Creating an online library of map and geospatial data: Challenges and Opportunities

Digital Library Federation Spring 2005

T. Wangyal Shawa

GIS Librarian

Princeton University Library

shawatw@princeton.edu

April 14, 2005

Welcome to Princeton University

When the project was started

- The project was formally started on February 20, 2004 as a pilot map scanning project.
- The goals of the pilot project were to:

  a) Virtually integrate Princeton University library's analog and digital maps.

  b) Provide a flexible intuitive user interface that will enable users to search, browse, view, or download maps.

  c) Design a system architecture and standards for digitizing maps, metadata, and compressing images.

  d) Establish workflows.

Challenges of creating an online library of map and geospatial data

- Design a system to integrate various forms of geographic information and make them accessible online.
- Select software packages that will integrate complex systems.
- Design an interface that will not only allow you to search but also to browse, and download.
- Organize data if browsing option is allowed.
- Assign file name once map is scanned.

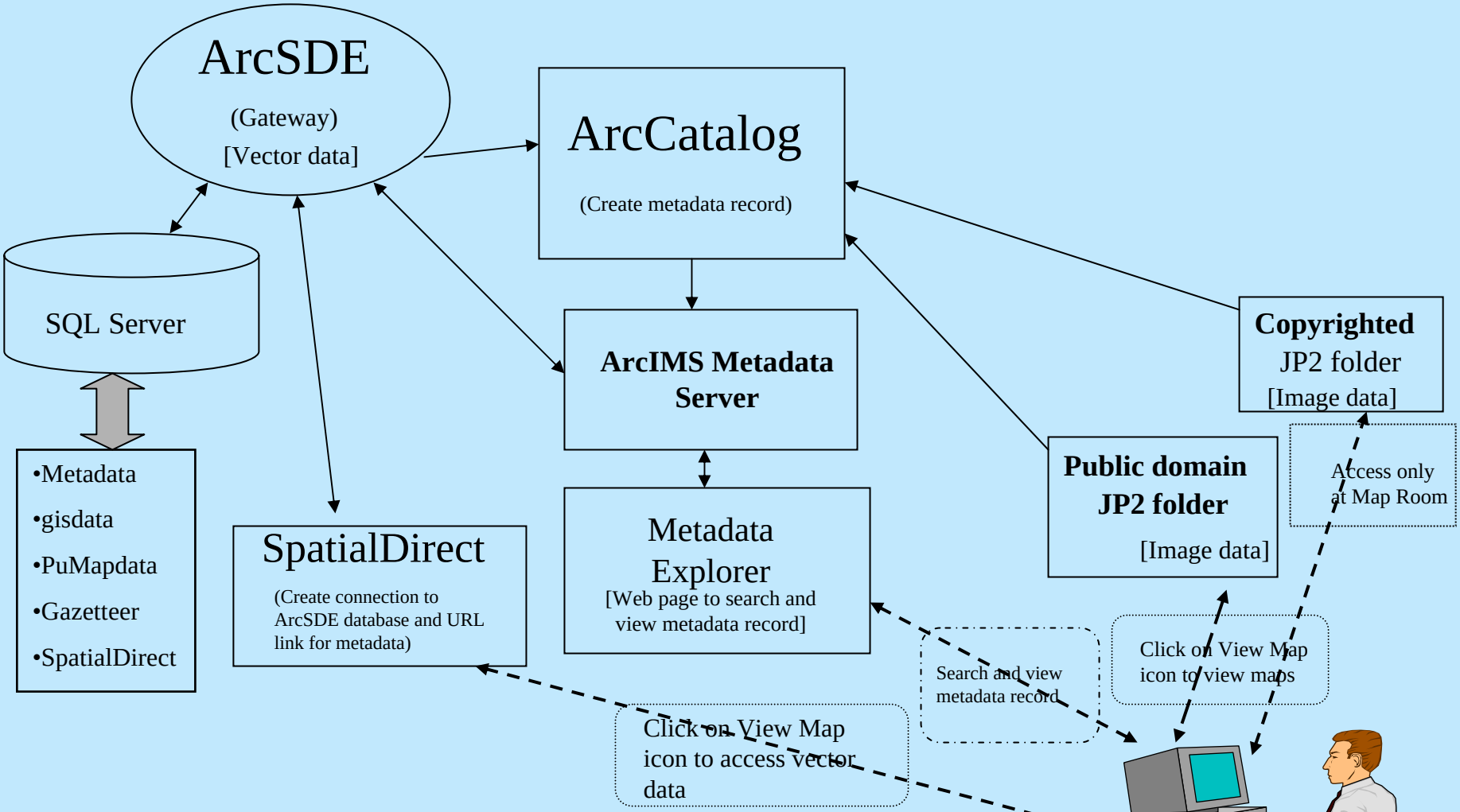
Challenges of creating an online library of map and geospatial data

- Design workflows that are easy to maintain and implement.
- Convince administrators to give necessary support to start the project.
- Determine type of server and disk space needed.
- Select and purchase scanner and computer for scanning maps.

Software packages for system design

- ESRI software packages (ArcCatalog, ArcIMS, and ArcSDE)
- Mapping Science's GeoJP2 Image Server, and Encoder and Decoder
- Microsoft's SQL Server database
- Safe Company's FME and SpatialDirect

Present System Architecture



•Scanned maps in JP2 formats are in JP2 folder as well as in Copyrighted folder

•Vector data in ArcSDE formats are in SQL Server database (gisdata)

• For the time being, all the non-compressed TIFF files and image info text files are stored in a \\ibnetapp1\gis folder and the rest of the data and programs are stored in gisserver.princeton.edu

Standards

- Scanning Standard: All the maps were scanned at 400 dpi with 256 colors and saved in a non-compressed TIFF file format. The reason for making this decision was based on in-house tests.

  Scanning of a paper map (USGS 1:24,000 topographic map) at 400 dpi with 256 colors versus 500 dpi with 24-bit color shows very little difference. A minor quality improvement hardly justifies the larger file sizes (500 dpi with 24-bit color: file size 441MB, 400 dpi with 24-bit color: file size 278MB, 400 dpi with 256 color: file size 96.2MB) and extra time it takes in scanning and saving it on a computer.

  The objective of our map scanning is to preserve map information and therefore, it is not important to capture all the subtle color differences or color “noise” generated by the condition of the paper and the printer.

Standards

- Compression Standards: The TIFF files are later compressed using Mapping Science's GeoJP2 software into JPEG2000 file with 10:1 compression ratio.
- Metadata Standards: All the scanned maps were individually cataloged using ESRI style ISO XML format. The ISO XML format was based on the DTD included with the draft ISO 19115 specifications.

Maps scanned

- 1951 Mercer county aerial photographs (112) and New Jersey Geological Survey Atlas Sheets (14)
- New Jersey USGS 1:62500 topographic maps (102)
- NJGS Topographic Name Sheets (45)
- USGS NJ 7.5 Minute Topographic series (161)
- A.M.S L902 series maps covering Japan (123)
- G.S.G.S 4416 series maps of Middle Danube 1:100,000 (70)
- G.S.G.S 4275 series maps covering Tunisia and Algeria (17)
- A.M.S L951 maps covering Korea (18)
- Russian Army's City maps of China (51)
- A.M.S. S901 series maps covering Philippine cities (47)
- NIMA's Iraq maps (5)
- NIMA's Honduras (4)
- England 1:10 000 published by German 1942 (118)

Workflows

- I developed workflows for scanning maps and for disseminating vector data.
- Scanning maps: one workflow deals with regular scanning and another with scanning of maps brought in or requested by our patrons to be scanned for their class or research.
- At this stage, we are scanning only those maps that were cataloged in GeoMap database (a local map cataloging database).

Regular scanning workflow

a) First, find the GN number in the GeoMap database

b) Open the PuMapdata database

c) Enter basic information into the PUMapdata

d) Create a text file for each entry

Regular scanning workflow

e) Open WIDEimage software and scan the map

f) Save the image in the same folder as the one in which you saved the database text file. The filename should be the same as the corresponding .txt file. For example, with E:\PuMap10.txt, your image will be “E:\PuMap10.tif”

g) Encode all the TIFF images overnight into JP2 files

h) Copy JP2 and TIFF images to server, and delete images from local computer

i) Share JP2 files for creating a metadata

j) Open ArcCatalog and select a JP2 image and create metadata

k) Search JP2 image record in the GeoMap database by GN number

l) Enter necessary information in Metadata Editor from the GeoMap

m) Publish metadata in ArcIMS Metadata Server. Then it is ready for search in the Metadata Explorer

n) Create Excel spreadsheet to keep a record of images that have metadata records.

File Edit View Insert Format Records Tools Window Help

Record Id: 4792
Alternate Id: 4792
Added: 6/26/1991 Updated: 3/10/2004

GN = 4814
STATUS = ISIS
STATUS = c
CALL = LF G4371.C5.svar.A4 AOF-119
TITLE = Geologic map of the Wiseman A-3 Quadrangle.
DATE = 1981
SCALE = 1:00063360
Lang.Id = 23594: Eng
CORP.SOURCE.SER = Alaska Division of Geological and
eophysical Surveys. Open File Reports AOF-119
PERSONAL.NAME = Dillon, J. T.
PERSONAL.NAME = Hamilton, W. B.
PERSONAL.NAME = Lueck, Larry
Author.Id = 27725: Dillon, J. T.
Author.Id = 32167: Lueck, Larry
Author.Id = 29581: Hamilton, W. B.
NOTES = Fossils localities table, cross section, inset
ation location and traverse map (1:25,000), references.
GEOG = U.S.--AK--Wiseman A-3 Quad.
Subject Id = 23933: Fossils
Subject Id = 23987: Geology
LAT.1 = N6700
LAT.2 = N6715
LON.1 = W15100
LON.2 = W15130
CONSER = P04
ACQ = AK/order
RECORD.PREP = 02/18/85 crb i
RECORD.PREP = 12/06/84 jhp c

Brief | Search

Go to Record Id: | Recent Adds | Recent Updates | Copy to New Record

GN	Long Pointer Group Target	4814
STATUS	Long Pointer Group Target	ISIS
STATUS	Long Pointer Group Target	c
CALL	Long Pointer Group Target	LF G4371.C5.svar.A4 AOF-119
TITLE	Long Pointer Group Target	Geologic map of the Wiseman A-3 Quadrangle.
DATE	Long Pointer Group Target	1981
SCALE		1:00063360

rd: 1

View

NUM

File Edit View Insert Format Records Tools Window Help

Digital Map Database

Image number 10 Added 2/20/2004 2:58:58 PM Last updated 2/25/2004 1:04:01 PM

Write metadata to folder: E:\PuMapData

Title: France 1:15,000 .Maubeuge city plan. A.M.S. M961.

Publisher: Army Map Service

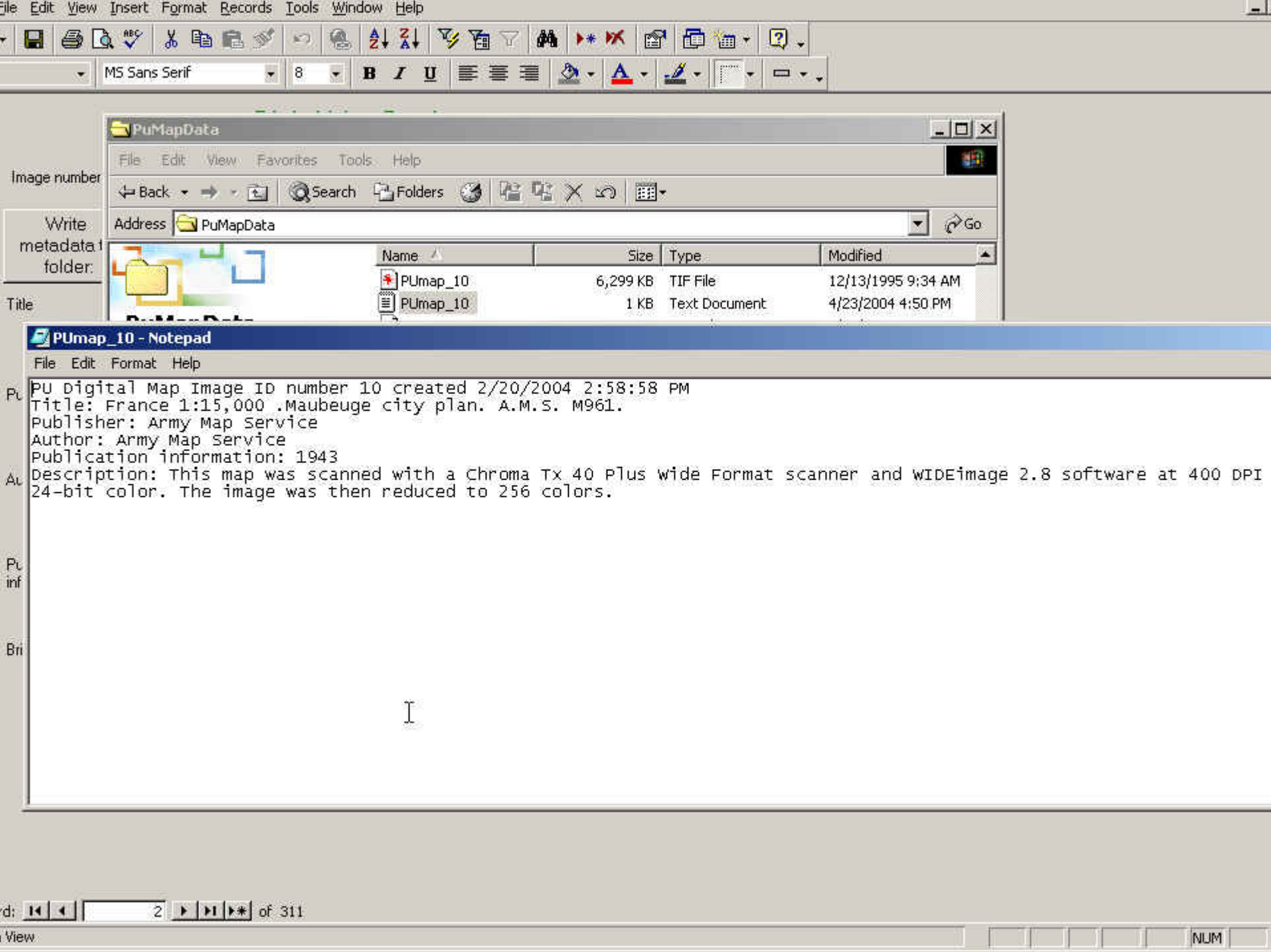
Author: Army Map Service

Publication information / Date: 1943

Brief Description: This map was scanned with a Chroma Tx 40 Plus Wide Format scanner and WIDEimage 2.8 software at 400 DPI in 24-bit color. The image was then reduced to 256 colors.

rd: 1 of 311

View NUM


File Edit View Insert Format Records Tools Window Help
MS Sans Serif
8
Image number
Write metadata t folder:
Title
PuMapData
File Edit View Favorites Tools Help
Back Search Folders
Address PuMapData
Go
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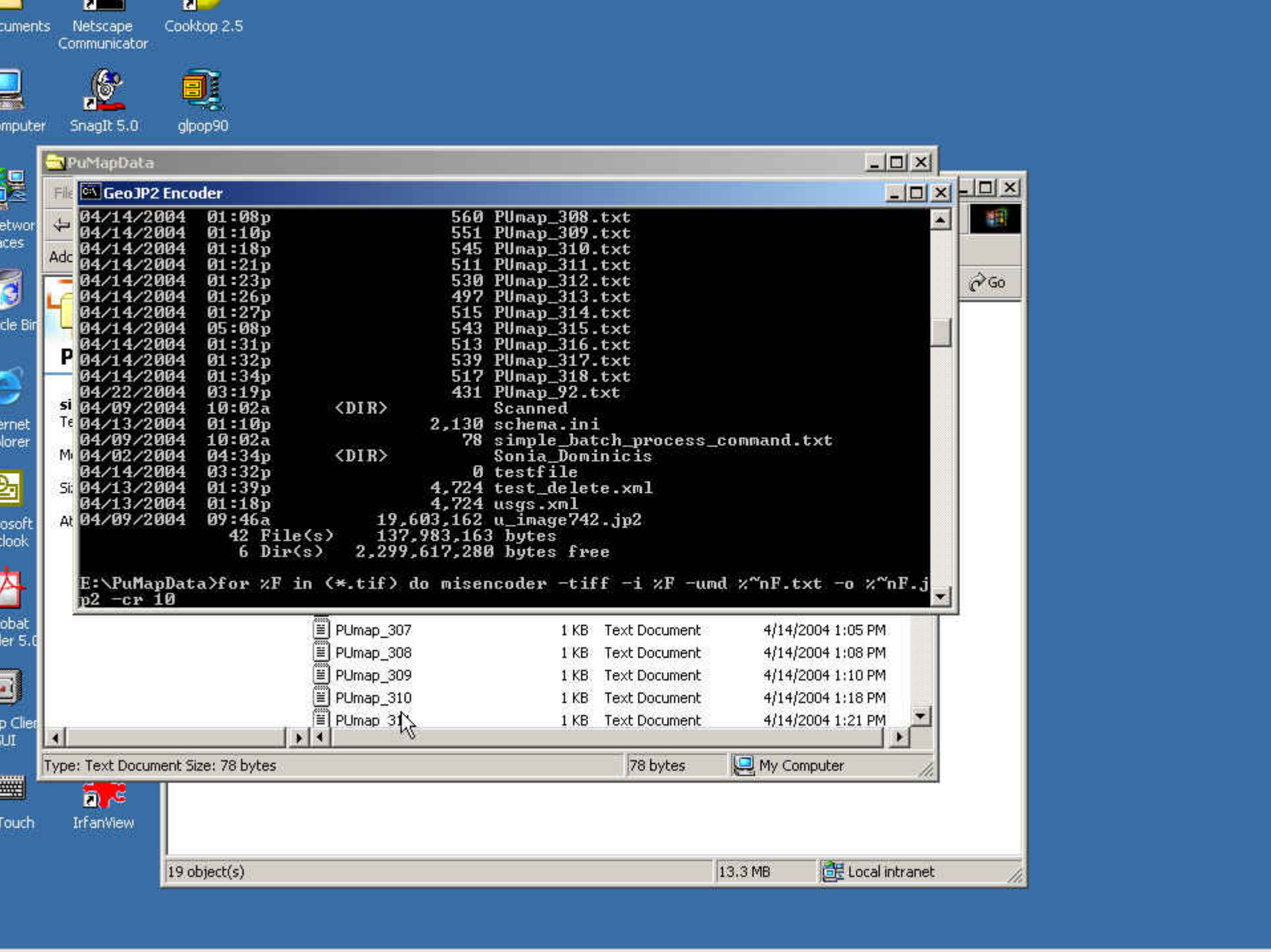
Size
Type
Modified
PUmap_10
6,299 KB
TIF File
12/13/1995 9:34 AM
PUmap_10
1 KB
Text Document
4/23/2004 4:50 PM
PUmap_10 - Notepad
File Edit Format Help
PU Digital Map Image ID number 10 created 2/20/2004 2:58:58 PM
Title: France 1:15,000 .Maubeuge city plan. A.M.S. M961.
Publisher: Army Map Service
Author: Army Map Service
Publication information: 1943
Description: This map was scanned with a Chroma Tx 40 Plus Wide Format scanner and WIDEimage 2.8 software at 400 DPI
24-bit color. The image was then reduced to 256 colors.
2
of 311
NUM


Netscape Communicator
Cooktop 2.5
SnagIt 5.0
glpop90
PuMapData
GeoJP2 Encoder
04/14/2004 01:08p 560 PUmap_308.txt
04/14/2004 01:10p 551 PUmap_309.txt
04/14/2004 01:18p 545 PUmap_310.txt
04/14/2004 01:21p 511 PUmap_311.txt
04/14/2004 01:23p 530 PUmap_312.txt
04/14/2004 01:26p 497 PUmap_313.txt
04/14/2004 01:27p 515 PUmap_314.txt
04/14/2004 05:08p 543 PUmap_315.txt
04/14/2004 01:31p 513 PUmap_316.txt
04/14/2004 01:32p 539 PUmap_317.txt
04/14/2004 01:34p 517 PUmap_318.txt
04/22/2004 03:19p 431 PUmap_92.txt
04/09/2004 10:02a <DIR> Scanned
04/13/2004 01:10p 2,130 schema.ini
04/09/2004 10:02a 78 simple_batch_process_command.txt
04/02/2004 04:34p <DIR> Sonia_Dominicis
04/14/2004 03:32p 0 testfile
04/13/2004 01:39p 4,724 test_delete.xml
04/13/2004 01:18p 4,724 usgs.xml
04/09/2004 09:46a 19,603,162 u_image742.jp2
42 File(s) 137,983,163 bytes
6 Dir(s) 2,299,617,280 bytes free
E:\PuMapData>for %F in (*.tif) do misencoder -tiff -i %F -umd %~nF.txt -o %~nF.jp2 -cr 10
PUmap_307 1 KB Text Document 4/14/2004 1:05 PM
PUmap_308 1 KB Text Document 4/14/2004 1:08 PM
PUmap_309 1 KB Text Document 4/14/2004 1:10 PM
PUmap_310 1 KB Text Document 4/14/2004 1:18 PM
PUmap_31 1 KB Text Document 4/14/2004 1:21 PM
Type: Text Document Size: 78 bytes
78 bytes
My Computer
19 object(s)
13.3 MB
Local intranet
IrfanView

ArcCatalog - ArcInfo - E:\PUmap_1534.jp2

File Edit View Go Tools Window Help

Location: E:\PUmap_1534.jp2

Stylesheet: FGDC

Contents | Preview | Metadata

- PUmap_1508.jp2
- PUmap_1509.jp2
- PUmap_151.jp2
- PUmap_1510.jp2
- PUmap_1511.jp2
- PUmap_1512.jp2
- PUmap_1513.jp2
- PUmap_1514.jp2
- PUmap_1515.jp2
- PUmap_1516.jp2
- PUmap_1517.jp2
- PUmap_1518.jp2
- PUmap_1519.jp2
- PUmap_152.jp2
- PUmap_1520.jp2
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- PUmap_155.jp2
- PUmap_1550.jp2
- PUmap_1551.jp2
- PUmap_1552.jp2
- PUmap_1553.jp2
- PUmap_1554.jp2

New Jersey, Tuckahoe Sheet (1905)

Data format: Raster Dataset

File or table name: PUmap_1534.jp2

Theme keywords: Topographic map, Contour line, Elevation, Roads, geoscientificInformation, 15 Minute Quadrangle Map

Abstract: A scanned USGS 1:62500 topographic map.

FGDC and ESRI Metadata:

- Identification Information
- Data Quality Information
- Spatial Data Organization Information
- Spatial Reference Information
- Distribution Information
- Metadata Reference Information
- Binary Enclosures

Metadata elements shown with blue text are defined in the Federal Geographic Data Committee's (FGDC) *Content Standard for Digital Geospatial Metadata (CSDGM)*. Elements shown with green text are defined in the *ESRI Profile of the CSDGM*. Elements shown with a green asterisk (*) will be automatically updated by ArcCatalog. ArcCatalog adds hints indicating which FGDC elements are mandatory; these are shown with gray text.

Identification Information:

Citation:

Citation information:

Originators: United States Geological Survey

Title:

New Jersey, Tuckahoe Sheet (1905)

***File or table name:** PUmap_1534.jp2

Publication date: 1905
Publication time: October 2004
Geospatial data presentation form: raster digital data

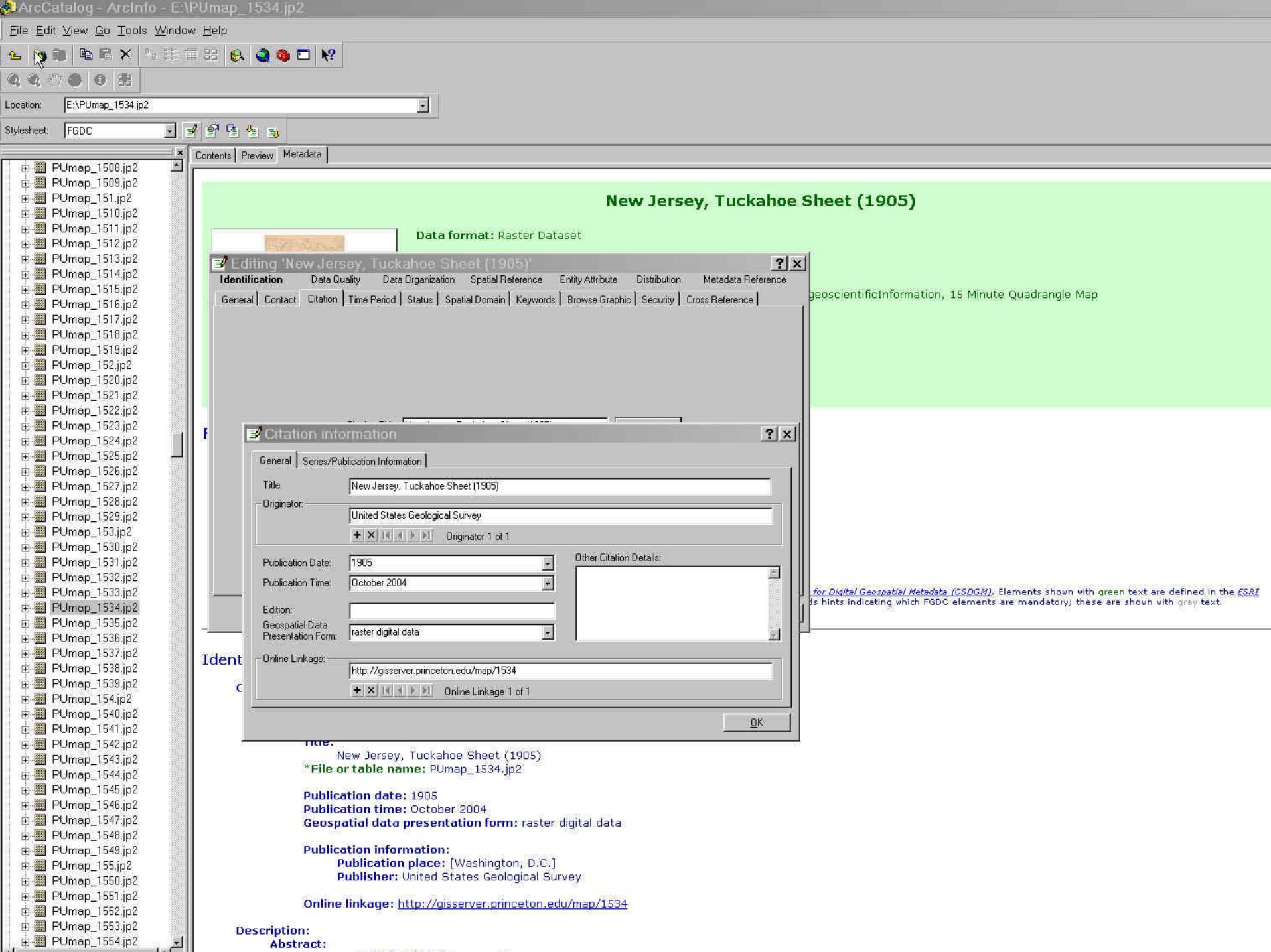
Publication information:

Publication place: [Washington, D.C.]
Publisher: United States Geological Survey

Online linkage: http://gisserver.princeton.edu/map/1534

Description:

Abstract:


ArcCatalog - ArcInfo - E:\PUmap_1534.jp2
File Edit View Go Tools Window Help
Location: E:\PUmap_1534.jp2
Stylesheet: FGDC
Contents Preview Metadata
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PUmap_1509.jp2
PUmap_151.jp2
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PUmap_1554.jp2
New Jersey, Tuckahoe Sheet (1905)
Data format: Raster Dataset
Editing 'New Jersey, Tuckahoe Sheet (1905)'
Identification Data Quality Data Organization Spatial Reference Entity Attribute Distribution Metadata Reference
General Contact Citation Time Period Status Spatial Domain Keywords Browse Graphic Security Cross Reference
geoscientificInformation, 15 Minute Quadrangle Map
Citation information
General Series/Publication Information
Title: New Jersey, Tuckahoe Sheet (1905)
Originator: United States Geological Survey
Originator 1 of 1
Publication Date: 1905
Publication Time: October 2004
Other Citation Details:
Edition:
Geospatial Data Presentation Form: raster digital data
Online Linkage: http://gisserver.princeton.edu/map/1534
Online Linkage 1 of 1
OK
for Digital Geospatial Metadata (CSDGM). Elements shown with green text are defined in the ESRI
s hints indicating which FGDC elements are mandatory; these are shown with gray text.
Ident
New Jersey, Tuckahoe Sheet (1905)
*File or table name: PUmap_1534.jp2
Publication date: 1905
Publication time: October 2004
Geospatial data presentation form: raster digital data
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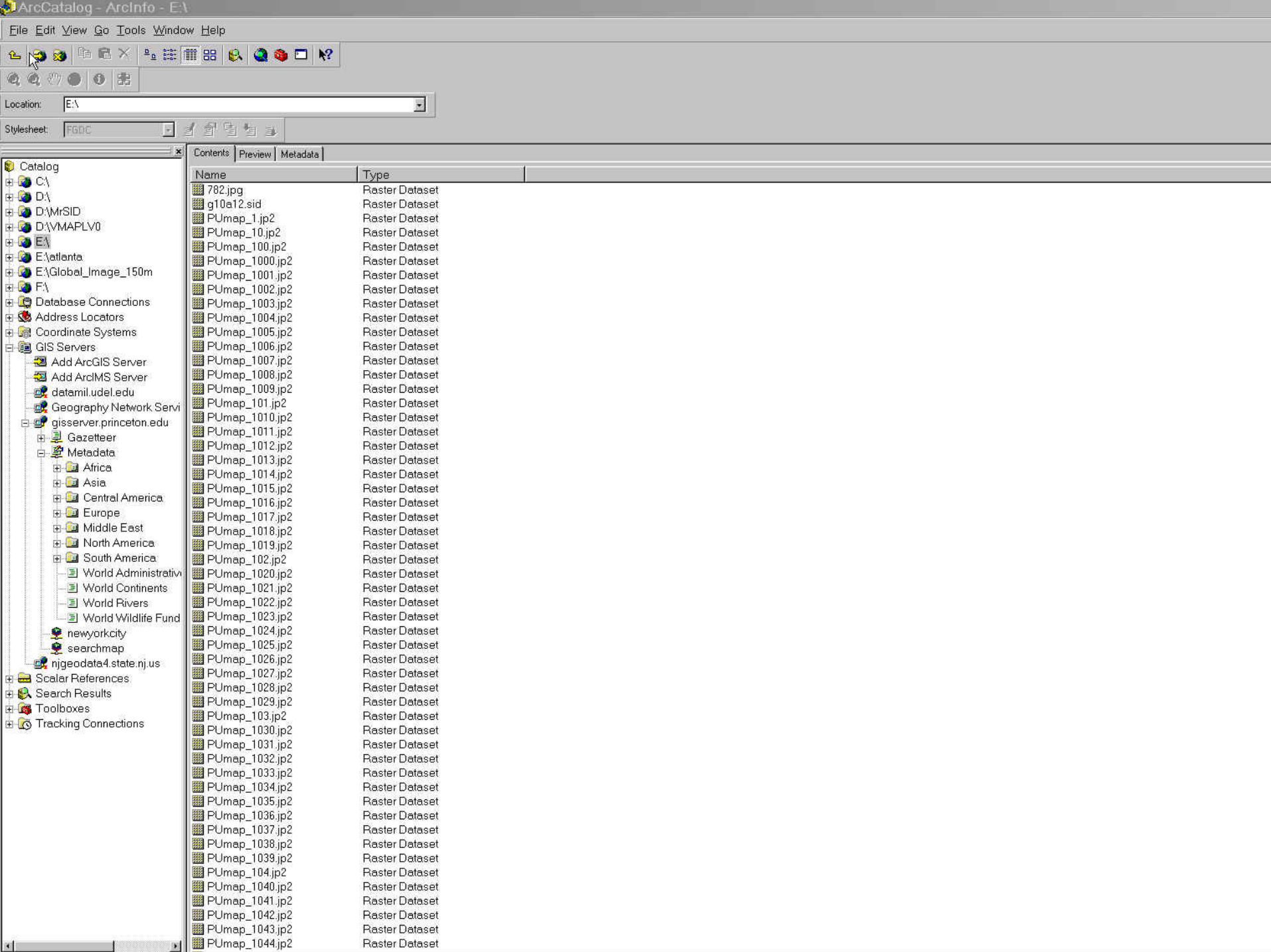
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Database Connections
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Coordinate Systems
GIS Servers
Add ArcGIS Server
Add ArcIMS Server
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South America
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World Continents
World Rivers
World Wildlife Fund
newyorkcity
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Scalar References
Search Results
Toolboxes
Tracking Connections
Contents Preview Metadata
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g10a12.sid Raster Dataset
PUmap_1.jp2 Raster Dataset
PUmap_10.jp2 Raster Dataset
PUmap_100.jp2 Raster Dataset
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PUmap_1042.jp2 Raster Dataset
PUmap_1043.jp2 Raster Dataset
PUmap_1044.jp2 Raster Dataset

Edit View Favorites Tools Help

Back Search Favorites

http://gisserver.princeton.edu/metadataexplorer/explorer.jsp Go

Digital Map & Geographic Data
Princeton University Library

SEARCH BROWSE

Type place name & press Find:

FIND

or draw search area ☐ :

Choose content type:

<All Content Types>

Choose content theme:

<All Content Themes>

Optional Keyword (e.g. river):

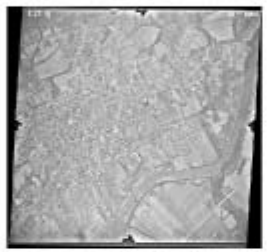
289-1909

START SEARCH

☐ Search NSDI Clearinghouse

Records Found: 1

Content Found by Search



Content Title: 1951 Mercer County Aerial Photograph (289-1909)
Coverage Area: Princeton
Publisher: NJDEP Bureau of Tidelands Management
Resolution: X Axis - 1.000000, Y Axis - 1.000000

View Map View Details

Internet

Edit View Favorites Tools Help

http://gisserver.princeton.edu - GeoJP2 viewer - Microsoft Internet Explorer

Zoom in
Zoom out
Pan
Center
Last extent
Full extent
JPG quality
Image info
Metadata
Export
Print
Help

Map: 443976,551162 -- Image: 21 , 237

Internet

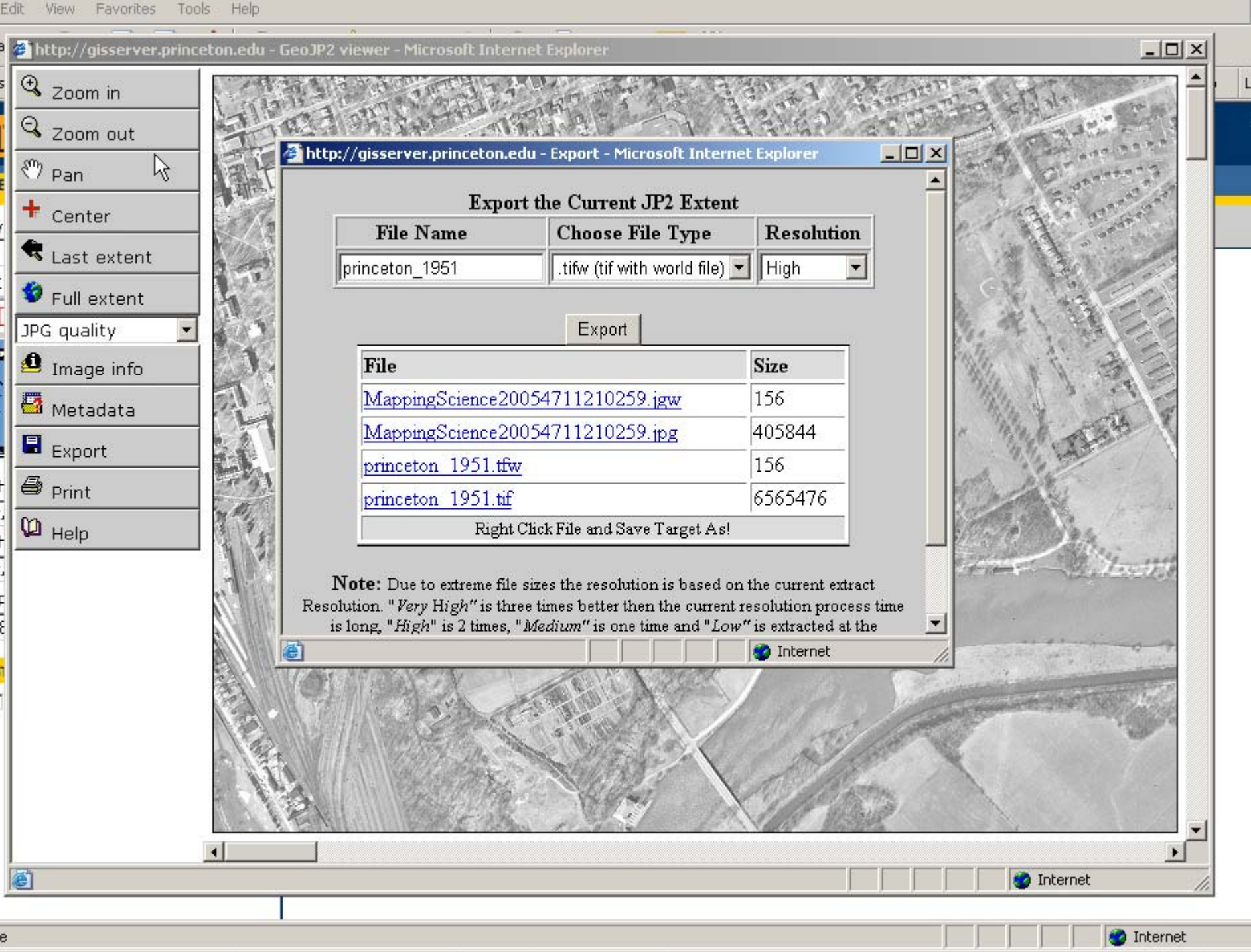
Internet

http://gisserver.princeton.edu - GeoJP2 viewer - Microsoft Internet Explorer

Zoom in
Zoom out
Pan
Center
Last extent
Full extent
JPG quality
Image info
Metadata
Export
Print
Help

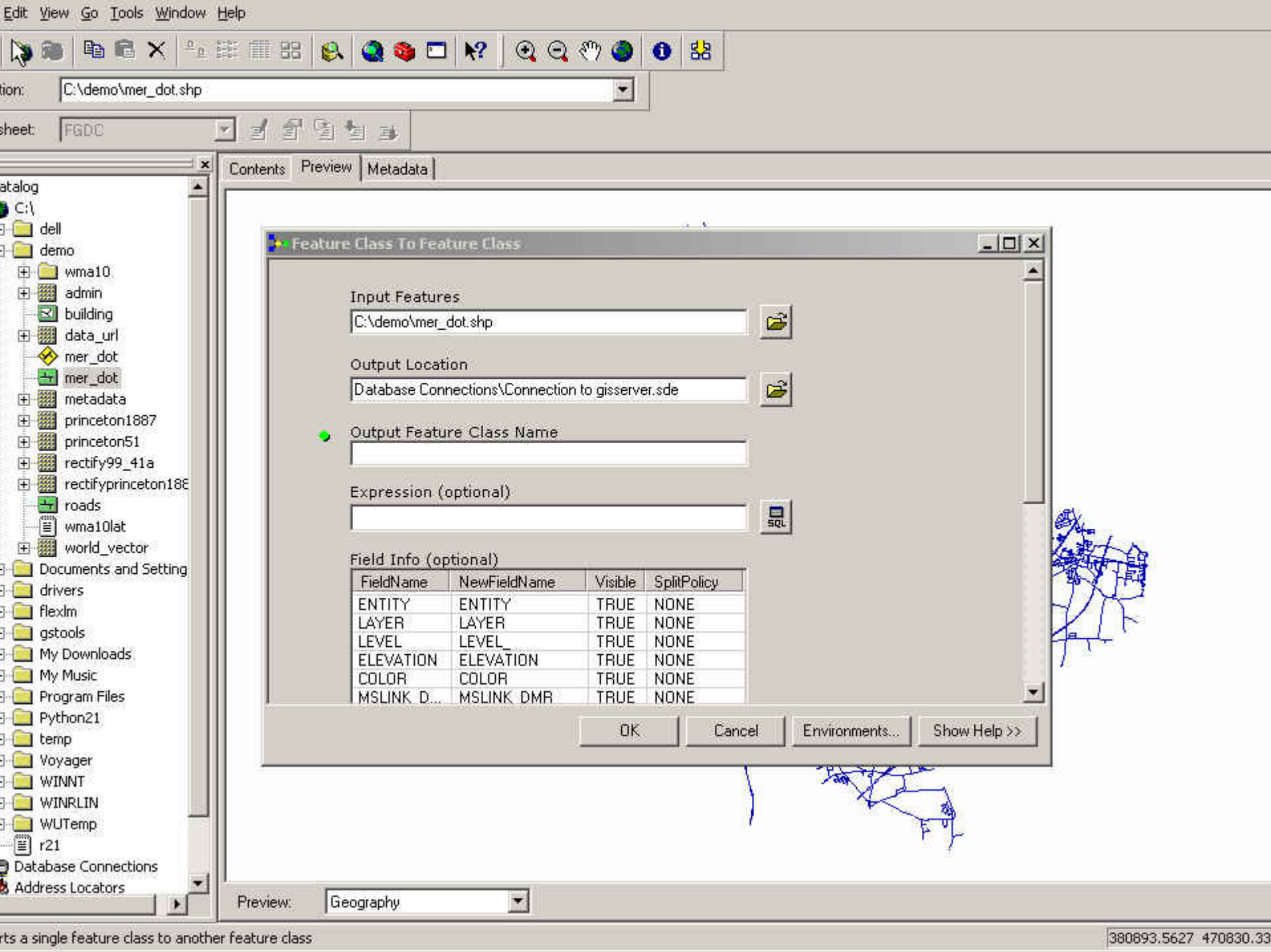
Map: 448522,550958 -- Image: 74 , 228

Internet


Edit View Favorites Tools Help
http://gisserver.princeton.edu - GeoJP2 viewer - Microsoft Internet Explorer
Zoom in
Zoom out
Pan
Center
Last extent
Full extent
JPG quality
Image info
Metadata
Export
Print
Help
http://gisserver.princeton.edu - Export - Microsoft Internet Explorer
Export the Current JP2 Extent
File Name
Choose File Type
Resolution
princeton_1951
.tifw (tif with world file)
High
Export
File
Size
MappingScience20054711210259.jgw
156
MappingScience20054711210259.jpg
405844
princeton_1951.tfw
156
princeton_1951.tif
6565476
Right Click File and Save Target As!
Note: Due to extreme file sizes the resolution is based on the current extract Resolution. "Very High" is three times better then the current resolution process time is long, "High" is 2 times, "Medium" is one time and "Low" is extracted at the
Internet
Internet
Internet

Workflow for vector data

- Upload datasets into ArcSDE using ArcCatalog
- Use SpatialDirect's Spatial Assistant to connect to ArcSDE tables
- Select the data and set the right permission
- Open Administration interface web page and enter necessary information
- Create the map image and URL
- Create metadata, copy URL in metadata, and publish it in ArcIMS metadata server
- Data is ready to search, view, browse, and download in Metadata Explorer


Edit View Go Tools Window Help
C:\demo\mer_dot.shp
FGDC
Contents
Preview
Metadata
Feature Class To Feature Class
Input Features
C:\demo\mer_dot.shp
Output Location
Database Connections\Connection to gisserver.sde
Output Feature Class Name
Expression (optional)
SQL
Field Info (optional)
FieldName NewFieldName Visible SplitPolicy
ENTITY ENTITY TRUE NONE
LAYER LAYER TRUE NONE
LEVEL LEVEL_ TRUE NONE
ELEVATION ELEVATION TRUE NONE
COLOR COLOR TRUE NONE
MSLINK_D... MSLINK_DMR TRUE NONE
OK
Cancel
Environments...
Show Help >>
Catalog
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wma10
admin
building
data_url
mer_dot
mer_dot
metadata
princeton1887
princeton51
rectify99_41a
rectifyprinceton188
roads
wma10lat
world_vector
Documents and Setting
drivers
flexlm
gstools
My Downloads
My Music
Program Files
Python21
temp
Voyager
WINNT
WINRLIN
WUTemp
r21
Database Connections
Address Locators
Preview:
Geography
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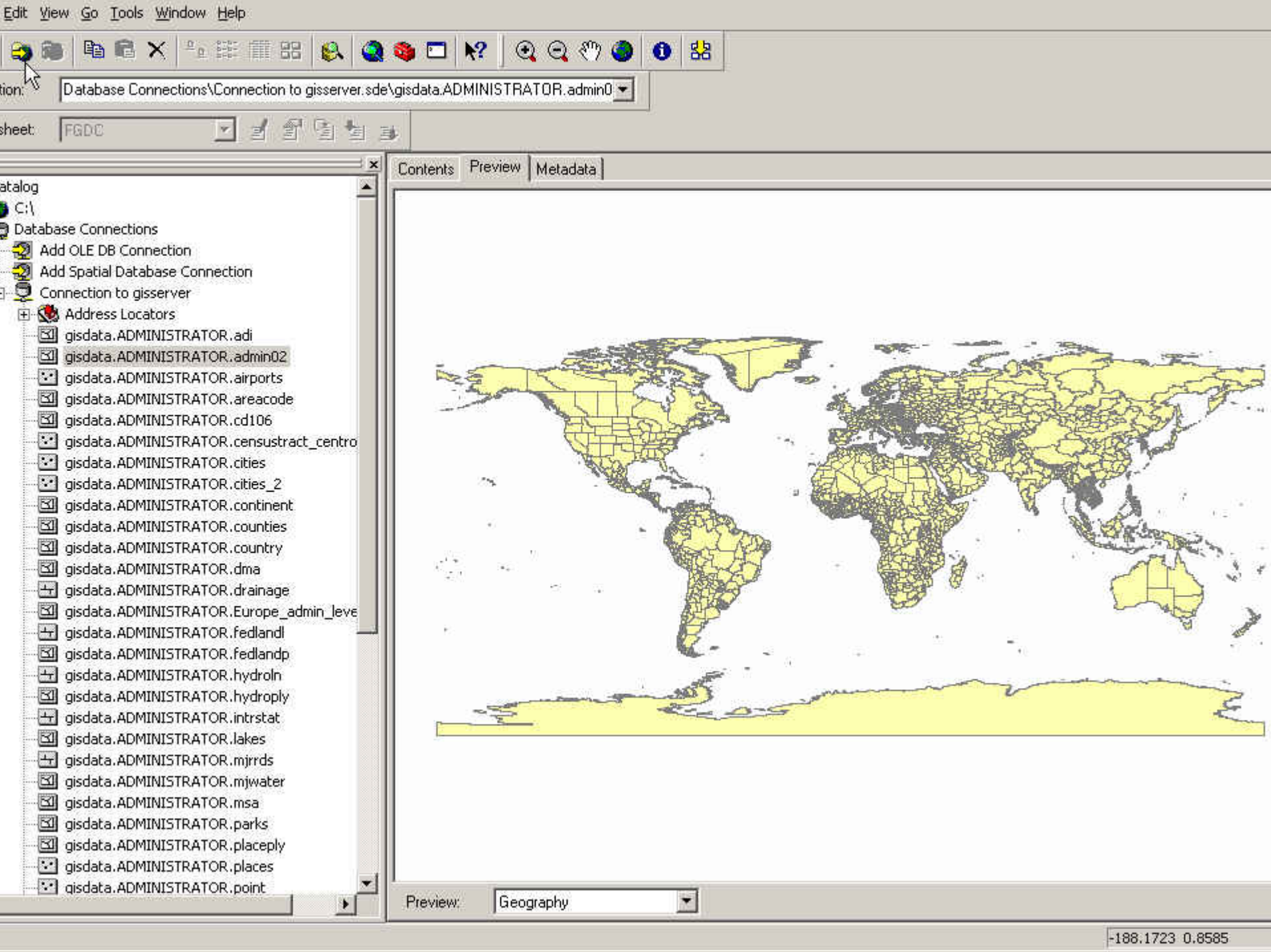
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33	USA Water Feature Area	GISDATA.ADMINISTRATOR.HYDROPLY_gisserver	usa_water_area.gif	Very Large (23.7 MB)	ESRI
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42	2000 Census Tracts Centroid	GISDATA.ADMINISTRATOR.CENSUSTRACT_CENTROID_2000_gisserver	usa_CT_centroid.gif	Very Large (30.4 MB)	ESRI
43	European Administrative Level 3 Boundary	GISDATA.ADMINISTRATOR.EUROPE_ADMIN_LEVEL3_gisserver	EuropeAdmin3.gif	Very Large (63.3 MB)	ESRI

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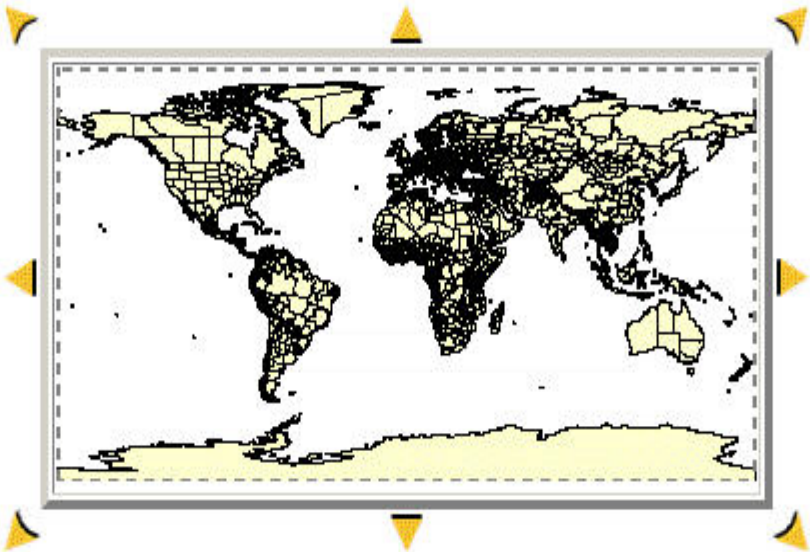

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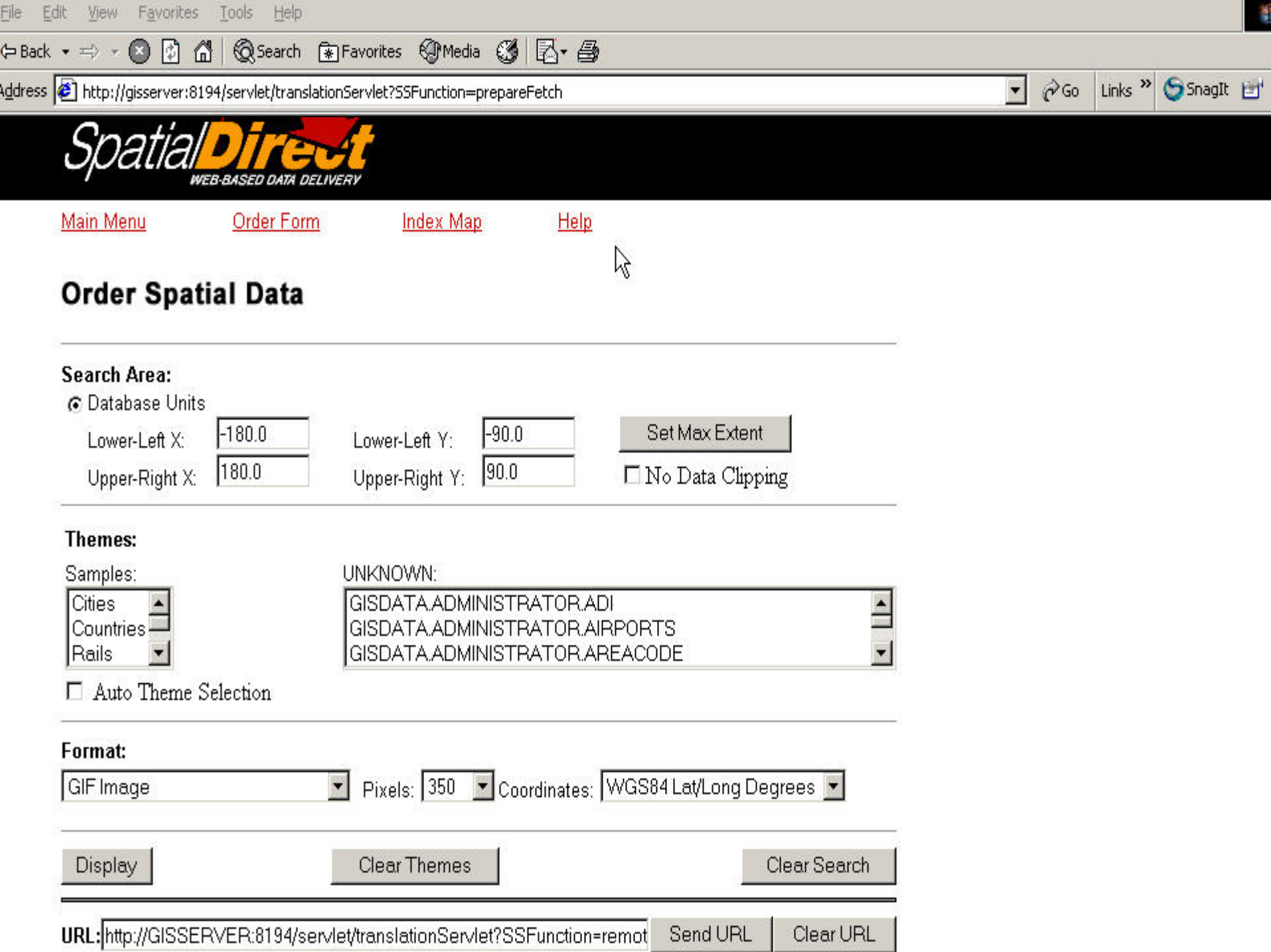
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Coverage Area: World
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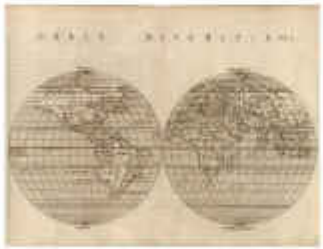

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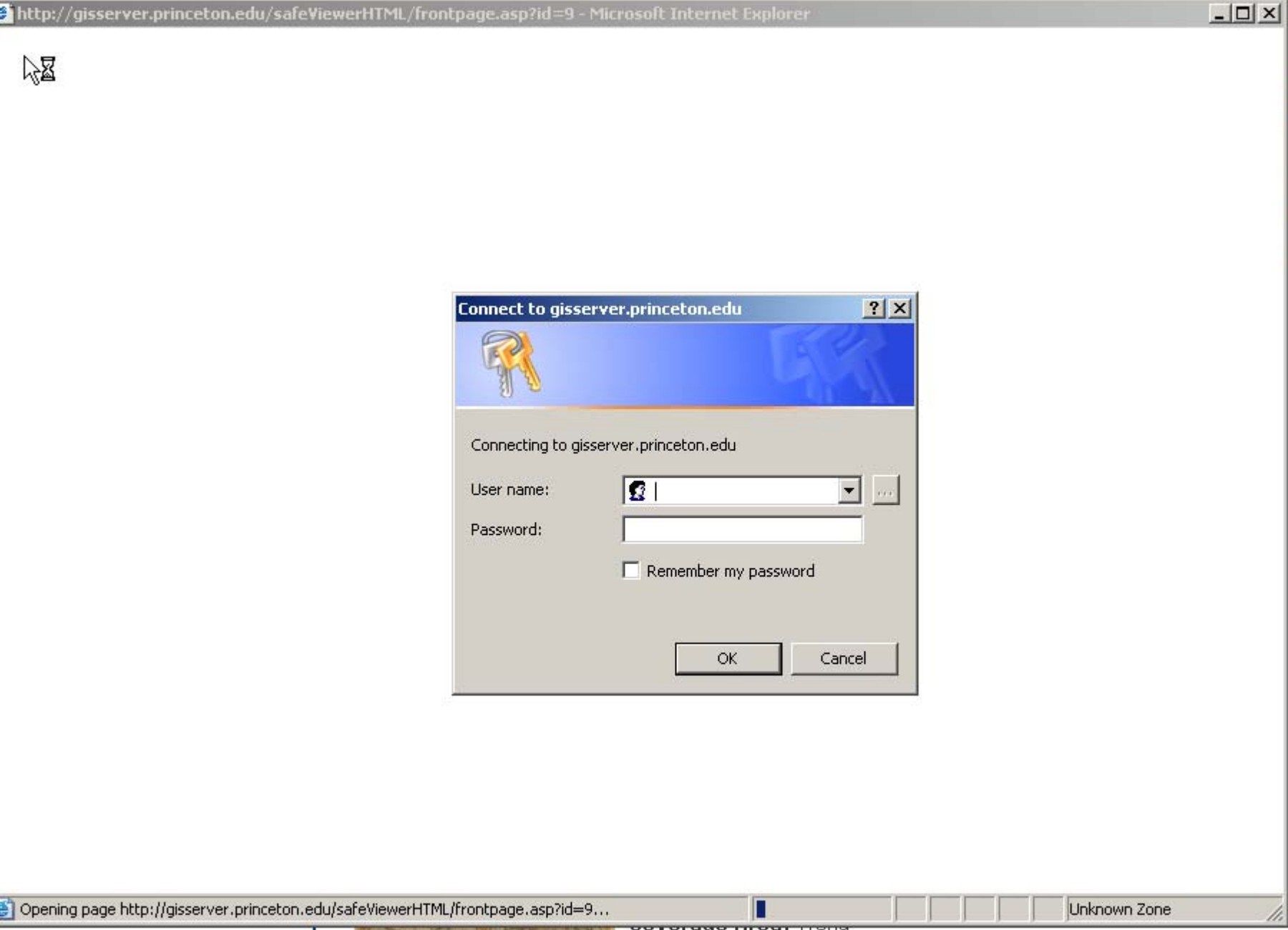

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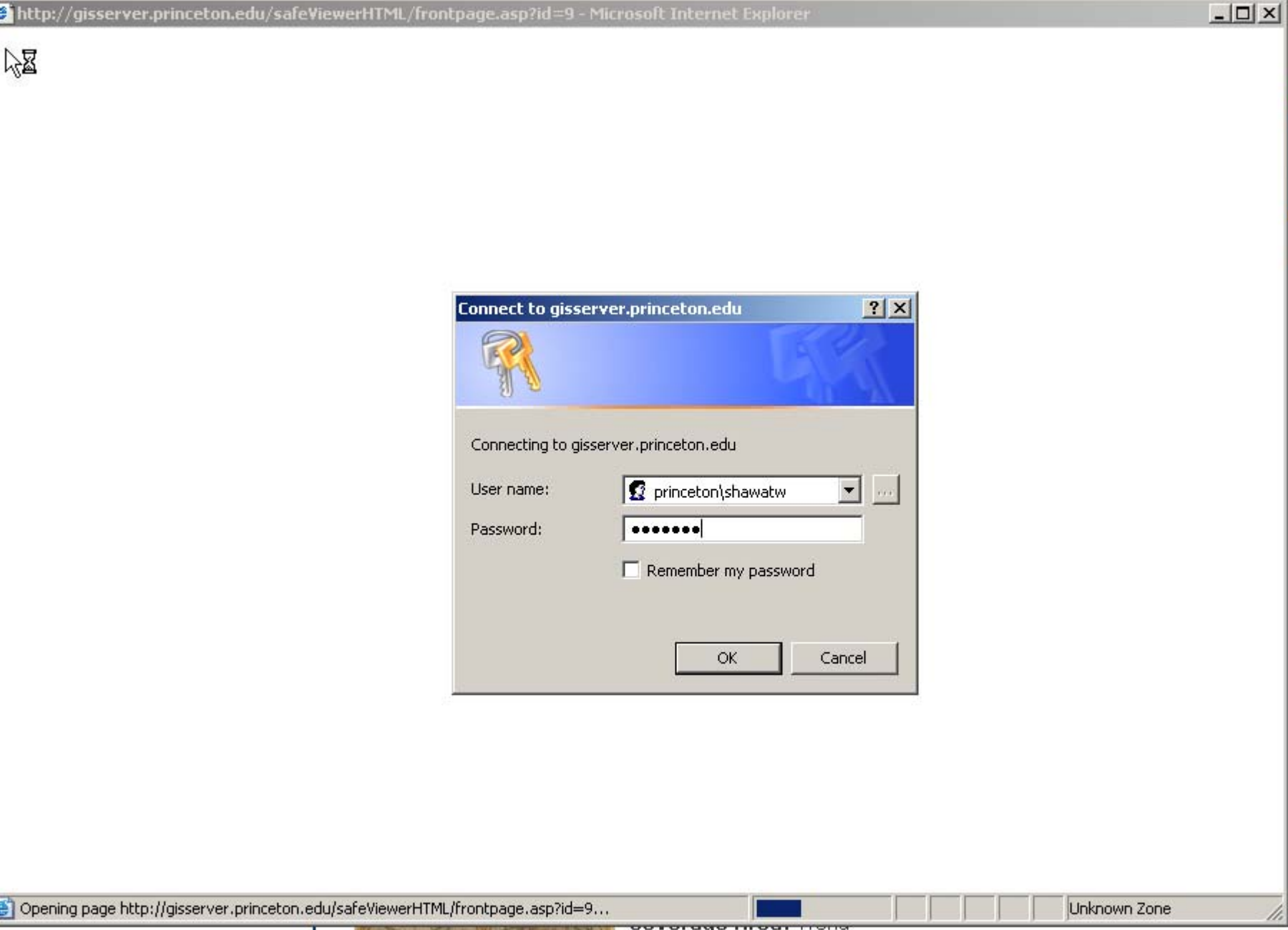

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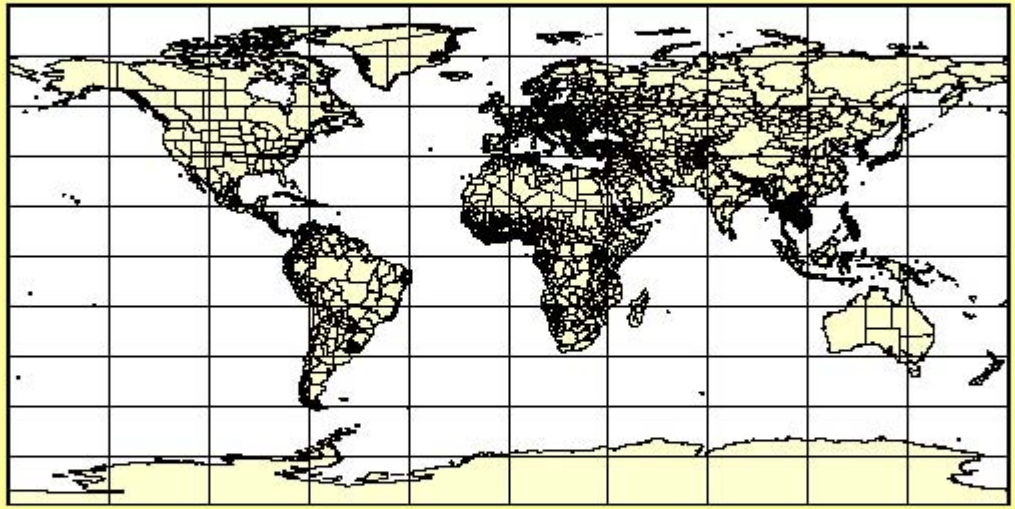

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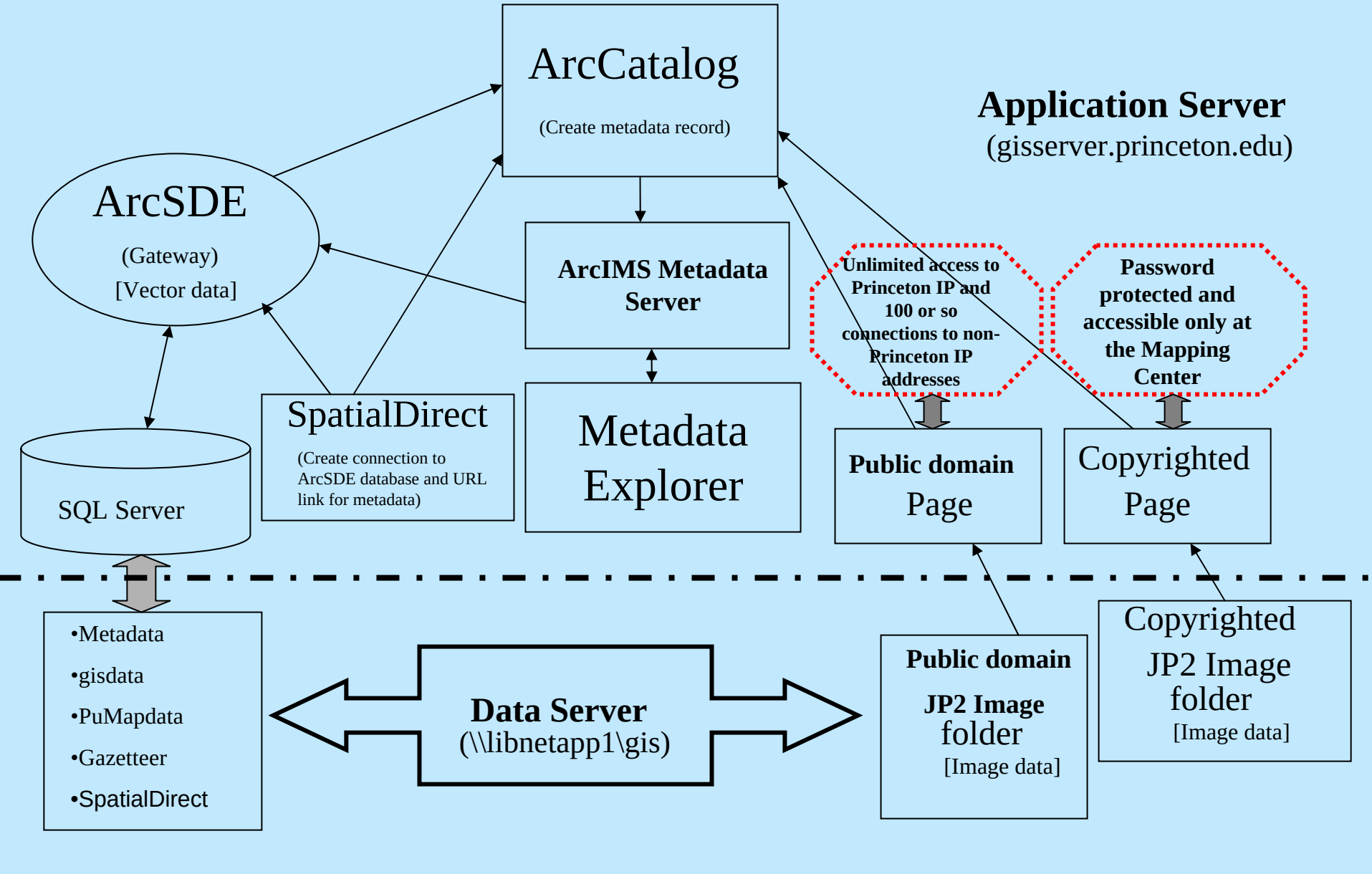
Lessons Learned

- Staff time: building a complex digital data infrastructure required help from Systems, database specialists, and programmers. To continue with a scanning project, you need a dedicated support staff. Depending on student workers is not very productive. However, using computer science students to design custom interfaces and applications can be very productive because they have different computer language skills.
- Hardware issues: to scan maps you need a lot of memory on a computer. We have a computer with 1GB of RAM and on a few occasions I found that it was not enough, especially when scanning a large map. I also found that putting scanned maps online required a large disk space. For example, 1300 maps (different sizes) that were scanned at 400 dpi with 256 colors needed 140 GB non-compressed TIFF file and 50GB of JP2 file compressed at 1:10 ratio.

Future System Architecture



Example of data visualization

- Click here  to see an example of data visualization of Princeton University campus using georeferenced 1887 topographic map, 1951 and 1999 aerial photographs, campus building footprints, and Mercer county road dataset. All of these datasets were downloaded from our Digital Map and Geographic Data web site http://gisserver.princeton.edu/metadataexplorer/explorer.jsp

Thanks for coming to the presentation

Any Questions?

Tsering Wangyal Shawa, GIS Librarian

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