2009 Kansas Field Conference

June 3–5, 2009

Southwest Kansas
Climate, Energy, and Water Consumption

Field Guide

Edited by

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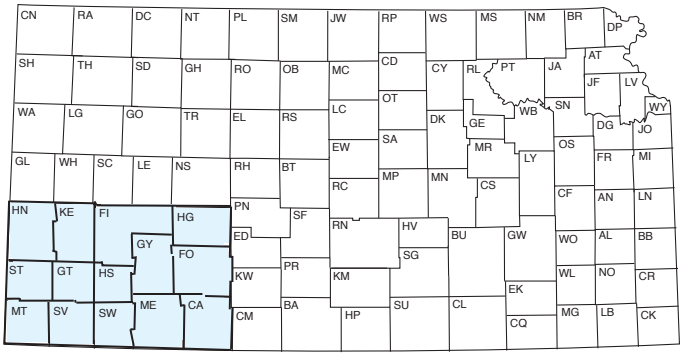

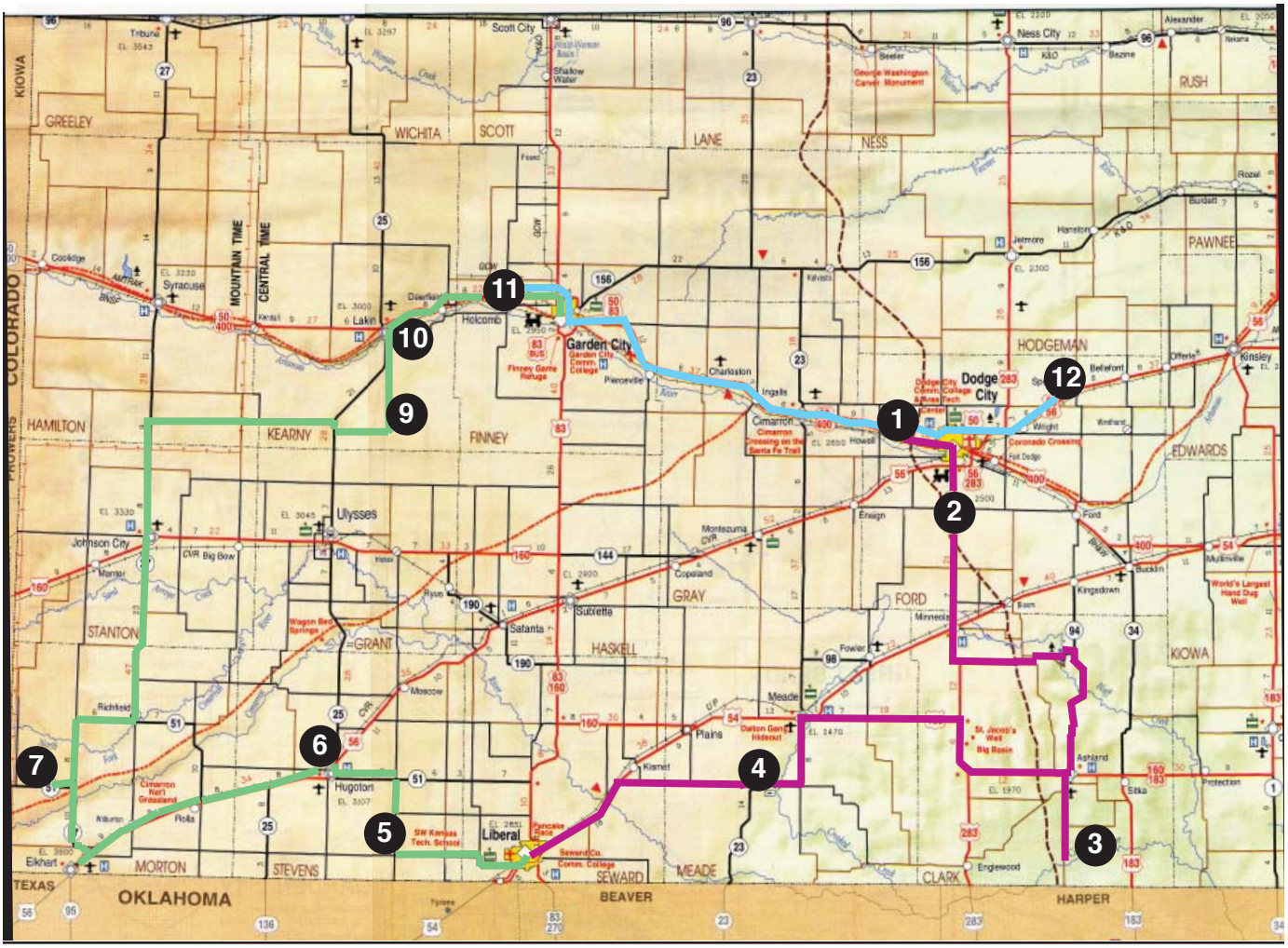

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Acknowledgments

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Kansas Field Conference

Southwest Kansas
Climate, Energy, and Water Consumption

June 3–5, 2009

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Dennis Schwartz, Member, Kansas Water Authority
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Susan Stover, Kansas Water Office
John Strickler, Past Chairman, The Nature Conservancy, Kansas Chapter
Josh Svaty, Representative, Ellsworth
Ruth Teichman, Senator, Stafford
Jim Triplett, Biology Department, Pittsburg State University
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Vincent Wetta, Representative, Wellington
Jerry Williams, Representative, Chanute

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BIOGRAPHICAL INFORMATION

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Natural Resource Coordinator
Kansas Department of Wildlife and Parks
Address and Telephone
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Experience
Fisheries biologist, Florida Game and Freshwater Fish Commission, 1986–89; Kansas Department of Wildlife and Parks, 1989–present
Education
Northeastern State University – BS, 1980
Oklahoma State University – MS, 1983

David Barfield
Title and Affiliation
Chief Engineer
Kansas Department of Agriculture, Division of Water Resources
Address and Telephone
109 SW 9th St., 2nd floor
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785–296–3710
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Current Responsibilities
Responsibilities over state's water resources including four compacts, 32,000 water rights, safety of dams and other structures
Experience
Joined KDA–DWR in 1984; 1984–87, special studies in water management, 1987–92 dam safety, 1992–2007 interstate water issues; 3 years engineering in Africa; 3 years consulting in Minnesota
Education
University of Kansas – BS, 1978
University of Kansas – MS, 1991

Larry Biles
Title and Affiliation
State Forester
Kansas Forest Service
Address and Telephone
2610 Claflin Road
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Current Responsibilities
State Forester
Experience
Kansas Forest (Hiawatha and Manhattan); U.S. Forest Service (Atlanta, Ga.); USDA – Extension Service (Washington DC)
Education
University of Missouri – Forestry, 1967
Kansas State University – Ornamental Horticulture, 1974

Pete DeGraaf
Title and Affiliation
Kansas House of Representatives, 81st District
Address and Telephone
1545 E 119th St.
Mulvane KS 67110
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Current Responsibilities
Director, Financial Counseling Service

Lon Frahm
Title and Affiliation
Kansas Geological Survey Advisory Council (GSAC) member
Kansas Water Authority member
Address and Telephone
PO Box 60
Colby KS 67701
785–443–3174
lfrahm@st-tel.net
Current Responsibilities
Farms 16,000 acres, irrigated and dryland, near Colby; Kansas Geological Survey Advisory Council (GSAC) member; Kansas Water Authority member, Kansas Arts Commissioner; Midwest Energy Board of Directors; Groundwater Management District #4 Board Member
Education
Kansas State University – BS, 1980
Kansas State University – MAB, 2002

Lisa French
Title and Affiliation
Kansas Water Authority member
Address and Telephone
8016 W Long View Road
Partridge KS 67566

620–665–0231
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Current Responsibilities

Project Coordinator, Cheney Lake Watershed: education and assistance for farmers and landowners to implement conservation practices that impact water quality of Cheney Reservoir.

Experience

Diversified crop and livestock farm in Reno County since 1980. Prior to work with Cheney Watershed, worked for Kansas Rural Water Center and the Clean Water Farms Project.

Education

University of Nebraska – BS, 1978

Steve Frost

Title and Affiliation

Water Conservation Manager
State Conservation Commission

Address and Telephone

109 SW 9th St., Suite 500
Topeka KS 66612–1215
785–296–8964
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Current Responsibilities

Program Manager for CREP, WTAP, AWEP water right retirement

Experience

DWR Water Commissioner; Exec. Director, SW KS GMD #3; KDHE regulatory analyst

Education

University of Colorado – BA, 1979
University of Kansas – MPA, 2005

Rocky Fund

Title and Affiliation

Kansas House of Representatives, 50th District

Address and Telephone

13161 S Road
Hoyt KS 66440
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rockfund@hotmail.com

Current Responsibilities

State Representative; District manager, Rural Water District #1, Jackson County

Experience

K-12 art teacher (21 years); Owner/operator farrier (horseshoer) business (1976–2000)

Education

Wichita State University – BFA, 1978

Raney Gilliland

Title and Affiliation

Assistant Director for Research
Kansas Legislative Research Department

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Raney.Gilliland@klrd.state.ks.us

Current Responsibilities

Staff House and Senate Agriculture committees; Senate Natural Resources; Senate Utilities; Joint Committee on Administrative Rules and Regulations

Education

Kansas State University – BS, 1975
Kansas State University – MS, 1979

Bob Grant

Title and Affiliation

Kansas House of Representatives, 2nd District

Address and Telephone

407 W Magnolia
Cherokee KS 66724
620–457–8496
grantbnl@ckt.net

Current Responsibilities

State Representative

Experience

1967–1992, Kansas Army ammunition plant; Catering business, bar and grill owner, 1985–2005

Education

Southeast High School – 1966
Labette Community College – AA, 1971
Pittsburg State

Burke Griggs

Title and Affiliation

Counsel
Division of Water Resources, Kansas Department of Agriculture

Address and Telephone

109 SW 9th St., 4th Floor
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785–296-4616
burke.griggs@kda.ks.gov

Current Responsibilities

Representing Kansas in interstate water litigation; representing the chief engineer of DWR in interstate matters; representing DWR in District Court

Experience
Assistant professor of history, Boston College, 1997–2003; Attorney, Stevens and Brand, LLP, Lawrence, 2006–08
Education
Stanford University – BA, 1990
Yale University – PhD, 1998
KU Law School – JD, 2006

Mike Hayden
Title and Affiliation
Secretary
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Address and Telephone
1020 S Kansas Ave.
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offsec@ksoutdoors.com
Experience
Speaker of the Kansas House, 1983–87; Governor of Kansas, 1987–91; Assistant Secretary of Interior for Fish, Wildlife and Parks; President, American Sportfishing Assoc.
Education
Kansas State University – BS, Wildlife Conservation, 1966
Ft. Hays State University – MS, Biology, 1974

Gary Hayzlett
Title and Affiliation
Kansas House of Representatives, 122nd District
Address and Telephone
PO Box 66
Lakin KS 67860
620–355–6297
Current Responsibilities
State Representative; Chair, House Transportation Committee
Experience
Businessman

Dave Heinemann
Title and Affiliation
Past Chair, Geological Survey Advisory Council (GSAC)
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Topeka KS 66610
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Current Responsibilities
Legislative representative for American Cancer Society and Stand Up For Kansas
Experience
Special Assistant to the Secretary of Revenue, 5 years; Executive Director, KCC, 2 years; General Counsel, KCC, 2 years; State Representative, 27 years; Speaker Pro Tem, Kansas House Commission, 11 years; GSAC member, 1991–2007
Education
Augustana College – BA, 1967
University of Kansas – 1967–68
Washburn Law School – JD, 1973

Bob Henthorne
Title and Affiliation
Chief Geologist
Kansas Department of Transportation
Address and Telephone
2300 Van Buren
Topeka KS 66611
785–291–3860
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Current Responsibilities
Oversee all geologic investigations conducted and constructed by KDOT
Experience
Worked for KDOT for 27 years
Education
University of Kansas – BS, 1983

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Title and Affiliation
Kansas State Senate, 3rd District
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Current Responsibilities
State Senator; President, Holland Technologies, Inc.
Experience
Holland Technologies, Inc., 1994–present; KS House, 1/03–12/08
Education
Indiana University – BS, Business, 1982
University of Minnesota – MBA, 1987

Carl Holmes
Title and Affiliation
Kansas House of Representatives, 125th District

Address and Telephone
P.O. Box 2288
Liberal KS 67905
620–624–7361
repcarl@aol.com
Current Responsibilities
Chair, Energy and Utilities Committee; Chair, Joint Committee on Administrative Rules and Regulations; Chair, Kansas Electric Transmission Authority; Vice chair, Joint Committee on Energy and Environment
Experience
Member, Agriculture and Natural Resources Budget Committee; Chair, Advisory Council on Energy (national think tank); Executive Committee, The Energy Council
Education
Colorado State University – BS, 1962
Kansas University

Mitch Holmes
Title and Affiliation
Kansas House of Representatives, 114th District
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211 SE 20th Ave
St. John KS 67576
620–234–5834
mimi.holmes@juno.com
Current Responsibilities
Appropriations, Federal and State Affairs (Vice Chair), and Local Government committees
Experience
Computer programmer, college instructor, retail sales, business owner
Education
Hutchinson Community College – AA, 1984
Friends University – BS, 1988

Kelsey Holste
Title and Affiliation
District Representative for U.S. Congressman Jerry Moran
Address and Telephone
PO Box 766
Salina KS 67402
785–309–0572
Kelsey.holste@mail.house.gov
Current Responsibilities
Focus on agricultural issues and concerns from constituents and handle casework
Experience
Account manager at John Morrell and Co.; Study abroad advisor at Kansas State
Education
Kansas State University – BS, 2005
Kansas State University – MS, 2008

Steve Irsik
Title and Affiliation
Chair, Kansas Water Authority
Address and Telephone
5405 Six Road
Ingalls KS 67853
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steve@ucom.net
Experience
Farmer, rancher, and agricultural business
Education
Kansas State University – BS, 1969

Forrest Knox
Title and Affiliation
Kansas House of Representatives, 13th District
Address and Telephone
17120 Udall Road
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785–783–5564
repnox@gmail.com
Current Responsibilities
Vice Chair, House Energy and Utility Committee
Experience
Engineering; Stockman
Education
Kansas State University – BS, 1978
Technion – MS, 1989

Annie Kuether
Title and Affiliation
Kansas House of Representatives, 55th District
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Current Responsibilities
Ranking democrat, Energy and Utilities Committee; Judiciary Committee
Experience
13th year in legislature
Education
Webster Groves High – 1970
Bowling Green State University, Ohio

Cindy Lash
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Research Analyst
Kansas Legislative Research Department
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Current Responsibilities
Staff the Senate Utilities Committee, House Energy and Utilities Committee, Joint Energy and Environmental Policy committee, and Kansas Electric Transmission Authority
Experience
Kansas Legislative Post Audit, 1983–2007; KLRD, 2007–present
Education
Rutgers – BA, 1975
University of Kansas, Graduate Studies

Janis Lee
Title and Affiliation
Kansas State Senate, 36th District
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Current Responsibilities
Assistant Minority Leader; Ranking member, Senate Utilities Committee; Member, Ways and Means, Agriculture, and Natural Resources committees
Experience
Farmer and rancher
Education
Kansas State University – BS, 1970

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Title and Affiliation
Assistant Director
Kansas Water Office
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Current Responsibilities
Oversees development of Water Plan and issues associated with reservoir operations
Experience
7 years at DWR, interstate compacts, subbasin management, and water use compliance and enforcement
Education
University of Kansas – BS, 1992

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Kansas House of Representatives, 86th District
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Current Responsibilities
Education Committee; Ranking minority member on Federal and State Affairs; Member, Government Efficiency and Fiscal Oversight and Joint House and Senate Committee on Kansas Security
Experience
Reading resource teacher, Wichita
Education
Bethel College – BS, 1975
Northern Arizona University – MA Ed, 1981

Margaret Long
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Kansas House of Representatives, 36th District
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Current Responsibilities
Utilities Committee; Ranking Democrat, Transportation Committee
Experience
Midwest Motor Freight Line; 40 years at TWA
Education
Ward High School – 1956
Kansas City KS Community College
Kansas City KS Vo Tech

Brad Loveless
Title and Affiliation
Manager, Biology and Conservation Programs
Westar Energy
Address and Telephone
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Current Responsibilities
Energy planning and environmental stewardship, environmental interactions on Westar wind

sites; carbon planning; Kansas Association of Conservation and Environmental Education (KACEE) Board Member

Education
The Ohio State University – BS, 1981
University of Kansas – MS, 1985

Patrick Maloney

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Kansas House of Representatives, 116th District

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Current Responsibilities
Agriculture and Transportation committees

Experience
Farmer/Rancher

Education
University of Kansas – BS, Bus. Adm., 1963
University of Kansas – BS, Sec. Ed., 1964

Ed Martinko

Title and Affiliation
Director
Kansas Biological Survey

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Higuchi Hall
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Current Responsibilities
Director, Kansas Biological Survey

Experience
Environmental and remote sensing research; research administration

Education
College of Emporia – BS, 1967
University of Colorado – MA, 1970
University of Kansas – PhD, 1976

Melvin Neufeld

Title and Affiliation
Kansas House of Representatives, 11th District

Address and Telephone
7405 15th Road
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Current Responsibilities
Chair, Federal and State Affairs Committee; Member, Education and Government Efficiency and Technology committees

Experience
Speaker of the Kansas House, 2007 and 2008; Chair: Administrative Rules and Regulations, Human Services Budget, and Appropriations committees; House Select Committee on Healthcare

Education
Tabor College

Ralph Ostmeyer

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Kansas State Senate, 40th District

Address and Telephone
Box 97
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rostmey@ink.org

Current Responsibilities
Farmer and Rancher; Vice Chair, Agriculture Committee: Member, Federal and State Affairs, Local Government, and Rules and Regulations committees

Experience
School Board; Soil conservation; County Commission; State representative

Education
High School – 1961
Fort Hays

Catherine Patrick

Title and Affiliation
Director of Division of Operations
Kansas Department of Transportation

Address and Telephone
700 SW Harrison
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Cisneros@ksdot.org

Current Responsibilities
Responsible for coordinating annual construction and maintenance programs to ensure consistency with operational objectives

Experience
Field Engineer, Asst. Bureau Chief, construction and maintenance, Topeka/Bonner Springs Metro Engineer, Northeast Kansas District Engineer

Education
Kansas State University – BS, Civil Engineering, 1987

Don Paxson
Title and Affiliation
Vice Chair
Kansas Water Authority
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2046 U.S. Highway 24
Penokee KS 67659
785–421–2480
dpaxson@ruraltel.net
Current Responsibilities
Vice Chair, Kansas Water Authority and Chair of Budget Committee
Experience
Paxson Electric and Irrigation for 35 years; has a 1,600-acre dryland and irrigated farming operation
Education
High School – 1956

Adrian Polansky
Title and Affiliation
Secretary of Agriculture
Kansas Department of Agriculture
Address and Telephone
109 SW 9th St.
Topeka KS 66612
785–296–3902
Adrian.Polansky@kda.state.ks.us
Current Responsibilities
Administrator for Kansas agriculture regulation and policies; advocate for agriculture; works with legislature for agriculture
Experience
Owner, Polansky Seed; Past Director of USDA FSA; President, Kansas Crop Improvement Association; Chairman, U.S. Wheat Association
Education
Kansas State University – BS, Agronomy, 1972

Larry Powell
Title and Affiliation
Kansas House of Representatives, 117th District
Address and Telephone
2209 Grandview East
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Current Responsibilities
Chair, Agriculture and Natural Resources Committee
Experience
House, 8 years; Rancher
Education
Cimarron High School
Garden City JuCo – AA
Kansas State University

Mark Rude
Title and Affiliation
Executive Director
SW KS Groundwater Management District #3
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409 Campus Dr., Suite 108
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Current Responsibilities
Direct activities of GMD3 and the Western Water Conservation Project
Experience
Oil-field geology to 1987; KSDA–DWR (Garden City), 1987–2005; Executive Director GMD3, 2005–present
Education
Wichita State University – BS, 1985

Jean Schodorf
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Kansas State Senate, 25th District
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3039 Benjamin Ct.
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Current Responsibilities
Chair, Education Committee; Member, Ways and Means and Commerce committees
Experience
Speech/language pathologist. Owns Little House on the Prairie
Education
University of New Mexico – BA, 1972
University of New Mexico – MS, 1973
Wichita State University – PhD, 1981

Dennis Schwartz
Title and Affiliation
Kansas Water Authority member

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Tecumseh KS 66542
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Current Responsibilities
General Manager, Rural Water District; President, Kansas Rural Water Association; Director; National Rural Water; Kansas Water Authority since 1988
Experience
Water Manager, 33 years; State and national water organizations

Don Steeples
Title and Affiliation
Senior Vice Provost
University of Kansas
Address and Telephone
1450 Jayhawk Blvd., Room 250
University of Kansas
Lawrence KS 66045–7535
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Current Responsibilities
Oversees about 25% of KU–Lawrence campus including facilities and Schools of Engineering, Pharmacy, and Architecture
Experience
McGee Professor of Geophysics at KU since 1993; Kansas Geological Survey, 1975–1992
Education
Kansas State University – BS, 1969
Kansas State University – MS, 1970
Stanford University – PhD, 1975

Chris Steineger
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Current Responsibilities
State Senator
Education
Kansas State University – BS, 1986
University of Kansas – MS, 1991

Susan Stover
Title and Affiliation
Manager, High Plains Unit; Environmental Scientist
Kansas Water Office
Address and Telephone
901 S Kansas Ave.
Topeka KS 66612
785–296–0876
susan.stover@kwo.ks.gov
Current Responsibilities
Strategic planning for High Plains aquifer management; Develop water conservation programs; Draft State and Federal legislative proposals; Assist with State Water Plan
Experience
Previously worked for KDHE in contamination remediation; supporter of scientific literacy—edited two K-12 books on hands-on geology; presented at middle school workshops
Education
University of Nebraska – BA, geology, 1979
University of Arizona – graduate work in hydrology, 1981–82
University of Kansas – MS, geology, 1993

John Strickler
Title and Affiliation
Trustee, The Nature Conservancy, Kansas Chapter; Treasurer, KACEE (Kansas Association for Conservation and Environmental Education)
Address and Telephone
1523 University Drive
Manhattan KS 66502–3447
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jstrickl@ksu.edu
Current Responsibilities
Board of Trustees, Kansas Chapter, The Nature Conservancy; Treasurer, KACEE
Experience
Chair, The Nature Conservancy, Kansas Chapter; Executive Director, KACEE; Special Assistant for Environment and Natural Resources to Gov. Hayden, 2 years; Acting Secretary, Kansas Department of Wildlife and Parks, 1987 and 1995; Kansas Forest Service, KSU, 33 years; U.S. Forest Service, 4 years
Education
University of Missouri – BS, 1957
Kansas State University – MS, 1968

Josh Svaty
Title and Affiliation
Kansas House of Representatives, 108th District
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1606 Avenue JJ
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Current Responsibilities
Energy and Utilities, Agriculture and Natural Resources committees
Experience
Family farming
Education
Sterling College – BA, 2002

Ruth Teichman
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Kansas State Senate, 33rd District
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434 E Old Highway 50
Stafford KS 67578
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Current Responsibilities
Ways and Means, Financial Institutions and Insurance, Natural Resources, and Education committees
Experience
Farming; Banking (director); School board; Hospital (lab and medical records); Buyer for Pegues Department Store
Education
Kansas State University – BS, 1965

Jim Triplett
Title and Affiliation
Professor, Pittsburg State University
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1034 E 520th Ave.
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Current Responsibilities
University professor, biology, PSU; Chair, Neosho Basin Advisory Committee
Experience
Lt. US Navy, 1968–1971; Ohio State Fisheries and Wildlife Division, 1975–1981; Biology Dept, PSU, 1981–present; Chair, PSU Biology, 1985–2008
Education
Kansas State College of Pittsburg – BA, 1966
Kansas State College of Pittsburg – MS, 1968
University of Kansas – PhD, 1976

Jim Ward
Title and Affiliation
Kansas House of Representatives, 88th District
Address and Telephone
3100 E Clark
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Current Responsibilities
House assistant minority leader
Education
Creighton University – BA, 1981
Washburn School of Law – JD, 1985

Vincent Wetta
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Kansas House of Representatives, 80th District
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1204 N Poplar
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Current Responsibilities
State Representative
Experience
41 years as conductor–engineer for BNSF Railway Co.
Education
Wichita State University – BA, 1996

Jerry Williams
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21225 Kiowa Road
Chanute KS 66720
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Jerry.Williams@house.ks.gov
Current Responsibilities
Farmer/Rancher and State Representative
Experience
Education: teacher, coach, principal and superintendent; Home health/hospital/nursing home administrator
Education
Southeast State University (Durant, Okla.) – BS Ed., 1966

Emporia State University – ED SP, 1971
Wichita State University – MS, Gerontology, 1985

Kansas Geological Survey Staff

Bill Harrison
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Director and State Geologist
Kansas Geological Survey
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Current Responsibilities
Plan and initiate major research programs; Assess scientific quality of current programs
Experience
Kansas Geological Survey, 12 years; Lockheed Martin Idaho Technologies; EG&G Idaho, Inc.; ARCO Exploration and Technology; University of Oklahoma/Oklahoma Geological Survey, Faculty/Staff Geologist
Education
Lamar State College of Technology – BS, 1966
University of Oklahoma – MS, 1968
Louisiana State University – PhD, 1976

Rex Buchanan
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rex@kgs.ku.edu
Current Responsibilities
Supervise publication and public outreach activities, media relations, and nontechnical communications
Experience
Kansas Geological Survey, 31 years; University–Industry Research, University of Wisconsin, 3 years; Salina Journal, 4 years
Education
Kansas Wesleyan University – BA, 1975
University of Wisconsin–Madison – MA, 1978
University of Wisconsin–Madison – MS, 1982

Cathy Evans
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Write news releases and educational materials; edit publications; assist with field conference and guidebook
Experience
Kansas Geological Survey; University Press of Kansas; Spencer Museum of Art
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Southwest Kansas
Climate, Energy, and Water Consumption

June 3–5, 2009

Welcome to the 2009 Field Conference, co-sponsored by the Kansas Geological Survey (a division of the University of Kansas), the Kansas Water Office, the Kansas Department of Transportation, and the Kansas Department of Wildlife and Parks. Previous Field Conferences have focused on specific topics, such as energy or water, or specific regions of the state. This year's Field Conference is centered around natural-resource and environmental issues in southwestern Kansas. This is an area rich in natural resources, including the Hugoton Natural Gas Field and the Ogallala aquifer. The use of those resources has helped power the economy of southwestern Kansas and the entire state, but their depletion, along with the rise of new sources of energy such as wind power, has led to a number of issues critical to the future of Kansas.

Day 1

We'll begin and end this year's Field Conference in Dodge City, on the edge of the High Plains of western Kansas. Dodge City, Liberal, and Garden City (all places we'll spend the night) are the three big regional cities in southwestern Kansas. Each is known for, among other things, the meat-packing industry. We'll take a look at water-quality issues presented by the meat-packing business here in Dodge City. In addition, this region's growth and other economic activities, such as moving grain and cattle, have necessitated highway maintenance and construction. We'll see a new construction project west of Dodge City and hear from staff of the Kansas Department of Transportation, who will discuss the impact of stimulus funds on highway projects in western Kansas and the rest of the state.

From here we'll head south to see some of the state's geologic diversity. Many people think the western Kansas landscape is flat and uninteresting, but we'll have lunch in a place that proves them wrong: Clark County State Lake, nestled in the valley of Bluff Creek. The canyon here is rimmed by outcrops of the Ogallala Formation beneath which much older Cretaceous and Permian rocks crop out, including brightly colored red beds and the Day Creek Dolomite.

At our next stop, south of Ashland, we'll view research aimed at studying the impact of control measures on phreatophytes (water-loving plants), such as salt cedars and cottonwoods, that have been blamed for using significant amounts of ground water here in this relatively arid region. Previous participants may remember discussing this issue near Larned a few years ago and during last year's conversation in Nebraska about the Republican River. This year, the research project we'll see is aimed at attempting to quantify the amount of water consumed by these plants, particularly salt cedars, and at studying the success of various phreatophyte-control measures, such as burning or mechanically removing the plants.

Our final stop of the day is at Meade County State Lake, another scenic location where a lake has been created, in this case by damming Stumpie Arroyo. This is an appropriate place to consider some of the challenges that climate change may pose for southwestern Kansas. Precipitation is scant and surface water is rare in this area, which makes it terrifically reliant on ground water. Any changes in climate, either in terms of increased temperatures or precipitation patterns, could have a disproportionate impact here. We'll discuss observed changes in the climate and its implications for southwestern Kansas.

We'll end the day in Liberal, where we'll hear about the state's Data Access and Support Center (DASC) and their ability to develop and display databases that can be used to help understand the state's natural-resource issues.

Day 2

We'll begin the second day by traveling west-northwest to a location where we'll discuss the complex issue of water-rights impairment. Many people know that Kansas water rights are generally apportioned according to time: the so-called "first in time, first in right" rule. Impairment occurs when pumping from a more recent water right interferes with pumping from an older water right. Determining when that senior water

right has been impaired, and resolving that impairment, is a delicate legal issue, yet critical to water management and property rights in the state.

We'll use this as a backdrop to discuss the role of IGUCAs, or Intensive Groundwater Use Control Areas. These locations are designated by the Chief Engineer of the Division of Water Resources of the Kansas Department of Agriculture. IGUCAs are aimed at ground-water management in areas where depletion has been particularly severe. There has been recent disagreement about the authority to create IGUCAs within a groundwater management district.

From there we'll head north to near Hugoton, where we'll learn about cellulosic ethanol at the construction site of the state's first cellulosic-ethanol plant. The site is operated by Abengoa Energy with partial funding from the U.S. Department of Energy, and is aimed at using plant waste to produce ethanol (the plant will also produce ethanol from corn, using conventional methods). The technology for large-scale cellulosic ethanol is still under development, and this plant is aimed at producing about 13 million gallons annually. The plant operators will walk us through the production process, describe the interaction with local farmers to produce and transport biomass for use at the plant, and discuss the challenges and opportunities facing cellulosic ethanol.

The next stop is the Cimarron National Grassland, one of the true treasures in Kansas. At over 100,000 acres, it's the largest parcel of publicly accessible land in Kansas. We'll head to Point of Rocks, a landmark on one branch of the old Santa Fe Trail (wagon ruts are still visible here) to talk about the grassland, how the area was acquired and operated by the U.S. Forest Service, the unique geology and paleontology, and the area's unusual plants and animals, including lesser prairie-chickens.

Northeast of here, outside of Johnson City, we'll look at the excavation of a bison bonebed along the dry bed of Bear Creek. The site, on the edge of a playa, has produced a number of bison bones, some of which are still fully articulated (or connected together as they were when the animals were alive). The bison probably died about 9,000 years ago, and several artifacts, including stone points and tools, have been recovered here. Geoarcheologist Rolfe Mandel will describe the site and its excavation, giving us a glimpse of ancient life on the High Plains.

At the end of the day, we'll visit issues related to ditch irrigation south of the Arkansas River. In this area we'll also discuss the Upper Arkansas Conservation Reserve Enhancement Program (CREP), aimed at retiring water rights in 10 counties along the upper Arkansas River. Approximately 9,900 acres of land has been voluntarily taken out of irrigation agriculture as part of that program; putting that land back into native grass has proved to be a challenge, and we'll see some locations where landowners are working with the program to re-vegetate those soils.

Day 3

The final day will begin with breakfast at the Holcomb Station power plant, west of Garden City, and a review of the process of changing water rights. To provide the necessary additional water for the proposed expansion of the power plant at Holcomb, the operators purchased property and water rights. However, the use of those water rights for electrical generation requires that they be changed from agricultural to industrial use, a process that we'll discuss in more detail.

We'll end the trip's discussions east of Dodge City at the Spearville wind-power plant. In addition to learning about the wind farm, we'll discuss the need for additional transmission lines in western Kansas.

About the Kansas Field Conference

Some issues are best understood by seeing them firsthand. The 2009 Field Conference marks the 15th year the Kansas Geological Survey (KGS) has worked with co-sponsors to develop this opportunity for policy-makers to see and experience some of the natural-resource issues with which they grapple. Participants have been selected to provide a range of legislative, government, education, and private-business expertise. Local and regional experts in natural-resource issues will meet us at each site and describe the location and the issues related to it. The objective is to let participants see the results of their decisions and to talk with local, State, and Federal governmental officials, environmental groups, business people, and citizens' organizations. The result should give participants a broader, more-informed perspective useful in formulating policies. In addition, the Field Guide you are holding provides background on sites and issues and serves as a handy reference long after the Field Conference is over.

During the Field Conference, participants are expected to be just that—participants. We want you to

contribute to the discussion, to ask questions, and to otherwise join in on deliberations. **The bus microphone is open to everyone, and we encourage everyone to participate.**

Please remember that in the course of the Field Conference, we do not seek to resolve policy or regulatory conflicts. We do try to provide opportunities to familiarize policy makers with resource problems. By bringing together experts on the unique technical, geographical, geological, environmental, social, and economic realities of southwestern Kansas, we hope to go beyond merely identifying issues. We want this combination of first-hand experience and interaction among participants to result in a new level of understanding of the state's natural-resource issues.

In doing this, we attempt to present, as nearly as possible, all sides of contentious issues. Please know that the opinions presented during the Field Conference are not necessarily those of the KGS or Field Conference co-sponsors. Nonetheless, we do believe it is important for participants to hear various viewpoints on complex issues.

The Kansas Field Conference is an outreach program of the Kansas Geological Survey, administered through its Geology Extension program. Its mission is to provide educational opportunities to individuals who make and influence policy about natural-resource and related social, economic, and environmental issues in Kansas. The KGS's Geology Extension program is designed to develop materials, projects, and services that communicate information about the geology of Kansas, the state's natural resources, and the products of the Kansas Geological Survey to the people of the state.

The Field Conference was begun in 1995 with the support of Lee Gerhard, then the Survey's director and state geologist. The Field Conference is modeled after a similar program of national scope, the Energy and Minerals Field Institute, operated by the Colorado School of Mines. The KGS appreciates the support of Erling Brostuen, retired Director of the Energy and Minerals Field Institute, in helping develop the Kansas project.

The KGS Field Conference has been recognized by

- The National Institute of Standards and Technology as among 50 Best Practices for Communication of Science and Technology for the Public, 2001; and
- The Division of Environmental Geosciences of the American Association of Petroleum Geologists, which presented the Field Conference with its Public Outreach Award in 1998.

The KGS appreciates your attendance at this year's Field Conference and your willingness to share your insights for its improvements. Your input has helped make the Field Conference a model that has been adopted by other state geological surveys.

Sponsors

Kansas Geological Survey

Since 1889, the Kansas Geological Survey (KGS) has studied and reported on the state's geology. Today the KGS mission is to study and provide information about the state's geologic resources and hazards, particularly ground water, oil, natural gas, and other minerals. In many cases, the Survey's work coincides with the state's most pressing natural-resource issues.

By statutory charge, the Kansas Geological Survey's role is strictly one of research and reporting. The KGS has no regulatory function. It is a division of the University of Kansas. The KGS employs about 70 full-time staff members and about 80 students and grant-funded staff. It is administratively divided into research and research-support sections. KGS programs can be divided by subject into water, energy, geology, and information dissemination.

Water—Water issues affect the life of every Kansan. Western Kansas agriculture and industry rely heavily on ground water; in eastern Kansas, growing populations and industry generally use surface water. KGS water research and service include an annual water-level-measurement program (in cooperation with the Kansas Department of Agriculture, Division of Water Resources), studies of recharge rates, water quality in the Arkansas River, depletion of the Ogallala aquifer, the interaction between streams and aquifers, and a variety of other topics.

Energy—Kansas produced more than $6 billion worth of oil and natural gas last year. Because much of the state has long been explored for oil and gas, maintaining that production takes research and information. The KGS does research on the state's petroleum reservoirs, new methods of providing information, and new methods of exploring for and producing oil. The KGS recently completed a multi-year study of the resources of the Hugoton Natural Gas Area, a study that resulted in the drilling of a substantial

number of additional wells. Researchers are also studying issues related to the geologic sequestration of carbon dioxide. The KGS works with the Kansas Corporation Commission to enable online reporting of oil and gas information, and has a branch office in Wichita, the Wichita Well Sample Library, that stores and loans rock samples collected during the drilling of oil and gas wells in the state.

Geology—Much of the KGS's work is aimed at producing basic information about the state's geology, information that can be applied to a variety of resource and environmental issues. The KGS develops and applies methods to study the subsurface, such as high-resolution seismic reflection; undertakes mapping of the surficial geology of the state's counties; and studies specific resources, such as road and highway materials. The KGS reports on nonfuel minerals (such as salt, gypsum, aggregates, etc.) and is charged with studying geologic hazards, such as subsidence, earthquakes, and landslides.

Geologic Information—To be useful, geologic information must be disseminated in a form that is most appropriate to the people who need it. The KGS provides information to the general public, policy-makers, oil and gas explorationists, water specialists, other governmental agencies, and academic specialists. Information is disseminated through a publication sales office, automated mapping, the state's Data Access and Support Center (DASC; located at the KGS), a data library, electronic publication, and Geology Extension.

KGS staff participating in the 2009 Field Conference include the following:

Bill Harrison, Director and State Geologist
Rex Buchanan, Deputy Director, Outreach and Public Service
Cathy Evans, Writer/Editor, Public Outreach
Shane Lyle, Senior Research Assistant, Geology Extension
Bob Sawin, Senior Research Associate, Public Outreach

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Kansas Department of Transportation

The Kansas Department of Transportation (KDOT) was founded in 1917. It is charged with providing a statewide transportation system to meet the needs of Kansans. Its primary activities are road and bridge maintenance; transportation planning, data collection, and evaluation; project scoping, designing, and letting; contract compliance inspection of material and labor; Federal program funding administration; and administrative support. In addition to dealing with roadways for automobile traffic, KDOT is responsible for other modes of transportation, including aviation, rail, and bicycles/pedestrians. The Department has more than 3,000 employees. KDOT's headquarters are in Topeka with six district offices, 26 area offices, and 112 sub-area offices across the state. KDOT is responsible for maintenance of about 9,600 miles of State highway.

The agency is organized into divisions of public affairs, administration, aviation, engineering and design, operations, and planning and development. Within the Division of Operations is the Bureau of Materials and Research. This Bureau is responsible for approved materials, pavement management, testing, and research. Within that Bureau is a geotechnical unit that includes a geology section. That section supplies information and recommendations regarding surface and foundation geology, hydrology, and bridge-deck conditions to the Bureau of Design for project-plan preparation; conducts special surveys on selected subjects such as soil shrinkage, rock expansion, and pile-foundation requirements; and constructs new water wells in rest areas and rehabilitates and maintains existing wells for all KDOT facilities. Robert Henthorne is the chief geologist within the unit.

Because the State's ten-year Comprehensive Transportation Program ended in 2009, Governor Kathleen Sebelius created a task force to examine transportation in Kansas and develop recommendations. That 35-member task force made recommendations that were aimed at keeping roads and bridge safe and in good repair, developing new business models, and working within today's current fiscal realities. In early 2009, Kansas received about $378 million from the American Recovery and Reinvestment Act of 2009, or so-called stimulus funding. Five State highway projects were targeted for use of that money, including improvements to US–69 in Overland Park, I–135 and 47th Street in Wichita, K–23 in Gove County, K–61 in McPherson County, and K–18 between Ogden and Manhattan. In

addition, some money will go to local jurisdictions and public transportation. The current Secretary of the Kansas Department of Transportation is Deb Miller, the first female director in the agency's history.

Kansas Department of Transportation
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785–296–3566
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Source: 2008 Annual Report, Kansas Department of Transportation.

Kansas Department of Wildlife and Parks

The Kansas Department of Wildlife and Parks is responsible for management of the state's living natural resources. Its mission is to conserve and enhance Kansas' natural heritage, its wildlife, and its habitats. The Department works to assure future generations the benefits of the state's diverse living resources; to provide the public with opportunities for the use and appreciation of the natural resources of Kansas, consistent with the conservation of those resources; and to inform the public of the status of the natural resources of Kansas to promote understanding and gain assistance in achieving this mission.

The Department's responsibility includes protecting and conserving fish and wildlife and their associated habitats while providing for the wise use of these resources, and providing associated recreational opportunities. The Department is also responsible for providing public outdoor-recreation opportunities through the system of State parks, State fishing lakes, wildlife-management areas, and recreational boating on all public waters of the state.

In 1987, two State agencies, the Kansas Fish and Game Commission and the Kansas Park and Resources Authority, were combined into a single, cabinet-level agency operated under separate comprehensive planning systems. The Department operates from offices in Pratt, Topeka, five regional offices, and a number of State park and wildlife area offices.

A cabinet-level agency, the Department of Wildlife and Parks is administered by a Secretary of Wildlife and Parks and is advised by a seven-member Wildlife and Parks Commission. All positions are appointed by the Governor with the Commissioners serving staggered four-year terms. As a regulatory body for the Department, the Commission is a nonpartisan board, made up of no more than four members of any one political party, advising the Secretary on planning and policy issues regarding administration of the Department. Regulations approved by the Commission are adopted and administered by the Secretary. Mike Hayden is the Secretary of Wildlife and Parks.

Kansas Department of Wildlife and Parks
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Kansas Water Office

The mission of the Kansas Water Office (KWO) is to provide the leadership to ensure that water policies and programs address the needs of all Kansans. The KWO evaluates and develops public policies, coordinating the water-resource operations of agencies at all levels of government. The KWO administers the Kansas Water Plan Storage Act, the Kansas Weather Modification Act, and the Water Assurance Act. It also reviews plans of any State or local agency for the management of water and related land resources in the state. The KWO advises the Governor on drought conditions and coordinates the Governor's drought-response team. The Drought Monitoring Program collects climate data from a variety of sources, monitors drought activities, and publishes a weekly Drought Report during periods of drought.

The KWO develops the Kansas Water Plan, which is revised periodically and addresses the management, conservation, and development of water resources in the state. Numerous water-related public and private entities, as well as the general public, are involved in its preparation and planning. The Water Plan is approved by the Kansas Water Authority, a 13-member board whose members are appointed, along with 11 nonvoting *ex officio* members who represent various State water-

related agencies. Besides approving the Water Plan, the Authority approves water-storage sales, Federal contracts, administrative regulations, and legislation proposed by the KWO. Much of the input for the Water Plan comes from 12 Basin Advisory committees that are composed of volunteer members from each of the state's drainage basins. During this year's Field Conference, we will be in the Upper Arkansas and Cimarron basins.

Current programs and projects at the KWO include

- Public water-supply system GIS mapping assistance
- The Upper Arkansas River Conservation Reserve Enhancement Program
- Reservoir sustainability, which is studying issues related to sedimentation in the state's reservoirs
- Water planning
- Water conservation
- Water assurance
- Drought monitoring
- Water marketing
- Weather modification

Tracy Streeter is the Director of the KWO.

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Schedule and Itinerary

Wednesday, June 3, 2009

6:00 a.m.	Breakfast at the Dodge House Hotel & Convention Center, Dodge City
7:15 a.m.	Conference Overview *Bill Harrison*, Director, Kansas Geological Survey
8:00 a.m.	**Bus leaves La Quinta Inn & Suites for Site 1**
8:10 a.m.	**SITE 1** • US–400 Southwest Dodge City Bypass, Dodge City *Deb Miller*, Secretary, Department of Transportation *Jerry Younger*, Asst. Secretary, Department of Transportation *Larry Thompson*, District Engineer, Department of Transportation
9:45 a.m.	Bus to Site 2
10:00 a.m.	**SITE 2** • Dodge City Wastewater Treatment Plant, Dodge City *Joseph E. Finley*, P.E., Director of Engineering Services, City of Dodge City
11:00 a.m.	Bus to Lunch
11:45 a.m.	Lunch at Clark County State Lake
12:45 p.m.	Bus to Site 3
1:15 p.m.	**SITE 3** • Ashland Research Site, Ashland *Jim Butler*, Senior Scientist, Kansas Geological Survey
2:00 pm	Bus to Site 4
3:00 pm	**SITE 4** • Kansas Climate, Meade State Park *Mary Knapp*, State Climatologist, K-State Research and Extension
4:00 pm	Bus to motel
4:45 pm	Arrive at Holiday Inn Express, Liberal
6:00 pm	Dinner at Vargas Restaurant adjacent to Holiday Inn Express
7:30 pm	Evening Presentation—Data Access Service Center (DASC), Liberal *Ken Nelson*, GIS Section Manager, Kansas Geological Survey/DASC Manager
8:05 pm	Return to Holiday Inn Express, Liberal

US–400 Southwest Dodge City Bypass

The Southwest Dodge City Bypass, a vital connecting link between US–56 and US–50/ US–400, is located approximately 3 miles west of Dodge City (fig. 1). A project to improve the bypass includes construction of a two-lane roadway on a four-lane right-of-way with access control, four bridges, and 15 surface-drainage structures. Due to design complexities and the large-scale use of many natural resources, the successful completion of a transportation project such as this requires the coordination of many Kansas Department of Transportation (KDOT) bureaus.

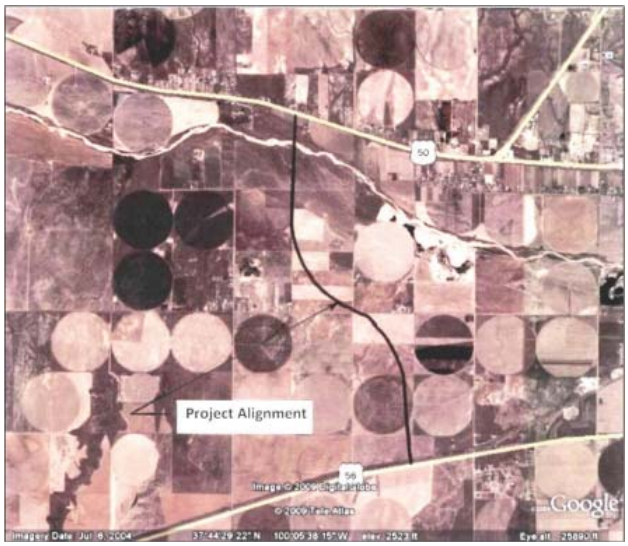

Figure 1. Aerial view of the project area.

Geology of the Project

The bypass project begins on the northern edge of the Arkansas River bluff and extends into the floodplain for approximately 3 miles. The soil mantle at the project is composed of topsoil, alluvium, and loess. The topsoil is silty clay with a very weak accumulation of organic material. It is characteristically a brown to dark-brown color. The loess deposits were derived from windblown sediments from the ancient Arkansas River and are composed almost entirely of silt-sized particles. Due to the interlocking nature of the silt particles, loess is most stable when cut on a vertical slope. When loess is left on a less steep slope, the material is severely erodible. Unconsolidated materials that were deposited by the Arkansas River comprise the alluvium. The source of the alluvial materials is generated from the erosion of the Rocky Mountains. The alluvium consists of sand- to cobble-sized particles of granites, basalts, gabbros, granitic pegmatites, and a host of other rocks. The thickness of the soil mantle ranges from 0 to 80 feet thick.

Bedrock underlying the project is the Ogallala Formation. This formation is very similar to the alluvial material and is also composed of sediments derived from the Rocky Mountains. The main distinguishing characteristic is the presence of sporadic cementation. The cementing agents are either calcium carbonate or silica. Within the silica-cemented portions, opals can be found. These are not the "fiery" gem form but some do have a whitish-red to blue hue.

Project Items

Roadway and Paving Construction—This project will require 2.87 miles of new roadway, which is primarily constructed upon engineered fills (fig. 2). Only a minor portion of the northernmost ramps requires the excavation of the Ogallala Formation.

Figure 2. Roadway and drainage construction south of Marshall Road.

Construction of the roadway will require the excavation of 288,097 cubic yards of common excavation (mainly soil) and 31,767 cubic yards of rock excavation (the cemented portion of the Ogallala). The construction contractor will also

provide an additional 624,616 cubic yards of borrow material for engineered fill. This amount of soil and rock would fill a football field from sideline to sideline and end zone to end zone 787 feet deep!

This is the first project for KDOT that allowed alternative bids for the type of pavement to be used. The bid alternatives were either 10-inch-thick concrete pavement with 8-inch-thick concrete shoulders or 13-inch-thick hot-mix asphalt pavement with 8-inch-thick asphalt shoulders. The lowest bid on the project was for the hot-mix asphalt alternative. The asphalt will require approximately 31,000 tons of coarse aggregate that will be shipped from Lamar, Colorado, a distance of 154 miles.

Bridge Construction—The four new bridges on this project are on US–400 over US–50, US–400 over the Arkansas River, Marshall Road over US–400, and US–400 over US–56. These bridges will be a total of 0.44 miles in length with the longest being the 1,603-foot bridge over the Arkansas River (fig. 3). These structures will require 10.5 miles of driven piling for the foundations and 760 tons of steel for the columns and decks.

Figure 3. Looking southeast from US–50 at the New Arkansas River bridge.

Conclusions

By KDOT construction standards, this is a relatively small project, being only 3.31 miles long with four bridges. However, the material and products required to construct even a small transportation project is still remarkable. Regardless of size, the coordination of KDOT's Bureaus of Planning and Development, Traffic Engineering; Design, Materials and Research; and Construction and Maintenance is imperative for the successful completion of all transportation projects.

Resource Contact

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Dodge City Wastewater Treatment Plant

The City of Dodge City (Dodge City) treats approximately 3.0 million gallons of residential wastewater and 3.2 million gallons of industrial wastewater each day. In 2008, 2.1 billion gallons of wastewater (6,467 acre feet) was treated. To offset increasing regional water demand, some of this water is reclaimed and used for municipal and agricultural irrigation projects.

The City's original wastewater treatment plant was built in the mid-1980s and operated by Dodge City. Since 1988, OMI, Inc., a private contractor, has operated the plant for Dodge City. This relieves the city of the burden of the waste-treatment operation and makes available, if needed, experts in the wastewater-treatment industry.

The original plant consisted of two anaerobic lagoons (where biological processes take place), two aerobic lagoons (where air is reintroduced to the water), two facultative lagoons (where water is stored for later use), and several pump stations (fig. 1).

In the early 1990s the aerobic lagoons were covered to trap off-gas generated by the biological degradation processes and to reduce the fugitive odors escaping the plant. A gas-handling building was added so that the collected gas could be flared.

In 2003, the plant was modified to meet the demands of industrial wastewater from the National Beef Packing facility and to provide additional capacity for the city. Added were a third anaerobic lagoon, another aerobic lagoon, two more facultative lagoons, an additional pump station, and a gas-handling building.

The plant can now receive between 6.8–7.2 million gallons per day or 7,617 acre feet of water. The anaerobic lagoons cover approximately 2.5 surface acres and are 30 feet deep. Effluent in these lagoons has about a 14-day residence time. The aerobic lagoons cover approximately 1 surface acre, are 20 feet deep, and have a 16-day residence time. The facultative lagoons are approximately 45 surface

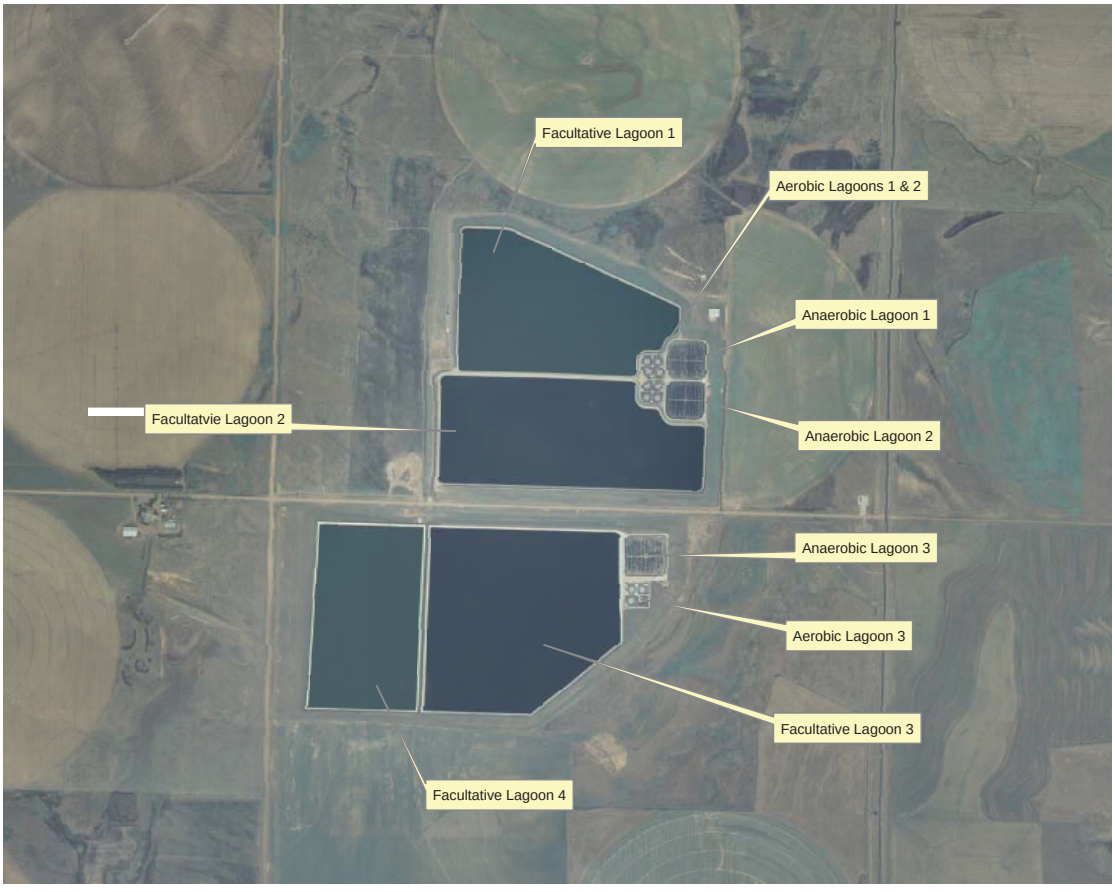

Figure 1. Aerial photo of Dodge City wastewater-treatment plant.

acres in area and 17 feet deep and have a 137-day total storage capacity for approximately 1.0 billion gallons of wastewater (3,112 acre feet).

Water from this treatment plant is used to irrigate 25 pivot circles (3,000 acres) of adjacent farm ground. The treated effluent is used to irrigate a mixture of corn and alfalfa (fig. 2).

Resource Contact

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Figure 2. Pivot-circle irrigation areas of farmland adjacent to Dodge City wastewater-treatment plant.

Ashland Research Site

The Ashland Research Site (ARS) is located in an area of salt cedar infestation along the Cimarron River in Clark County (fig. 1).

Work at the ARS is a component of the Phreatophyte Research Project jointly led by the Kansas Geological Survey and Kansas State University. Phreatophytes are plants that send their roots down to the water table and depend on ground water, either wholly or partially, for their water supply. The Phreatophyte Research Project was created to help evaluate evapotranspiration by invasive phreatophyte plant species, such as salt cedar (*Tamarisk* spp.) and Russian olive (*Elaeagnus angustifolia*) (fig. 2), in relation to other potential consumptive water uses, such as ground-water pumping for irrigation as well as surface-water evaporation from sand and gravel pits. Consumption of ground water by invasive phreatophytes in riparian corridors is thought to be one factor responsible for streamflow reductions in the Cimarron basin and elsewhere in western Kansas.

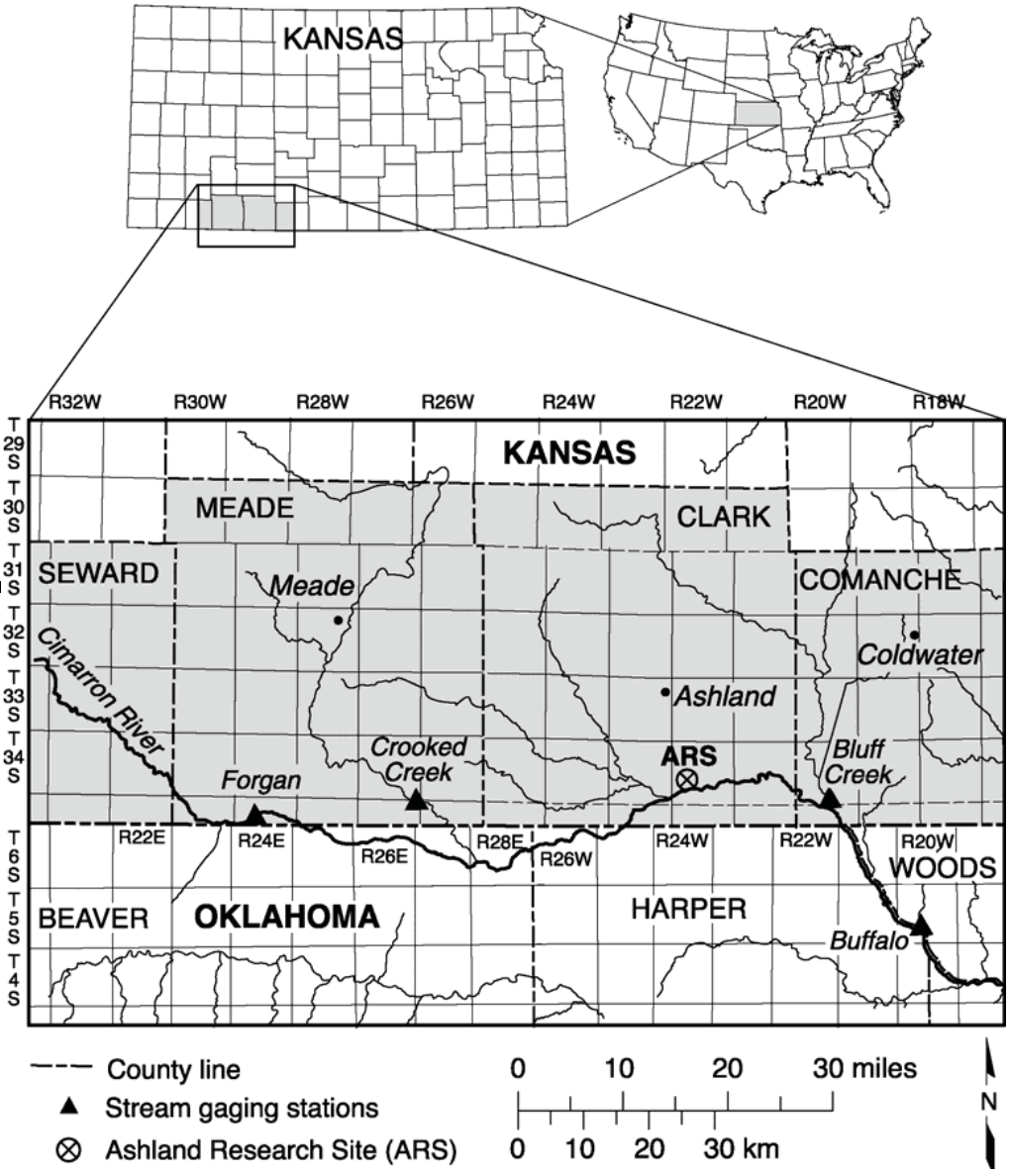

Figure 1. Location map of the Ashland Research Site (ARS) south of Ashland along the Cimarron River in Clark County (after Butler et al., 2008).

Figure 2. Like many riparian corridors in the western U.S., the vegetation along the Cimarron River in southwestern Kansas has become dominated by salt cedar (left) and Russian olive (right) (after Shea et al., 2005).

This research project may also aid the development of effective public policy with regard to long-term management of invasive phreatophytes and the reestablishment of native vegetation. Salt cedar, in particular, is very difficult and expensive to control once established.

Phreatophyte research at ARS was designed to supplement an existing Kansas Alliance of Wetlands and Streams (KAWS) project, which evaluated different salt cedar control measures. The primary objective of the ARS phreatophyte research was to develop methods for quantifying ground-water savings that might be gained by eradicating invasive phreatophytes, such as salt cedar. Funding for the Phreatophyte Research Project was provided by the Kansas Geological Survey, the Kansas Water Plan through the Kansas Water Office, and the Kansas Water Resources Institute.

Salt Cedar

Salt cedar is native to Eurasia and was introduced into the United States in the early 1800s for ornamental and bank-stablization purposes. A deciduous shrub or small tree that grows from 5 to 30 feet tall, salt cedar has a slender, branched trunk; small, gray-green, scale-like leaves; clustered pink to white five-petal flowers; and tiny reddish-brown seeds. Salt cedar is not a preferred forage crop by either livestock or wildlife.

The ecology of salt cedar makes this plant more costly and complex to control than typical herbaceous weeds. Salt cedar can spread both by seed and vegetative regrowth. A single salt cedar can produce as many as 500,000 seeds that remain viable for up to one year. The plant can regenerate and produce new shoots after top growth has been removed.

Salt cedar is an invasive phreatophyte, and extensive phreatophyte-control programs in Kansas and elsewhere could be potential sources of surface- and ground-water savings. Prior to initiating such programs, however, it is important to understand the water savings that will be achieved through these programs. That is a major focus of work at the ARS.

Research at the ARS

The ARS is located in an area of salt cedar infestation along the north bank of the Cimarron River at the Arnold Ranch. The ranch has been owned and operated by the Arnold family since the late 1880s. According to the Arnold family, salt cedar was first noted on the ranch after the flood of 1939. Salt cedar sprouted on the wet sand deposited by the flood, and its distribution has changed little since then.

The ARS is composed of four experimental plots that are used to evaluate three different salt cedar control techniques (fig. 3). Salt cedars have been cut and chemically treated in Plot 2, repeatedly cut in Plot 3, and have been cut and will eventually be burned in Plot 4. Plot 1 is a control area that remains unaltered during the life of the project.

Two monitoring wells were installed in Plot 1, Plot 2, and Plot 3 (six total) to monitor ground-water levels in the alluvial aquifer near the Cimarron River. No monitoring wells were installed in Plot 4 due to the potential for well damage by the burn applications. Submersible pressure transducers were installed in the six wells to record water-table position every 15 minutes. A neutron-probe access tube was emplaced next to each well to estimate the water content and specific yield in the unsaturated soil above the water table. A weather station was installed in Plot 3 to record ambient weather data and to calculate how conducive conditions are for evapotranspiration. Water-level data collection began in mid-August 2004 and has continued to present.

Evapotranspiration (ET) is a component of the water cycle and is generally defined as water transferred to the atmosphere as vapor (water's gaseous form) either through direct evaporation of water from the surface or shallow subsurface, or through transpiration by plants. It is difficult to separate ET into evaporation and transpiration, so it is typically considered as a single component in a water budget.

The initial water-level data collected in late summer through early fall of 2004 clearly indicate that the water table at the ARS responds to the location and relative health of the salt cedar plant

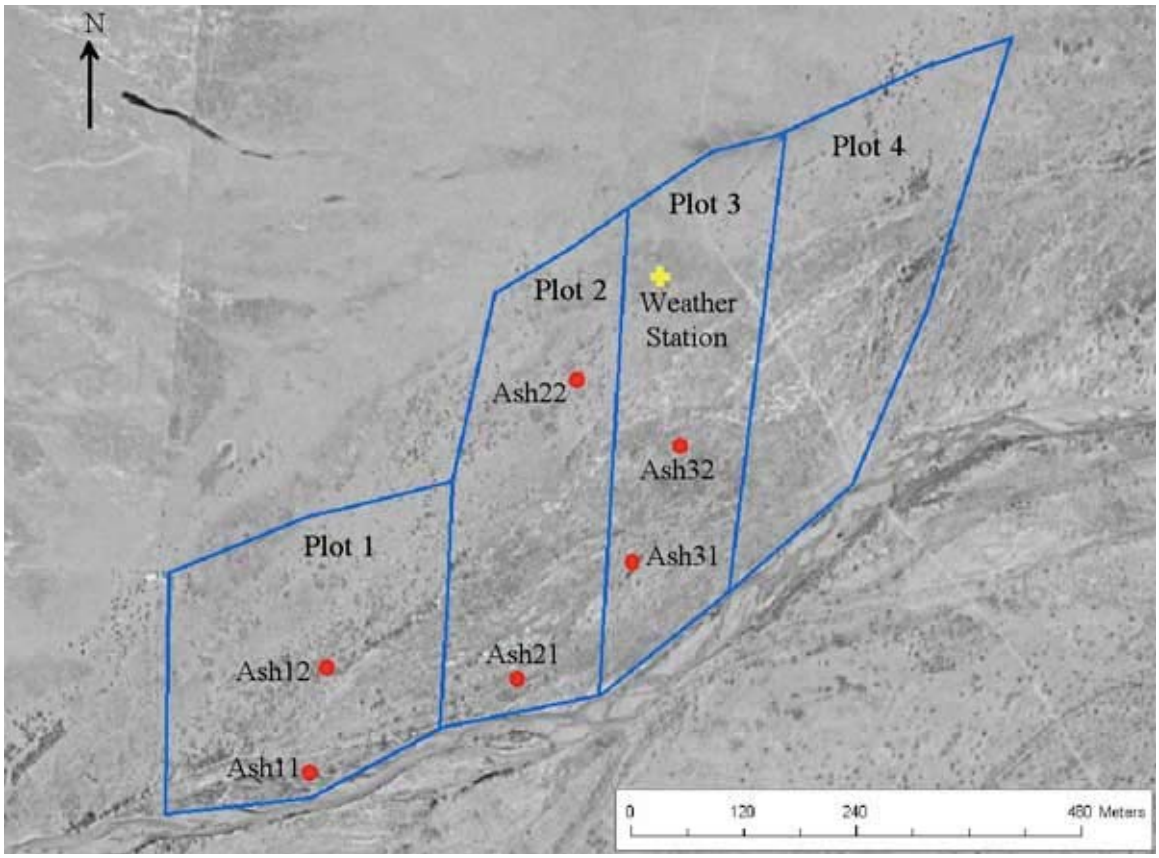

Figure 3. Aerial photo of Ashland Research Site with location of the experimental plots, monitoring wells, and weather station (after Butler et al., 2005).

community during its growing season. The water-level data display a distinctive pattern of daily fluctuations similar to daily water uptake by plants and indicate the potential of using water-table fluctuations as a tool to quantify potential ground-water savings achieved by salt-cedar eradication (fig. 4).

After the plant water-uptake cycles were established, salt cedar control activities began in March 2005. To gauge the salt cedar's effect on the aquifer, circular vegetation stands ranging from 70 to 100 feet in radius were left around the monitoring wells after the first cutting. Over the next four months, the radii of these circles were steadily reduced from approximately 70–100 feet to 45 feet, then to 20 feet, and finally just a single tree was left standing at each location.

Results

Comparing soil properties and water uptake of the uncut control site and the clear-cut test sites allows estimation of differences in relative water loss among the test sites. The relative ground-water savings gained from salt cedar eradication were estimated by a method specifically developed for this project by the KGS/KSU research team. One month after clear cutting, the relative ground-water consumption was reduced to approximately 40% of pre-cutting use. Ten months later, the aggregate water reduction was approximately 17%, indicating that initial net gains had declined over time. Twenty-four months later, ground-water consumption in the clear-cut plots had effectively returned to their pre-cut baseline, indicating that the gains achieved by salt cedar eradication were not maintained through time.

The cause of the progressive increase in ground-water consumption after clear cutting may be due to transpiration by increased native plant growth and salt-cedar regrowth. Additionally, solar and wind-driven surface evaporation may have increased because the soil was no longer shaded and protected by stands of salt cedar. Further work is needed to assess the impact of native plant growth, surface evaporation, and salt cedar regrowth.

Because of the lack of a long-term decrease in ground-water consumption after salt cedar eradication, the results of this study demonstrate that phreatophyte eradication programs completed solely for ground-water conservation should be carefully considered. Long-term monitoring is critical for assessing the actual hydrologic impact and ultimate net ground-water savings, if any, achieved by large-scale eradication programs.

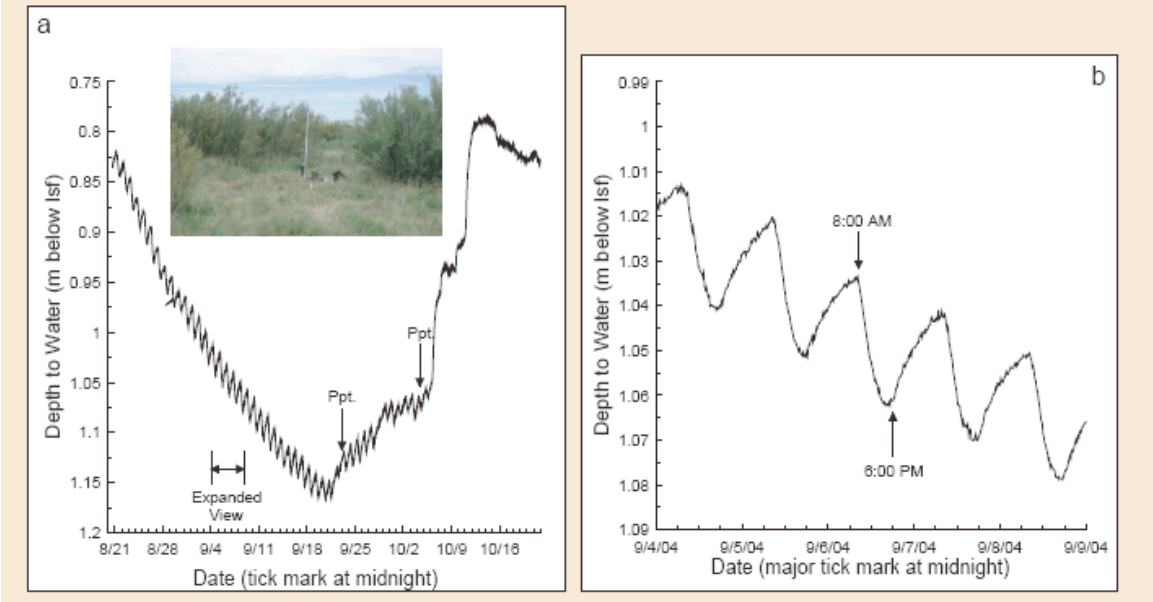

Figure 4. Depth to water at well Ash22 in late summer and early fall of 2004. a) Rises in the water table after 9/21 are primarily due to rises in the Cimarron River stage due to decreases in upstream irrigation and plant uptake and by increases in precipitation. b) Expanded view of a five-day period that shows the distinctive pattern of water-level fluctuations, which are produced by daily plant transpiration cycles and are a diagnostic indicator of ground-water use by phreatophytes (after Butler et al., 2005; Butler et al., 2007).

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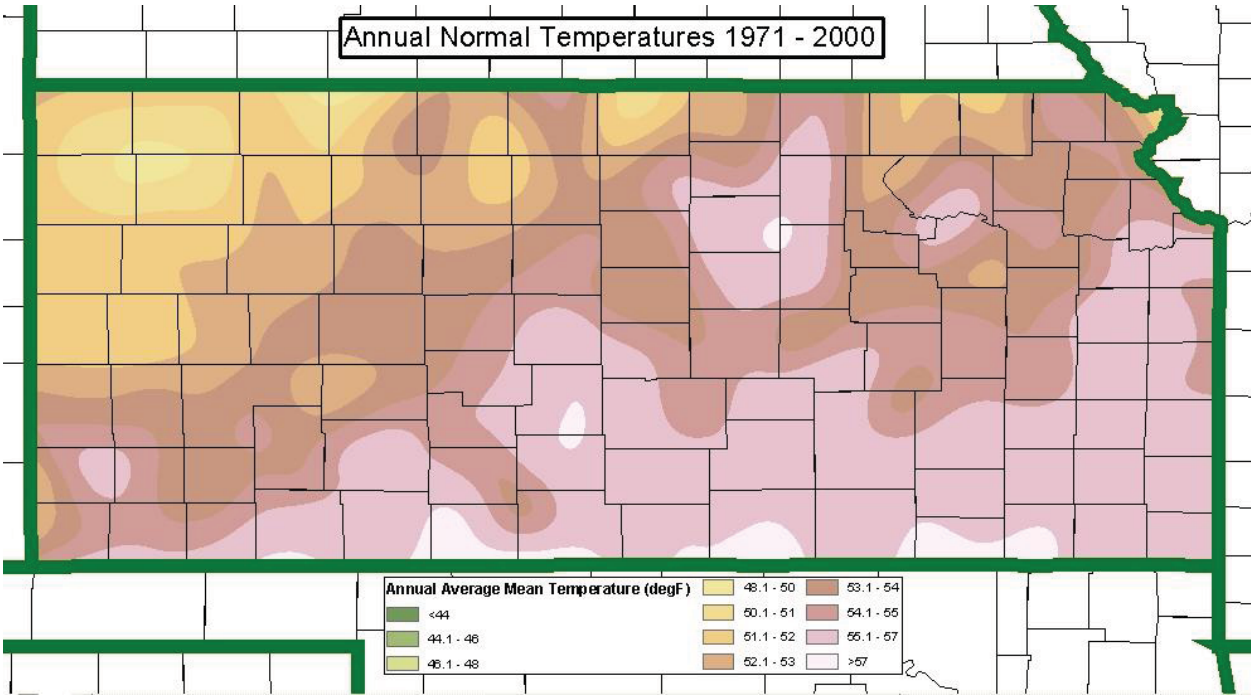
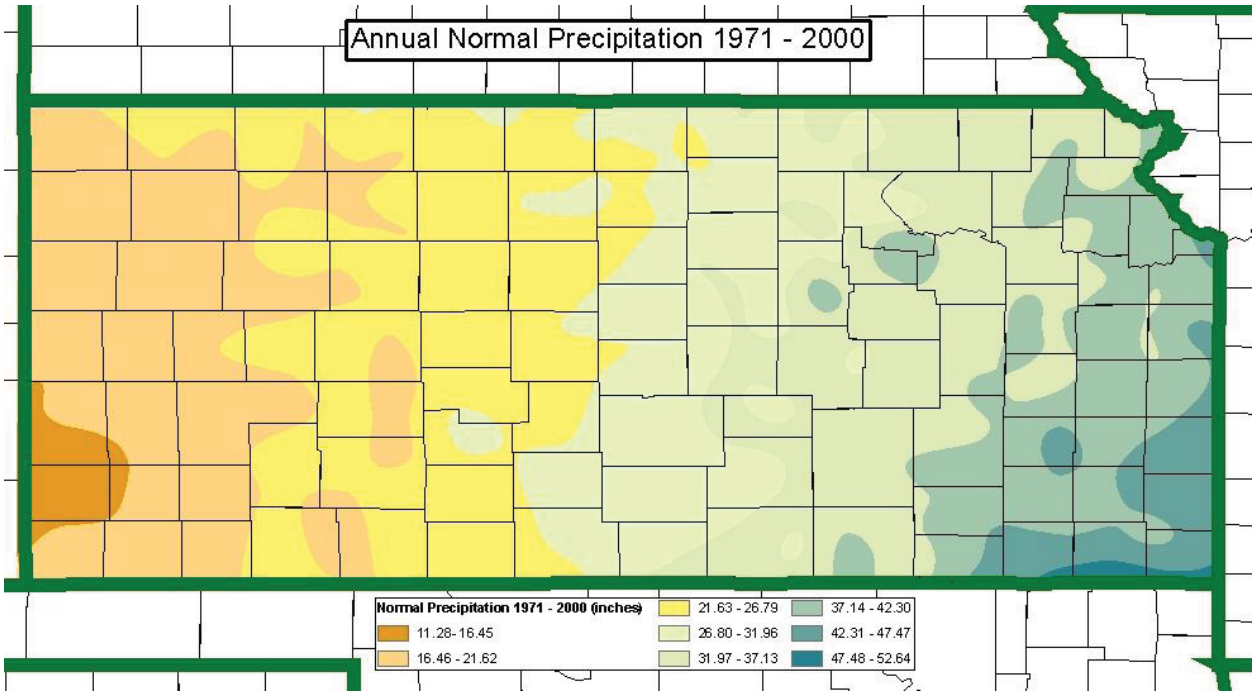
Kansas Climate

Climate changes and anomalies in Kansas over the past century are well documented. Between 1900 and 2000, the overall average temperature (fig. 1) and precipitation (fig. 2) in Kansas increased—2.1° F and 0.1 inches in the winter and 0.3° F and 0.8 inches in the summer—according to NOAA records. In a state with extreme seasonal conditions, all-time high and low temperatures range from 121° (Fredonia and



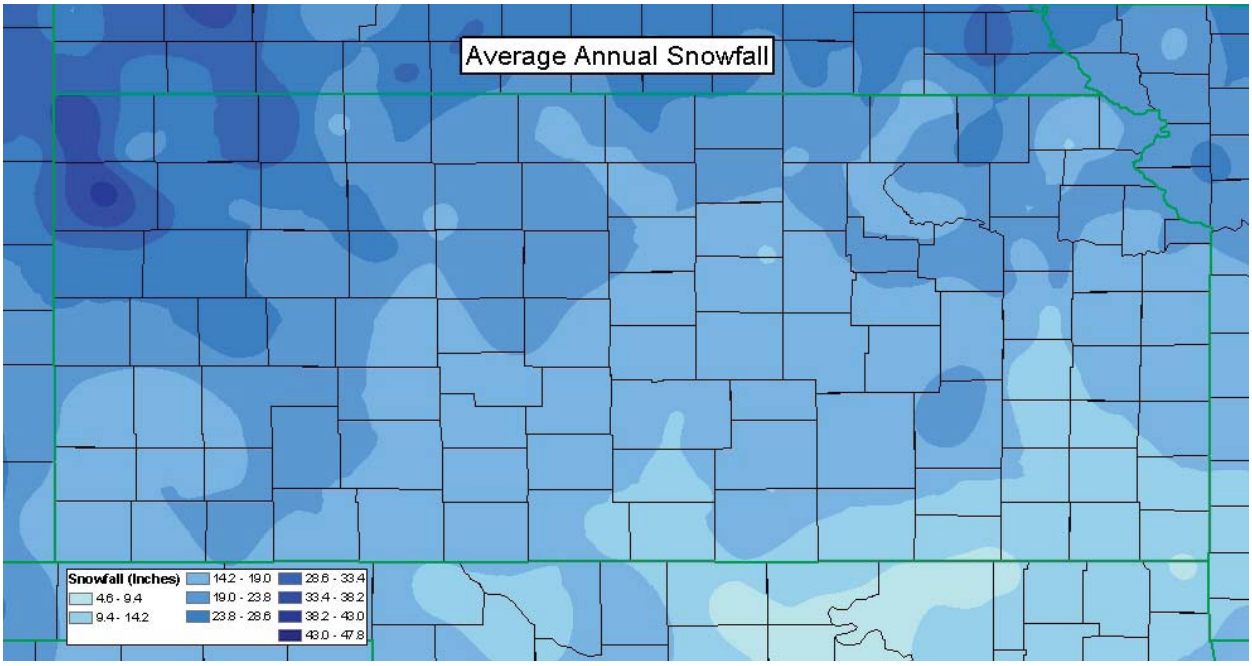
Courtesy Weather Data Library

Figure 1. Average annual normal temperatures 1971–2000 for Kansas.



Courtesy Weather Data Library

Figure 2. Average annual normal precipitation for 1971–2000 for Kansas.



Courtesy Weather Data Library

Figure 3. Average annual snowfall for Kansas.

Alton, July 1936) to -40° (Lebanon, February 1905). Annual precipitation records range from 71.99 inches (Hiawatha, 1973) to 4.77 (Johnson, 1956). A record 102 inches of snow fell in Goodland in the winter of 1979–1980 (fig. 3), and the state's largest known hailstone, weighing 1.67 pounds with a 5.7-inch diameter, was found near Coffeyville in September 1970. In 2008 a record 187 tornadoes were spotted in Kansas, far above the average of 59.

What will happen in the 21st century is the subject of much debate. Most climate models, such as the Canadian and Hadley models, predict a continued increase in temperature and variation in precipitation through the century—up in eastern Kansas and down in western—although they disagree on the degree of change. Simulations by the Intergovernmental Panel on Climate Change (IPCC), a scientific intergovernmental body set up by the World Meteorological Organization and the United Nations Environment Program, show global warming could cause damaging societal and ecological changes. Regional IPCC models of the Great Plains states indicate Kansas could face decreases in growing seasons, fluctuations or drops in crop yields, stress on livestock production, and increased frequency and duration of heat. Model results do vary. But if global warming progresses, as the models generally predict it will, the state's ecological system, human health, and the economy may be affected.

In March 2008 the Kansas Energy and Environmental Policy Advisory Group (KEEP) was established by the governor to identify ways to respond to the challenge of global climate change, to make the state more energy efficient and energy independent, and to spur economic growth. The Advisory Group members represent a broad base of industry, utilities, State and local governments, environmental interest groups, and academia.

The Kansas State climatologist provides organizations, such as KEEP, and the public with up-to-date information on Kansas weather and climate trends. Based at the K-State Research and Extension office in Manhattan, the Weather Data Library supplies forecasts and daily weather summaries and NEXRAD Radar as well as current data and maps on temperature, precipitation, soil droughts, freeze and frost-free dates, and fire weather information. The climatologist also provides a weekly series of short programs on weather phenomena and recent meteorological events in Kansas on the K-State Radio Network (http://www.oznet.ksu.edu/news). K-State Research and Extension is a partnership between Kansas State University and Federal, State, and county government, with offices in every Kansas county.

Sources

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National Weather Service, Kansas Weather Forecast Office, Wichita, Kansas web site, http://www.crh.noaa.gov/ict/?n=ksrecords (verified May 2009).

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Schedule and Itinerary

Thursday, June 4, 2009

6:00 a.m.	Breakfast at Vargas Restaurant adjacent to Holiday Inn Express
7:30 a.m.	**Bus leaves Holiday Inn Express to Site 5**
8:00 a.m.	**SITE 5 •** Water Rights Impairment, Stevens County *David Barfield*, Chief Engineer, Kansas Department of Agriculture, Division of Water Resources *Mark Rude*, Executive Director, GMD 3
8:45 a.m.	Bus to Site 6
	Bus Session • IGUCA *David Barfield*, Chief Engineer, Kansas Department of Agriculture – Division of Water Resources *Burke Griggs*, Counsel, Kansas Department of Agriculture – Division of Water Resources
9:00 a.m.	**SITE 6 •** Abengoa Bioenergy Hybrid Refinery, Hugoton *Tom Robb*, Abengoa Bioenergy *Steve Morris*, State Senator, District 39, Hugoton; Senate President
10:15 a.m.	Bus to Lunch at Morton County Historical Society Museum
11:00 a.m.	Lunch at Morton County Historical Society Museum
12:00 p.m.	Bus to Site 7
12:15 p.m.	**SITE 7 •** Cimarron National Grassland, Point of Rocks *Joe Hartman*, District Ranger, U.S. Department of Agriculture, U.S. Forest Service *Bob Sawin*, Kansas Geological Survey
1:00 p.m.	Bus to Site 8
	Bus Session • Lesser Prairie-Chickens *Randy Rogers*, Kansas Department of Wildlife and Parks
1:45 p.m.	**SITE 8 •** Winger Archeological Site / Playas in Kansas and the Great Plains *Rolfe Mandel*, Kansas Geological Survey
3:15 p.m.	Bus to Site 9
	Bus Session • Kansas–Colorado Arkansas River Compact *David Barfield*, Chief Engineer, Kansas Department of Agriculture, Division of Water Resources

4:00 pm	**SITE 9 •** Conservation Reserve Enhancement Program (CREP), Kearny County *Steve Frost*, State Conservation Commission
4:15 pm	Bus to Site 10
5:00 pm	**SITE 10 •** Western Water Conservation Projects Fund, Lakin *Randy Hayzlett*, Chairman, Arkansas River Litigation Fund Advisory Committee, WWCPF *Mark Rude*, Executive Director, GMD 3
5:30 pm	Bus to Motel
6:00 pm	Arrive at Clarion Inn, Garden City
7:00 pm	Bus to Dinner
8:30 pm	Return to Clarion Inn, Garden City

Water Rights Impairment

This stop examines the regulatory and geologic issues associated with a water rights impairment claim in Stevens County.

Merriam-Webster's provides a single definition of the word "impairment": "to damage or make worse by or as if by diminishing in some material respect." It lists the word "injure" as a synonym.

The Kansas Water Appropriation Act and regulations do not contain a formal definition of the word "impairment," but variations on the word "impair" or "impairment" appear 15 times in the Act and 53 times in the regulations. Curiously, the main statutory authority for the Chief Engineer to administer water rights to address impairment, K.S.A. 82a–706b, does not use the word "impair" or "impairment" at all. Rather, the statute phrases it in terms of unlawful diversion and preventing water from moving to a person having a prior right to its use.

Based on the water appropriation statutory and regulatory context, some general conclusions can be drawn about the nature of impairment:

- Impairment usually refers to a condition caused when water diverted under one or more junior (newer) water rights reduces the quantity or quality of water available to one or more senior (older) water rights such that the senior water right(s) cannot be satisfied.
- New water rights are prohibited from causing the following at an existing water right point of diversion: unreasonable raising or lowering of the static water level or unreasonable increase or decrease of streamflow or unreasonable deterioration of water quality beyond a reasonable economic limit. "Unreasonable" and "reasonable" are not defined or quantified, and may vary under different circumstances.
- Changes to a water right's point of diversion, place of use, or use made of water are prohibited from impairing existing water rights, even if the changed water right is senior to the water right that would be impaired.

The statutes and regulations outline a procedure for dealing with impairment:

1. Complainant files a written complaint.
2. Chief Engineer investigates the complaint.
3. Chief Engineer issues a report.
4. Complainant has option to file a request to secure water.
5. If request to secure water is filed and justified, Chief Engineer administers other water rights as necessary to provide water to the senior water right.
6. Chief Engineer ceases administration when the impairment condition is no longer occurring.

Over the last year, the Kansas Department of Agriculture–Division of Water Resources (DWR) and stakeholders have considered ways to increase due process associated with impairment claims, especially in the ground-water setting. Draft regulatory amendments have been prepared that would effect the following provisions:

- Opportunities for groundwater management districts to comment and provide assistance on impairment investigations within their districts.
- Requirements for complainants with nondomestic water rights to provide information showing that their pump system and well are adequate.
- Cost recovery up to a certain limit from nondomestic complainants whose impairment claims are determined to be unfounded.

As of April 2009, when this summary was written for the KGS Field Conference, these regulatory amendments were pending review by the Attorney General's office.

Stevens County Impairment

The above mentioned regulatory amendments stemmed in large measure from a particular impairment claim in Stevens County, resulting from interference between irrigation wells owned by Matt Mills and Jim Gooch. (Other nearby wells owned

by Doug Mills were also found to be causing some interference but because his water rights are senior to Mr. Gooch's second water right, and because Mr. Gooch's senior water right was exhausted prior to the point of administration, Doug Mills' water rights were not administered in 2008.)

During the summer of 2008, the Chief Engineer directed Matt Mills to cease pumping for about nine days in August due to significant reductions in Mr. Gooch's ability to satisfy his water right. This occurred after Matt Mills had already pumped 86.2% of his authorized quantity. By the end of the 2008 irrigation season, Matt Mills had pumped 90.4% (226 AF) of his authorized quantity (250 AF). Mr. Gooch pumped 92.7% (419 AF) of his authorized quantity (452 AF) in 2008.

Some stakeholders expressed various concerns about this water right administration:

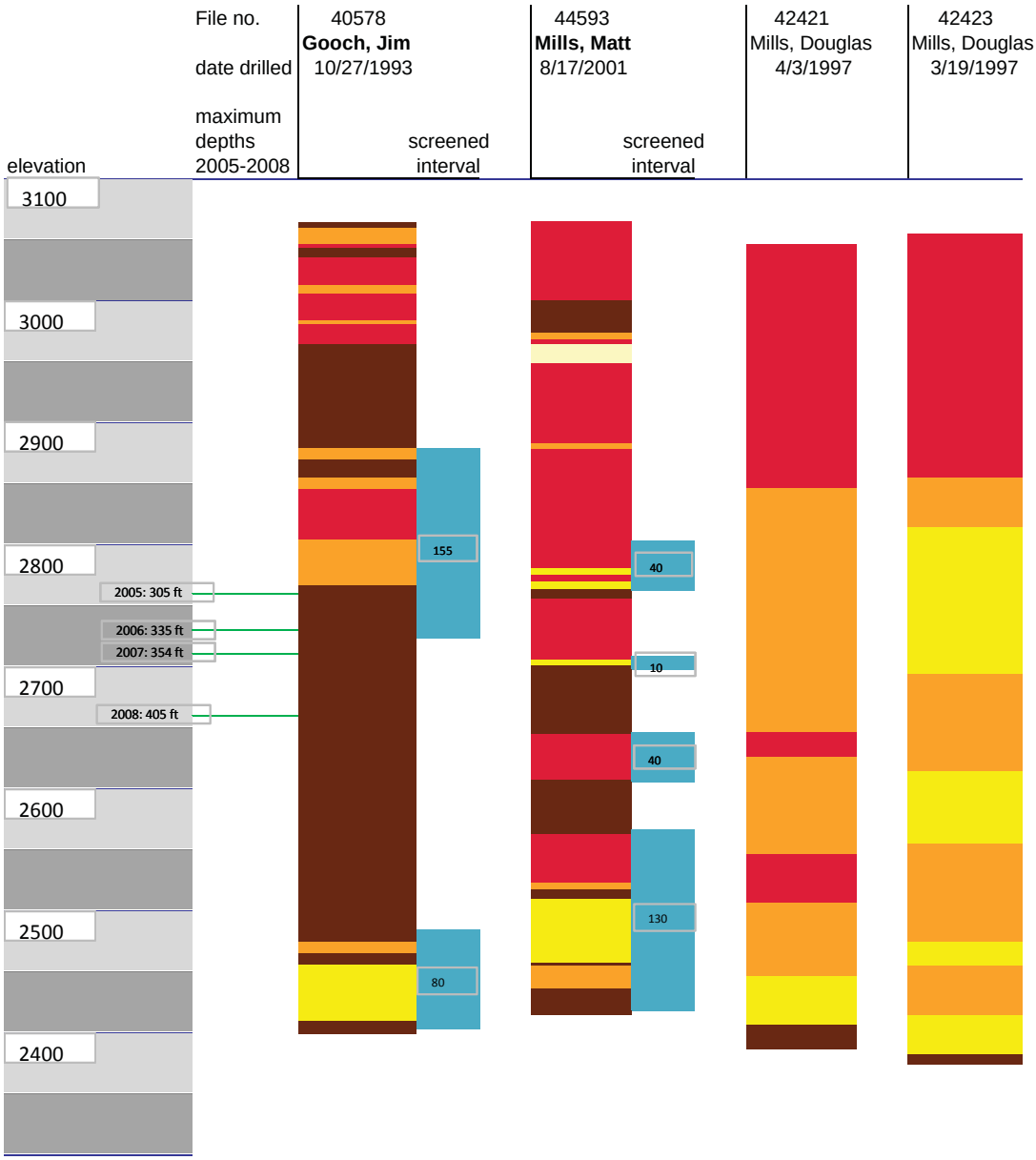
- It is a dispute between neighbors and should not involve the State.
- The State should not administer water rights based on rate reductions.
- Many other irrigators deal with rate reductions—either by adjusting their practices or revving up their engines.
- The motor of Mr. Gooch's pump system is not powerful enough.
- This impairment claim could have a cascading effect and spread throughout the region.
- The State should not curtail irrigation for a corn crop (Matt Mills' crop) to supply water to a field of forage grass (Mr. Gooch's crop).

The Chief Engineer's actions were based on factual data from the investigation:

- Pressure transducers and rate loggers installed in Mr. Gooch's production well, an observation well on his property, and in Matt Mills' well showed that there was a significant and fairly immediate reduction in water availability at Mr. Gooch's well when Matt Mills exercised his water right.
- This reduction became acute in late summer, when Mr. Gooch's crops urgently needed watering.
- Well logs (fig. 1) show that the two production wells share a relatively thin productive zone near the bottom of each well.
- The well logs show that the aquifer is less productive at Mr. Gooch's well than at Matt Mills' well.
- The Kansas Water Appropriation Act specifies that priority in time establishes the right to use water, not the type of crop being irrigated.
- Jim Gooch's second water right, File No. 40,578 (priority date Feb. 3, 1992) is senior to Matt Mills' water right, File No. 44,593 (priority date May 26, 2001).
- Unlike many other wells in the Ogallala, these wells are screened in a confined zone and the reductions in water availability do not appear to result from regional lowering of the water table but rather from direct well-to-well interference.
- Mr. Gooch had made reasonable adjustments to his pump system, including lowering the pump in the well and adjusting gear ratios, to improve his ability to capture the available supply.

Mr. Gooch has again filed a request to secure water in 2009, in anticipation of shortages later in the irrigation season. The Chief Engineer and staff carefully reviewed the additional available data in 2008 to determine how administration should occur in 2009. While each water right obtained most of its water in 2008, records show that maximum pumping depths declined approximately 50 feet from 2007 to 2008 and approximately 100 feet since 2005 (fig. 2). As a result, on April 22, 2009, the Chief Engineer made the following conclusions and orders for administration in 2009:

- There appears to be adequate supply for Mr. Gooch and Matt Mills to each *mostly* satisfy their water rights.
- Conservation practices, including irrigation scheduling, will be required of both Mr. Gooch and Matt Mills to make the best use of this shared supply without waste of water.
- To secure water for the senior water right, the Chief Engineer is limiting Matt Mills' water use to 80% of his authorized quantity in 2009.
- Mr. Gooch should examine whether his pump system, including but not limited to the motor



color	K, ft/day	drilled material
	300	gravel
	100	coarse-medium sand
	1	fine sand, silty sand
	0.01	sandy clay, fine sand and clay, silt
	0.001	clay, silty clay

File 40578 maximum well depths 2005-2008

date	max dtw (ft)
07/25/2005	305
08/01/2006	335
10/07/2007	354
08/14/2008	405

Figure 1. Lithologic profile of irrigation wells showing relationship of productive zone at bottom of each well.

and gear assembly, could be further adjusted or upgraded to deliver more of the available supply.

- Matt Mills should seek to avoid or minimize his impacts on Mr. Gooch's ability to satisfy his water right so as to avoid or minimize administration of his (Matt Mills') water right.
- The Chief Engineer and his staff will continue monitoring this site using pressure transducers and rate loggers with telemetry to post results nearly real-time on a website, and through site visits as well.
- The real-time monitoring data showing water levels at their wells and pumping rates and times are available to Mr. Gooch and Matt

Mills to inform their decisions on when and how much to apply water.

- Following the conclusion of the 2009 irrigation season, the Division of Water Resources will review the data to determine next year's administration. If pumping water levels continue to decline, further reductions in Mr. Mills' pumping may be required.

It should be noted that the Gooch/Mills site is but one of a number of ongoing impairment investigations throughout the state. During 2006–2008, 28 impairment claims were filed with the DWR. The majority were in north-central Kansas. Sixteen were ground-water and 12 were surface-water claims. Of the 28 claims, 12 were determined to be impairment, 14 were determined not to be impairment, and two are pending further investigation. Currently, about two dozen impairment claims are in various stages of investigation throughout the state.

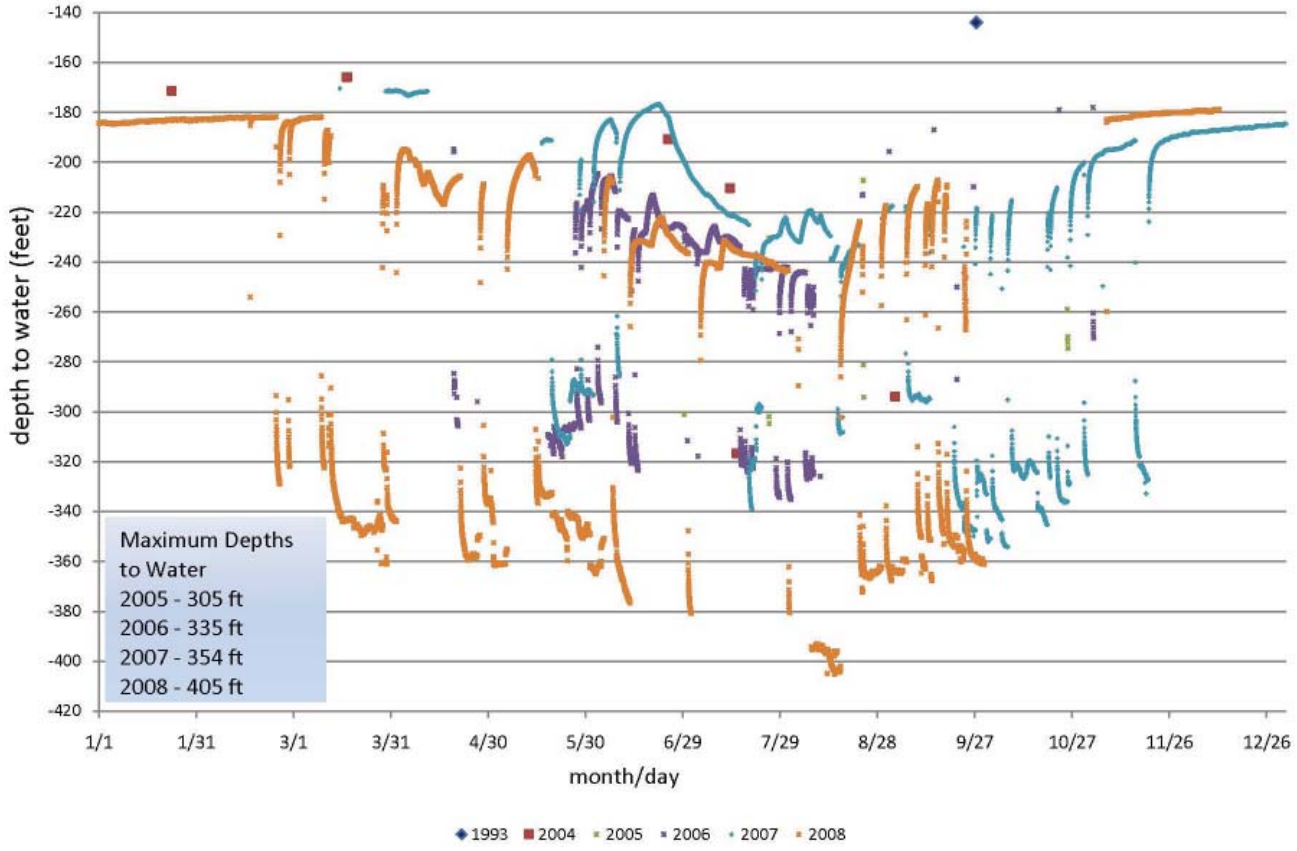


Figure 2. Depth to water in complainant's irrigation well. Pressure transducer data show water-level fluctuation and reduction in water availability. Maximum pumping depths declined approximately 50 feet from 2007 to 2008 and 100 feet since 2005.

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Abengoa Bioenergy Hybrid Refinery

In August 2007, Abengoa Bioenergy announced plans to locate a cellulosic-enthanol plant on land west of Hugoton. Traditional ethanol plants use grain, such as corn or sorghum, to produce ethanol; participants who attended the 2007 Field Conference will remember touring a conventional ethanol plant at Colwich, outside of Wichita. Unlike the Colwich facility, the Hugoton plant is designed to use unconventional feedstocks, mainly corn stover, but also switchgrass, milo stubble, and wheat straw, to produce ethanol. It is designed to be the first commercial-scale cellulosic-ethanol plant in the U.S.

The total cost of this project is estimated at $500 million. Approximately $77 million of that will come from the U.S. Department of Energy. Construction on the plant is expected to begin in late 2009 or early 2010 and is expected to be complete in 2011 or 2012. The plant will use as much as 1,400 tons per day of crop residue to produce about 13 million gallons of ethanol per year from cellulosic sources. It will also produce about 87 million gallons of conventional ethanol from corn.

Cellulose is the material that makes up the cell walls of many types of plant matter and is one of the most common organic compounds. Cellulose can be turned into ethanol by either biological methods, using special enzymes or microorganisms, or by gasification. The Hugoton plant will use a biochemical process called enzymatic hydrolosis in which enzymes are used to break down the cellulose (fig. 1).

Abengoa is currently contracting with local producers for the biomass needed to operate the plant. In addition, in June 2008, researchers from the Oklahoma Bioenergy Center announced plans to plant about 1,000 acres of land near Guymon, Oklahoma, to switchgrass that will be used in the Hugoton plant. That project will allow operators of the Hugoton plant the chance to test harvest, transport, and storage methods necessary for using switchgrass. Switchgrass is an attractive option for feedstock because it requires little fertilizer and can be grown on poor soils.

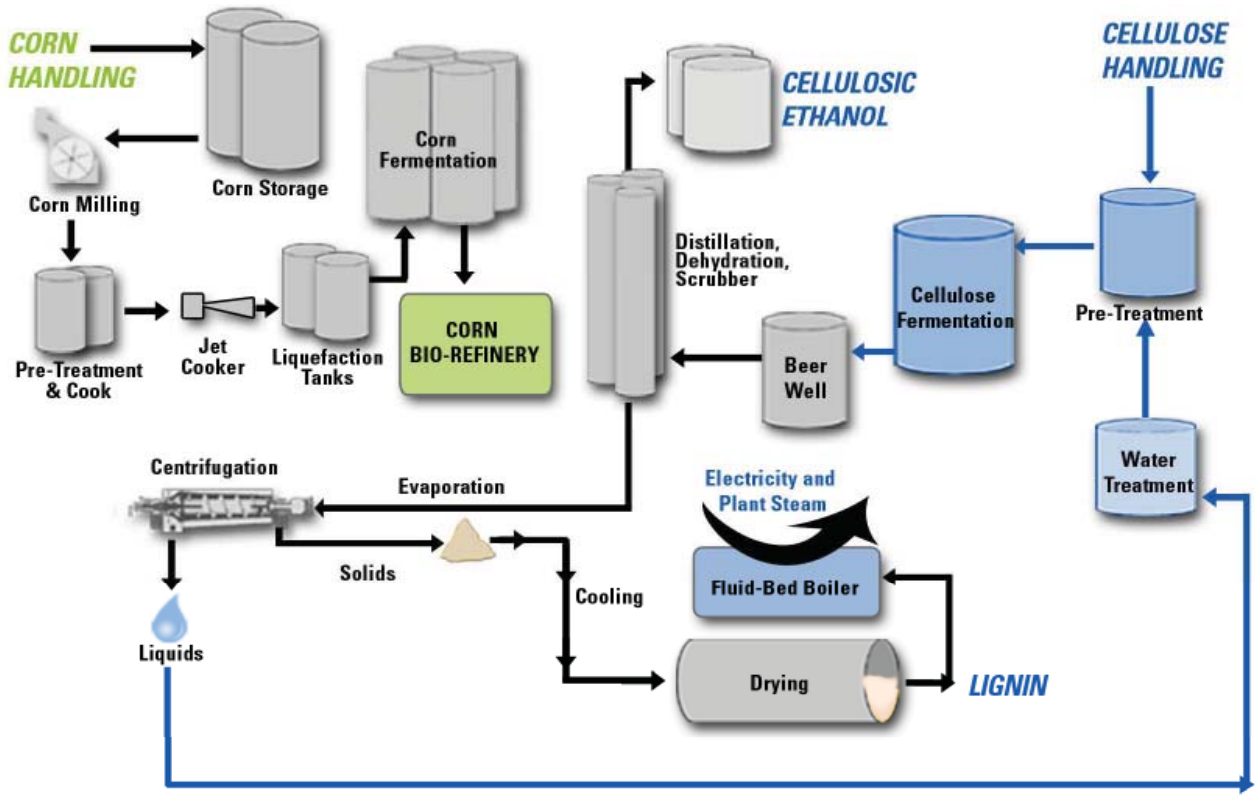

Figure 1. Ethanol facility with cellulose fermentation (courtesy ICM, Inc.).

The production of cellulosic ethanol is clearly still in its infancy. The Federal Energy Independence and Security Act of 2007 mandated the manufacture of more than 20 billion gallons of advanced biofuels by the year 2022, including 16 billion from cellulosic sources. Projects such as the Hugoton plant will be critical if such goals are to be met.

Abengoa Bioenergy

Headquartered in suburban St. Louis, Abengoa Bioenergy is a subsidiary of Abengoa S.A., headquartered in Spain. Abengoa S.A. is present in over 70 countries where it operates through five business units: solar, bioenergy, environmental services, information technology, and industrial engineering and construction. Its research and development activities are devoted to producing bioethanol from cellulose biomass and the development of new bioethanol-based products. Abengoa also operates a biomass demonstration plant in Salamanca, Spain, and a biomass plot plant in York, Nebraska.

Source

Abengoa Bioenergy web site: http://www.abengoabioenergy.com/sites/bioenergy/en/ (accessed May 12, 2009).

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Cimarron National Grassland

Cimarron National Grassland (fig. 1), in the extreme southwest corner of Kansas, is located primarily in Morton County, but a small portion extends into neighboring Stevens County. A mixture of shortgrass prairie, sand-sage prairie, and wooded riparian areas characterize the grassland. Rock cliffs, cottonwood groves, grassy fields, yucca, and sage brush are scattered throughout the land. Composed of 108,175 acres, the grassland has the longest publicly owned stretch of riparian habitat and is the largest publicly owned land parcel in Kansas.

National grasslands are essentially identical to national forests for administrative purposes. Like national forests, they may be open for hunting, grazing, mineral extraction, recreation, and other uses. Cimarron National Grassland is one of 20 national grasslands in the United States. It is also the only land managed by the U.S. Forest Service (USFS) in Kansas.

The Cimarron National Grassland is near the center of where the 1930s Dust Bowl occurred, when severe drought and dust storms plagued the Midwest. The silty and sandy soils of this region are highly susceptible to wind erosion when the vegetative cover is removed (Buchanan and McCauley, 1987). Over-cultivation of marginal land, poor conservation practices, and drought all contributed to immense dust storms and soil erosion of the Dust Bowl.

The Cimarron National Grassland literally grew out of the Dust Bowl. In 1938 the Federal government began purchasing devastated land for restoration. Purchased land was taken out of agricultural production to help arrest the wind erosion that was ravaging the Great Plains. In 1954 this land was designated a national grassland and assigned to the USFS. Originally known as Land Utilization Projects, the grasslands were renamed Cimarron National Grassland in June 1960. The grassland still encompasses some remaining private-land parcels which are variably interspersed throughout the Federal land.

The semi-arid climate is characterized by mild winters, hot dry summers, and cool evenings and remains susceptible to drought. Precipitation, usually

Figure 1. View from Point of Rocks overlooking the Cimarron River and Cimarron National Grassland.

less than 16 inches per year, generally occurs in April through September. Snowfall is minimal and short-lived. Although the Cimarron River is dry most of the year, water can be found 12 to 18 inches below the surface.

Rangeland Management

The Cimarron National Grassland is managed through permitted livestock grazing on 30 grazing allotments. An allotment is the basic land unit for livestock management on lands administered by the USFS. Each allotment has a stocking rate based on annual precipitation.

Currently, the Morton County Grazing Association (MCGA) has the only livestock-grazing permit on the Cimarron National Grassland. The MGCA is composed of 100 members who are ranchers and farmers in Morton and Stevens counties.

As a part of its permit, the MGCA maintains approximately 500 miles of fence and over 250 livestock-watering facilities. The water facilities benefit wildlife species and are incorporated into the wildlife-management program at the grassland. With the assistance of the Kansas Department of Wildlife and Parks (KDWP), 90 guzzlers (watering features) and 35 developed areas have been created to provide water and shelter for wildlife. In addition to these structural improvements, prescribed range burning is also used to maintain rangeland health.

On average, approximately 5,000 to 5,300 head of cattle are turned out to graze during the May 1st through October 31st grazing season. If conditions warrant, the grazing season may be extended into November and December.

Geology

The Cimarron River roughly divides the Cimarron National Grassland into two distinct geologic areas. The Neogene-age Ogallala Formation (23.03 to 2.588 million yrs before present [bp]) forms a bluff immediately north of the river. North of the Ogallala bluffs, younger Quaternary-age loess deposits (2.588 million yrs bp to present) cover the uplands. Quaternary alluvium occupies the valley floor of the meandering Cimarron River. South of the river, Quaternary sand dunes and sheet-sand deposits were blown out of the river valley and drape the land surface. The sand dunes are generally covered by vegetation, but were historically active in the 1930s. A few small areas are still active today.

The oldest rocks in the grasslands—and also the most problematic—crop out in a small area below the Ogallala Formation at Point of Rocks (fig. 2). Exposed are red and tan beds of sandstone, siltstone, and shale that are currently assigned to the Jurassic System (Zeller, 1968); however, the rocks at this isolated exposure have historically been classified as Triassic by some, while others suggest they may be Cretaceous or Permian in age. These different geologic classifications vary widely in time, 299.0 to 65.5 million yrs bp. Typically, geologists can use fossils to date most sedimentary rocks, but these rocks are unfossiliferous. The present Jurassic assignment is based on correlation to similar rocks in Oklahoma, Colorado, and New Mexico where the ages are known. This indirect approach has not yet provided a definitive age for these rocks. Modern technology that uses isotopes to age-date rocks may ultimately provide a solution to the problem.

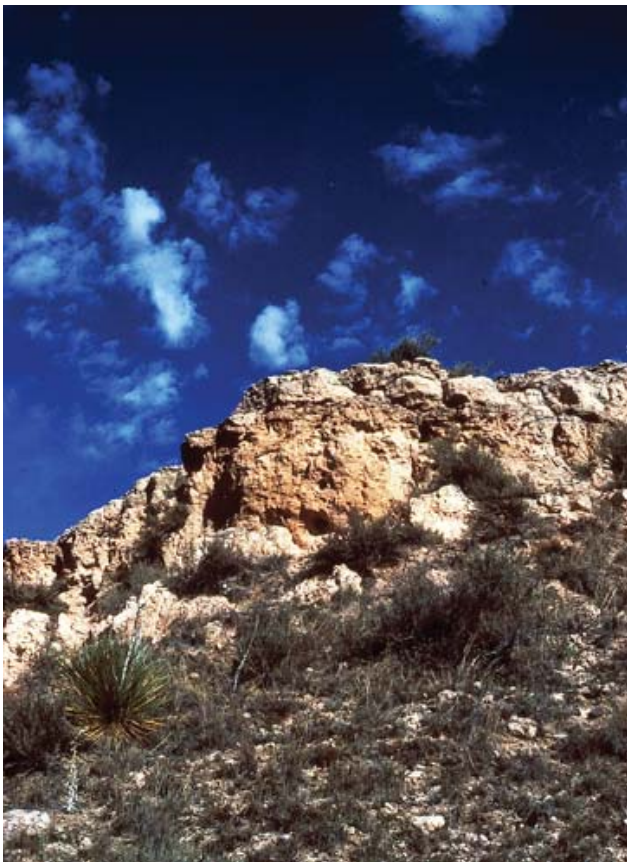

Figure 2. Point of Rocks in the Cimarron National Grassland.

Wildlife

Wildlife found on the grassland includes mammal and avian species such as elk, pronghorn (the correct name for antelope), mule and whitetail deer, porcupines, bobwhite and scaled quail, wild turkey, lesser prairie chicken, and dove. Approximately 345 different bird species are present on the grasslands at one time or another and draw people here from throughout the world to view them.

There are also a wide variety of amphibians and reptiles. Because the grassland is a fringe habitat for both eastern and southwestern species, a large number of different species, approximately 31, make their home here. These animals often go unnoticed because of their small size, nocturnal habits, and their efforts to stay out of the hot sun. The most common and easiest to spot include woodhouse toads in floodplains and sandy areas; bullfrogs near ponds and water tanks; northern earless lizards on flat bare areas of sand or gravel; ornate box turtle in grassy areas; and Central Plains milk snakes with their bright orange and black stripes in rocky areas. The western rattlesnake, which inhabits rocky areas or vacant rodent burrows, is poisonous.

Recreation

Recreational opportunities on the grassland include hunting, fishing, camping, hiking, biking, horseback riding, photography, and birdwatching. The grasslands were named by the American Birding Association as one of the top 100 birding locales in the United States and has been featured in *Birder's World*. The USFS works with the KDWP and other partners to produce and update pamphlets, checklists, and books on birds located on the grassland.

The grassland is available for public hunting, and is a major hunting attraction because it is the largest public land parcel in the state. Big game include mule deer, whitetail deer, and pronghorn. Upland and migratory game birds include bobwhite and scaled quail, pheasant, lesser prairie chicken, and mourning dove.

Ten fishing ponds are open year round with only light to moderate use. Trout are stocked in some of the ponds in the winter, and channel catfish are stocked during the summer.

Three hiking trails and one campground are located in the grassland. The *Turkey Trail*, named for the large flock of wild turkey in the area, is 10 miles long and meanders along the Cimarron River, providing many opportunities for viewing wildlife—particularly birds—and different varieties of vegetation.

Twenty-three miles of the Santa Fe Trail cut across the grassland, making it the longest publicly owned stretch of this mid-1800s trade route. Known as the Dry Route, the Cimarron Cut-off of the Santa Fe Trail has two of the trail's best known landmarks, Point of Rocks and Middle Spring. Capped by the Ogallala Formation, Point of Rocks is a flat-topped outcrop that overlooks the Cimarron River valley. Near Point of Rocks, Middle Spring provided a dependable, year-round source of water along the overland trail. Numerous wagon ruts are still visible in the vicinity. The *Middle Springs Nature Trail* is a short, easy walk around the spring. The *Companion Trail to the Santa Fe Trail* is a 19-mile trail that parallels the existing remnants of the Santa Fe Trail, and consists of a grassy trace across the prairie.

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Lesser Prairie-Chickens

The sandsage prairie on the Cimarron National Grassland is one of the characteristic habitats of the lesser prairie-chicken (*Tympanuchus pallidicinctus*). The lesser prairie-chicken is a nonmigratory species of grouse whose habitats include sandsage, shinnery-oak, and mixed-grass prairies of the southern plains. The species population and range have decreased by more than 90% in the past 100 years (fig. 1). This population decline led the U.S. Fish and Wildlife Service (FWS) to designate the lesser prairie-chicken a candidate for listing as threatened under the Endangered Species Act.

Grassland fragmentation and habitat loss are contributing factors to population decline of the lesser prairie-chicken. Large-scale conversion of prairie to cropland and extensive drought leading up to the Dust Bowl seriously reduced viable habitat. Kansas currently harbors the largest population of lesser prairie-chickens and a portion of the most extensive remaining range, which also includes parts of Colorado, Oklahoma, Texas, and New Mexico. One of the greatest threats to the species is tree invasion of prairie habitats in eastern parts of this range. Significant drought could also severely impact the remaining habitat and production of the species.

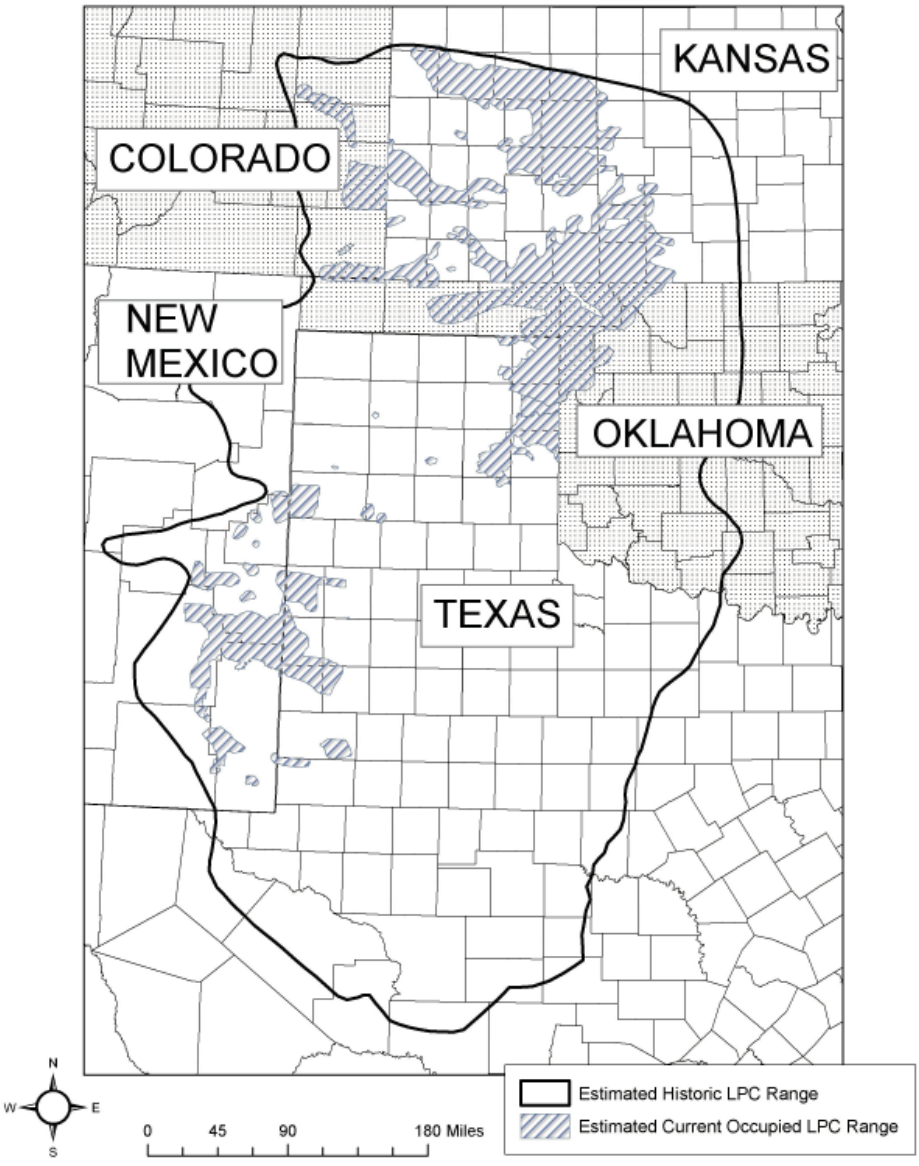

Figure 1. Historic and current range for lesser prairie-chickens in central North America.

In addition to habitat loss, recent wind-energy development in their remaining range may further reduce the viable rangeland available to prairie-chickens. Prairie-grouse species instinctually tend to avoid tall features that offer a vantage point for predators. Wind turbines, transmission lines, communications towers, and oil, gas, and transportation structures fragment the open grassland horizon and appear to make otherwise suitable habitat unavailable for nesting and brood-rearing.

Prairie-Chicken Ecology

Kansas currently harbors two species of prairie-grouse. The greater prairie-chicken (*Tympanuchus cupido*) is much more abundant than the lesser prairie-chicken. A third species of prairie-grouse, the sharp-tailed grouse (*T. phasianellus*), disappeared from its historic western Kansas range during the droughts of the 1930s. Attempts to restore sharptails in the 1980s and 1990s, while initially promising, ultimately proved unsuccessful.

Prairie-chickens may be best known for their unique spring breeding behavior. Early in spring, groups of males assemble on communal mating grounds known as leks. The low, booming sounds produced by greater prairie-chicken cocks accounts for the common reference to their leks as "booming grounds." Similarly, the higher-pitched, bubbly sounds made by lesser prairie-chicken cocks has conferred the term "gobbling grounds" to their leks. These sounds can carry as much as 2 miles across the open prairie, serving as an audible beacon to prairie-chicken hens. Males compete through a series of spectacular displays (fig. 2), calls, and sparring (fig. 3) for the coveted innermost territories on the lek. The one or two males most successful in attaining and defending these small territories typically perform about 90% of the matings on the lek. Unlike the polygamous ring-necked pheasant or the more monogamous bobwhite, prairie-chickens do not form lasting behavioral bonds between cocks and hens.

The overall distribution of lesser prairie-chickens has sharply declined. Greatest densities of lesser prairie-chickens in Kansas occur in the remaining sandsage prairies of southwest Kansas, but extensive populations also occur in the mixed prairies of the Red Hills. Lessers have also increased in number and expanded their range where seeded Conservation Reserve Program (CRP) grasslands are present in proximity to native mixed prairies of the Pawnee, Walnut, and Smoky Hill drainages in west-central Kansas. This expansion of lesser and greater prairie-chicken populations in west-central Kansas has brought these two historically overlapping species back together in a zone ranging from 20 to 40 miles in width. Some mixed leks with cocks of both species occur in this zone of overlap.

Courtesy of Mike Blair, Kansas Department of Wildlife and Parks.

Figure 2. Male prairie-chicken displaying during mating season.

Courtesy of Mike Blair, Kansas Department of Wildlife and Parks.

Figure 3. Sparring prairie-chickens during mating season.

Endangered Species Act (ESA)

If and when a species becomes listed under the ESA, that action triggers both a regulatory and conservation responsibility for Federal, State, and private landowners. These responsibilities stem from the ESA Section 9 requirement that prohibits "take" (i.e., harass, harm, pursue, shot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of listed species. Along with Section 9 prohibitions, Federal agencies must ensure that their actions will not jeopardize the continued existence of the listed species and carry out programs for the conservation of listed species.

The lesser prairie-chicken is presently an ESA candidate species, not a listed threatened or endangered species. Candidate species are plants and animals for which the FWS has sufficient information that indicates serious decline to propose listing under the ESA, but are precluded by other higher priority activities or species.

Candidate species do not receive statutory protection under the ESA. In fact, while lesser prairie-chicken numbers are sharply declining in Colorado, Oklahoma, Texas, and New Mexico, the Kansas population is presently viable and large enough to sustain a regular hunting season, although the season length and bag limit in southwest Kansas was restricted in 1995 to better manage the population. Since hunting regulations were restricted, harvest of lesser prairie-chickens has typically amounted to a few hundred birds annually.

Candidate species are assigned a listing priority number (LP) to categorize their relative threat or risk. The LP numbers are scaled from 1 to 12 based on the magnitude and immediacy of threats, as well as their taxonomic uniqueness (e.g., full species have higher priority than subspecies). The LP number dictates the relative order in which listing rules are prepared. Species classified LP 1 to 3 are considered at greatest risk.

Annual reviews are conducted by the FWS to appraise the status of candidate plants and animals. The latest FWS review was released in December 2008. A total of 251 species (109 plant and 142 animal) are presently candidates awaiting preparation of ESA listing rules. In this review two species were removed from candidate status, one species was added and 11 species, including the lesser prairie-chicken, had a change in priority.

The 2008 candidate review found that threats to the lesser prairie-chicken have increased. According to the FWS, continued habitat fragmentation puts the lesser prairie-chicken at substantial, ongoing, and imminent risk. Consequently, the candidate status was changed from LP 8 to LP 2, which is a threat magnitude considered to be high and imminent.

While the lesser prairie-chicken's threat status has been upgraded, it still remains on the warranted but precluded list of species. The FWS "warranted but precluded" finding means the species becomes a candidate for future listing and its status must be re-evaluated annually. If listing of the lesser prairie-chicken remains warranted but is not precluded by higher priority listings, the FWS will then issue a proposal to add the animal to the endangered species list.

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Winger Archeological Site

The Winger archeological site[1] is a bison bonebed exposed in a stream bank that cuts into one of the many small playa basins dotting the High Plains landscape. Playas are naturally occurring depressions found throughout western Kansas and the Great Plains. The bonebed represents the remains of at least seven bison killed by Late Paleoindian hunter-gatherers about 9,000 years before present (yrs bp). Archeological material collected from this site includes articulated bones, a fire hearth, Allen points, and fragments and flake tools. Due to its age and association with the playa, the Winger site is an important window to the paleoecology and cultural aspects associated with some of the earliest human inhabitants in Kansas.

The late Virginia Buckner, an avocational archeologist who lived in southwestern Kansas, first discovered the Winger site in 1966. Buckner conducted periodic excavations, and later the Smithsonian Institution conducted a small exploratory investigation before abandoning the site in 1972. Rolfe Mandel with the Kansas Geological Survey relocated the site in 2001 and investigated it in 2002.

Physiographic Setting

The Winger site is located in the semiarid High Plains region of the Great Plains physiographic province. The surface is relatively flat and featureless, but there are thousands of shallow depressions, or playas, scattered across the plains (fig. 1).

The meander reach of an intermittent stream that rarely carries water has cut into the southern fringe of a modern playa basin and partially exposed the bonebed layer. This playa basin is elliptical and is about 1.5 km^2 (0.6 mi^2). The basin floor is about 5 m (16 ft) below its surrounding rim. The bonebed is located in the stream bank about 9 m (30 ft) below the basin surface (fig. 2).

Near-surface deposits consist of late Wisconsinan alluvium and loess. The loess at Winger is a fine-grained silt deposited by wind about 20,000 to 10,000 yrs bp. Wind deflation probably carved the playa out of these Wisconsinan deposits. About 9,000 yrs bp the playa slowly filled deposits that are similar to modern pond sediments, and then rapidly filled with alluvium from Bear Creek. A recent sand dune drapes

Figure 1. During wet periods playas in western Kansas fill with water, similar to these in the Texas Panhandle. Courtesy of High Plains Underground Water Conservation District No. 1, Lubbock TX.

[1]To help preserve the site, artifact collecting is prohibited. The Winger site is on private property and should not be revisited.

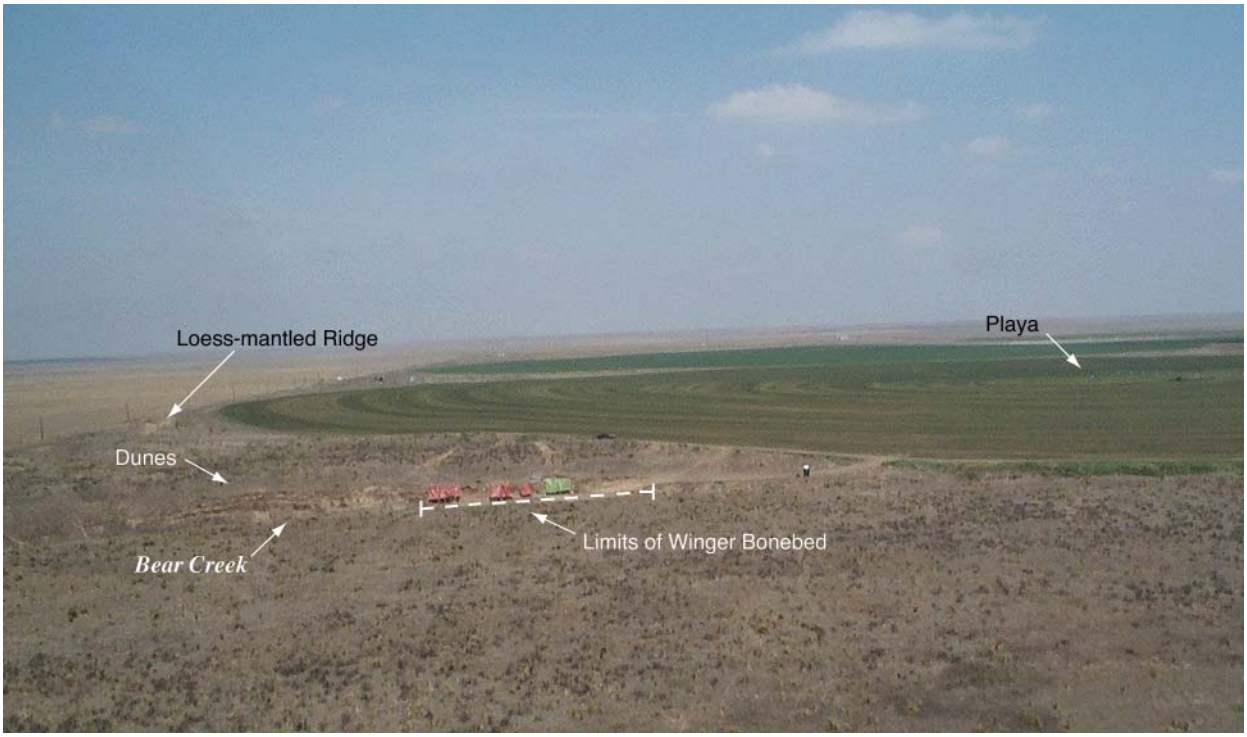

Figure 2. Aerial photograph showing the location of the Winger bonebed in relation to Bear Creek and the sand dunes, loess-mantled ridge, and playa. View is to the north.

over these deposits. Barbed wire within the eolian, or windblown, sands indicates that the dune was active during modern time (fig. 3).

Archeology

A June 2002 University of Kansas excavation documented numerous articulated or partially articulated bison bones. The bone assemblage probably represents a winter or spring kill of a mixed age, cow-calf herd with a few adult males. There is only a single layer of bones, so there is no evidence of more than one kill event at this site (fig. 4). In several instances, bison limbs were folded together rather than extended, indicating that some animals collapsed while standing, apparently in a pond or playa margin. That so many bison were killed while standing together indicated that a restriction or impediment probably prevented them from leaving the playa. Paleoindian hunters may have used a narrow arroyo or gully to herd and contain the bison.

A concentration of burned bison bones near the center of the exposure indicate the presence of a small hearth where some of the bison were probably cooked and consumed during butchering activities. Articulated skeletons surrounding a hearth suggest that the bison were killed, butchered, and processed at the kill site.

Lithic artifacts found at the Winger site include a few flakes, tools, and projectile points made of either Alibates flint or Dakota quartzite. Alibates flint is a multi-colored agatized dolomite with the ability to hold a sharp edge. Originating from quarries in the Texas Panhandle, it was highly prized and traded throughout much of North America. Dakota quartzite occurs as veins or massive blocks within the Cretaceous Dakota Formation and is found locally where the Dakota crops out. The rock ranges in color from white to brown and light red. Some notable examples of the Dakota quartzite occur in eastern McPherson County where it caps hills and forms hard, resistant ledges and near the Southside Ditch head gates on the Arkansas River in Kearny County (Tolsted and Swineford, 1983).

The lithic artifacts were more precisely classified by archeologists as a bifacial thinning flake, an ovate biface, a unificial flake, and Allen points (fig. 5). These served as butchering tools, knives, and dart points. One complete point was found at an oblique angle with the tip down on the edge of the bonebed, which suggests that a Paleoindian hunter missed his

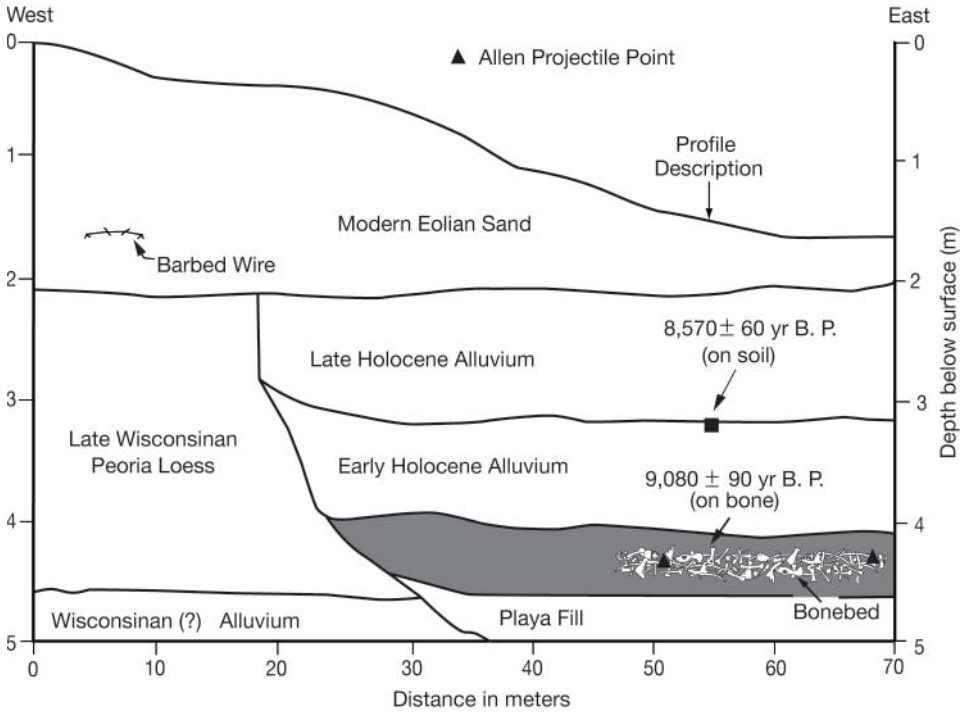

Figure 3. Stratigraphy exposed along the length of the cutbank at the Winger site (after Mandel and Hofman, 2006).

Figure 4. Bison bones at the Winger site. Photo scale is 20 cm (~8 inches) long. (After Mandel and Hofman, 2006.)

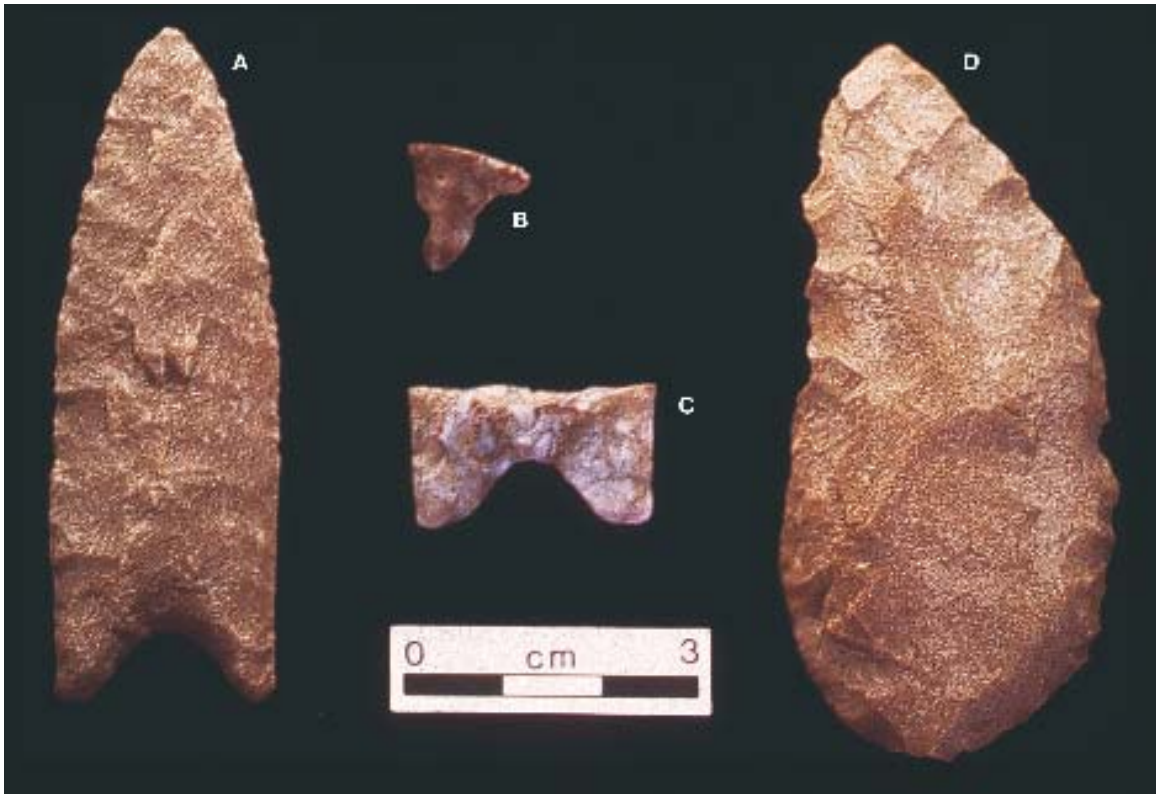

Figure 5. Paleoindian artifacts recovered at the Winger site in June 2002. A, Allen point made from Dakota quartzite; B, corner of an Allen point; C, base of an Allen point made from Alibates flint; D, ovate biface made from Dakota quartzite.

intended target and left the projectile embedded in the soft sediment of the arroyo or playa.

Knowing the age of an archeological site is critical for understanding the broader archeological record and the progression of human cultural and technological adaptations through time. Several techniques were used at Winger to establish the relative age of the site. Methods include stratigraphic position, which assumes that deeper artifacts are older than those close to the surface, and analytical techniques, such as radiocarbon (^{14}C)[2] dating to quantify periods of time, and tool changes which indicate technological advances or adaptations.

The Allen points at Winger were identified by their manufacture techniques and the way they were hafted or attached to dart shafts. This identifies a specific hunting and gathering culture and technological adaptations, in this case, to people associated with the Allen complex. The radiocarbon age and diagnostic Allen points indicate the people at Winger were of Paleoindian age, a period spanning 12,000 to 8,000 yrs bp.

Conclusion

The association of the Winger bonebed with pond deposits underscores the significance of playas as locations for human activities through time. As focal points for water, animal, and plant resources, playas were attractive to human groups in the High Plains environment.

Research indicates that the Winger site is significant in several respects. First, Winger is the largest intact bison kill/butchery site recorded in Kansas and probably the largest in the region. The diagnostic Allen point recovered from the site and radiocarbon dating firmly establish both the time and cultural period of the people who visited this site. Second, the Winger site is minimally disturbed.

[2] Radiocarbon dating, or carbon dating, is a radiometric dating method that uses the naturally occurring radioisotope carbon-14 (^{14}C) to determine the age of carbonaceous materials up to about 60,000 years. After plants and animals die, the ^{14}C fraction of the organic material comprising the organism declines at a fixed exponential rate due to the radioactive decay of ^{14}C. Comparing the remaining ^{14}C fraction of a sample to that expected from atmospheric ^{14}C allows the age of the sample to be estimated.

Evidence of butchering, dismemberment marks, and fractures can be readily identified and studied. Finally, the combination of well-established time and cultural period along with exceptional site preservation is unmatched in the region. It provides a rare opportunity to substantially increase the knowledge and understanding of the Allen technological complex, as well as human tool use and decision-making.

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Playas in Kansas and the Great Plains

Playas (fig. 1), also known as lagoons, buffalo wallows, and mud holes, are shallow ephemeral pools that serve two indispensable roles in southwestern Kansas and throughout much of the Great Plains. Most observably, they are the main source of water for hundreds of plant and animal species, both year-round and migratory, in a region where surface water is in short supply. Less apparent is their vital contribution to the ground-water supply. Playas are a primary source of recharge for the extensive High Plains aquifer, which includes the Ogallala aquifer and provides virtually all of the municipal, industrial, and irrigation water in the region.

Figure 1. A Cheyenne County playa during wet (top) and dry (bottom) periods. Photos courtesy of Rolfe Mandel.

Naturally occurring, basically round, and lined with clay soil that catches and holds water, playas and their origin remain something of a mystery. Although there are several theories, no definite cause has been determined. Whatever their origin, playas have become an important component of their semi-arid environment. Due to farming practices and other development, however, the number of playas, marshes, and other wetlands has dropped significantly since the area was settled. Today, only about 48% of pre-settlement wetlands remain in Kansas.

To help preserve these intermittent wetlands, several agencies and organizations—in particular the nonprofit Playa Lakes Joint Venture (PLJV)—have been observing and collecting information on the region's playas. Dedicated to conserving bird habitat in the Southern Great Plains, the PLJV is a partnership of government and private organizations and covers an area that includes eastern Colorado and New Mexico, western Nebraska, Kansas and Oklahoma, and the Texas Panhandle. Kansas PLJV partners include the Kansas Alliance for Wetlands and Streams (KAWS), Kansas Association of Conservation and Environmental Education (KACEE), Kansas Grazing Lands Coalition (KGLC), and Kansas Department of Wildlife and Parks (KDWP).

The PLJV partners and others have identified more than 60,000 playa wetlands in the PLJV region, which includes 155 counties in the six states. Preliminary counts estimated Kansas had just over 10,000 playas. Recent studies by University of Kansas researchers, however, indicate that number may be closer to 25,000 as new techniques using high-resolution color digital images have helped identify a higher density of playas. The abundance and close proximity of the relatively indistinct playas is not noticeable from the ground but becomes discernable from the air during wet periods.

Playas have served the water needs of wildlife as well as humans on the Great Plains for thousands of years and currently range in size from a tenth of an acre to more than 50 acres or more. Evidence of Paleoindian occupation in the vicinity of playas in southwest Kansas 9,000 years ago indicates they were likely a dependable water source under prevailing late Pleistocene/early Holocene climatic conditions.

Conservation Efforts

Nearly all playas in Kansas and the western Great Plains are on privately owned land, making conservation efforts more complex. Seventy percent

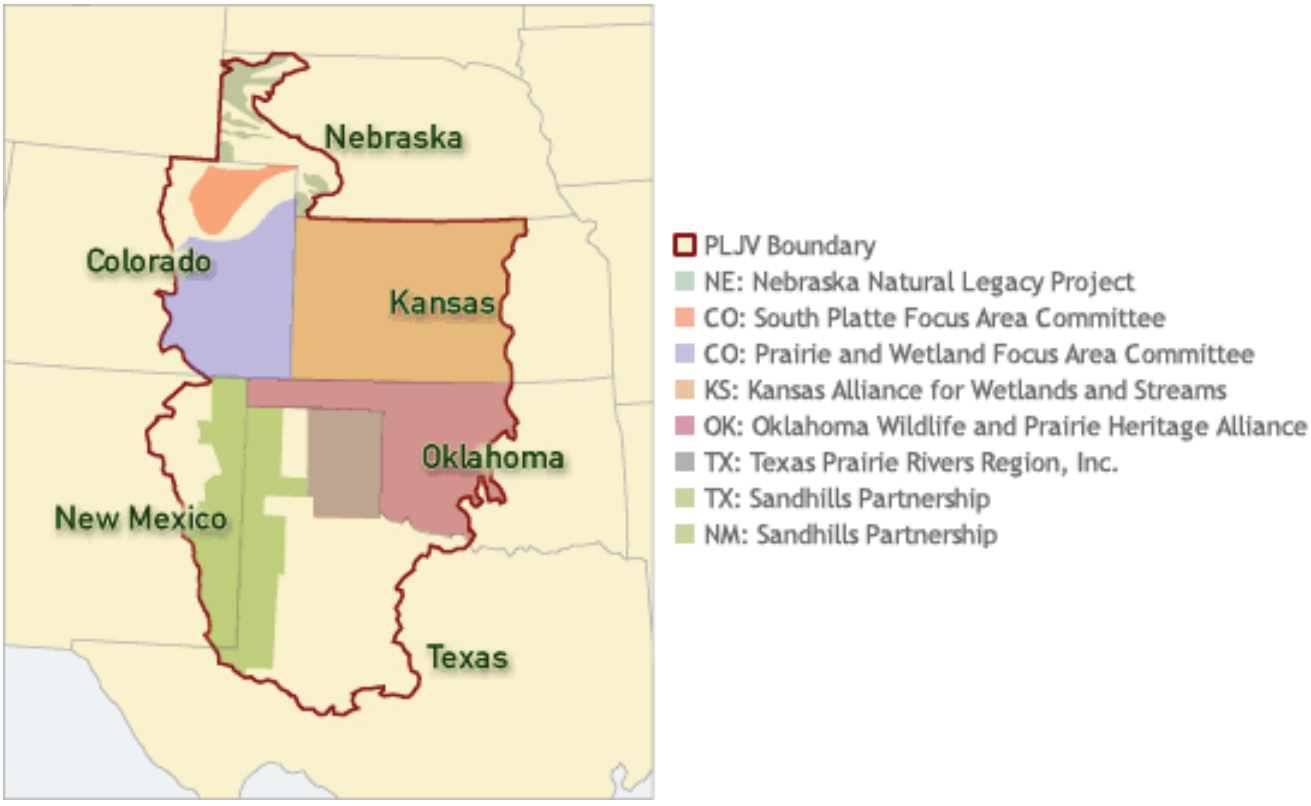

Figure 2. Playa Lakes Joint Venture (PLVJ) boundaries.

of the playas have been altered from their natural state. Many have been tilled or intentionally filled to prevent random flooding that can cause crop failure year after year. The biggest threat to playas is sedimentation. This occurs in cropland playas when rain or irrigation runoff carries loose soils into a basin and gradually fills it up. Sediment buildup reduces the volume of water that playas can hold and increases the rate of evaporation, which decreases the amount of water percolating into the aquifer.

According the PLJV, the best way to conserve the wetlands and protect them from sediment buildup is to maintain native prairie grasses around undisturbed playas and plant native grass buffers around cropland playas. Scientists and others continue to study playas to learn more about how they fit into the High Plains ecosystem. Through a grant-funded project, University of Kansas researchers are looking not only at the distribution of playas but at their health and geologic structure. Understanding the benefits of playas and their influence on ground water and wildlife can help landowners make informed decisions about land usage.

A number of Federal and State programs are designed to help landowners with playa issues. The USDA's Wetland Restoration, Non-floodplain Initiative (CP23A) aims to restore and conserve these small, isolated wetlands in western and central Kansas. In addition, theKDWP offers a one-time signup incentive payment to landowners who establish a CP23A contract.

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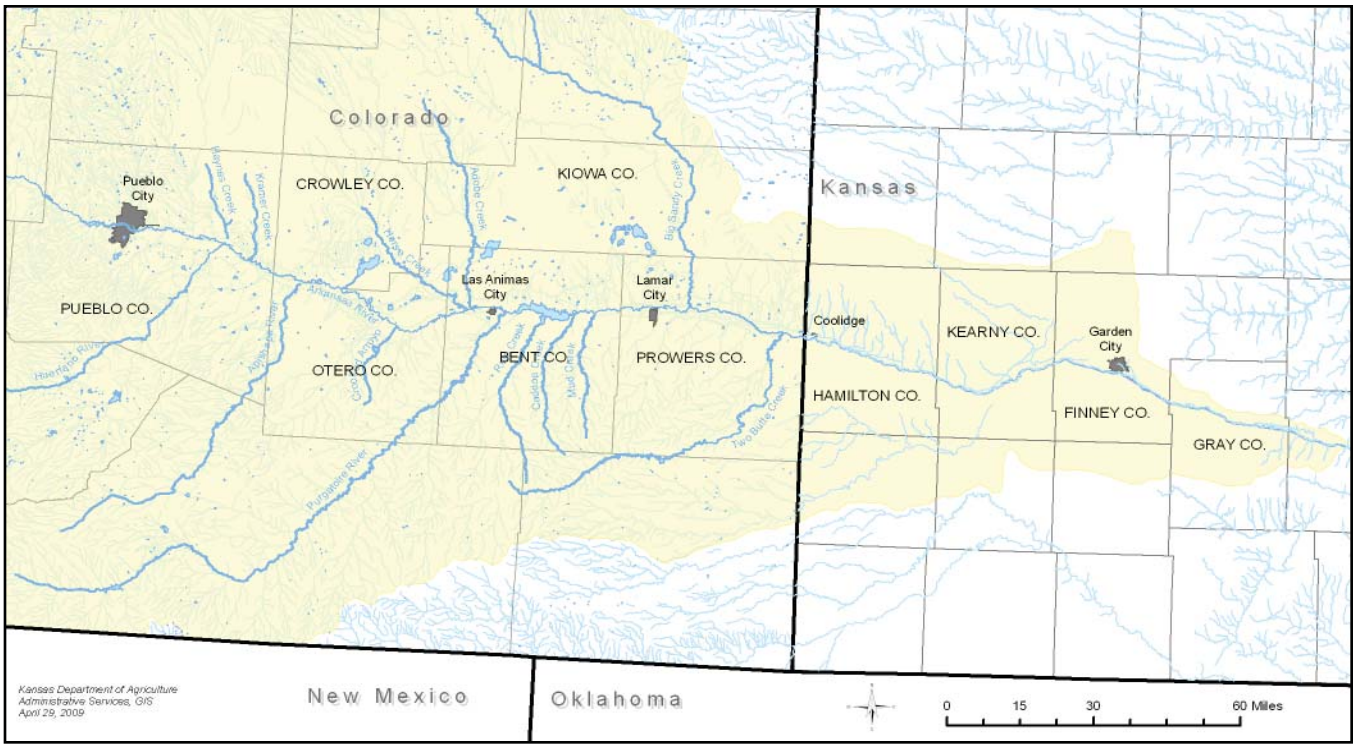
Kansas-Colorado Arkansas River Compact



Compact Arises Out of Interstate Litigation

Some of Kansas' earliest irrigation developed in the Arkansas River valley in southwest Kansas, where six active irrigation ditches remain between the Colorado-Kansas state line and Garden City.

Kansas and Colorado, and their residents, have a long history of disputes and litigation over the apportionment Arkansas River waters dating to 1902. The Arkansas River Compact was negotiated in 1948 between the states to settle existing disputes, remove causes of future controversy, and to equitably divide and apportion the waters of the Arkansas River between the states. The compact marked the culmination of decades of failed settlements and temporary agreements.

How the Compact Allocates Arkansas River Water

Principally, the compact seeks to protect the status quo as of 1949 and to allocate the benefits of the remaining water supply and water stored in John Martin Reservoir. The compact stipulated that any future development should not materially deplete flows that would otherwise be available to Kansas. Rather than provide a specific allocation of water to the states, the compact allowed each state to call for water to be released from John Martin up to a maximum rate, regardless of any similar call by the other state.

Without specific allocations, both Kansas and Colorado sought to use any stored water quickly, before the other state used it all, in what became known as the "race to the reservoir."

In the late 1970s, the states realized that conservation storage in John Martin could be used more effectively and developed an operating plan with a system of storage accounts. The 1980 Operating Plan provided that compact waters stored in John Martin would be allocated 40 percent to Kansas and 60 percent to Colorado. Kansas ditches benefit from the operating plan since they can call for water during peak demand by summer crops, usually in July, rather than April or May, as they had done before the plan was developed.

Litigation Regarding the Compact

After the compact was adopted by the states and Congress, Colorado allowed high-capacity irrigation wells to be developed in the Arkansas River valley. The well pumping reduced river flow and materially depleted water that would have been available to Kansas. Kansas filed *Kansas v. Colorado*, No. 105, Original, in 1985 to enforce the terms of the Arkansas River Compact. The U.S. Supreme Court appointed Arthur L. Littleworth as special master for this case.

In 1995, on the special master's recommendation, the court found that Colorado's post-compact well pumping violated the compact. The case then went into a remedies phase to determine damages and compensation for Colorado's past violations. In April 2005, Colorado paid Kansas more than $34 million in damages for Colorado's compact violations from 1950 through 1999 and more than $1 million in legal costs in June 2006. Some of this money will be used for water conservation projects in the affected area, the Upper Arkansas River basin.

Following extensive negotiations between the states based on the rulings of the court, the special master submitted the judgment and decree to the Supreme Court in January 2008. Seeking to recover additional costs related to expert witness testimony and technical analyses supporting the litigation, Kansas filed an exception to the special master's limitation on awarding costs. In March 2009, the court overruled Kansas' argument and approved entry of the judgment and decree. Agreement by the states on an evaluation of Colorado's use rules (see below) is the only thing remaining in this case.

Compact Compliance Efforts

The judgment and decree includes the hydrologic-institutional model and accounting procedures that are used to determine if Colorado is in compliance. Division of Water Resources' staff and technical experts monitor Colorado's efforts on an ongoing basis. Each year, the accounting for the prior 10-year period is reviewed. For the periods reviewed (1997-2006 and 1998-2007), Colorado was in compliance. Based on the data available to date, it appears that Colorado will be in compliance for the third full 10-year compliance period (1999-2008).

Some Current Issues

Colorado's Irrigation Use Rules – The states are negotiating Colorado's implementation of their rules governing irrigation pumping in Colorado's Arkansas River basin below Pueblo.

Colorado Tri-State Decree – Colorado's water court has approved ~50 percent of Colorado's Amity canal rights, including new groundwater pumping, to be changed for power plant use. Kansas is reviewing the final decree and will monitor for effects on state line flows.

Trinidad Operating Plan 10-Year Review – Trinidad Reservoir is upstream of John Martin. Kansas is closely reviewing the reservoir operating plan for effects on inflow into John Martin.

More information about the Arkansas River Compact is available from the Kansas Department of Agriculture at (785) 296-3717, or online at www.ksda.gov/dw

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Upper Arkansas River Conservation Reserve Enhancement Program (CREP)

In December 2007, the Upper Arkansas River Conservation Reserve Enhancement Program (CREP), a State–Federal voluntary program, opened for enrollment. The Upper Arkansas CREP is a unique, innovative water conservation program that provides incentives for landowners to enroll irrigated acres, put them into a conservation practice (typically grass) for the life of a 14- to 15-year contract, and permanently retire the associated water right. The overarching goal is to reduce the water-shortage stress along the Arkansas River corridor. In addition to water conservation, CREP provides improvements to water quality, additional wildlife habitat, soil conservation, and energy-use reduction.

Arkansas River

The Arkansas River and interconnected alluvial and Ogallala High Plains aquifers are vital to the health of the region. Decades of low to no flow in the river and intense ground-water development have created serious water shortages and water-quality problems along the river corridor (fig. 1). Special concerns such as permanent re-vegetation of the fragile sandhill areas of southwest Kansas are exemplary of the critical stress issues capable of being addressed by CREP.

CREP Enrollment

Since inception, 8,198 acres have been enrolled, with 16,479 acre feet of annual water right authorization permanently retired. For comparison, this is an amount sufficient to meet the annual municipal water needs of Garden City and Dodge City. Another 1,705 acres of CREP offers are being processed. If they are approved, the total number of acres enrolled would be 9,903.5 as of May 2009 (table 1).

As a State–Federal partnership program, Kansas is responsible for a minimum of 20% of the total program costs, half of which must be in the form of cash payments that directly benefit producers. To meet the State's share of the costs, Kansas pays landowners a one-time "State upfront payment" of $62 or $35 for every irrigated acre enrolled. In addition, Kansas gets credit for cash used in the Western Water Conservation Projects Fund for efficiency and conservation improvements along the upper Arkansas River. The 2007 Kansas Legislature authorized the use of up to $2 million dollars for the State upfront payments from the damage award monies from the *Kansas v. Colorado* lawsuit that went into the State Water Plan Fund for water conservation.

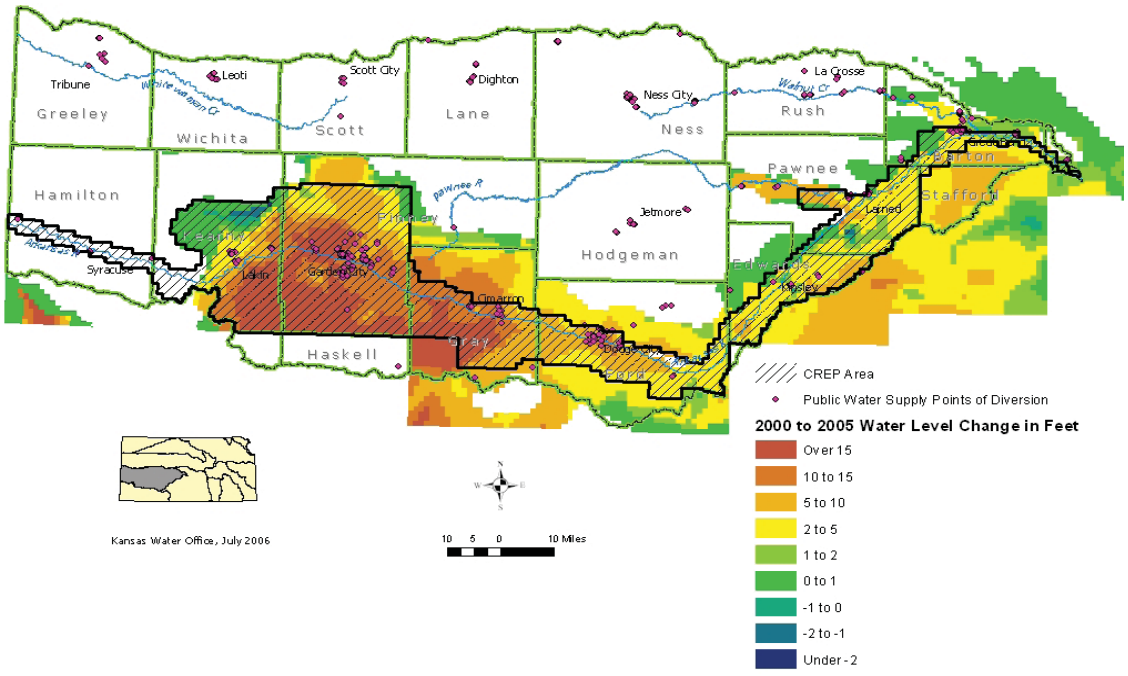

Figure 1. Map of Upper Arkansas River valley water-level declines in the High Plains aquifer in the CREP counties.

Table 1. CREP County Totals as of May 4, 2009.

County	Total Acres
BT	0
FI	695.4
FO	0
GY	3,806.0
HM	0
KE	5,160.4
PN	241.7
Program Total to Date	9,903.5

Landowners receive annual rental and maintenance payments from the USDA–Farm Service Agency (USDA) ranging from $102 to $127 per irrigated acre. Landowners may also receive cost share for grass seeding from USDA, Pheasants Forever, and other incentive payments, depending on the conservation practice.

As of December 31, 2008, a total of $496,670 has been expended by the State Conservation Commission (SCC) for the State upfront payments to producers for irrigated acres enrolled into CREP. In addition, producers will receive approximately $14.5 million in additional direct payments on these acres from USDA over the 14- to 15-year CREP contract period. This is roughly a 1:30 State-to-Federal ratio for direct payments, a good leveraging of State dollars.

The Kansas Legislature has approved a program capacity of 40,000 total acres over the 5-year life of the enrollment period (fig. 2). The State's agreement with the USDA currently provides for a cooperative enrollment of up to 20,000 acres with special restrictions to minimize economic impacts. Funding for the State upfront payments to producer incentives is currently authorized until June 30, 2009; funds need carryover approval annually.

Agency and Organization Cooperation

In this specialized version of the popular Conservation Reserve Program (CRP), the State of Kansas and the Farm Services Agency have a partnering relationship with many other resource entities: the SCC, the Kansas Department of Agriculture–Division of Water Resources (DWR), Kansas Water Office (KWO), USDA, Groundwater Management Districts #3 and #5, Kansas Department of Wildlife and Parks, Kansas Department of Health and Environment, Kansas Geological Survey, and Pheasants Forever.

The SCC administratively implements the CREP and acts as the State's "CREP Coordinator," who works with interested landowners and facilitates the roles of the various agency partners. The KWO has been chiefly responsible for long-term development

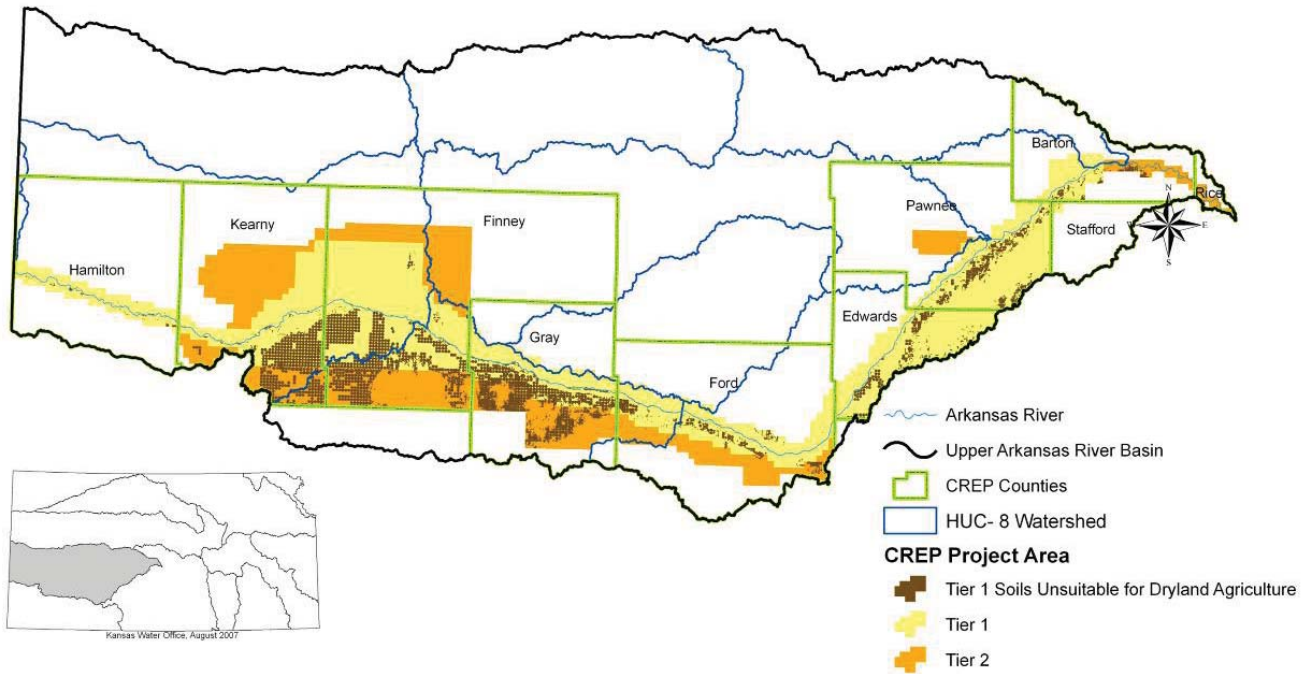

Figure 2. Map of Upper Arkansas River CREP-eligible project area.

and preparing the approval of the CREP program. The DWR maintains an eligibility data base for quick evaluation of potential CREP acres. DWR also provides legal separation of water rights where needed, and the final review and order to terminate the water right.

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Western Water Conservation Projects Fund (WWCPF)

The State of Kansas has received a damage award from the State of Colorado as part of the Arkansas River Compact (K.S.A. 82a–520). According to Kansas statute (KSA 82a–1801–1803), a portion of these funds was placed in the Water Conservation Projects Fund (WCPF) reserve account for water conservation efficiency projects in the Arkansas River valley in Kansas. One efficiency improvement project being implemented with this fund (now named the Western Water Conservation Projects Fund [WWCPF]) is the Southside Ditch improvement. The Southside Ditch diverts water from head gates on the Arkansas River east of Kendall. The ditch continues along the south side of the river past Lakin, towards its terminal end near Deerfield.

Statutes

82a–1801. Specifies that after recovering litigation expenses, the remaining money is to be split into two funds, 66 2/3% in the impacted area and 33 1/3% for efficiency and conservation projects through the State Water Plan fund (no geographic limit).

82a–1802. Establishes that the interstate water litigation fund be administered by the Attorney General for the reimbursement of those that contributed to the court cost fund, expenses incurred by the State for current or future litigation, and the monitoring or enforcement compliance of an interstate water compact or a settlement.

82a–1803. Establishes the WCPF to be administered by the director of the Kansas Water Office. The water conservation projects fund may be used in those areas of the state lying in the upper Arkansas River basin and directly impacted by the shortage of water caused by overuse of the Arkansas River in Colorado.

The WWCPF, which was established in 2008 and replaced the WCPF, may be used for 1) efficiency improvements to canals or laterals owned by a ditch company or projects to improve the operational efficiency or management of such canals or laterals; 2) water use efficiency devices, tailwater systems, or irrigation system efficiency upgrades; 3) water measurement flumes, meters, gauges, data collection platforms or related monitoring equipment; 4) artificial recharge or purchase of water rights for stream recovery or aquifer restoration; 5) maintenance of the Arkansas River channel; or 6) monitoring and enforcement of Colorado's compliance with the Arkansas River Compact.

General Background Information

The Kansas–Colorado Arkansas River Compact was negotiated in 1948 between the states of Kansas and Colorado to settle existing disputes and remove causes of future controversy concerning the waters of the Arkansas River and to equitably divide and apportion the waters of the Arkansas River between Kansas and Colorado.

The Arkansas River Compact provides specific rules for the distribution of water stored in John Martin Reservoir. The reservoir is located approximately 60 miles west of the state line and has a capacity for irrigation water supply of approximately 338,000 acre feet. The reservoir has an effective priority date in Colorado of 1948, and other junior appropriations in Colorado are subject to the prior right at John Martin Reservoir.

The compact designates the irrigation season as April through October. The gates at the reservoir are closed during the winter and all inflows are stored. During the irrigation season, river flows needed to supply the canals are released from the dam and excess flows are stored. A 1980 operating plan allocates 40% of the water stored in John Martin Reservoir to Kansas and 60% to Colorado, with separate accounts for each state.

The Kansas ditch companies (canals) call for state line Arkansas River flows up to 500 cubic feet per second (cfs) from the Kansas account while storage remains in the reservoir. A provision of the Compact requires that reservoir releases be applied directly to beneficial use. After the reservoir has been emptied, Kansas is entitled to any flow that reaches the state line after Colorado pre-Compact uses. In 1985, Kansas filed *Kansas v. Colorado* to enforce the terms of the Arkansas River Compact, specifically the pre-Compact flows.

As a part of *Kansas v. Colorado*, an economic analysis provided the basis of a Special Masters Report that said reduced streamflows affected ground-water levels and in turn increased pumping costs and contributed to crop losses. The increased pumping costs and crop losses were determined as appropriate damages, and the economically impacted area in Hamilton, Kearny, and Finney counties was defined. The WWCPF may be used to address stream and ground-water resources in the affected area and is shown in fig. 1.

A stakeholder group, the Arkansas River Litigation Fund Committee, representing the affected area, formed in 2005 to provide recommendations on potential WWCPF projects. The group consists of representatives from six irrigation ditch companies, Compact representatives, Southwest Kansas Groundwater Management District #3 (GMD3), the Kansas Water Office, and the Division of Water Resources.

The 2008 Kansas Legislature provided an opportunity to GMD3 to administer these funds through a grant agreement with the Kansas Water Office (SB 534). The Arkansas River Litigation Fund Committee and the GMD3 board make recommendations to the Director of the Kansas Water Office, who must approve all projects.

Western Water Conservation Project Fund Activities

In 2005, GMD3 contracted for the "Upper Arkansas River Conservation Project Reconnaissance Study" to identify potential projects to increase the efficiency of the irrigation system. The study costs were reimbursed from the WCPF.

In 2006, reimbursement to ditch irrigation companies were made for litigation contributions and projects that provided data, such as measured streamflows, during litigation.

In 2006, feasibility studies for three proposed conservation projects were initiated to collect and analyze data and to examine the cost-benefits as well as the interaction and complementary effects of multiple conservation projects. The three studies include

1) Southside Ditch
   a) Southern Alternative Delivery System
   b) Lining of Southside Ditch
2) Lake McKinney
   a) Restoring Lake McKinney Capacity, Update Control Structures
   b) Alternate Delivery System around Lake McKinney
3) Arkansas River: Enhanced Aquifer Recharge from Arkansas River Flows.

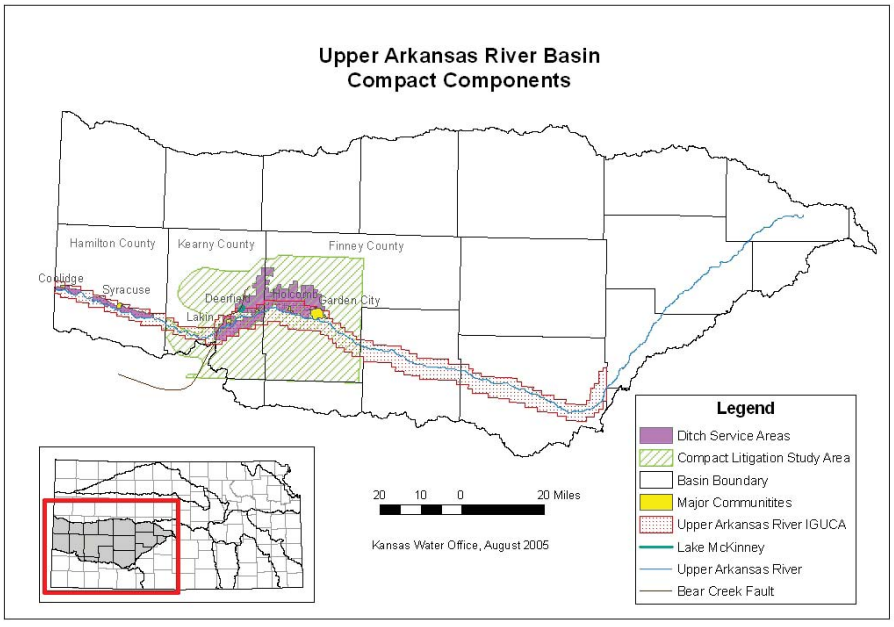

Figure 1. Ditch systems and green area eligible for Western Water Conservation Projects fund.

In 2008, conservation project implementation began with construction of the Southern Alternate Delivery System and the two Lake McKinney projects. The Southside Ditch project will restore the conveyance capacity of the main ditch canal, replace needed diversion structures, and construct a new connector channel to the Arkansas River on the tail end of the system (fig. 2). When completed, the Southside Ditch main canal can be used as an alternate delivery route for downstream surface-water rights, which reduces transient losses when river flows are low (fig. 3).

Engineering design began in 2008 to restore the historic storage capacity of Lake McKinney. Design specifications include replacement of the dam-outlet control gates and rebuilding two dikes as well as design of a lake bypass for when water supply is limited.

Also in 2008, the "Preferred Interstate Supply Evaluation" was authorized to review the Arkansas River operational factors controlled by the Kansas and Colorado Arkansas River Compact, associated agreements, and by court decree. This review will determine which river operations may be managed to maximize the water supply delivered into Kansas. The evaluation will also review the river infrastructure and existing project studies for the purpose of maximizing beneficial water supply.

Figure 2. Improvements to Southside Ditch. Photo courtesy of Randy Hayzlett.

Figure 3. Arkansas River near Kendall, October 2007. Photo courtesy of Kevin Salter.

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SCHEDULE AND ITINERARY

Friday, June 5, 2009

8:00 am	**Bus leaves for Holcomb Station and Breakfast**
8:15 am	Breakfast courtesy Sunflower Electric Power Corporation
9:15 am	**SITE 11** • Changes in Beneficial Use of Water and the Proposed Station Expansion, Holcomb *David Barfield*, Chief Engineer, Kansas Department of Agriculture—Division of Water Resources
9:45 am	Bus to Site 12
	Bus Session • Natural Resource Supply and Highway Construction *Bob Henthorne*, Chief Geologist, Kansas Department of Transporation
11:15 am	**SITE 12** • Wind Energy and Transmission at the Spearville Wind Farm, Spearville *Scott Jones*, Kansas City Power & Light *Kelly Harrison*, Westar Energy
12:00 pm	Bus to motel
12:30 pm	Return to La Quinta Inn & Suites, Dodge City

Changes in Beneficial Use of Water and the Proposed Station Expansion at Holcomb

This summary begins with an overview of changes in the beneficial use of water and then focuses on the proposed power plant in Holcomb.

When plans for a new power plant, ethanol plant, or other large industry are announced, it is common for the public, legislators, and water users to question what impacts the proposed facility could have on water resources. The answer depends on a number of factors including the water demands of the new use, its location, and source of supply.

If the location is in an area where no new appropriation of water is available, options for supplying water include purchasing and converting existing water right(s) or purchasing water from a municipality or other water supplier. Water rights can only be converted if the point of diversion will remain the same or if the changed point of diversion will be moved a limited distance and remain within the same local source of supply as the original point of diversion.

Changes in the use made of water are governed by regulations limiting the authorized quantity of the changed water right to the consumptive use of the initial water right. For example, an irrigation water right typically diverts water for only a part of a year (the growing season) and a portion of the water applied to a field seeps into the ground and in effect returns to the local source of supply. Conversely, an industrial water right is typically exercised year-round, and usually none of the water is returned to the source of supply. (There are exceptions, such as once-through cooling systems at power plants.) Thus, if an irrigation water right is changed to an industrial water right, the authorized quantity must be adjusted so that there is no net change in the total quantity diverted from the source of supply.

The Sunflower Electric facility in Holcomb is located in an area of the state where withdrawals exceed recharge, and it is closed to new appropriation of water. Therefore, water supply options for the proposed expansion include purchasing and converting water rights or purchasing water from a utility.

Based on meetings with representatives of Tri-State Generation and Transmission and their partners in 2007, it is our understanding that they acquired or plan to acquire on the order of 22,230 acre feet of irrigation water rights in the area. Assuming 2 acre feet/acre of authorized use and 130 acres per pivot, this would equate to about 85 circles.

Tri-State estimated that the 22,230 acre feet of authorized quantity for irrigation would convert to about 16,000 acre feet for industrial use after applying the consumptive use rule. They indicated that the proposed new coal-fired electrical power generation unit would consume approximately 8,000 acre feet of water per year, and that they had plans for a second additional unit in the future.

To date the Kansas Department of Agriculture, Division of Water Resources, has not received any applications related to this project. The developer might be waiting for a final outcome on the air emissions permit, which is reportedly in litigation and the subject of legislation, before proceeding with water right change applications.

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Wind Energy and Transmission at the Spearville Wind Farm

Wind energy was a priority of former Kansas Governor Sebelius' State energy proposals. The Governor sought to require utilities to generate 10% of their electricity from renewable sources by 2010 and 20% by 2020. She persuaded utilities to voluntarily meet these requirements two years ago but initiated proposals for the 2009 legislative session that would make this a mandate.

The Spearville Wind Energy Facility is a 100.5-megawatt component of Kansas City Power & Light's (KCP&L) 4,000-megawatt generation portfolio. The 100.5-megawatt facility generates enough electrical energy annually to supply approximately 33,000 homes.

In Kansas, the projected total commercial wind-generation capacity will be approximately 1,011 megawatts by the end of 2009. Statewide, another approximately 6,771 megawatts at 44 sites is proposed for future construction (fig. 1).

Constructing a new wind-generation facility is a multi-faceted process of site selection, construction, grid connection, and delivery into a power grid for distribution. The stop at the Spearville Wind Energy facility, located in Ford County, examines these aspects in closer detail.

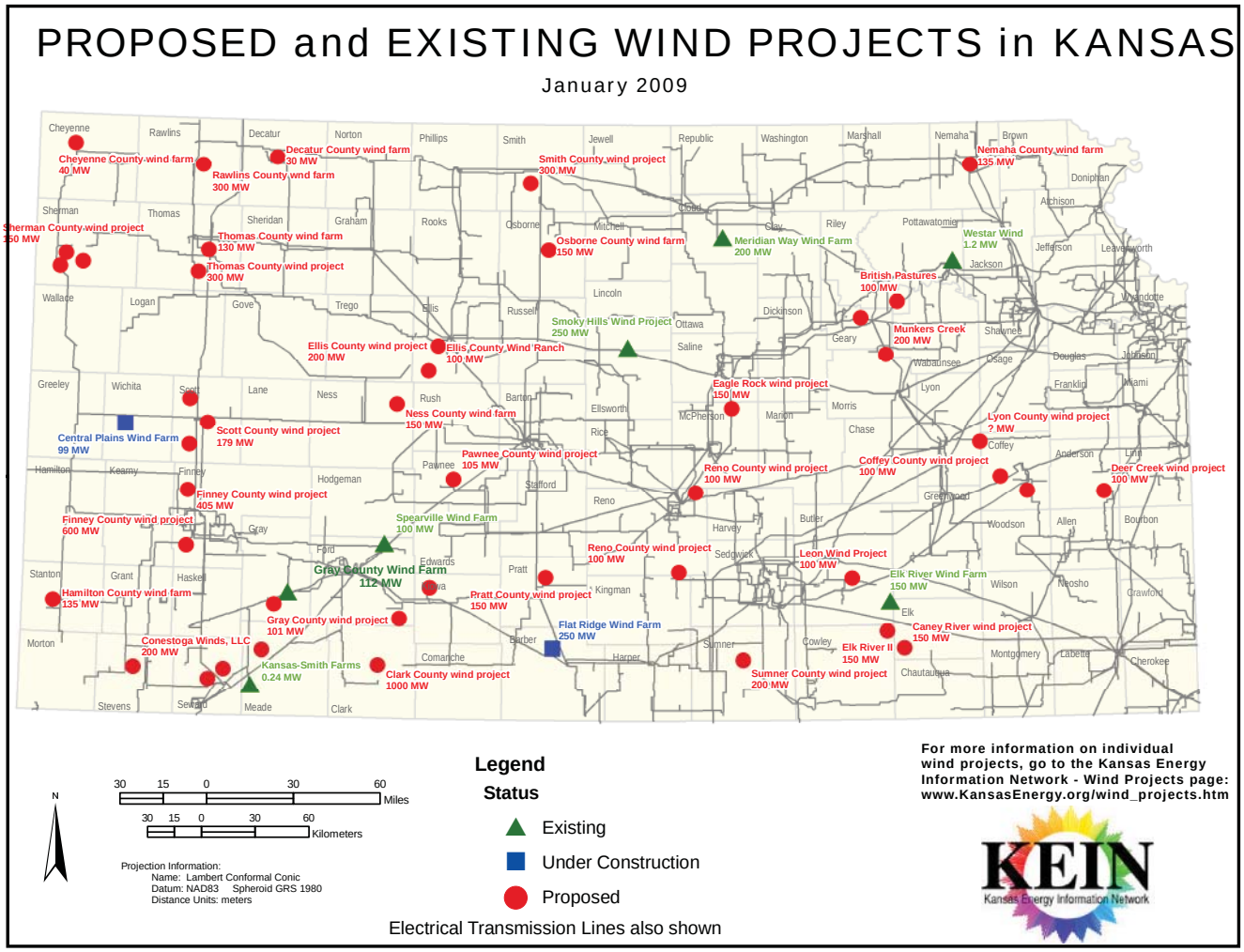

Figure 1. Proposed and existing wind projects in Kansas, with approximately 1,011 megawatts of capacity available by the end of 2009 and another 6,771 megawatts proposed for future construction.

Site Selection

Before construction can begin, a careful site-selection process is completed to properly site a facility not only for wind requirements, but also to avoid adverse impacts on wildlife and habitat. Site selection includes consideration of impacts to regional wetlands, migratory-bird flyways, Kansas native prairie, culturally significant areas, local and regional aviation, microwave-communication towers, and existing power grids.

Connecting and Delivering Wind Generation into the Grid

Once a potential wind-generation site has been selected, the next steps are connecting it to the grid and obtaining delivery rights to a selected area. Any new generation, fossil fuel or renewable, has to go through the generation-interconnection process to be added to a transmission grid.

The Southwest Power Pool (SPP) regulates access to the grid. The SPP is a regional transmission organization, mandated by the Federal Energy Regulatory Commission to ensure reliable supplies of power, adequate transmission infrastructure, and competitive wholesale prices of electricity. A regional transmission organization, such as the SPP, is like an "air traffic controller" of the electric-power grid. They do not own the power grid, but independently operate the grid minute-by-minute to ensure that power gets to customers and to eliminate power shortages. SPP covers a geographic area of 370,000 square miles and manages transmission in eight states: Arkansas, Kansas, Louisiana, Missouri, Nebraska, New Mexico, Oklahoma, and Texas. SPP has 54 members in the above states and Mississippi that serve over 5 million customers.

Grid connection and delivery rights to a selected area is essentially accomplished through two independent processes—Generation Interconnection Requests (GSRs) and Transmission Service Requests (TSRs), which are submitted by the generator to the SPP.

A GSR is simply a request to connect a generator, such as a wind farm, at a specific location on the transmission system. It does not include the transmission service necessary to deliver the energy from the generator to a specific user. Transmission service lines must be constructed from a generator to a high-voltage transmission line on the grid. Ideally, generators are situated close to the grid so that service-line construction costs are not prohibitive to development of a wind-generation facility. The GSR evaluation process is a queuing process (first-come, first-served) in which the SPP studies a group of generators in a geographically defined area to determine the overall impact on the transmission system of connecting these generators to the grid.

In the process of evaluating these combined interconnection requests, SPP determines the required transmission upgrades and allocates the cost of these upgrades to the individual generators. The process does allow the customer to withdraw their request at various stages, which commonly happens.

A TSR application requests energy delivery from a specific energy source to a specific user in the transmission system. The TSR evaluation, like that for a GSR, is also an aggregated study evaluation. The process combines all long-term, firm transmission service requests (one year or longer) received within a defined window of time and evaluates their collective impact on the SPP transmission system. The process determines the required upgrades needed for the TSR's approval and assigns the costs of these upgrades to the applicants based upon approved allocation methods defined in the SPP's Open Access Transmission Tariff. The tariff ensures that transmission service is provided on a nondiscriminatory, just, and reasonable basis and helps provide the foundation for a competitive electric-power market. The objective is to provide for more effective regulation and transparency in the operation of the transmission grid. A requestor may withdraw from this process at several stages as costs and conditions are defined.

Wind Farm Construction and Energy Generation

Construction begins after site selection and application to access the grid is completed. All the turbines at Spearville came online in October 2006. The total capital cost of the project was approximately $166 million and consists of 67 General Electric turbines. Building the turbines required 1,700 tons of rebar. Each foundation contains 272 cubic yards of

concrete for a total of 18,224 cubic yards requiring 1,822 truck loads of concrete.

Each turbine blade is 121 feet long and weighs 14,000 pounds. Each tower is 262 feet high and weighs 120 tons. The tower with a blade fully extended over the turbine nacelle is 391 feet tall and visible from Dodge City, 17 miles southwest. A breeze of only 8 miles per hour will rotate the blades.

Each of the 67 General Electric turbines produces up to 1.5 megawatts. The towers and blades were made in Texas, the nacelles and rotors in Florida, and the controllers were made in California.

After construction, a generator transmits power onto the transmission grid. A substation at the generator uses large transformers to convert the generator's voltage to extremely high voltages for long-distance transmission on the grid. Typical voltages for long-distance transmission are in the range of 155,000 to 765,000 volts in order to reduce line losses. Power coming off the transmission grid is stepped down at a power substation and sent into distribution grids at the lower voltages used by homes and businesses.

Sources

Kansas Commercial Wind Projects, 2009, KCC State Energy Office, 3/31/09: http://wwg.kansas.gov/ks_wind_projects.pdf.

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Southwest Power Pool, 2008, Wind Integration, 12/4/08: http://www.spp.org/publications/SPP_Wind_Integration_QA.pdf.

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