

SOCIOECONOMIC IMPACTS OF DEVELOPING WIND ENERGY IN THE GREAT PLAINS

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ABSTRACT—Wind energy has been growing rapidly in the Great Plains because of the region's favorable wind resources and because it has been stimulated by a federal production tax credit and by state renewable portfolio standards. Wind energy installations also offer economic development opportunities for rural areas. The purpose of this study was to determine the socioeconomic effects of the recent development of a wind energy center on nearby communities. Project construction occurred over a six-month period, with the workforce peaking at 269. Project operation supports 10 permanent jobs and expenditures to local businesses and households totaling \$1.4 million annually. These include easement payments to landowners totaling \$413,000 the first year. In addition, the project is expected to make annual local property tax payments totaling \$456,000. Wind energy projects do offer substantial economic benefits to nearby communities.

Key Words: wind energy, renewable energy, rural development, economic impact

Great Plains Research 19.1: 3-12

ARCHEOLOGICAL INTERPRETATION OF THE FRONTIER BATTLE AT MUD SPRINGS, NEBRASKA

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ABSTRACT—Between February 4 and 7, 1865, Cheyenne, Sioux, and Arapaho warriors engaged a force of U.S. Army soldiers at Mud Springs, Nebraska. Historical records from both sides indicate that this fight marked an early phase of the Indian Wars. Based on systematic metal detections, firearms identification, and terrain analysis, this paper adds archeological insights into the arms and tactics used by the opposing sides. Well-armed Native fighters used terrain to approach U.S. troops, who maintained a defensive posture. U.S. soldiers appear to have dug a rifle pit to see approaching attackers.

Key Words: battlefield archeology, Civil War in the West, firearms identification, Indian Wars, viewshed analysis, weapons fan analysis

Great Plains Research 19.1: 13-25

CAUSES AND IMPACTS OF SALINIZATION IN THE LOWER PECOS RIVER

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ABSTRACT—River salinization is a byproduct of water resource development that results from cumulative impacts of flow-regime modifications and crop irrigation. However, historical salinization in the Lower Pecos River is often attributed to natural, high-salinity groundwater. Here, evidence from literature and U.S. Geological Survey gaging stations is reviewed to summarize historical changes associated with water development that potentially contributed to Pecos River salinization. A suite of hydrological changes, initiated in the 1880s, likely contributed to streamflow salinization: (1) reduced flood frequency and magnitude, (2) diminished streamflow, (3) increased evapotranspiration, and (4) increased prevalence of natural, high-salinity groundwater. Salinization is presently highest where these cumulative impacts were greatest (Red Bluff Dam to Girvin, Texas). Prior to water-resource development, higher, fresher streamflows and periodic floods diluted natural, high-salinity groundwater inflows and continuously exported salts from the drainage. Predevelopment salinity was low enough to support at least 44 native fishes, 13 of which have disappeared from the region. Only seven euryhaline natives remain in the most salinized river reach. However, flow-regime restoration and improved irrigation practice could potentially reduce salinization and partially restore a freshwater fauna.

Key Words: brine aquifer, cumulative impacts, euryhaline fishes, irrigation, native fishes, natural flow regime, salt balance

Great Plains Research 19.1: 27-44

NEAR-SURFACE SOIL-WATER MONITORING FOR WATER RESOURCES MANAGEMENT ON A WIDE-AREA BASIS IN THE GREAT PLAINS

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ABSTRACT—In the Great Plains, soil water is one of the most critical factors related to sustainable production on cropland and rangeland, while the need for better water management grows in the face of increasing water demand during dry years. Soil water is also an important factor related to flood modeling and quantification of the boundary conditions in atmospheric models such as global circulation models. The objectives of this study were to install a wide-area automated soil-monitoring network, determine effective calibration procedures, and develop new products to illustrate the status of soil water. Soil-monitoring sensors were established at 51 sites across Nebraska under rain-fed conditions and under a grass cover. Four sensors were installed at each site at depths of 10, 25, 50, and 100 cm. The sensors were calibrated for three soil types: sandy, loamy, and clay. Data are collected daily, assessed for quality, and archived. Six quality-assurance (QA) tests were developed based on the properties of soil water, the statistical characteristics of the measurements, the soil properties, and the precipitation measurements. The quality-assured data from the network are used in maps to determine the spatial status of soil-water availability as expressed by the percentage of maximum available water in the layer (or profile). Data is also presented on the interannual and mean annual patterns of soil water across a range of climates, from semiarid to subhumid, in the Great Plains. The results of this study demonstrate the feasibility of monitoring soil water. This capability will be valuable in drought mitigation, water management planning, ecosystem research, and other studies. The dataset will be of great value for researchers in the Great Plains to quantify weather forcing, climate change, and the water balance, especially in rangeland areas.

Key Words: calibration, Great Plains, QA, sensor/probe, soil water, soil-water availability, soil-water network, Theta, Vitel

PRECIPITATION EVENT SIZE CONTROLS ON LONG-TERM ABUNDANCE OF *OPUNTIA POLYACANTHA* (PLAINS PRICKLY-PEAR) IN GREAT PLAINS GRASSLANDS

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ABSTRACT—*Opuntia polyacantha* Haw. (plains prickly-pear) is a common cactus in the Great Plains of North America. We used two data sets, from Montana and Colorado, to test the hypothesis that there is a range of precipitation event sizes upon which *O. polyacantha* specializes. Events smaller than this range (>2 to ≤ 6 mm) do not moisten sufficient soil to be utilized, and larger events have negative effects on the status of *O. polyacantha* because they favor the development of taller and denser grass canopies. Multiple regressions of either green cladode density (northern mixed prairie) or *O. polyacantha* frequency (shortgrass steppe) with precipitation event sizes indicated negative effects of large precipitation events on the yearly changes in the either density or frequency of *O. polyacantha*. We suggest that weather conditions in the Great Plains may cause *O. polyacantha* to be controlled almost entirely by light competition from grasses and other negative biotic effects.

Key Words: cactus, northern mixed prairie, prickly-pear, shortgrass steppe, small precipitation events

Great Plains Research 19.1: 55-64

ECOLOGY OF SMALL MAMMALS, VEGETATION, AND AVIAN NEST SURVIVAL ON PRIVATE RANGELANDS IN NEBRASKA

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ABSTRACT—Small mammals can be an important bioindicator of ecosystem health. They serve as both predator and prey in many ecosystems. By means of live trapping and nest monitoring, we studied the ecological relationships between small mammals, avian nest survival, and vegetation composition and structure on six private ranches in the Sandhills of Nebraska during 2004. Our study documented six species (132 captures) of small mammals, and we monitored 139 bird nests. Pastures with high small-mammal populations did not suffer higher nest mortality, indicating that small-mammal abundance does not predict avian productivity. We found several vegetation characteristics that influenced small-mammal abundance on our sites. Small-mammal capture indices declined with increased percentage of lying-litter cover in pastures. Long-duration grazing systems had higher small-mammal indices than medium- or short-duration grazing systems, and proximal pastures had higher similarity indices for both birds and small mammals. Our study shows that landowners can affect the small-mammal community through grazing management.

Key Words: daily nest survival, grassland, grazing, Nebraska Sandhills, small mammals

Great Plains Research 19.1: 65-72

MARGINAL VALUE OF IRRIGATION WATER USE IN THE SOUTH SASKATCHEWAN RIVER BASIN, CANADA

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ABSTRACT—The allocation of water is part of water management. In order to achieve maximum benefits to society, water should be allocated toward uses that have the highest value, followed, as an alternative, by the next highest level or one with equal value. Such decisions require knowledge of water value at the last unit of use. Within agriculture, irrigation is important. Irrigation water must be allocated to various crops; therefore, producers require knowledge of the marginal value of water among alternative crops. This study estimates marginal value product for irrigation water within the southern areas of the Canadian Prairie Provinces using a crop-response model. Marginal values were estimated under the present and a future climate scenario. Cash crops such as potatoes and dry beans had higher marginal values of water, around \$1,000 per 1,000 m³. Cereals and oilseed crops lagged behind (close to \$200 per 1,000 m³). Results show modest increases in marginal value under climate change, compared to the volatility resulting from commodity market price changes seen today.

Key Words: Canada, crops, irrigation water, marginal value, South Saskatchewan River Basin

Great Plains Research 19.1: 73-88

HISTORICAL CHANGES IN THE OCCURRENCE AND DISTRIBUTION OF FRESHWATER MUSSELS IN KANSAS

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ABSTRACT—The surface waters of eastern and central Kansas once supported an impressive variety of native freshwater mussels, but a widespread decline in species richness accompanied the urban, industrial, and agricultural development of this region. Statewide mussel surveys implemented during the past two decades have shed new light on the scope and severity of this decline. Of the 48 mussel species originally known from Kansas, six are now extirpated, one lacks reproductively viable populations (i.e., faces imminent extirpation), and 38 others have suffered evident range reductions or a widespread thinning of former populations. Soil erosion and stream siltation, other forms of water and sediment pollution, physical habitat degradation, stream flow attenuation, and declines in the native fishes serving as biological hosts for larval mussels all have contributed to these changes. Dams and other impediments to fish migration now hinder the reestablishment of mussel colonies following prolonged droughts and major water pollution events. Some mussel populations in this region display unique morphological, developmental, and genetic attributes, implying their continued attrition may lead to the eventual loss of distinctive forms or subspecies.

Key Words: aquatic habitat restoration, freshwater mussels, prairie streams, zoogeographical surveys

Great Plains Research 19.1: 89-126