U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Selected ARC/INFO coverages created for investigations of the distribution and resources of coal in the Kaiparowits Plateau, southern Utah: an accompaniment to Hettinger and others, 1996 version 1

By

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CONTENTS

FIGURES

INTRODUCTION

The U.S. Geological Survey (USGS) is undertaking a five-year effort to identify and characterize coal beds and coal zones that could provide the fuel for the Nation's coal-derived energy during the first quarter of the 21st century. As part of the National Coal Assessment, Hettinger and others (1996) have completed an assessment of the coal deposits in the John Henry member of the Straight Cliffs Formation, Kaiparowits Plateau of southern Utah. Their report delineates the distribution of coal and provides estimates of resources in the basin. It also serves as a basis for future coal resource assessment, coal availability and recoverability, and coal reserve studies. A fundamental component of their work was the digital geologic and geographic data compiled in a Geographic Information System (GIS). GIS technology allowed for the spatial integration of data layers and resulted in the ability to display, analyze, and query data and to produce information that is useful for land-use planning.

The Kaiparowits Plateau digital data are contained in Environmental Systems Research Institute (ESRI) ARC/INFO coverages. A coverage is a digital representation of a theme or map in the form of vector data. A coverage stores related features and associated feature attributes in tables to create a set of thematically associated data considered as a unit or layer. The ARC/INFO coverages are contained in "workspaces" stored in a structured data library. Workspaces provide an umbrella to store both coverages (spatial locations) and attributes (INFO tables). The data structure is described in the section entitled, "Database Management, Design, and Organization".

The ARC/INFO coverages are being released as they meet the Federal Geographic Data Committee (FGDC) compliant metadata standards and criteria. The data layers included in this report were used to generate figures 1, 3, 8, 9, 10, 11, 13, 15, and 22 in Hettinger and others (1996).

This report will discuss:

a) digital file download utilities and procedures
b) the Kaiparowits database design and organization
c) the ArcView project provided, which functions as an analytical tool capable of displaying and analyzing the layers and results discussed in Hettinger and others (1996)
d) metadata provided for each coverage
e) UNIX Platform Considerations

The Appendices 1 through 4, provide a brief description of each coverage, a list of the coverages and tables (and the items within) contained in each ArcView project view, respectively. More detailed information can be found in the metadata associated with each coverage.

GETTING STARTED: DOWNLOADS

STEP 1. Download files.

The entire suite of files can be downloaded in the form of a TAR file (that has been compressed with GZIP) from the World Wide Web. The location is:

http://energy.cr.usgs.gov:8080/coal/kaip_arc1.html

Save the files to disk on your computer by copying the GZIP file (***kaip.tar.gz***) to your preferred directory.

STEP 2. Run the GZIP and TAR utilities.

Special utilities or commands are necessary to extract or unload the data and the ArcView project file from the GZIP and TAR files.

I. UNIX platform

Software to uncompress and extract files in these formats are readily available for UNIX platforms (if your UNIX distribution doesn't include these utilities, a source for downloading them is the Free Software Foundation. For more information, visit the web site at:

http://greenwood.cr.usgs.gov/maps/software.html

To extract the suite of files from the GZIP and TAR files, in the directory where ***kaip.tar.gz*** resides, the command sequence is as follows:

```
gzip –d kaip.tar.gz
tar -xvf  kaip.tar
```

II. Windows and Macintosh platforms

Windows and Macintosh users can acquire and use one of the many freeware, shareware, or commercial GZIP and TAR utilities available for these platforms from one of many sources such as:

http://greenwood.cr.usgs.gov/maps/software.html (to find/download GZIP and TAR for Windows and/or Macintosh)

http://www.winzip.com/download.cgi (for built-in Windows support for popular Internet file formats, download WinZip evaluation version)

http://www.shareware.com (GZIP and TAR utility for the Macintosh and other platforms)

Save the GZIP and TAR utilities to the preferred program directory on your computer. On Windows and Macintosh systems, the GZIP and TAR utilities can be accessed by simply placing the cursor on the utility icon in the directory where the utility resides, and double-clicking with the mouse button.

Note: On a Macintosh platform, after selecting a file to unTAR, a window may appear that contains an option to convert NL (new line) to CR (carriage return). Do not select this option.

The work space has a directory structure included that the ArcView project will automatically access. Any changes or movement of files within the directory structure may result in ArcView not performing optimally. See the section below entitled, "The ArcView Project -- Recommendations and Dependencies". See Figure 1 for a diagram of the directory structure.

Basic Contents of the TAR File

The directory where the data have been extracted from the TAR file should contain the following files and directories:

.arc - a UNIX platform ARC/INFO startup file

alias.txt - a UNIX platform file that contains shortcuts to access long directory paths at system level (described in the sections entitled, "Database Management, Design, and Organization" and "UNIX Platform Considerations")

exports - ARC export files for each of the coverages included in this report are stored in this directory and are being provided for import into software packages in addition to ESRI products.

k1.apr - the ArcView project file (instructions are in the section entitled "The ArcView Project")

kaip - the top level directory where ARC/INFO coverages reside (see Figure 1)

readme.doc - this *readme* file in a Microsoft Word for Windows version 7 document. (This *readme* file is also available at http://energy.cr.usgs.gov:8080/coal/kaip_arc1.html in a html document)

stat_nca - UNIX platform file that contains global variables, which are shortcuts to directories in ARC/INFO (described in the sections entitled, "Database Management, Design, and Organization" and "UNIX Platform Considerations")

utah - the top level directory where ARC/INFO coverages reside (see Figure 1)

DATABASE MANAGEMENT, DESIGN, AND ORGANIZATION

The Kaiparowits data structure is a component of the larger USGS Energy Team Regional/National Coal Assessment Data Library. It parallels the Regional/National structure that resides on a Energy Team server in the Central Region. The database is organized into a hierarchical structure with the top level directories containing work areas defined by an area of geographic extent. Work areas provide an umbrella to store ARC/INFO "workspaces" as well as other types of files. A workspace stores ARC/INFO coverages and the associated attribute data in the INFO directory. The major Kaiparowits work areas are **utah** and **kaip**, which correspond to state-wide Utah coverages or layers of information and Kaiparowits Plateau coverages, respectively.

The following Data Library Organization Chart is provided to guide users to the location and naming conventions of the ARC/INFO coverages. Below is a description of the database structure.

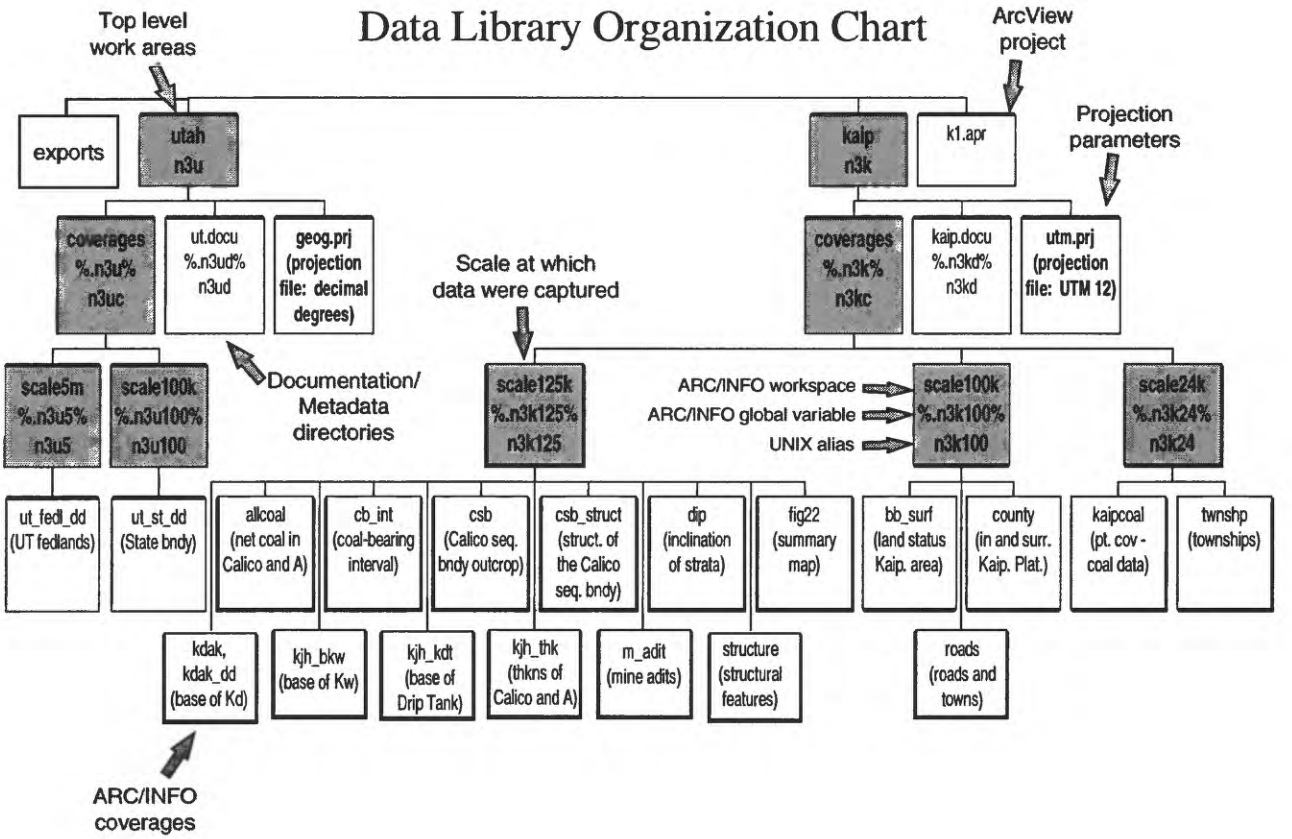

Figure 1. -- Directory structure of the Kaiparowits Plateau files included in this digital publication. This chart illustrates an example of the directory structure of the USGS Central Energy Team Regional/National Coal Assessment Data Library.

Below each of the level 1 top-level directories are level 2 subdirectories containing the important individual components for the spatial analysis and ArcView projects. The components consist of

ARC/INFO coverages, metadata documents, and a file containing projection parameters for the coverages (*geog.prj* and *utm.prj*). Projection files contain the parameters used in a GIS workspace to georeference or register the digital information to the surface of the Earth for accurate overlay, analysis and resource calculations. Often, it is necessary to store a coverage in more than one projection in order to display data at various scales, of which there is only one case in this report (*kdak* and *kdak_dd*; in **kaip/coverages/scale125k**). Coverages used to display data at a Utah statewide scale are inaccurate in the chosen projection for spatial analysis in the Kaiparowits Plateau study area (Universal Transverse Mercator – UTM, zone 12). ArcView can change projections interactively when the data (either coverages or shapefiles) are stored in geographic decimal degrees (latitude and longitude). For this reason, it is important to keep a copy of coverages in geographic decimal degrees format for ease of display in ArcView of combinations of coverages from various workspaces at various scales (local, statewide, national). *kdak_dd* is in geographic decimal degrees for the Utah statewide index map. Geographic format is not a true projection, but a spherical reference system. It is appropriate for graphical display, but caution must be exercised in performing spatial analysis using area and perimeter with coverages stored in geographic format. The coverages included in this report that are stored in geographic decimal degrees are those coverages that are included exclusively for display in a locality map.

Because the directory structure organizes spatial information, scale and resolution of the data are important factors in arranging the hierarchy of a spatial data repository. This gives an immediate identifier to the level of detail based on the scale at which the data were captured. Resolution is directly related to the accuracy and obviously important in analysis and interpretation. Multiple scales are necessary to adequately display differing National, regional, and site-specific products and analyses. This type of grouping of ARC/INFO coverages in workspaces defined by scale (m = million, k = thousand), provides a more useful means of storage than including the resolution of the data in the coverage name. To do the latter may pose a problem in that the filenames could become very long. To help increase efficiency and avoid typing long path names, global variables were developed and are included in this report in a file named *stat_nca*. Included also are aliases that expedite moving through the directory structure at the UNIX system level. That file is named *alias.txt*. The use of the global variables, aliases and the ARC/INFO startup file will be discussed in the section entitled, "UNIX Platform Considerations".

The filenames are significant, descriptive, and designed to be intuitive. They give basic thematic information and are annotated in Figure 1. For a brief description of the coverages, see Appendix 1. More detailed documentation is included in the formal metadata for each coverage (see section entitled "Metadata".

THE ARCVIEW PROJECT

Introduction/Compilation

The ArcView project (*kl.apr*) was created using ESRI ArcView GIS software Version 2.1. ArcView GIS software is a desktop GIS with a user-friendly graphical user interface (GUI) allowing users to easily load and display spatial and tabular data. ArcView provides tools to query, analyze and present

results of the data. The output of an ArcView analysis is the "project" file that by convention carries the *.apr* extension.

The ArcView project serves several purposes, including:

1) immediate graphical representation of the data
2) prompt familiarity with the coverages used to create the graphics
3) simplified spatial analysis
4) ability to easily create additional graphics based on user-defined selection/display of attributes

The ArcView project file has been designed for maximum utility on a variety of computer platforms. Initial compilation was on a Intel Pentium platform running Windows NT. It can be opened in either ArcView 2.1 or ArcView 3.0, and it accommodates all types of computer platforms including: UNIX, Windows-based PCs, and Macintosh.

Recommendations and Dependencies

After you have successfully extracted files from the TAR file, it is important to keep the directory structure intact as provided so that ArcView can locate the associated coverages, that is, with the ArcView project file stored at the same directory level as the **kaip** and **utah** directories. The directory structure is the key or pathway for ArcView to locate and display themes. Moving the ArcView project file relative to the data will require editing to adjust paths stored within the project file or development of system-specific environment variables for ArcView and the system properties. Additionally, if the project file is saved before exiting, it is recommended that the project be saved to a new file. Saving the project to the original file before exiting will alter entire paths to the associated coverages in the project file; this can be significant if the project file is subsequently moved to another directory or computer system. For example, the paths in this ArcView project file begin with the top-level directories, i.e., *kaip/coverages/scale100k/county*. Whenever an ArcView project is saved, all paths to where the data reside are placed in the ArcView project file. If the user downloads this suite of files to the d: drive and saves the ArcView project, the path listed above is now altered to *d:/kaip/coverages/scale100k/county*.

ArcView Procedure

Once the ArcView program is started, click on the File pulldown menu and select Open Project. Select the appropriate drive in the lower right of the Open Project window, then select *kl.apr* and click on OK. When the project file is open, you will see the application window that contains the ArcView user interface. Like all the windows in ArcView, you can move, resize, minimize, or maximize this window. This ArcView project was developed using 16-bit color. Set your monitor to that setting or greater for the best viewing. On both Macintosh and UNIX platforms, we found that the original application window may need to be enlarged slightly by dragging the upper right or lower right corner.

The application window contains a View document window that partially overlies the Project window. The Project window displays the names of all the documents contained in this ArcView project. The ArcView user interface consists of menus, buttons, and tools arranged in three bars at the top of the

application window. Along the bottom of the application window is the status bar. When you place the cursor over a button or tool, the status bar displays a one-line description of the operation it performs. **Loading of this ArcView project is complete when the lightning bolt tool, turns from gray to black (becomes active).**

The first view is an index map showing the location of the Kaiparowits Plateau, southern Utah.

Step 1. **Hotlinks:** As instructed in the note at the lower right on the first view, move the cursor using the left mouse button to click on the lightning bolt in the application window tool bar, to use the hotlink tool. The hotlink tool links to other views, tables, images, text. With the tip of the lightning bolt tool, click inside the Kaiparowits Plateau to link to the next view, which is Figure 1, showing the location of the Kaiparowits Plateau, Utah, modified from Hettinger and others (1996). (The hotlink is associated with the theme labeled "Kaiparowits Plateau" in the legend. This theme should be and must be active in order for the predefined action to occur. The theme labeled "Kaiparowits Plateau" is active when it appears to be contained in a raised box in the legend. Click the left mouse button with the cursor in the general vicinity of a theme in the legend to make that particular theme active.)

Step 2. **Selection Tool -- Making Windows Active:** Use the left mouse button to click on the black arrow (the selection tool) in the tool bar. Use the selection tool to click anywhere in the Project window to make it active. In the white portion of the Project window are a list of views. Each view contains a display, and is a modification of one of nine figures from Hettinger and others (1996), including figures 1, 3, 8, 9, 10, 11, 13, 15, and 22. By double-clicking with the mouse button on the name of a view, that view becomes active. Sequentially display each of the figures to view the coverages included in this report.

Theme Display and Properties

The data files that make up each view are referred to as "themes" in ArcView. Themes are synonymous with ARC/INFO coverages or ArcView shapefiles. The theme names appear along with the legend information in a gray box to the left of the view, and in this ArcView project, serve as a short description of the coverage.

Theme Properties: To see the coverage name and path, as shown in the Data Library Organization Chart, click with the left mouse button in the general vicinity of a theme in the legend box. The theme name and its associated legend become a raised box. Now click on the word Theme in the menu bar along the top of the view user interface to activate a pull-down menu. Select Properties from the pull-down menu. In the left margin of the Theme Properties window, the Definition tool, when highlighted and active, lists the source.

A single click with the left mouse button on the icon containing a hammer and a question mark (query builder) lists the fields in the active theme. Each field is an attribute that can be queried for spatial analysis. Each attribute is described in Appendix 4 and is explained in detail in the formal metadata associated with each coverage. In the Query Builder window, click in the box to the left of Update Values to place an "X" in the box and make it active. Now double-click any field with the left mouse

button to see all of the values stored in the selected field. Cancel the Query Builder and Theme Properties windows to return to the View tools.

Identify Tool: The leftmost tool in the View tool bar is the identify tool. This tool contains the letter "i" inside a black solid circle, and can be used, for example, to identify the values in color ramp figures or specific attributes.

Additional Features or Items

Note that values assigned to contour intervals have been assigned to the polygons by taking the midpoint of the range of values defined by that polygon. See the formal metadata associated with each coverage for further information.

Revisit this web site for future additions (http://energy.cr.usgs.gov:8080/coal/kaip_arc1.html).

The final view listed in the Project window is the index map that is activated upon loading this ArcView project.

METADATA

A critical aspect of this report is the documentation of the digital layers or themes. As a result of the 1994 Executive Order 12906, metadata (information about the data, i.e., it's source, scale, process steps, etc.) documentation is required for all "new" (post 1994) digital spatial information generated by U.S. Government agencies. Metadata is being organized by the Federal Geographic Data Committee (FGDC) into a National clearinghouse of digital information, the National Spatial Data Infrastructure (NSDI). NSDI serves as a metadata repository, provides pointers to accessible digital information, reduces digital compilation effort within the Federal Government and Public, and provides a forum for exchange of data and ideas. Documentation augments utility, educates people about the data, assists them in determining its usefulness, and helps track content and data quality.

For each of the coverages included in this report, FGDC-compliant metadata have been compiled using several tools including: ESRI's DOCUMENT.AML, a text editor, and tools developed by the USGS including CNS, XTME, and MP (http://geochange.er.usgs.gov/pub/tools/metadata). The metadata documents are stored in an ASCII text file in each of the subdirectories, *kaip.docu* or *ut.docu*, at the level where the coverages reside (all coverages stored below the **kaip** top-level directory have metadata files in the subdirectory *kaip.docu*).

The metadata filenames are *'coveragename'.meta*, i.e., metadata for the coverage *roads* is named *roads.meta*. The process was more efficient and successful by using DOCUMENT.AML only to extract pertinent information from the coverages. The DOCUMENT CREATE command allows the user to capture and extract metadata information from the coverage. The information processing done by DOCUMENT CREATE includes converting and reporting the bounding coordinates in latitude and longitude decimal degrees, reporting of the native dataset environment, calculating and reporting the spatial data organization information and spatial reference information, reporting some of the entity and

attribute information and metadata reference information. That information is also written to INFO files associated with the coverage. Once CREATE is complete, the user quits that DOCUMENT option, and runs another DOCUMENT option (FILE) to create an ASCII metadata file from the INFO files created during DOCUMENT CREATE. The resultant ASCII metadata file can then be referenced while using other tools that proved to be more appropriate for entering the additional metadata information.

The tools developed by the USGS (XTME, CNS and MP) serve to ensure that metadata are structured appropriately for the NSDI. XTME creates a metadata template that can be filled in while in the program or saved and edited using a text editor. Use of a text editor simplifies cutting and pasting information you might have in unformatted documentation files and in the ASCII text file saved from running DOCUMENT FILE. Users can transfer metadata files in and out of XTME and the text editor as needed. CNS ("chew 'n spit") is a utility that formats the data properly for XTME and MP and stores any additional information into the "leftovers" file. CNS proved to be a critical tool for formatting FGDC-compliant metadata. MP is used upon completion of metadata compilation. MP scans the metadata document and reports to the user by line number any errors that were encountered. With a text editor, the user can then isolate and correct those errors, and rerun MP. Occasionally running CNS once again on the metadata file immediately before running MP will correct some of those errors (that is, errors caused by inappropriate formatting). MP can also be used to write the metadata file in ASCII, HTML, SGML, or DIF formats.

Printing of metadata from a word processing program gives better results than simply printing the raw ASCII text file, in that the word processing program will force long lines of text to wrap rather than get truncated.

UNIX PLATFORM CONSIDERATIONS

ARC/INFO Global Variables

The global variables, as mentioned in "Database Management, Design, and Organization", provide an efficient way to access coverages in a hierarchical data structure. Use of variables reduces typing and allows a user to process coverages in workspaces other than in the one the user is currently working.

The global variables are activated on a UNIX machine by first performing a global edit on the paths in the file *stat_nca*. One can change */coal2/nca/reg3/* to be the entire path, including the name of the disk, to where the **utah** and **kaip** top-level directories were downloaded. For instance, if the files are housed in a subdirectory you named *kp* (for Kaiparowits Plateau) in your home directory on a SUN server, change */coal2/nca/reg3/* to */home1/(username)/kp/*. Next, copy *stat_nca* to *$ARCHOME/stations/stat_nca*, and put the *.arc* file (a startup file) in your home directory. Normally only the system administrator has write access to *$ARCHOME/stations* and can copy *stat_nca* from your directory. The *.arc* file contains a single command (*&station nca*) that activates the stations file (*stat_nca*) when the ARC/INFO program is started.

The global variables are indicated on the Data Library Organization Chart (see Figure 1.) and are used as a shortcut in ARC/INFO in typing the directory path. For example, at the Arc prompt, type:

workspace %.n3k125% to move to *kaip/coverages/scale125k/*. To describe the *roads* coverage from a workspace other than the one in which it resides, at the Arc prompt, type:
describe %.n3k100%roads

An Arcedit example is as follows: Displaying the structural features with township and range lines can be accomplished by typing:
ec %.n3k125%structure
bc %.n3k24%twnshp 2

Aliases

Aliases are UNIX-platform codes used to define long commands. The aliases work the same as the global variables except at the UNIX-system level, rather than within ARC/INFO. These particular aliases expedite moving through the directory structure at the UNIX-system level. In order for the aliases to work, a person must edit the paths in the file *alias.txt*. The procedure is the same as that described for *stat_nca* (change */coal2/nca/reg3/* to be the entire path, including the name of the disk, to where the **utah** and **kaip** top-level directories were downloaded). The following statement must be typed at the system prompt or added to the *.cshrc* file in your home directory: *source alias.txt* (in this case, the *alias.txt* file would also reside in your home directory; if not, include the path to *alias.txt* in the command that is placed in the *.cshrc* file). The aliases are activated each time you log onto the UNIX system or by typing from your home directory: *source .cshrc*

Examples:
To use an alias to move to the directory that contains the metadata for all of the coverages below the **kaip** top-level directory, at the system prompt, type: *n3kd* which stands for *kaip/kaip.docu*
To list the files in *kaip/coverages/scale125k/*, type: *n3k125* (to move to that directory)
and then type: *ls -al*

The *n3* at the beginning of each alias and global variable defines the directory structure as it exists in the USGS Energy Resource Survey Team's Regional/National Coal Assessment Data Library. The *n* stands for the top-level directory of that library, *nca*, and the *3* stands for the next level subdirectory where Colorado Plateau data reside, *reg3* (for Region 3), based on defined USGS Energy Resource Regions:

(see http://www-gd.cr.usgs.gov/resass/fig3.jpg
and http://energy.usgs.gov/factsheets/nca/2.html
and http://energy.cr.usgs.gov:8080/coal/index.html
and http://energy.usgs.gov/factsheets/nca/nca.html
and associated web pages)

For example: the alias *n3kd* stands for */nca/reg3/kaip/kaip.docu/*

Regional/National Coal Assessment
Data Library Structure

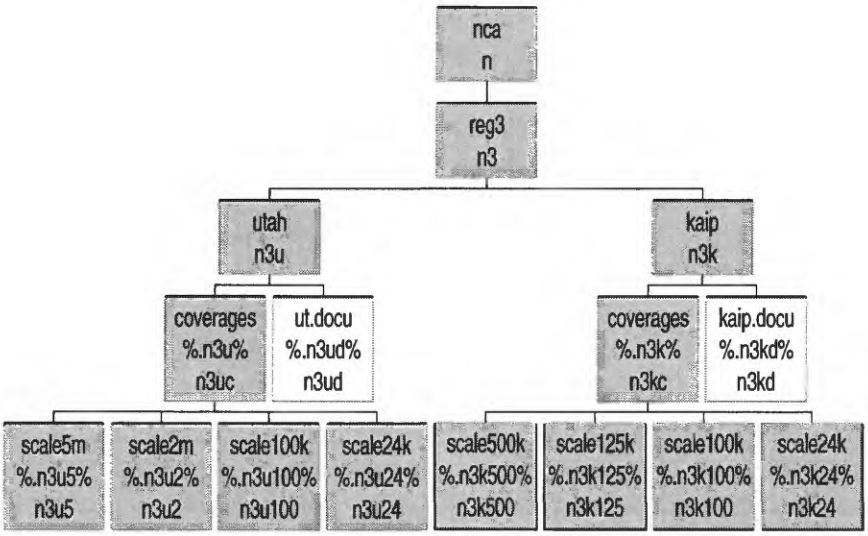

Figure 2. -- Example of the directory structure of the USGS Central Energy Team Regional/National Coal Assessment Data Library.

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Sargent, K.A. and Hansen, D.E., 1982, Bedrock geologic map of the Kaiparowits coal-basin area, Utah, U.S. Geological Survey Miscellaneous Investigations Series Map, Map I-1022-I, scale 1:125,000.

U.S. Department of Commerce, Bureau of Census, 1990, TIGER line files Precensus files, scale 1:100,000.

Utah State Geographic Information Database (SGID), 1995, Public Land Survey System, Utah Division of State Lands and Forestry, Logan, Utah, scale 1:24,000.

APPENDIX 1

The following is a list of the coverages and a brief description of each. More detailed documentation are included in the metadata files associated with each coverage. Note: in the ARC/INFO workspace names designated by scale, k = thousand and m = million.

Directory and workspace:
kaip/coverages/scale24k:

twnshp — Polygon coverage: township and range in the Kaiparowits Plateau study area.

kaipcoal — Point coverage: point source data for coal in the John Henry Member of the Straight Cliffs Formation east of 112 degrees longitude in the Kaiparowits Plateau study area.

kaip/coverages/scale100k:

bb_surf — Polygon coverage: land management status "clipped" from the statewide Utah land ownership coverage originally derived from Gap Analysis (Edwards, 1993). The clip is a bounding box that surrounds the Kaiparowits Plateau study area.

county — Polygon coverage: counties in the Kaiparowits Plateau study area.

roads — Line coverage: roads in the Kaiparowits Plateau study area.

kaip/coverages/scale125k:

allcoal — Polygon coverage: the total coal coverage containing eleven different attributes of information including net coal thickness and estimated coal tonnages. This layer was derived from a "union" process, i.e., intersection and overlay of numerous layers and retaining attributes of each.

cb_int — Polygon coverage: the Kaiparowits Plateau area, representing **total** coal-bearing intervals or **partially eroded** coal-bearing intervals.

csb — Polygon coverage: the outcrop of the Calico sequence boundary. It defines the base of the coal-bearing John Henry Member of the Straight Cliffs Formation east of 112 degrees of longitude.

csb_struct — Polygon coverage: the structure contours of the Calico sequence boundary in the Kaiparowits Plateau study area.

dip — Polygon coverage: the inclination of strata within the Kaiparowits Plateau study area.

fig22 Polygon coverage: showing areas of the Kaiparowits Plateau where geologic conditions are more favorable for current underground mining technology (Hettinger and others, 1996, fig. 22).

kdak Polygon coverage: the outline of the Kaiparowits Plateau east of 112 degrees of longitude, delineated by the base of the Upper Cretaceous rocks (Dakota Sandstone) except along its northern boundary which is delineated by the Paunsaugunt fault and volcanic rocks of Tertiary age.

kdak_dd Polygon coverage: same as above, in geographic decimal degrees.

kjh_bkw Polygon coverage: the outcrop of the base of the Wahweap Formation (Upper Cretaceous) east of 112 degrees of longitude. The northern boundary is delineated by the Paunsaugunt fault and volcanic rocks of Tertiary age.

kjh_kdt Polygon coverage: the outcrop of the base of the Drip Tank Member of the Straight Cliffs Formation (Upper Cretaceous) east of 112 degrees of longitude. The northern boundary is delineated by the Paunsaugunt fault and volcanic rocks of Tertiary age.

kjh_thk Polygon coverage: contours of the combined thickness of the Calico and A-sequences in the Kaiparowits Plateau study area.

m_adit Line coverage: coal mine adits within the Kaiparowits Plateau study area.

structure Line coverage: the structural features within the Kaiparowits Plateau study area.

utah/coverages/scale100k:

ut_st_dd Polygon coverage: the Utah State boundary (in geographic decimal degrees).

utah/coverages/scale5m:

ut_fedl_dd Polygon coverage: generalized land status in Utah (in geographic decimal degrees).

APPENDIX 2

The following is a list of coverages contained in each ArcView project view, the theme name(s), and the source scale. The figure numbers correspond to those in Hettinger and others (1996). [thk = thickness; bndy = boundary; elevs = elevations]

coverage name	Theme name	source scale

a) Figure 1 – Location of Kaiparowits Plateau

m_adit	Mine adits	(captured at 1:125,000 scale)
roads	Roads	(captured at 1:100,000 scale)
kdak (arc)	Base Upper Cret.	(captured at 1:125,000 scale)
kdak (poly)	Kaiparowits Plateau	(captured at 1:125,000 scale)
county	County	(captured at 1:100,000 scale)
bbsurf	Land Status	(captured at 1:100,000 scale)

b) Figure 3 – Generalized geologic map

twnshp	Townships	(captured at 1:24,000 scale)
kjh_bkw	Tert. and Cret. undiv.	(captured at 1:125,000 scale)
kjh_kdt	Drip Tank Member	(captured at 1:125,000 scale)
csb	Calico and A-sequences	(captured at 1:125,000 scale)
kdak	Base Upper Cret.	(captured at 1:125,000 scale)

c) Figure 8 – Isopach map, Calico and A-sequences

csb	Calico and A-sequences	(captured at 1:125,000 scale)
kaipcoal	Data points	(captured at 1:24,000 scale)
cb_int	Coal-bearing interval	(captured at 1:125,000 scale)
twnshp	Townships	(captured at 1:24,000 scale)
kjh_thk	Calico and A-sequences thk	(captured at 1:125,000 scale)

d) Figure 9 – Structural features and inclination of strata

csb	Calico sequence bndy	(captured at 1:125,000 scale)
structure	Structure	(captured at 1:125,000 scale)
dip	Dip	(captured at 1:125,000 scale)
twnshp	Townships	(captured at 1:24,000 scale)

coverage name	Theme name	source scale

e) Figure 10 – Structure contour map of the Calico sequence boundary

csb	Calico and A-sequences	(captured at 1:125,000 scale)
kaipcoal	Data point	(captured at 1:24,000 scale)
twnshp	Townships	(captured at 1:24,000 scale)
csb_struct	Calico sequence bndy elevs	(captured at 1:125,000 scale)

f) Figure 11 – Isopach map of net coal in the Calico and A-sequences

csb	Calico and A-sequences	(captured at 1:125,000 scale)
kaipcoal	Data point	(captured at 1:24,000 scale)
twnshp	Townships	(captured at 1:24,000 scale)
allcoal	Total coal	(captured at 1:125,000 scale)

g) Figure 13 – Reliability for coal resources in the Calico and A-sequences

csb	Calico and A-sequences	(captured at 1:125,000 scale)
twnshp	Townships	(captured at 1:24,000 scale)
allcoal	Reliability	(captured at 1:125,000 scale)

h) Figure 15 – Overburden on the Calico sequence boundary

csb	Calico and A-sequences	(captured at 1:125,000 scale)
twnshp	Townships	(captured at 1:24,000 scale)
allcoal	Overburden	(captured at 1:125,000 scale)

i) Figure 22 – Summary map

twnshp	Townships	(captured at 1:24,000 scale)
csb	Calico and A-sequences	(captured at 1:125,000 scale)
fig22	Summary map	(captured at 1:125,000 scale)
cb_int	Coal-bearing interval	(captured at 1:125,000 scale)

j) Location of the Kaiparowits Plateau, Utah

kdak_dd	Kaiparowits Plateau	(captured at 1:125,000 scale)
ut_st_dd	Utah State bndy	(captured at 1:100,000 scale)
ut_fedl_dd	Land Status (generalized)	(captured at 1:5,000,000 scale)

APPENDIX 3

The following is a list of tables contained in each ArcView project view. Tables can be accessed in ArcView by first making a theme active, and then selecting **Table...** from the Theme pull-down menu. The figure numbers correspond to those in Hettinger and others (1996). See Appendix 4 for an overview of the items (fields) in each table. [undiv = undivided; thk = thickness; bndy = boundary; elevs = elevations]

coverage name	Table name	source scale
a) Figure 1 – Location of Kaiparowits Plateau		
m_adit	Attributes of Mine adits	(captured at 1:125,000 scale)
roads	Attributes of Roads	(captured at 1:100,000 scale)
kdak (arc)	Attributes of Base Upper Cret.	(captured at 1:125,000 scale)
kdak (poly)	Attributes of Kaiparowits Plateau	(captured at 1:125,000 scale)
county	Attributes of County	(captured at 1:100,000 scale)
bbsurf	Attributes of Land Status	(captured at 1:100,000 scale)
b) Figure 3 – Generalized geologic map		
twnshp	Attributes of Townships	(captured at 1:24,000 scale)
kjh_bkw	Attributes of Tert. and Cret. undiv.	(captured at 1:125,000 scale)
kjh_kdt	Attributes of Drip Tank Member	(captured at 1:125,000 scale)
csb	Attributes of Calico and A-sequences	(captured at 1:125,000 scale)
kdak	Attributes of Base Upper Cret.	(captured at 1:125,000 scale)
c) Figure 8 – Isopach map, Calico and A-sequences		
csb	Attributes of Calico and A-sequences	(captured at 1:125,000 scale)
kaipcoal	Attributes of Data points	(captured at 1:24,000 scale)
cb_int	Attributes of Coal-bearing interval	(captured at 1:125,000 scale)
twnshp	Attributes of Townships	(captured at 1:24,000 scale)
kjh_thk	Attributes of Calico and A-sequences thk	(captured at 1:125,000 scale)
d) Figure 9 – Structural features and inclination of strata		
csb	Attributes of Calico sequence bndy	(captured at 1:125,000 scale)
structure	Attributes of Structure	(captured at 1:125,000 scale)
dip	Attributes of Dip	(captured at 1:125,000 scale)
twnshp	Attributes of Townships	(captured at 1:24,000 scale)

coverage name	Table name	source scale

e) Figure 10 – Structure contour map of the Calico sequence boundary

csb	Attributes of Calico and A-sequences	(captured at 1:125,000 scale)
kaipcoal	Attributes of Data point	(captured at 1:24,000 scale)
twnshp	Attributes of Townships	(captured at 1:24,000 scale)
csb_struct	Attributes of Calico sequence bndy elevs	(captured at 1:125,000 scale)

f) Figure 11 – Isopach map of net coal in the Calico and A-sequences

csb	Attributes of Calico and A-sequences	(captured at 1:125,000 scale)
kaipcoal	Attributes of Data point	(captured at 1:24,000 scale)
twnshp	Attributes of Townships	(captured at 1:24,000 scale)
allcoal	Attributes of Total coal	(captured at 1:125,000 scale)

g) Figure 13 – Reliability for coal resources in the Calico and A-sequences

csb	Attributes of Calico and A-sequences	(captured at 1:125,000 scale)
twnshp	Attributes of Townships	(captured at 1:24,000 scale)
allcoal	Attributes of Reliability	(captured at 1:125,000 scale)

h) Figure 15 – Overburden on the Calico sequence boundary

csb	Attributes of Calico and A-sequences	(captured at 1:125,000 scale)
twnshp	Attributes of Townships	(captured at 1:24,000 scale)
allcoal	Attributes of Overburden	(captured at 1:125,000 scale)

i) Figure 22 – Summary map

twnshp	Attributes of Townships	(captured at 1:24,000 scale)
csb	Attributes of Calico and A-sequences	(captured at 1:125,000 scale)
fig22	Attributes of Summary map	(captured at 1:125,000 scale)
cb_int	Attributes of Coal-bearing interval	(captured at 1:125,000 scale)

j) Location of the Kaiparowits Plateau, Utah

kdak_dd	Attributes of Kaiparowits Plateau	(captured at 1:125,000 scale)
ut_st_dd	Attributes of Utah State bndy	(captured at 1:100,000 scale)
ut_fedl_dd	Attributes of Land Status (generalized)	(captured at 1:5,000,000 scale)

APPENDIX 4

The following is an overview of items (other than those created by ARC/INFO) found in tables in each ArcView project view. More detailed information is contained in the formal metadata files associated with each coverage. [thk = thickness; bndy = boundary; elevs = elevations]

Attributes of Base Upper Cret. (arc):

Line type Each line is identified by a character string that describes the boundary type:

Value	Description
dash	northern boundary where the Kaiparowits Plateau merges with the Aquarius Plateau.
plat	the Kaiparowits Plateau is delineated by the base of Upper Cretaceous rocks east of 112 degrees of longitude

Attributes of Calico and A-sequences thk:

Thick Combined thickness of the Calico and A-sequences

Attributes of Calico sequence bndy elevs:

Elevation Elevation of the Calico sequence boundary

Attributes of Coal-bearing interval:

Coal-bearing interval T = total coal-bearing interval
P = partially eroded coal-bearing interval

Attributes of County:

Source Each line has a code showing where the U.S. Bureau of Census obtained the data:

Value	Description
B	USGS 1:100,000-Scale DLG-3 File
D	Census Bureau Precensus Update

Boundary type All arcs are encoded as follows:

1 - State-State border occurring on land.

2 - County-county border, within State, occurring on land.

Attributes of Data points: -99 in a field means NO DATA

X in UTMs	UTM coordinate location
Y in UTMs	UTM coordinate location
Point identifier	identifies each point by its original name
Depth to top of 1st coal	depth to the top of the first coal
Depth to bottom of lowest coal	depth to the bottom of the lowest coal
Total coal thickness	total thickness of coal beds > 1 ft thick in the Calico and A-sequences. Used to generate Fig. 11, Hettinger and others (1996)
Surface elevation	surface elevation of drill hole
Elev of the CSB	elevation of the Calico Sequence boundary If the value for ELEVCSB in Appendix 1 of Hettinger and others (1996) has an asterisk beside it, then it was derived by subtracting ESTDEPTHCSB (see below) from SURFELEV. Used to generate Fig. 10, Hettinger and others (1996)
Depth to the CSB	depth to the Calico sequence boundary Used to calculate ELEVCSB by subtracting DEPTHCSB from SURFELEV. Used to generate Fig. 15, Hettinger and others (1996)
Est. depth to the CSB	estimated depth to the Calico sequence boundary inferred by correlations to nearby drill holes
Thk of Calico and A-sequences	thickness of the Calico and A-sequences, used to generate Fig. 8 in Hettinger and others (1996)
Thk of Drip Tank Member	thickness of the Drip Tank Member

Number of coal beds in total interval	number of coal beds >1 ft thick in the total coal-bearing interval
Net coal thk of beds 1-2.4' thk	net thickness of coal in beds ranging from 1-2.4' thick, used to generate Fig. 16a in Hettinger and others, 1996
Number of coal beds 1-2.4' thk	number of coal beds with thickness ranging from 1-2.4', used to generate Fig. 16b in Hettinger and others, 1996
Net coal thk of beds 2.5-3.4' thk	net thickness of coal in beds ranging from 2.5-3.4' thick, used to generate Fig. 17a in Hettinger and others, 1996
Number of coal beds 2.5-3.4' thk	number of coal beds with thickness ranging from 2.5-3.4', used to generate Fig. 17b in Hettinger and others, 1996
Net coal thk of beds 3.5-7.4' thk	net thickness of coal in beds ranging from 3.5-7.4' thick, used to generate Fig. 18a in Hettinger and others, 1996
Number of coal beds 3.5-7.4' thk	number of coal beds with thickness ranging from 3.5-7.4', used to generate Fig. 18b in Hettinger and others, 1996
Net coal thk of beds 7.5-14' thk	net thickness of coal in beds ranging from 7.5-14' thick, used to generate Fig. 19a in Hettinger and others, 1996
Number of coal beds 7.5-14' thk	number of coal beds with thickness ranging from 7.5-14', used to generate Fig. 19b in Hettinger and others, 1996
Net coal thk of beds 14.1-20' thk	net thickness of coal in beds ranging from 14.1-20' thick, used to generate Fig. 20a in Hettinger and others, 1996
Number of coal beds 14.1-20' thk	number of coal beds with thickness ranging from 14.1-20', used to generate Fig. 20b in Hettinger and others, 1996
Net coal thk of beds 20-40' thk	net thickness of coal in beds ranging from 20-40' thick
Number of coal beds 20-40' thk	number of coal beds with thickness ranging from 20-40'
Net coal thk of beds >40' thk	net thickness of coal in beds that are >40' thick
Number of coal beds >40' thk	number of coal beds with thickness >40'
Map number	identification number in plate 1 and appendix 1 (Hettinger and others, 1996).

Attributes of Dip:

Dip range of inclination of coal-bearing strata in degrees

Attributes of Land Status:

Base land ownership defined from BLM 1:100,000-scale quadrangles

Surface ownership 8-character (or less) code as follows:

PRIVATE	(private)
STATE	(State)
BLM	(Bureau of Land Management)
FS	(Forest Service)
NPS	(National Park Service)
WATER	(water)
TL	(Tribal Lands)
NREC	(National Recreation Area)
BJ	(Bankhead Jones Land Use Lands)
WA	(Wilderness Area -- denotes Federal agency surface ownership in most cases -- see *Base land ownership* field for detail)

Attributes of Land Status (generalized):

Parcel name recognized name for the parcel

State codes State(s) within which the parcel resides

Based on standard U.S. Postal Service codes. If the parcel spans multiple States, the States are listed in order of ~% contained within. When all %'s appeared ~= the State codes were entered in alphabetical order.

Managing agency Agency or Bureau which manages the parcel

This coding scheme was developed for the graphic project and is by no means official. It was an attempt at a hierarchical scheme where *Managing agency* represents the largest agency maintaining jurisdiction/administration over the parcel

Coding scheme	
NPS	National Park Service
BLM	Bureau of Land Management
FS	US Forest Service
FWS	US Fish/Wildlife Service
DOD	Department of Defense
BGR	Background/Island Polygon
BIA	Bureau of Indian Affairs

Subclass of agency Divisions of *Managing agency* code

Coding scheme		
NPK	National Park	(NPS)
NRA	National Recreational Area	(NPS)
NMT	National Monument	(NPS)
NFT	National Forest	(FS)
NRA	National Recreational Area	(FS)
NMT	National Monument	(FS)
NWR	National Wildlife Refuge	(FWS)
BLM	no subclass for BLM	
BGR	Background/Island Polygon	
BIA	Bureau of Indian Affairs	
AIRFORCE	Department of Defense	(DOD)
DOD	Department of Defense	(DOD)
NAVY	Department of Defense	(DOD)

Attributes of Overburden:

Quadrangle	7.5' quadrangles
County	counties
Overburden	range of maximum overburden overlying coal in the Calico and A-sequences (in feet times 1000)
Surface ownership	Bureau of Land Management Land status (see *Attributes of Land Status*)
Coal ownership	Federal ('fed') or non-Federal ('nonfed')
Township and Range	township and range
Reliability	either identified ('iden') or hypothetical ('hypo')
Dip	inclination of coal-bearing strata, in degrees, within the Kaiparowits Plateau
Coal-bearing interval	either total ('T') or partially eroded ('P')
Total coal thickness	net coal, in feet, in the Calico and A-sequences
Millions of short tons	coal tonnage (in millions of short tons)

Attributes of Reliability: same as *Attributes of Overburden*

Attributes of Roads:

Road description Each road is identified by a character string that describes the road type:

Value	Description
town	within a town
state	State road
highway	highway
U.S.	U.S. interstate

Attributes of Summary map:

Quadrangle	7.5' quadrangles
County	counties
Overburden	range of maximum overburden overlying coal in the Calico and A-sequences (in feet times 1000)
Surface ownership	Bureau of Land Management Land status (see *Attributes of Land Status*)
Township and Range	township and range
Reliability	either identified ('iden') or hypothetical ('hypo')
Dip	inclination of coal-bearing strata, in degrees, within the Kaiparowits Plateau
Coal-bearing interval	either total ('T') or partially eroded ('P')
Coal ownership	Federal ('fed') or non-Federal ('nonfed')

Attributes of Total coal: same as *Attributes of Overburden*

Attributes of Townships: The following is modified from documentation from the Utah State Geographic Information Database (SGID) Users Guide.

Code

CODE	DESCRIPTION
0	Uncoded
1	Township or range line
2	Township or range line: location doubtful
3	Section line

Source

SOURCE	DESCRIPTION
0	Uncoded
101	Utah Automated Geographic Reference Center
125	Utah Division of Water Rights

201	U.S. Geological Survey
202	U.S. Forest Service
203	U.S. Bureau of Land Management

Attributes of Utah State bndy:

State	Based on standard U.S. Postal Service codes