located, the number of acres to be burned, and the estimated fuel load (light, average, or heavy). An animated map displays the smoke plume and its movement over the following 48 hours. You can review the plume movement to determine whether it impacts metropolitan areas. The animated plume only shows the impacts of the local fire, not those of neighboring regions.

Forecast Discussion

A discussion of weather conditions is also provided so you can further evaluate whether better days for burning lie ahead. When planning a prescribed burn it is important to consider the smoke plume models, local weather conditions, and factors that contribute to burning safely. Developing an effective burn plan will ensure that all relevant components are considered prior to burning.

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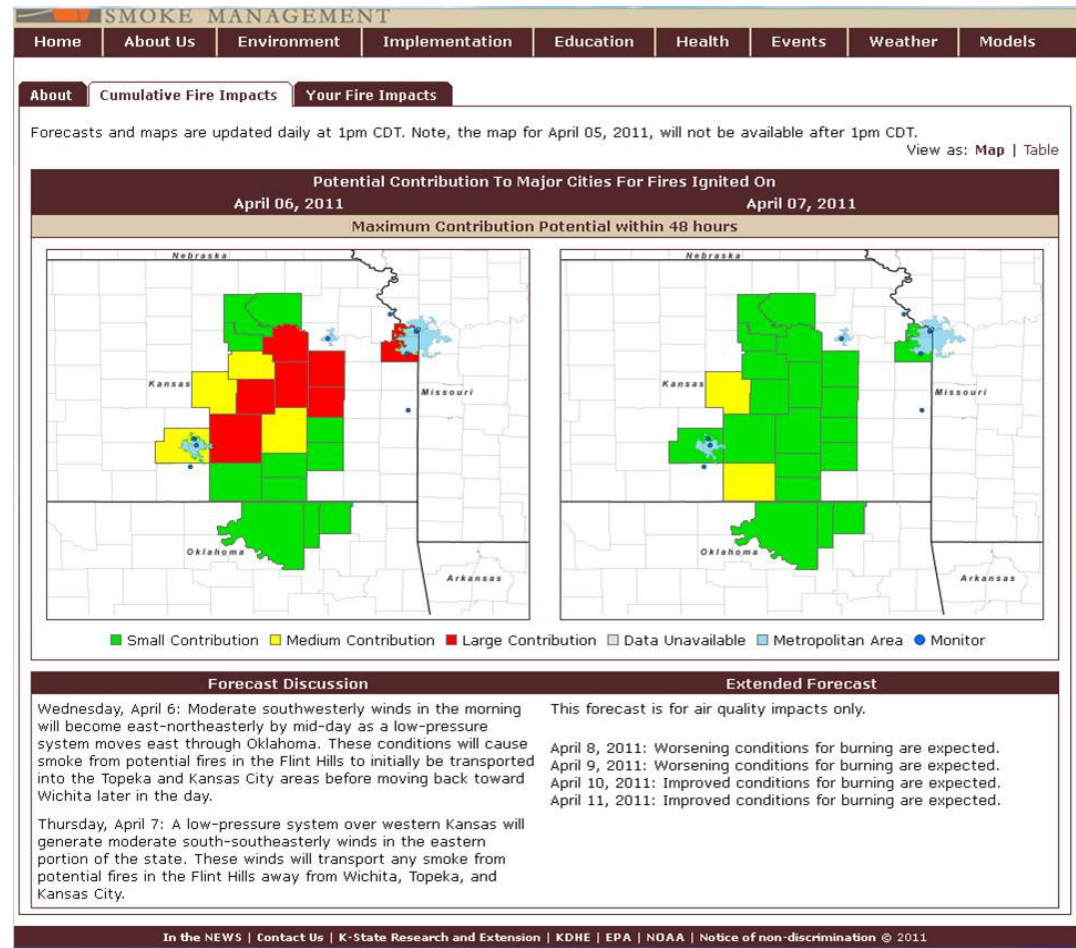
Burn Guidance Tools

Sonoma Technologies Inc. and KDHE developed tools to provide land managers daily information on when to burn to reduce air quality impacts.

Web site: <http://www.ksfire.org>

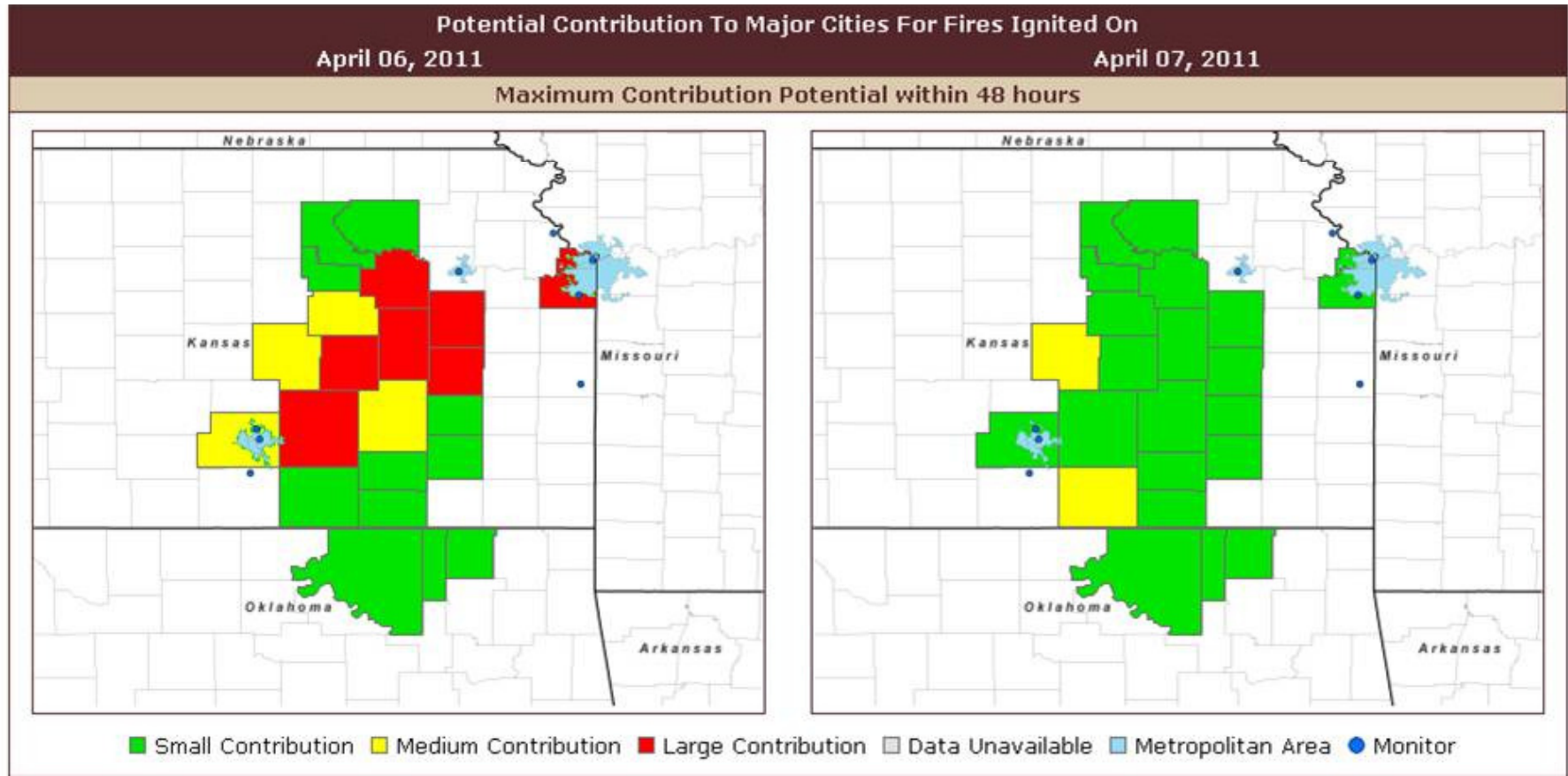
Tools provide daily:

- Burn guidance by county for the “next” two days
- Forecast discussions
- Extended outlooks
- County-level burning scenario playground

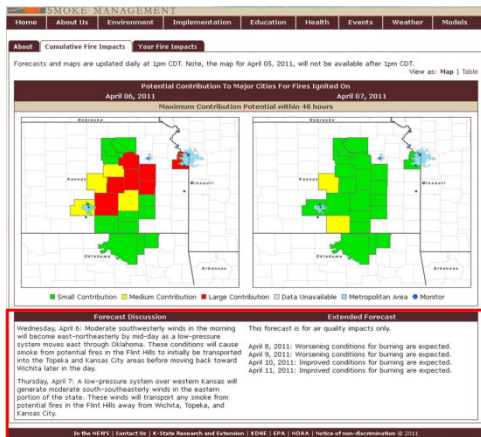


April 5, 2011 Model Guidance

- Maximum contribution to major cities based on cumulative impact from fires that could be ignited each day (e.g., April 6 and 7, 2011)
- County designated red, yellow or green based on county's contribution
- Uses forecasted meteorology and expected emissions for large burns



Example Guidance – Discussion



Meteorologists provide additional information on possible smoke impacts and extended outlooks.

Forecast Discussion

Wednesday, April 6: Moderate southwesterly winds in the morning will become east-northeasterly by mid-day as a low-pressure system moves east through Oklahoma. These conditions will cause smoke from potential fires in the Flint Hills to initially be transported into the Topeka and Kansas City areas before moving back toward Wichita later in the day.

Thursday, April 7: A low-pressure system over western Kansas will generate moderate south-southeasterly winds in the eastern portion of the state. These winds will transport any smoke from potential fires in the Flint Hills away from Wichita, Topeka, and Kansas City.

Extended Forecast

This forecast is for air quality impacts only.

April 8, 2011: Worsening conditions for burning are expected.
April 9, 2011: Worsening conditions for burning are expected.
April 10, 2011: Improved conditions for burning are expected.
April 11, 2011: Improved conditions for burning are expected.

Example Guidance – Individual Plumes

Stop < 03/18/2011 5:00 PM ▾ CDT >

Provides hourly plume movement and concentration to assess a burn.

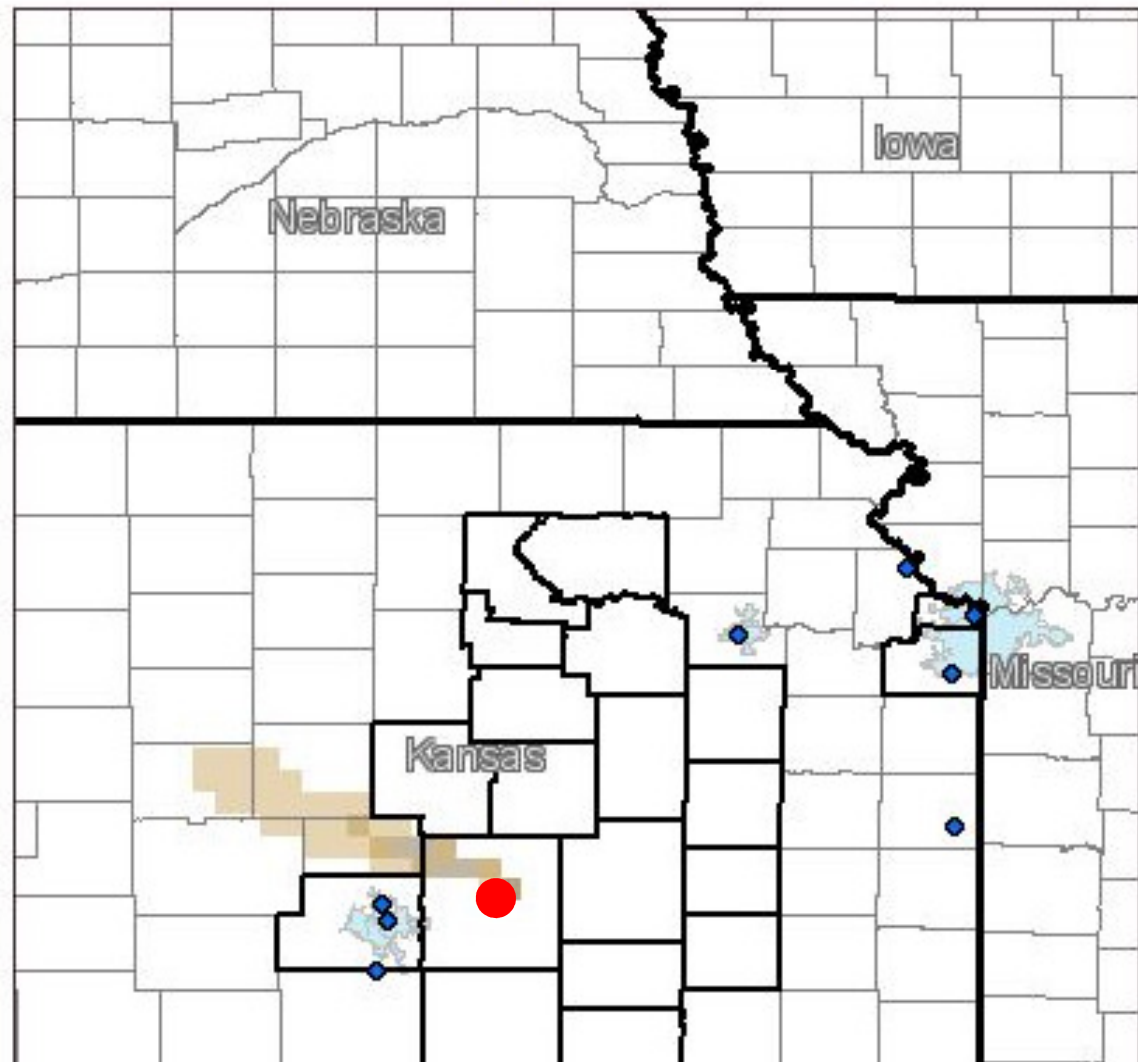
Users enter:

- County
- Fire size
- Fuel load

Plume is brown

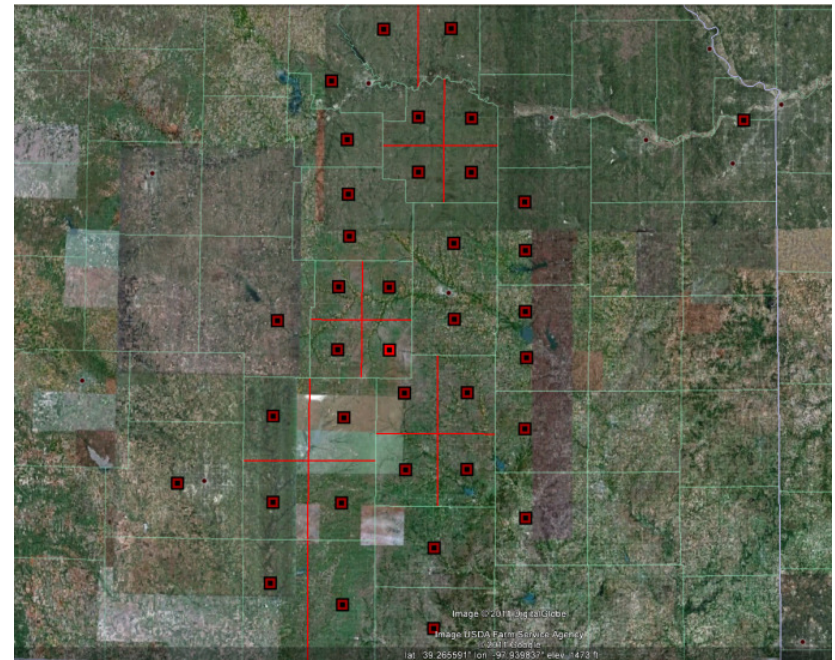
Fire location is red

Monitors are blue



Generating the Guidance

- STI created a system that runs BlueSky with HYSPLIT each day to predict smoke plume movement and dispersion
- Smoke plumes are derived from hypothetical burns
 - For individual plumes, burn characteristics are provided by users
 - For cumulative impact, burn characteristics are fixed
- Smoke emission estimates are generated from BlueSky Framework
- Weather inputs used by BlueSky are prepared from NCEP North American Model (NAM) 40 km forecast data



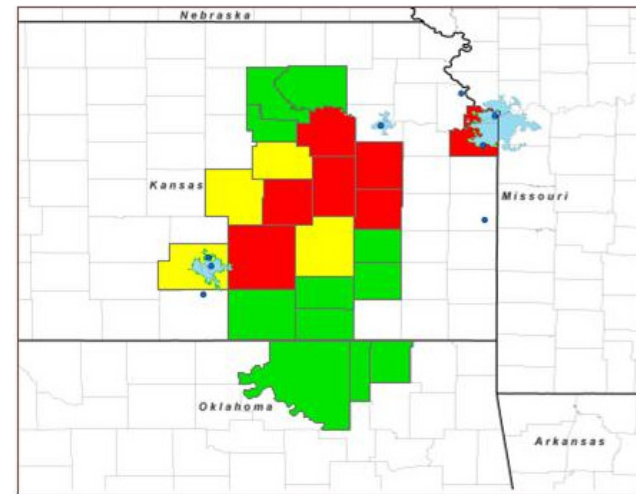
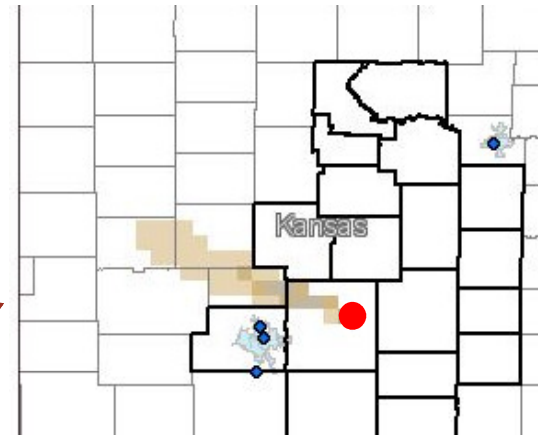
Hypothetical fire locations

The USDA Forest Service BlueSky Framework enables the use of state-of-the-science algorithms for simulating smoke impacts, air quality, and emissions from fires.

HYSPLIT is the Hybrid Single-Particle Lagrangian Integrated Trajectory Model, developed by the National Oceanic and Atmospheric Administration's Air Resources Laboratory.

Generating the Guidance

- Hypothetical fires burn each day from 10 AM to 6 PM
- Concentrations are tracked for 48 hours
- For individual fires, hourly smoke plumes from each burn are mapped at 15 km resolution
- For cumulative impact
 - 24-hr surface PM concentrations from all fires are summed by grid cell
 - If contribution is large and downwind concentration is high in city of concern, then the county is colored red



Forecasts and maps are updated daily at 1pm CDT. Note, the map for April 05, 2011, will not be available after 1pm CDT.

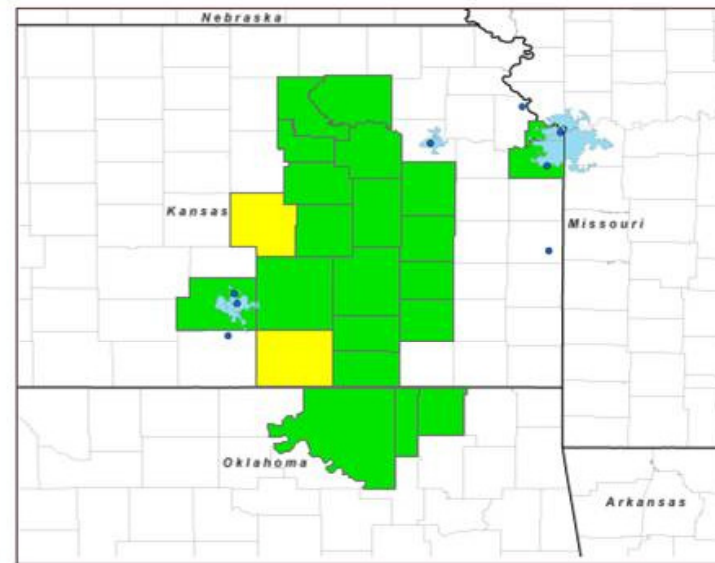
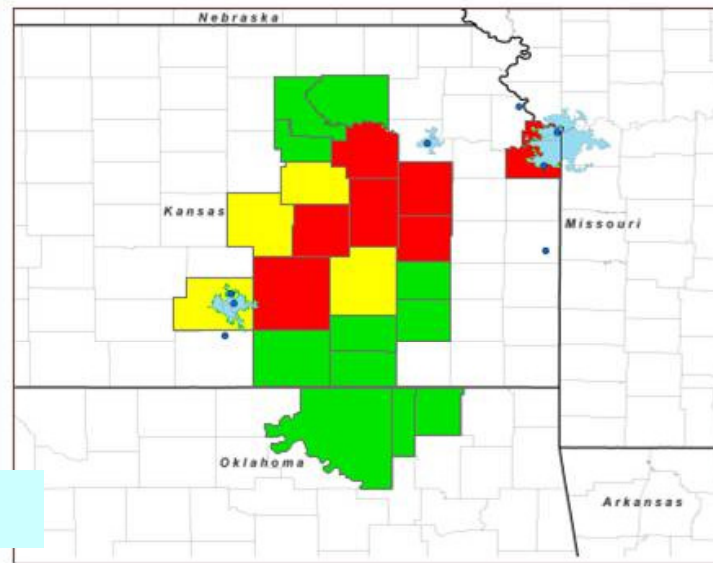
View as: [Map](#) | [Table](#)

Potential Contribution To Major Cities For Fires Ignited On

April 06, 2011

April 07, 2011

Maximum Contribution Potential within 48 hours



■ Small Contribution ■ Medium Contribution ■ Large Contribution □ Data Unavailable ■ Metropolitan Area ● Monitor

On Target

Forecast Discussion

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April 2011 Monitoring Results

Current Ozone Standard = 75 ppb

Date	Location	Pollutant	Concentration
April 6, 2011	Mine Creek	Ozone	76 ppb
April 6, 2011	Wichita - HD	Ozone	79 ppb
April 6, 2011	Wichita - Peck	Ozone	82 ppb
April 12, 2011	Konza Prairie	Ozone	78 ppb*
April 12, 2011	Topeka - KNI	Ozone	84 ppb
April 13, 2011	KC, Mo	Ozone	76 ppb
April 13, 2011	Konza Prairie	Ozone	79 ppb*
April 29, 2011	Peck	Ozone	77 ppb

*- CASTNET site that is not run by KDHE BOA

So..... What Now?

- April 2012 had least acres burned in decades.
- No exceedances of ozone or PM standards in 2012.
- Poor year to evaluate plan and model.
- Forecasting model improved for 2012 to
 - Provide sub-county-level information
 - Improve the display of individual plumes
 - Provide information to help users determine fuel load
- Continue and expand outreach efforts.
 - County officials, fire officials, more counties
- KDHE in final stages of completing 2011 exceptional event request.

Lessons Learned.....Don't Bite Off More Than You Can Chew!!!





QUESTIONS?

Contact Information:

Thomas Gross
Bureau of Air
1000 SW Jackson, Suite 310
Topeka, Kansas 66612
(785) 296-1692
tgross@kdheks.gov