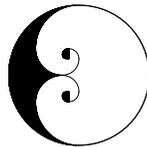
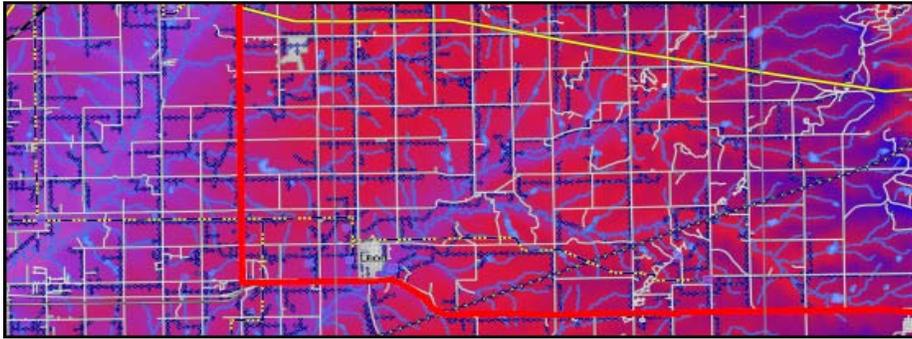


South Central Kansas Renewable Energy Resource Analysis

South Central Kansas Economic Development Commission
Wichita, Kansas

Butler, Chautauqua, Cowley, Elk,
Greenwood, Harper, Harvey, Kingman,
Marion, McPherson, Reno, Rice,
Sedgwick, and Sumner
Counties

September 2009



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Created by funding from the Rural Business Development Tax Credit program administered by the Kansas Department of Commerce and as invested by South Central Kansas Economic Development District, Inc. (SCKEDD). The Solar Map and 50 M Kansas Wind Resource Map layers were prepared by Coriolis and the 50, 70, and 100 M Wind Speed and Wind Power Map layers were prepared by AWS Truewind, LLC for the Kansas Corporation Commission. See original maps and associated reports for details. This material was prepared with the support of the U.S. Department of Energy (DOE) Grants No. DE-FG26-07NT43197 & DE-FG36-0747006. Whooping crane flyway data was acquired from the U.S. Fish and Wildlife Service. Untilled Land data was acquired from The Nature Conservancy. Prairie Chicken habitat data, flora and fauna data on threatened and endangered species, and species in need of conservation sitings, as well as protected areas, are from the Kansas Department of Wildlife and Parks. Data on archeological sites are from the Kansas State Historical Society. The latter two were accessed through The Kansas Geospatial Community Commons (KGCC). This multilayer pdf map is intended to facilitate the siting and development of renewable energy projects, particularly in early phases. All energy development projects should confirm resources with direct measurement in accordance with industry standards and development criteria with state and local officials. Neither the authors of this map or any data source used herein or any sponsoring agency assumes any responsibility for the completeness or accuracy of the information presented

A Guide for Map Use

Background

These maps were prepared to assist a wide audience seeking to evaluate renewable energy development project potential in the South Central Kansas region. Local and state government officials, land owners, renewable energy project developers large and small, and environmental advocates will all hopefully find them useful.

The maps consist of many layers of information acquired from diverse sources gathered together in a geographic information system (GIS) database and exported for viewing in Adobe Acrobat, available for free on the web. Although the files are large, particularly the regional map which is distributed in compressed (zipped) format, they should be easily accessible and transportable.

Map Structure

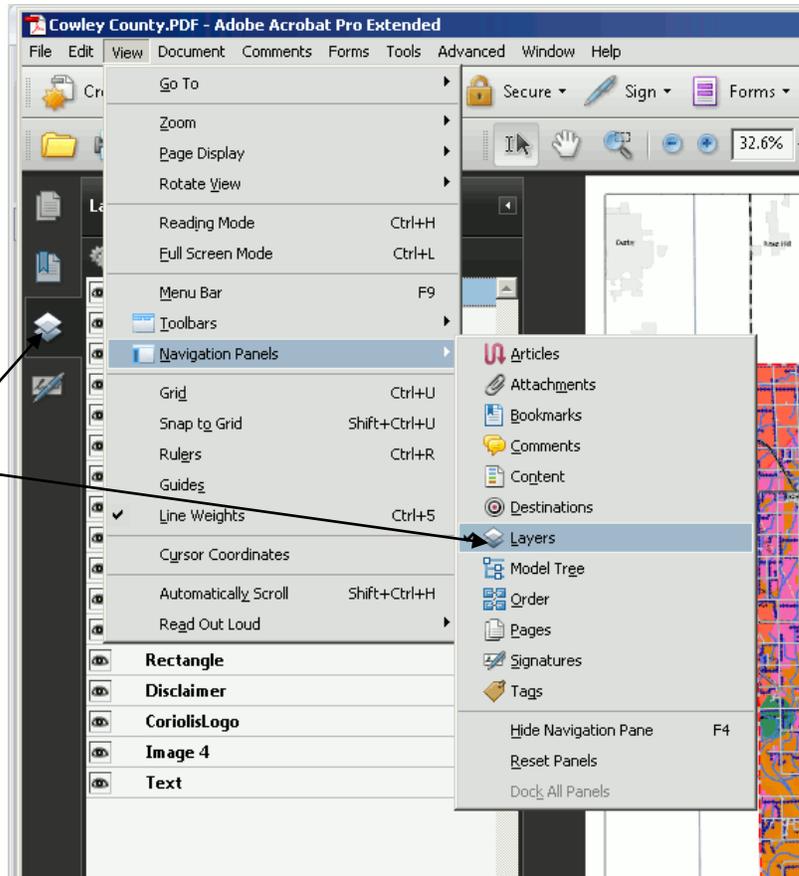
When first opened in Acrobat all of the very large number of layers will be viewable one on top of the other. This makes interpreting the information difficult if not impossible. The layer set is intended to be used with only a limited number of layers turned on and visible to evaluate a particular topic.

Map Use

Follow the instructions below to begin looking at the particular combination of layers that can provide information and insight into a particular issue you are interested in.

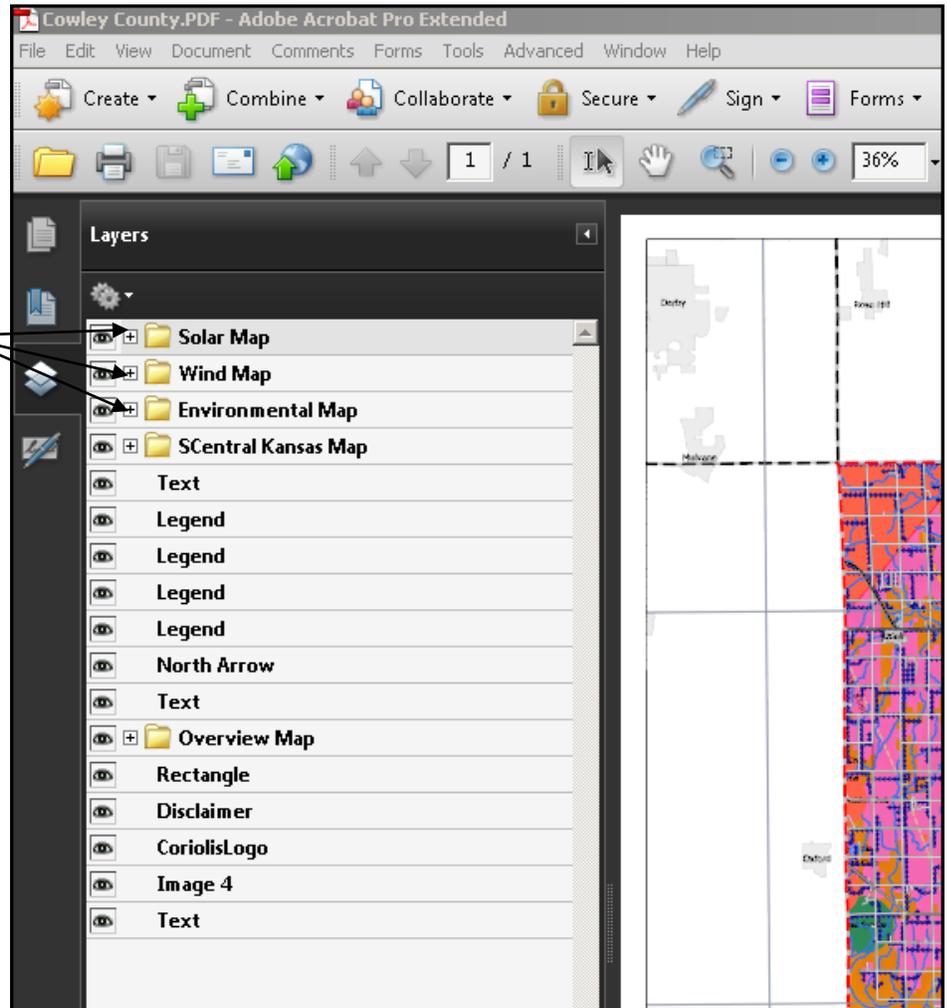
After the file has opened in Acrobat activate the layers tab.

Click on the layer icon at the left margin or in the View-Navigator Panels pull-down menu in Acrobat and then Layers

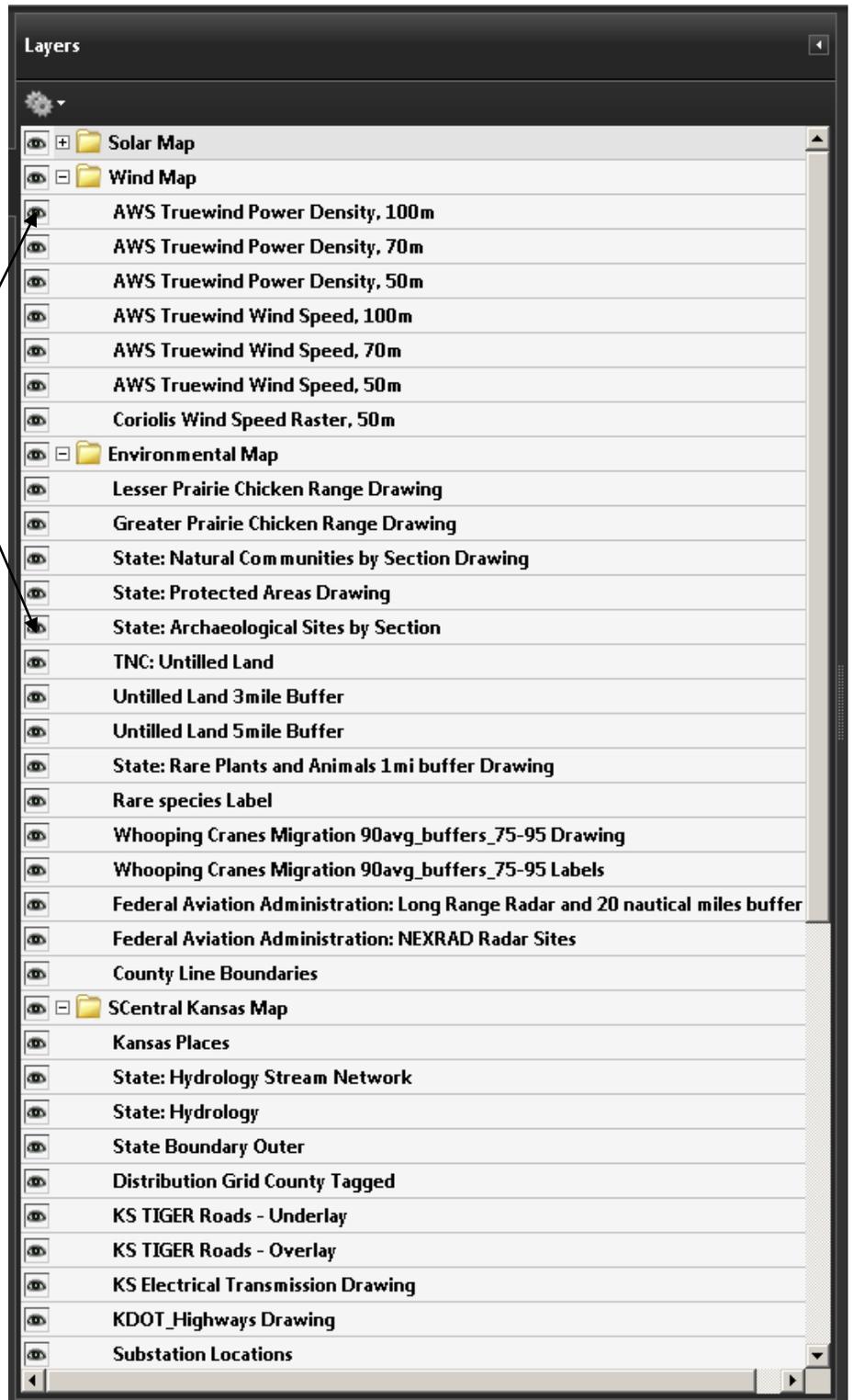


The layers tree will appear. Expand the Solar Map, Wind Map, Environmental Map Folders by clicking on the + tabs.

On the Regional Map (multi-county) titled South Central Kansas Renewable Resource Analysis there is a folder titled Environmental Concern Map. If you are viewing that map click on it as well.



Turn all of the layers in each of these folders off by clicking on the eye icon.



You are now ready to use the map. Turn back on the combination of layers that you want to evaluate by clicking in the empty eye icon box. Experiment. Looking at combinations of different layers of information can often lead to useful insights.

South Central Kansas Renewable Energy Resource Map(s)

Sources of Data for Key Individual Layers

Solar Map

Solar Radiation

Annual Solar Insolation (energy), Watt-hour/M²

Taken from the Kansas Solar Resource Map prepared for the Kansas Corporation Commission by Coriolis in 2008. Based on 15 years (1991-2005) of hourly solar insolation contained in the National Solar Radiation Data Base (NSRB) acquired from the National Renewable Energy Laboratory. A copy of the Kansas Solar Resource Map and associated information can be downloaded from <http://www.kcc.state.ks.us/energy/solar.htm>.

Solar: 1 January Avg thru Solar: 12 December Avg show month specific values taken from the data described above.

Wind Map

Truewind Power Density, 100 m

Taken AWS Truewind prepared a series of wind speed and power maps for the Kansas Corporation Commission in 2008 using their MesoMap method. Copies of the Wind Resource Map of Kansas are available at <http://www.kcc.state.ks.us/energy/wind.htm>.

Truewind Power Density, 70 m, Truewind Power Density, 50 m, Truewind Wind Speed, 100 m, Truewind Wind Speed, 70 m, Truewind WindSpeed, 50 m, are all part of the map set described above.

Coriolis Wind Speed Raster, 50 m

Taken from the Kansas Wind Resource Map prepared for the Kansas Corporation Commission by Coriolis in 2003 using the WindMap software. Copies of the individual county maps are available at http://www.kcc.state.ks.us/energy/comm_wind/cw_toolkit.htm.

Environmental Map

TNC: Lesser Prairie Chicken Range Drawing

Provided by Brian Obermeyer <bobermeyer@TNC.ORG> of The Nature Conservancy.

TNC: Greater Prairie Chicken Range Drawing

Provided by Brian Obermeyer <bobermeyer@TNC.ORG> of The Nature Conservancy.

State: Natural Communities by Section Drawing 2

Originator: Kansas Natural Heritage Inventory

Publication_Date: 20080718

Title: natural_communities

State: Protected Areas Drawing

Originator: Kansas Natural Heritage Inventory

Publication_Date: 20080718

Title: protected_areas

State: Archaeological Sites by Section

Wind and Prairie Task Force

TNC: Untilled Lands

Provided by Brian Obermeyer <bobermeyer@TNC.ORG> of The Nature Conservancy.

State: Rare Plants and Animals 1 mi buffer Drawing

Originator: Kansas Natural Heritage Inventory

Publication_Date: 20080718

Title: rare_species

TNC: Whooping Cranes Migration 90avg_buffers_75-95 Drawing

The Whooping Crane Migration data was provide by Brian Obermeyer <bobermeyer@TNC.ORG> and Chris Hise cmhise@TNC.ORG and the following information must accompany the data.

Required Reading for Users of the Whooping Crane Tracking Project Database

WCTP-GIS data or derivatives thereof (e.g., shape files, jpegs) may not be distributed or posted on the Internet without this explanatory document.

The Cooperative Whooping Crane Tracking Project (WCTP) was initiated in 1975 to collect a variety of information on whooping crane migration through the U.S. portion of the Central Flyway. Since its inception in 1975, a network of Federal and State cooperating agencies has collected information on whooping crane stopovers and funneled it to the U.S. Fish and Wildlife Service (Service) Nebraska Field Office where a database of sighting information is maintained. The WCTP database includes a hardcopy file of whooping crane sighting reports and a digital database in various formats based on those sighting reports. A subset of the database along with sight evaluation (habitat) information collected between 1975 and 1999 was summarized by Austin and Richert (2001).*

In the Fall of 2007, the WCTP database was converted to a GIS format (ArcGIS 9.2) to facilitate input, updates, and provide output options in a spatial context. During this process, inconsistencies between the digital database and sighting report forms were identified and corrected. Location information in various formats was derived from data in the corrected database, and new fields were added to the corrected database (e.g., latitude and longitude in decimal degrees, an accuracy field, and location comment field). The attached file contains observation data through the 2007 Fall migration and is referred to as the WCTP-GIS (2007b).

The appropriate use of the WCTP-GIS is constrained by limitations inherent in both the GIS technology and observer bias inherent in any database comprised of incidental observations. Without an understanding of the assumptions and limitations of the data, analyses and output from the spatial database can result in faulty conclusions. The following assumptions and characteristics of the database are crucial to interpreting output correctly.

- First and foremost, the database is comprised of incidental sightings of whooping cranes during migration. Whooping cranes are largely opportunistic in their use of stopover sites along the Central Flyway, and will use sites with available habitat when weather or diurnal conditions require a break in migration. Because much of the Central Flyway is sparsely populated, only a small percent of stopovers are observed, those observed may not be identified, those identified may not be reported, and those reported may not be confirmed (only confirmed sightings are included in the database). Based on the crane population and average flight distances, as little as 4 percent of crane stopovers are reported. *Therefore, absence of documented whooping crane use of a given area in the Central Flyway does NOT mean that whooping cranes do not use that area or that various projects in the vicinity will not potentially adversely affect the species.*
- In the database, the location of each sighting is based on the first observation of the crane group even though, in many cases, the group was observed at multiple locations in a local area. For this and other reasons described below, only large scale analyses of whooping crane occurrences are appropriate. GIS **cannot** be legitimately used with this database for measurements of distance of whooping crane groups from various habitat or geographic entities (i.e., using various available GIS data layers). In addition, point locations of whooping crane groups known to roost in various wetlands or rivers may not coincide with those wetlands. The user needs to refer to the attribute table or contact the Nebraska Field office for more specific information on individual observations.
- Precision of the data: When a “Cadastral” location (Township, Range, Section, ¼-Section) was provided on the original sighting form, the geographic point representing that sighting was placed in the center of the indicated Section or ¼-Section and the latitude and longitude of that point was recorded in DMS. These records are indicated by “Cadastral” in the accuracy field. When Cadastral information was lacking, Degrees-Minutes-Seconds (DMS) latitude and DMS longitude was derived by adding seconds (00) to the Degrees and Minutes of latitude and longitude originally estimated and recorded on the observation form. These observations are identified by “Historic” in the accuracy field. GPS latitude and longitude was used when available, but when none of the above was reported, the point was placed on text description of location (e.g. 3 miles N of Denton), and identified in the

accuracy field with "Landmark". DMS latitude and longitude were converted to decimal degrees which were used to populate the GIS data layer.

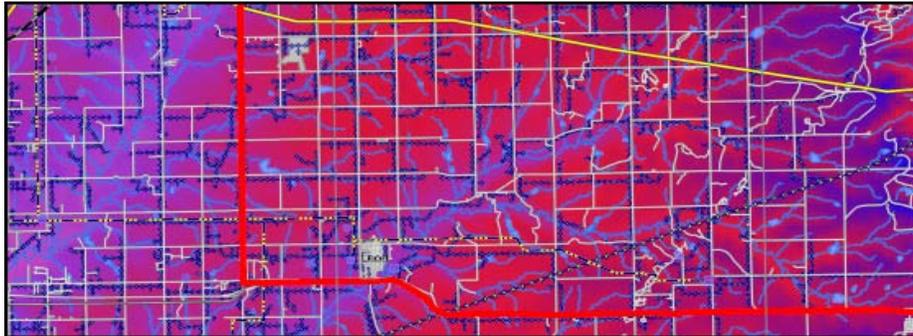
- **Observer bias:** Observer bias is an inherent characteristic of any data obtained through incidental sightings. That is, for the subset of crane use that is recorded, relatively more sightings are recorded in areas such as National Wildlife Refuges where knowledgeable observers are available to look for cranes and report their presence. However, relative use of such areas is also determined to some extent by habitat management on the areas and availability of alternative habitat in the region. For these reasons, representations of the crane migration corridor based on percent of confirmed sightings should be interpreted conservatively, particularly in Oklahoma and Kansas where a high percent of sightings occur on a few National Wildlife Refuges.

The WCTP-GIS (2007) will be updated annually following the Fall migration and distributed to State cooperators and Fish and Wildlife Service Ecological Services Field Offices in the Central Flyway. Contact information for these offices can be found at <http://www.fws.gov>. Federal regulatory agencies and project proponents should contact the appropriate Fish and Wildlife Service for help in evaluating potential project impacts to the endangered whooping crane.

* Austin, E.A. and A.L. Richert. 2001. A comprehensive review of observational and site evaluation data of migrant whooping cranes in the United States, 1943-99. U.S. Geological Survey. Northern Prairie Wildlife Research Center, Jamestown, North Dakota, and State Museum, University of Nebraska, Lincoln, Nebraska. 157 pp.

Renewable Energy
Resource Potential: South Central Kansas
South Central Kansas Economic Development District

Butler, Chautauqua, Cowley, Elk, Greenwood, Harper, Harvey, Kingman,
Marion, McPherson, Reno, Rice, Sedgwick, and Sumner
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