

Upper Arkansas River Basin High Priority Issue

Bioenergy and Water

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Nonetheless, some have raised concerns that increased corn production, a water-intensive [crop](#), may cause additional water table declines over time.^(3, 4)

Most U.S. ethanol is made from corn, but it can also be produced from other feedstocks such as grain sorghum, wheat, barley or potatoes. In Kansas, more than half of the ethanol produced comes from grain sorghum, with most facilities using corn and sorghum interchangeably.⁽³⁾ This new demand for corn, and the new opportunities for value-added processing and cattle production in rural communities, has created a significant economic development opportunity in Kansas and throughout the Upper Arkansas basin. However, the potential changes to the basin cropping patterns, specifically increasing the number of irrigated corn acres, may negatively impact the aquifer and stream conditions.

According to the U.S. Department of Agriculture National Agricultural Statistics Service (NASS) the number of irrigated corn acres in west central Kansas grew from 103,000 acres in 1990 to 139,000 in 2007 (Figure 2).⁽⁶⁾ Improved agronomic practices and crop genetics have led to higher corn yields. In west central Kansas, while there was a 15% increase in irrigated corn acres from 1993 to 2003, there was a 79% increase in irrigated corn production.⁽¹³⁾ In 2006, approximately 16% of Kansas corn and sorghum crops were used for ethanol production, up from 13% in 2000. Corn production in Kansas may be slowing down. According to NASS, producers intended to plant eight percent fewer corn acres in 2008, as a result of multiple factors including crop rotation considerations and high input costs. In 2008, Kansas was expected to plant their largest soybean crops in history.⁽⁶⁾

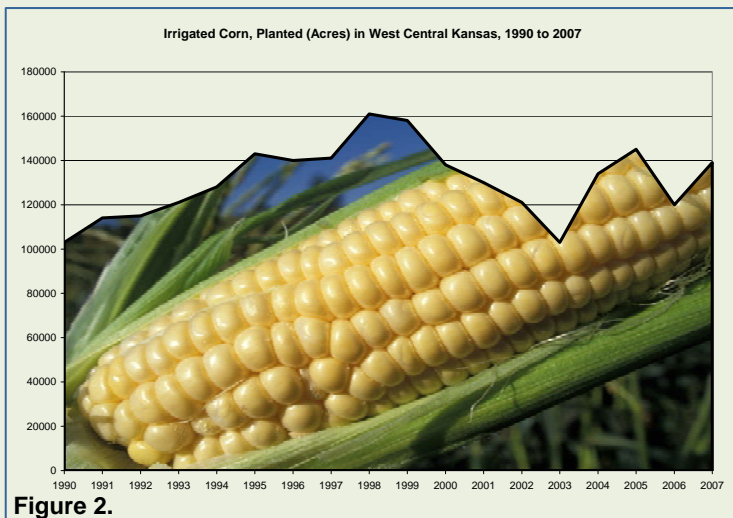


Figure 2.

Water Quality

Wastewater from ethanol plants is regulated by the Kansas Department of Health and Environment (KDHE), which administers both the federal National Pollution Discharge Elimination System (NPDES) permits and Kansas Water Pollution Control permits. In most instances, KDHE issues the state-level permit, which requires ethanol plants to use the wastewater for beneficial land applications rather than simply discharging into streams and rivers.

A rise in the number of corn acres may also impact the basin water quality through increased fertilizer application and soil erosion. In Kansas, corn has the greatest application rates of both fertilizer and pesticides per acre, higher than for soybeans and mixed-species grassland biomass. The switch from other [crops](#) or noncrop plants to corn may lead to higher application rates of highly soluble nitrogen. Harvested row crops, such as corn, have a higher potential for soil erosion than grasses or perennial crops. The potential water quality impact of an increased demand for corn may be mitigated through Best Management Practices (BMPs), especially those addressing soil erosion and herbicide applications.⁽¹⁾

The restoration of watersheds with impaired water quality and the protection of watersheds above public water supply reservoirs and ground water sources used for drinking water supplies are also a high priority issue in the Upper Arkansas basin.

Biodiesel

Biodiesel is produced using oils extracted from crops, animal fat or waste vegetable oil using a chemical process called transesterification. Most U.S. biodiesel is produced from soybean oil, although other vegetable oils such as canola, corn, cottonseed, flax seed, sunflower or peanut oil can be used. As of December 2008, no biodiesel plants are permitted in the Upper Arkansas basin.

Biodiesel production uses roughly three gallons of water per gallon biodiesel, about a gallon of which is consumptive use. Wastewater from biodiesel plants, which may contain high amounts of oxygen, grease and oils, is regulated by KDHE.

Biogas

Kansas has more than 36,000 farms with cattle and calves and ranks first nationwide in commercial cattle

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processed with more than eight million head.⁽⁸⁾ Because of the high number of [livestock](#) facilities in the state and in the Upper Arkansas basin, anaerobic digestion of wastes and the capture of methane gases may provide an alternative fuel source, while increasing the value-added potential of the industry. The key by-products of anaerobic digestion include digested solids and methane, the primary component of “biogas”. Biogases can be used to fuel a variety of cooking, heating, cooling and lighting applications, as well as to generate electricity. Capturing and using methane, a potent greenhouse gas, also reduces its release to the atmosphere.⁽⁵⁾

Cellulosic Ethanol

Cellulosic ethanol uses lignocellulose, the main structural material in any plant, as a feedstock. Cellulosic feedstocks require an extra step to break down the lignocellulose into fermentable starch, thus increasing production costs. The bulkier cellulosic feedstocks are also more costly to harvest, transport and store. Processing of cellulosic materials would require more water than corn, as the feedstock is dry. Research on cellulosic feedstocks (such as switchgrass, wood chips, and corn stover) is ongoing. The U.S. Department of Energy has set 2012 as a target year to achieve technological advances to make cellulosic ethanol cost competitive with corn ethanol. In 2007, Abengoa Bioenergy, a Spanish energy company, announced that Hugoton would be the site of the state’s first cellulosic ethanol plant. In conjunction with cellulosic ethanol research, some researchers are investigating the use of perennial polyculture crop systems for cellulosic feedstocks.

Production of cellulosic ethanol may have greater positive environmental impacts than grain-based ethanol such as reduced greenhouse gas emissions, decreased fertilizer application and less reliance on water intensive crops.

Corn Research and Varieties

Breeding of corn hybrids that maximize yield for ethanol production while reducing additional strains on water supplies has been a focus of much research by universities and corn breeding companies. Drought tolerant hybrids, specifically transgenic, drought-resistant corn, are especially important in areas of western Kansas where rainfall averages fewer than 16 inches per year. In addition to drought tolerant varieties, industries are identifying corn varieties that produce higher yield and more ethanol per acre. High total fermentable ethanol corn

hybrids provide higher levels of fermentable starch, consisting of the sum of all starches and simple sugars that ferment during the typical dry grind process.^(6,9)

Recommended Actions

1. Coordinate, where applicable, the development, implementation and public input process between the *Kansas Water Plan* and Kansas energy policy.
2. Maintain regulatory oversight by state and local government on the siting of ethanol and biodiesel plants, with special emphasis on the water supply and availability.
3. Look for water recycling opportunities within the bio-fuel facilities.
4. Promote research for less water-dependent corn varieties and improved irrigation scheduling that maintains or increases crop yield without increasing water use.
5. Promote research and pilot projects for viable, commercial cellulosic ethanol production and other bio-fuels that are less dependent on water intensive crop production.
6. Increase corn water use efficiency (amount of grain produced per inch of water) through research and extension efforts. Educational emphasis should be placed on utilization of irrigation scheduling tools such as KanSched and the Mobile Irrigation Lab.
7. Evaluate the biofuel facility watershed and watersheds of input crops, and identify potentially environmentally sensitive areas. Target programs to mitigate environmental impacts, such as stream buffers, grass filters, BMPs, etc.
8. Provide education and/or incentives for marginal lands that have expiring Conservation Reserve Program contracts that will not be renewed to stay in a conservation planting, with special consideration to acres that could return to irrigation.

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Resources

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