

Kansas Natural Resources and Environmental Management (Core)

Situation

Kansas is a state known for its picturesque grasslands, abundant streams and wetlands, productive agriculture, clean blue skies, and green grassland vistas. The native grasslands that exist throughout Kansas are one of the state's most important renewable natural resources. In Kansas, nearly 500 square miles are covered in water, with more than 10,000 miles of streams and rivers, most of which are privately owned. Kansas forest products are widely present and provide substantial economic value. Agricultural production is a major contributor to the state's economy, with wheat, grain sorghum and beef production leading in the United States. Priorities are given to management of agricultural land and protection of state's natural resources. Ecosystem services are non-priced amenities or market goods that include water quality and quantity, carbon sequestration, forest certification, energy conservation and recreation.

WATER: Water affects every facet of our lives, from drinking supplies to business uses and recreation. Its quality and quantity determine how and if it can be used. In Kansas, nearly 500 square miles are covered in water. In addition, there are more than 10,000 miles of streams and rivers in Kansas, most of which are privately owned.

In terms of water quality, assessments from K-State and Kansas State Agencies found many Kansas streams to be impaired by pollutants, such as, fecal coliform bacteria, herbicides, nitrogen, phosphorus and/or sediments. Pollutants come from a variety of sources including substances discharged from different point sources of factories and other facilities and from non-point sources, such as runoff from agricultural land or storm drains and yards in urban areas. Furthermore, bacteria, sediment, and excess nutrients from livestock and poultry waste have been shown to contaminate surface water, groundwater, and soils. One of the emerging challenges relates to harmful algal blooms that tarnish water resources in reservoirs, lakes, and ponds. Cyanobacteria cause a multitude of water-quality concerns, including the potential to produce toxins and taste-and-odor compounds that may cause substantial environmental, economic, and public health concerns.

A number of management practices are recognized to preserve, protect, and/or improve water quality. On agricultural fields, conservation practices include riparian buffer strips, reduced pesticide/herbicide use, vegetative filter strips, reduced tillage, fertilizer placement, and pesticide timing. Waste management projects have included research on the effects of land application of animal waste, wastewater recycling through irrigation systems, lagoons evaluations, filter strips to reduce water contamination and wetland cells constructed to treat dairy runoff. In addition, novel tools that reduce water usage such as irrigation management/scheduling, mobile and subsurface drip irrigation have gained momentum.

Irrigation consumes more than 90 percent of the groundwater used in Kansas. A primary source of groundwater in Central and Western Kansas, where irrigation is dominant, is the High Plains/Ogallala aquifer. That aquifer spans over 225,000 square miles through portions of Kansas, Nebraska, Oklahoma, Texas, Colorado, South Dakota, Wyoming, and New Mexico. In recent years, drawdown or depletion of the aquifer has surpassed the rate of natural recharge, which illustrates the limitations of what was once thought to be a boundless resource. New drought tolerant crops have been introduced in thermo-limited climate of Western Kansas that consume less water and produce comparable yields. The need has never been greater for technical information and assistance. Producers will continue to face new and unprecedented challenges as water continues to be one of the most debated and sought-after resources. Timely results

and recommendations from research projects and practice implementation will be important to the survival of agricultural operations.

AIR QUALITY: Improving air quality is a pressing issue in Kansas due to smoke from prairie burning, livestock production, and concentrated urban areas. Better smoke management from prescribed burning is needed. There is a need to burn the prairie and other grasslands for ecological and livestock production (economic) reasons. The constraint occurs due to negative air quality impacts downwind, particularly in urban areas, many times beyond Kansas' borders. The primary pollutant is ground-level ozone, and particulate matter. Soot particles or black carbon in smoke shade Earth's surface while warming the atmosphere and contributing to climate change.

GRASSLAND: Kansas grasslands are of prime economic importance to not only the state, but the entire nation. The state nationally ranks 12th in acres of pasture and rangeland. Of North America's 140 million pre-settlement tallgrass prairie acres, only 4% survives to this day and 80% is located in Kansas. Kansas presently has about 15.8 million total acres of native grasslands or rangelands, 2.5 million acres of pastureland, and at any given time, 3 to 6 million acres of annual forages. These grasslands are vital in supporting the state's largest agricultural commodity, beef cattle production, that generates billions of dollars for the state.

These grasslands help maintain the landscape and its watersheds and aid in maintaining the water quality in our streams and lakes. Grassland habitats are home to many of the state's rich diversity of native plants and wildlife species. These landscapes also provide scenic beauty, recreation, tourism, and contribute to cultural values.

For now and the future, Kansas grasslands encompass a host of rich natural resource opportunities and provide an equal number of resource management challenges. Numerous natural resource issues face our grassland managers which warrant the development and dissemination of sound research-based information. To meet the evolving needs of these managers, it is essential to provide access to a vast, rapidly expanding knowledge base to address topics such as:

- Overgrazing and the concurrent reduction of ecosystem services such as rainwater regulation and healthy, productive native vegetation and soil health.
- Livestock facilities located adjacent to or in streams, unfavorably impacting water quality.
- Loss of rangeland and pastureland productivity due to brush encroachment and weedy species. A developing challenge is the expanding invasion of Caucasian bluestems into native rangelands.
- Presence of invasive species, such as *Sericea lespedeza*, in the eastern half of Kansas.

To encourage adoption of new technology, a coordinated outreach program needs to be conducted utilizing numerous methodologies and targeting several strategic audiences such as farmers, ranchers, producers, and volunteer fire department staff.

FORESTRY: Although the Great Plains is not thought of as a forested region, Kansas' woodlands play an integral role in the environmental and economic well-being of the state. Approximately 2.2 million acres of the Kansas landscape are classified as forestland by the USDA. An additional 2.9 million acres are in the form of agroforestry resources (i.e. riparian forests, windbreaks, isolated trees). These acres, combined with the canopy found in urban and community settings, account for 10% of the total land area in the state. Kansas forests are steadily increasing in area. Since the first official inventory in 1936, Kansas forests have increased by 3.9 million acres (includes non-FIA forestland).

Collectively, 95 percent of Kansas rural forestland is privately owned, which poses a defined need for programming and services that target the ownership and management of the majority of our woodland resources. These should address the threats that create wildfire risk, threaten Kansas forest health, and loss of Kansas forestland. At the same time, these programs and services should promote the benefits of sustaining water quality and quantity, protecting and restoring forest biodiversity and wildlife habitat, sustaining and protecting forest and agroforestry ecosystem, and maintaining and promoting livelihoods and the economic benefits of woodlands.

Kansas woodlands and agroforestry resources face a number of threats from nonnative invasive insects and diseases including the recent detections of Emerald Ash Borer in eastern Kansas counties, and Thousand Cankers Disease of walnuts in Colorado, and several eastern states.

FISHERIES AND WILDLIFE: When Kansas was settled by Europeans, there was an abundance of fish and wildlife. As the state has become more populated, changing land cover and land use has had an adverse effect on the fisheries and wildlife resources. The methods of farming, ranching, and other land utilization practices have caused some wildlife populations to diminish and others to thrive. Lack of understanding what causes those changes creates misinformation and dissatisfaction. Wildlife and outdoor recreation are important to the quality of life for most Kansans. Kansas is noted for its quality populations of bobwhite quail, ring-necked pheasants and white-tailed deer.

Fisheries and wildlife associated activities in Kansas provide values for recreation as well as economic returns to landowners. A recent survey found that 1.1 million Kansas residents and nonresidents 16 years of age or older fished, hunted or watched wildlife in Kansas. In 2006, state residents and visitors spent \$839 million on fisheries and wildlife recreation in Kansas.

Many of the issues that fish and wildlife face on private lands are related to habitat management. The management of rangeland, woodlands, water and cropland varies greatly depending upon the ultimate purpose for that habitat. Many landowners who purchase land for the primary purpose of recreation may not be concerned about economic returns from that land. Information, research and outreach efforts need to be developed that assist those land managers in Kansas who value outdoor recreation.

MASTER NATURALIST PROGRAM: As part of the overall focus on natural resources and environmental management within the K-State Research and Extension, the selected topics of water, grasslands, forestry, fisheries and wildlife have been highlighted. It is essential that we educate the Kansas populace and help improve their knowledge of environmental concepts and Kansas natural resources. As high percentage of Kansas residents live within larger metro areas, it is critical that we develop a way to educate these individuals about natural resources and sustainable practices. Implementing a Kansas Master Naturalist (KMN) program is a way to engage citizens in appreciation of natural resources found in Kansas and how they are utilized, managed, enhanced and conserved.

Public Value

The unique and productive prairie landscape will be maintained and enhanced on private holdings across Kansas. The economic and physical health of all Kansans is dependent on understanding and wise management of our natural resources.

Range and grassland management research and extension will result in:

- Adoption of better grazing techniques resulting in healthier rangelands and improved soil health.
- Application of traditional and novel methods of weed and brush control to improve rangeland productivity, rancher income, and minimization of undesirable disturbance to soils and non-target species.
- Interest in and understanding of the complexity of native rangeland systems and the need for active management.
- Improved wildlife habitat, providing full ecosystem functioning, hunting opportunities, and aesthetic pleasure to the residents of Kansas.
- Training in prescribed burning techniques, increasing the capacity for individual landowners to improve and maintain private lands in Kansas.
- Improved water quality due to rancher adoption of mitigation practices reducing livestock contamination of streams and waterways.
- Reduced impact of smoke on urban populations due to increased understanding of smoke impacts related to prescribed burning and continued expansion of the burn window.

Water quality and water resources management research and extension will result in:

- Adoption of better conservation practices on agricultural land resulting in cleaner streams, improved soil health, higher yields
- Reduced contamination of Kansas streams, reservoirs, lakes, and ponds due to better land cover management, adoption of conservation practices, and adaptive fertilizer application
- Preventive management strategies reduce frequency and intensity of harmful algal bloom events in Kansas large

and small water bodies

- Education in novel tools, better irrigation management and scheduling, adoption of mobile and subsurface drip irrigation reduce water usage and prolong life of High Plains/Ogallala aquifer

The Kansas Master Naturalist program will result in:

- Active and engaged core of natural resource volunteers
- Improved physical and mental health through connection to natural resources
- Improved quality of life through environmentally informed decision making
- Improved physical and mental health through outdoor recreation and ecotourism
- Increased environmental resilience through proactive management and an environmentally informed public
- Enhanced ecosystem services and functionality, through proactive management and an environmentally informed public
- Natural resources agencies save federal, state, county and city funding dollars due to volunteer service.
- “Generational Impact” – participants pass along their passion and knowledge regarding the outdoors and the environment to their children, grandchildren, other family, friends and neighbors.

Outcomes

Short-Term (Knowledge)

Target audiences will become aware of both existing and emerging natural resource issues. Participants will gain an understanding of:

- Increased awareness of the public about the need for and the benefits of prescribed burning.
- Increased awareness about the weather conditions needed for safe prescribed burning and smoke management.
- Improved knowledge of environmental concepts and Kansas natural resources.
- Improved knowledge of newer technology that conserves water resources.
- Improved knowledge of benefits of best management practices.
- Improved knowledge of causes and consequences of harmful algal blooms
- Increased knowledge and skill development in the area of interpretation and leadership.
- Why environmental issues are of interest or concern.
- Who/what is impacted by these environmental issues.
- Which research-based methods could be employed to address and ultimately resolve the issues.

Audiences will increase their knowledge base regarding economically and environmentally sustainable practices that will prevent future problems and preserve natural resources. Stakeholders will recognize and appreciate the importance of their role in the process of collaboration and resolution of natural resource issues.

Indicators

- Increased participation in Burn Schools.
- Complete evaluation instruments available on the K-PICS website for water and grassland management programming.
- Have you tested your well water to determine its suitability for intended uses?
- Have you developed a cropping plan in response to limited water supply?
- After participating in this program, I gained increased understanding about _____.
- Increased outreach & service to the community in the area of natural resource management, conservation and environmental education.
- Continued enrollment within the Kansas Master Naturalist Program.

Medium-Term (Behavior)

Stakeholders and participants will develop long-range strategic plans and implement best management practices as they relate to the sustainable management of grasslands, water, forestry, energy, wildlife, and air. Partnerships will be made among stakeholders to work collaboratively to alleviate and prevent environmental concerns throughout Kansas.

Specific to water programs:

- Improved implementation of best management practices
- Improved timing and application efficiency of the use of fertilizer and pesticides
- Improved soil health due to BMPs
- Better water-quality condition of streams and ponds
- Better preparedness for harmful algal blooms

Specific to prescribed burning, air quality and smoke management programs:

- Improved utilization of the KSFire.org website, including decision models, app, and smoke management guidelines.
- Continued support of research on alternative season burning on livestock performance, including financial support by ranchers (TLA funding for KC Olson research). Continue widening of the burn window in early spring and late summer (for lespedeza and brush control).
- Reduction in the number and vehemence of complaints to environmental agencies on smoke issues (ozone and particulate matter).
- Reduction in the rate and overall acreage of rangelands lost to brush, especially eastern redcedar, each year.
- Increased requests for assistance with rangeland issues, including grazing management, from Extension, NRCS, and other agencies and NGOs.
- Fewer EPA exceptional event demonstrations needed related to smoke from prescribed burning.

Specific to the Kansas Master Naturalist program:

- Participants model and teach environmental stewardship and wise natural resource management.
- Increased number of hours of service to the community in the area of natural resource management, conservation and environmental education.
- Increased interest in continuing education in the areas of science, environment, ecology, interpretation, leadership, wildlife, native plants, range management, etc.

Indicators:

Specific to water programs:

- What BMPs, if any, do you plan to make based on what you have learned at this meeting?
- How has your management changed to address water quality and quantity issues?
- What changes, if any, have you implemented to reduce livestock impact on stream water quality?

Specific to air quality and smoke management programs:

- Fewer complaints to environmental agencies on smoke issues (ozone and particulate matter). Increased number and activity of burn cooperatives.

Specific to the Kansas Master Naturalist program:

- Increased number of hours of service to the community in the area of natural resource management, conservation and environmental education.
- Increased interest in continuing education in the areas of science, environment, ecology, interpretation, leadership, wildlife, native plants, range management, etc.
- Additional counties implement the Kansas Master Naturalist program
- Low turnover rate for Kansas Master Naturalist participants

Long-Term (Change in Condition)

Target audiences will benefit from measurable improvements in existing natural resource concerns and mitigation of emerging threats. Kansas citizenry will be environmentally literate and will make sound decisions regarding natural resources. Participants and their associated interests will become economically viable and environmentally sustainable. KDHE water quality monitoring data will show measurable improvement, similar to what has been shown in Clarks Creek, Grouse-Silver Creek, and the Cheney reservoir. The water footprint for the production of crops and livestock, and the maintenance of home landscapes and gardens has been reduced.

Specific to water programs:

- Increased participation and implementation of BMPs on agricultural fields
- Streams have cleaner and more abundant water
- Reduced occurrence of harmful algae blooms
- Better soil health

Specific to air quality and smoke management programs:

- Fire is retained as a range management tool.
- Increased public support for fire use and management.

Specific to the Kansas Master Naturalist program:

- Participants:
- Natural resources agencies save federal, state, county and city funding dollars due to volunteer service.
- “Generational Impact” – participants pass along their passion and knowledge regarding the outdoors and the environment to their children, grandchildren, other family, friends and neighbors.
- Program
- The Kansas Master Naturalist program is self-sustaining and financially sound.
- Community
- Increased perceived value for Kansas Natural Resources.
- Families regularly choose outdoor activities over indoor entertainment and technology.
- Increased community interest in nature and the environment.

Indicators

- Less out-of-state EPA air pollutant exceedances.
- How has your lawn management changed in response to water conservation concerns?
- How has your irrigation practices changed due to the availability of the 5 year flexible account?
- Which BMPs have you implemented?
- What economic impact (dollars saved or increased dollars earned) on a per head or per acre basis can you attribute to your participation in this program?
- Tax dollars saved by Natural resources agencies due to volunteer service.
- Expansion of the KMN program to 6 urban counties.

Outputs

Support existing resources as well as develop, implement, and evaluate new programs, services, publications, and decision-making tools that bolster long-term sustainable management practices for natural resources and the environment. These may include, but are not limited to air quality and smoke management, water quality and quantity, invasive species management, wildlife habitat development, nutrient management, riparian and woodland preservation and enhancement, irrigation management, and soil conservation.

Outputs specifically for smoke management:

- Maintain and update smoke management website and relevant social media pages to provide ranchers with information and models to inform their burning decisions
- Hold yearly smoke management meeting for Extension agents
- Provide press releases for local media related to smoke management, and encouragement to provide frequent updates during the burn season.
- Continue to participate and when appropriate, lead the Kansas smoke management legislative subcommittee.
- Write, edit, update, and distribute publications in support of smoke management in the Flint Hills.
- Incorporate smoke management information into burn workshop curriculum.

Participants and Stakeholders

- Producers, Ranchers, Operators, and Land Managers
- Agricultural Landowners

- Local, State, and Federal Government Agency Personnel
- Agricultural and Environmental Advisors and Consultants
- Local, State, and National Media
- Agricultural, Natural Resource, Environmental, and Industry Organizations
- Local, State, and Federal Government Officials

Outputs specifically for Kansas Master Naturalist Program:

- Curriculum book

Kansas Master Naturalist Participants and stakeholders

- Public
- K-State Research and Extension
- County and City Parks and Rec Department
- Nature Centers and Wildlife Areas
- Kansas Department of Wildlife, Parks and Tourism
- State, Federal, County and City Agencies