

**PROCEEDINGS OF THE AUSTRALIAN RANGELAND SOCIETY  
BIENNIAL CONFERENCE**

**Official publication of The Australian Rangeland Society**

**Copyright and Photocopying**

© The Australian Rangeland Society 2012. All rights reserved.

For non-personal use, no part of this item may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior permission of the Australian Rangeland Society and of the author (or the organisation they work or have worked for). Permission of the Australian Rangeland Society for photocopying of articles for non-personal use may be obtained from the Secretary who can be contacted at the email address, [rangelands.exec@gmail.com](mailto:rangelands.exec@gmail.com).

For personal use, temporary copies necessary to browse this site on screen may be made and a single copy of an article may be downloaded or printed for research or personal use, but no changes are to be made to any of the material. This copyright notice is not to be removed from the front of the article.

All efforts have been made by the Australian Rangeland Society to contact the authors. If you believe your copyright has been breached please notify us immediately and we will remove the offending material from our website.

**Form of Reference**

The reference for this article should be in this general form:

Author family name, initials (year). Title. In: Proceedings of the nth Australian Rangeland Society Biennial Conference. Pages. (Australian Rangeland Society: Australia).

For example:

Anderson, L., van Klinken, R. D., and Shepherd, D. (2008). Aerially surveying Mesquite (*Prosopis* spp.) in the Pilbara. In: 'A Climate of Change in the Rangelands. Proceedings of the 15th Australian Rangeland Society Biennial Conference'. (Ed. D. Orr) 4 pages. (Australian Rangeland Society: Australia).

**Disclaimer**

The Australian Rangeland Society and Editors cannot be held responsible for errors or any consequences arising from the use of information obtained in this article or in the Proceedings of the Australian Rangeland Society Biennial Conferences. The views and opinions expressed do not necessarily reflect those of the Australian Rangeland Society and Editors, neither does the publication of advertisements constitute any endorsement by the Australian Rangeland Society and Editors of the products.



*The Australian Rangeland Society*

**Title: Balancing ecological and environmental objectives in smoke management planning**

Author name:

Carolyn E. Blocksome  
Dept. of Agronomy, TH 2004  
Kansas State University  
Manhattan, Kansas 66506  
U.S.A.

Tom Gross  
Kansas Dept. of Health and Environment  
1000 SW Jackson, Suite 310  
Topeka, KS 66612-1366  
U.S.A.

Douglas Watson  
Kansas Dept. of Health and Environment  
1000 SW Jackson, Suite 310  
Topeka, KS 66612-1366  
U.S.A.

Key words: smoke management, prescribed burning, tallgrass prairie

## Abstract:

Prescribed burning is a rangeland management technology used world-wide for a variety of management objectives. The Flint Hills region of Kansas and Oklahoma represent the largest contiguous area of the remaining tallgrass prairie ecosystem in North America. Each year approximately two and one-half million acres of largely privately-owned prairie in this region experiences a prescribed burn during the month of April (Mohler and Goodin 2012). Late spring burning has been shown to achieve both ecological and economic objectives with a single burn.

This concentrated period of burning has contributed to air quality non-attainment in nearby cities where air quality monitors are located. Urban and regulatory concerns about the contribution of prescribed burning smoke resulted in the development of the Kansas Flint Hills Smoke Management Plan. The plan acknowledges the need for prescribed burning in maintaining the tallgrass prairie ecosystem, and includes minor regulations and a largely voluntary program for reducing non-attainment in urban areas.

During the summer and fall of 2010, regulators chose to utilize a collaborative approach to formulating a smoke management plan. Urban, rural, and wildlife interests were represented on the committee that formulated the plan. Following approval of the plan in December 2010, an extensive outreach campaign was initiated to inform the public and encourage voluntary compliance with the plan. Three non-attainment events related to smoke from prescribed burns were recorded in urban areas of Kansas in April 2011. Burn bosses indicated they knew about the plan but burned additional acres due to fear of increased regulations in the future.

## Text:

The tallgrass prairie ecosystem once covered much of the central United States and southern Canada. Due to cultivation and urbanization, only an estimated 4 percent of the tallgrass prairie remains from its pre-European settlement expanse (Samson and Knopf 1994). The Flint Hills region of Kansas and Oklahoma comprise the largest contiguous expanse of the tallgrass prairie ecosystem left in North America. The rolling topography and rocky soil of the Flint Hills region render it unsuitable for cultivation.

Prior to European settlement, the tallgrass prairie region was grazed by large herds of bison. Indigenous North Americans frequently used fire as management tool on the prairies for an estimated 10,000 years. Stand replacement fires have been estimated to occur every 0-10 years. (Brown and Smith 2000).

Ranchers in the Flint Hills region today rely on both prescribed burning and livestock grazing to manage their native grasslands. Without fire and grazing, the unique assemblage of plants that comprise the tallgrass prairie are unable to compete with woody species. Open prairies are important habitat for numerous grassland fauna. About 35% of the Flint Hills prairie (about 2.5 million acres) burns each year with varying fire return intervals for individual parcels of land.

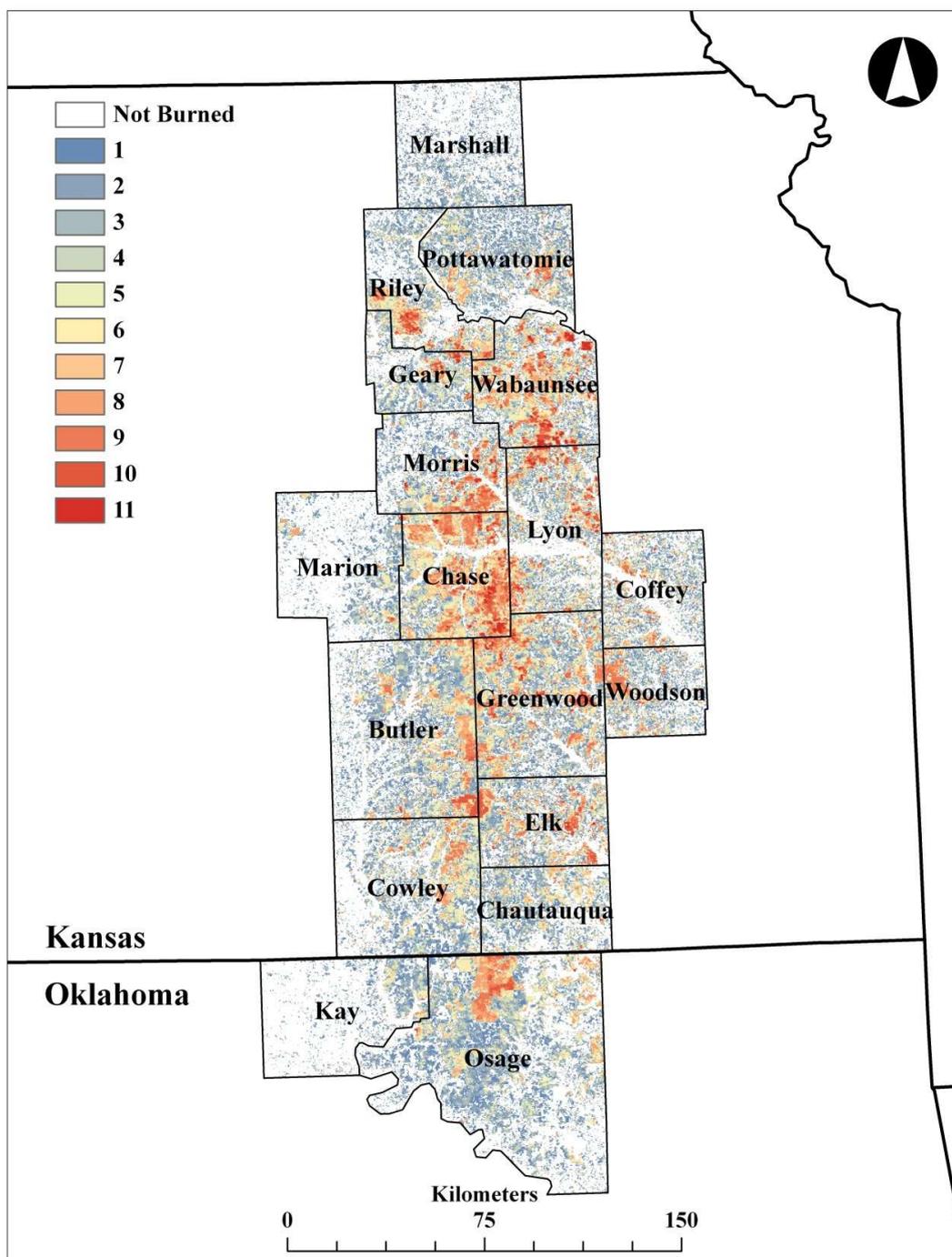


Figure 1. Flint Hills burn frequency from 2000-2010. The value in the legend indicates the number of years out of 11 that an area was burned. Mohler and Goodin 2012.

Livestock operations in the Flint Hills region conduct annual prescribed burns in April to maximize livestock gains and control woody species with a single burn. Yearling cattle respond with an average of 22 pounds of additional gain on pastures burned during late spring (Owensby *et al.* 1995). During the May-July time period, yearlings can gain two and one-half pounds per day grazing burned native tallgrass prairie in the Flint Hills (Owensby *et al.* 2008). Contracts between landowners and livestock managers often stipulate for prescribed burning.

Prescribed burning activity is further concentrated during April due to relatively few days with suitable weather conditions for burning (Weir 2011). In an average year, hundreds of thousands acres may be burned on a single day. These large burning events can contribute to air quality non-attainment in cities located within the Flint Hills or near the periphery which in recent years have received increased scrutiny by regulatory agencies.

In the summer of 2010, the Kansas Department of Health and Environment began writing a smoke management plan to address air quality concerns related to prescribed burning. A collaborative approach to writing the plan included representation from rural, urban, and wildlife interests. Agencies represented on the committee included the City of Wichita, Environmental Protection Agency Region 7 (EPA), Johnson County Environmental Services, Kansas Department of Health and Environment (KDHE), Kansas Farm Bureau, Kansas Forest Service, Kansas Livestock Association, Kansas Prescribed Fire Council, Kansas State University, Natural Resources Conservation Services (NRCS), Tall Grass Legacy Alliance/Greenwood County Extension, The Nature Conservancy in Kansas, and Kansas ranchers. Public input was solicited through several open meetings held throughout the autumn of 2010. The plan was adopted by the Kansas Department of Health and Environment in December of 2010.

The Kansas Flint Hills Smoke Management Plan (Kansas Department of Health and Environment 2010) contains both voluntary and regulatory components. Open burning activity other than specified exceptions (trash barrels, campfires, etc.) and rangeland burning is prohibited during April in thirteen rural counties and three urban counties (State of Kansas). Rangeland prescribed burning is allowed during April, and ranchers are requested to voluntarily use practices that reduce air quality problems. To assist ranchers in making prescribed burning decisions related to smoke management, a modeling tool was developed. The web-based tool allowed producers to model the probable direction of smoke from their fire. The modeling section of the website gave a rating to each county or sub-county area in the Flint Hills indicating the probability of smoke from fires contributing to air quality problems in an urban area. Contingency measures were listed as required by EPA.

EPA requested that the plan be implemented prior to the spring 2012 burning season, leaving about three months for outreach and education prior to initiation of burning activity. Agencies represented on the smoke management plan committee took the lead in promoting compliance with the regulatory portion of the plan and adoption of voluntary practices to minimize the

impact of smoke on urban areas. These practices were included in the smoke management plan itself and in an Extension publication that was handed out and posted to the smoke management website.

A comprehensive website was constructed that contained educational and regulatory information and smoke modeling tools ([ksfire.org](http://ksfire.org)). A combination of rancher meetings, press releases, news broadcasts, newsletter and newspaper articles, and staff trainings were used to promote the new plan. A brochure describing the Flint Hills Smoke Management Plan was produced and widely distributed by city, county, state, and local agencies and organizations. A electronic e-mail distribution network was created and used to distribute information and provide updates.

Several counties participated in a pilot program to collect data on the number of acres burned. In Kansas, prescribed burning requirements vary widely by county, with some, but not all, counties requiring ranchers to report the number of acres burned. Acres were reported both by the day and by the month. Individual rancher identities were not revealed.

There were four non-attainment days in Kansas urban areas in April 2011. Large wildfires in Texas and Oklahoma increased the background level of smoke in the air as southerly winds moved smoke into Kansas. An exceptionally large number of acres (2.7 million) were burned as determined by satellite imagery.

Following the burn season, two surveys were written and distributed throughout the Flint Hills. The first survey was distributed to burn bosses. Burn bosses make the final decision on whether to begin a prescribed burn. The second survey was distributed to county emergency management staff responsible for enforcing local and state prescribed burning regulations and for monitoring fire activity.

Burn bosses reported that Kansas State University Extension, public meetings, newspaper articles and word-of-mouth were the most common methods of receiving information about the smoke management plan. About half at least looked at the website. The most frequently used feature on the website was the modeling tool. Less than half used the model before making the decision to burn. The need to burn during April was seen as over-riding smoke management concerns. Those who modified their burning based on model predictions most often chose to burn earlier (prior to April 1) or deferred burning to a different day.

Emergency management staff, which included county dispatchers, fire chiefs, emergency managers, and law officials, learned about the smoke management plan primarily through Kansas State University Extension, word-of-mouth, intra-agency memos, and newspaper articles. Just over half looked at the website, and less than half used the modeling tool before authorizing a rancher to begin burning (not all counties require authorization). About 75% reported that they were adequately informed about the smoke management plan prior to the burn season. Most reported minimal impact on their workload in implementing the plan.

Additional outreach was implemented prior to the 2012 burn season. There were no instances of air quality non-attainment in 2012. Less than one-third of the normal acreage was burned due to dry conditions and an extremely early green-up.

A balance will continually need to be sought between the need for prescribed burning and the need for clean air. Days with the best smoke dispersal characteristics are frequently too windy to burn safely. Local safety and smoke concerns can be in conflict with regional smoke concerns. For example, the best direction to avoid laying smoke on a highway may be the same direction most likely to take smoke towards an urban area. Continued cooperation between rural and urban sectors will be necessary for the Kansas Flint Hills Smoke Management Plan to be successful.

Mohler, R.L., and D.G. Goodin. (2012). Mapping burned areas in the Flint Hills of Kansas and Oklahoma, 2000–2012. *Great Plain Research* **22**, 15-26.

Samson, F. and F. Knopf. (1994). Prairie conservation in North America. *BioScience* **44**:418-421.

Brown, J.K., and Smith, J.K. (2000). Wildland fire in ecosystems effects of fire on flora. U.S.D.A. Gen. Tech. Rep. RMRS-GRR-43 **2**, 7.

Owensby, C.E., R. Cochran, K. Anderson, E. Smith, and E. Vanzant. (1995). 50 years of range research revisited with a special focus on current research. (Kansas State Univ. Coop. Ext Service, Manhattan) p. 29.

Owensby, C.E., L.M Auen, H.F. Berns, and K.C. Dhuyvetter. (2008). Grazing systems for yearling cattle on tallgrass prairie. *Rangeland Ecol. and Manage.* 61:204-210.

Weir, J. (2011) Are weather and tradition reducing our ability to conduct prescribed burns? *Rangelands* **33**, 25-30.

Kansas Department of Health and Environment. (2010). State of Kansas Flint Hills Smoke Management Plan. (State of Kansas, Topeka).

Kansas Open Burning Regulations. K.A.R. 28-19-645. Available at:  
[http://www.kdheks.gov/befs/download/dist\\_offices/KS\\_Open\\_Burning\\_Regulations.pdf](http://www.kdheks.gov/befs/download/dist_offices/KS_Open_Burning_Regulations.pdf) (accessed 30 July 2012).