

## Creating a Distributed **NAT**ional **CARB**on Sequestration Database and Geographic Information System (**NATCARB**)



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## Goals

- Distributed National Database of Carbon Sequestration  
– MIDCARB ==> NATCARB
- Federation of Map Servers  
– Distribute the management  
– Distribute the computer resources/activity  
– Distribute the metadata
- Intelligent Portal  
– Interoperability through web mapping services  
– Tools to access and analyze the distributed data
- Partners  
– Increased synergy and communication among regions



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## Original MIDCARB Consortium



The MIDCARB (Midcontinent Digital Carbon Atlas and Relational DataBase) Carbon Sequestration Project  
[www.midcarb.org](http://www.midcarb.org)



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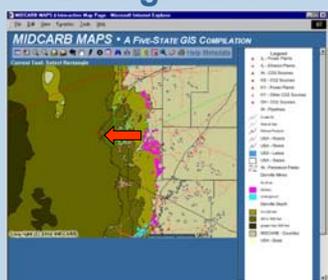
## MIDCARB Project Goals

- Characterize Major CO<sub>2</sub> Sources  
– Quantity, Quality, Location
- Characterize Potential Sequestration Sites  
– Geology and Reservoir Characteristics
- Develop Relational/Spatial Databases  
– Local and Regional Reporting Levels
- Supply this data to the public  
– For use as tools in cost/feasibility analyses, etc.

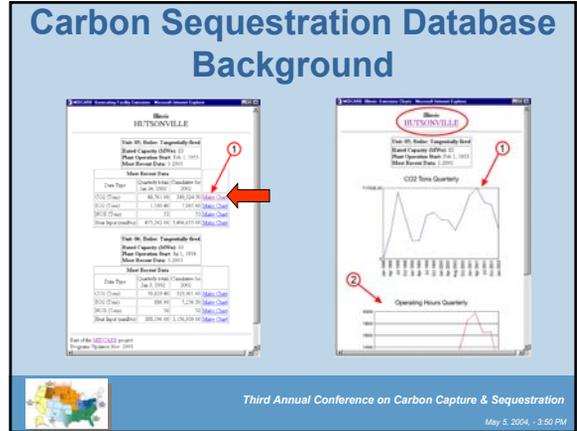
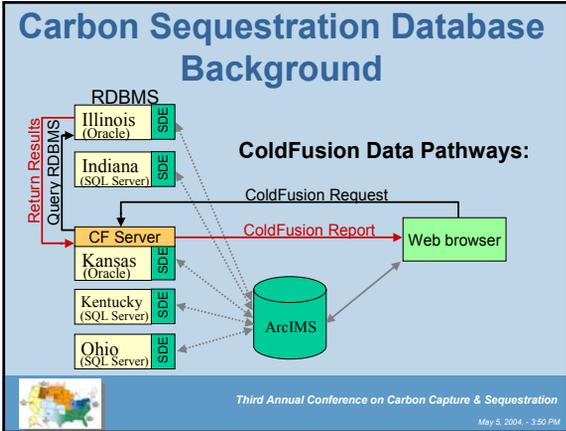


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## Carbon Sequestration Database Background




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- ### Carbon Sequestration Database Background
- 125 different layers from five different databases.
  - No background database of metadata. The database was the AXL file.
  - Hard to incorporate dynamic tools
    - Table of contents, Graphing.
    - Built on lists of codes in javascript parameters file.
  - Requests to multiple onsite databases for spatial data can be a performance bottleneck!
    - Performance heavily dependent on the off-site network speed for each server.
  - SDE/ODBC Connections through a firewall problematic.
- Management Headache
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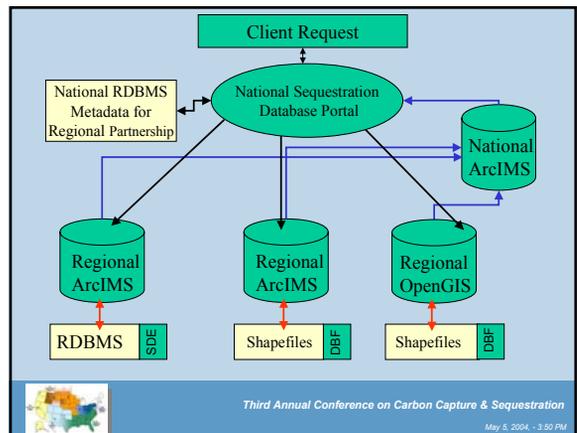
### National Database For Carbon Sequestration

Regional Carbon Sequestration Partnerships

The partnerships include several states and are designed to provide a national database of carbon sequestration data. The partnerships are designed to provide a national database of carbon sequestration data.

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- ### Federation of Web Mapping Services
- What are the advantages of a distributed national database?**
- De-centralization of metadata and data
  - Local control over data layers (maintain, enhance, add)
  - Portal is easily customized
  - Data requests & structures are driven by XML (IMS-XML)
  - Server Resources are split among different computers
  - Portal can request data in a multithreaded fashion
  - Portal can be interoperable with different databases in different formats
  - Interaction among GIS/IT personnel across partnerships
  - By incorporating and cooperating now we can answer national scale questions in the future
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## Metadata

- Portal serves as a central metadata repository and catalog:
  - Spatial information and data types are driven by local IMS servers
  - Repository allows for detailed information about models/datasets/calculations to be entered by the user and stored in the portal
- Regional partner requirements:
  - Publish data through ArcIMS
    - or Open GIS Consortiums (OGC) Web Mapping Service (WMS) and Web Feature Service (WFS)
  - Metadata publishing is pushed to the partnerships
- Distribute the management of the system to each partnership



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## Metadata: Map Service Metadata Application



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## Interoperability Through Web Mapping Services

How does the portal communicate in real-time with the other Regional Partnerships?

- A series of requests are generated based on the client input to the map portal. For example, the client would like to see the following:
  - Potential CO<sub>2</sub> storage in petroleum fields in Kansas,
  - Kansas and Illinois CO<sub>2</sub> sources,
  - Illinois net coal thickness
- The portal simultaneously issues a request to the regional map servers to create an image of the data.
- The portal stores the requested images locally and creates a world file for each image (so that the images can be georeferenced).
- The portal IMS server creates a national map with the stored georeferenced images.



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## Intelligent Portal

- Use the metadata catalog to build “Intelligent” requests (XML) to the federation of loosely coupled map services.
- The map table of contents is a dynamic system that runs off the metadata catalog.

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## NATCARB Intelligent Portal

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## National Sequestration Database

- Tools help answer technical and policy questions.
- Provides tools to access non-spatial data in a spatial way.
  - Emissions analysis for one power plant (identify) or many power plants (select all in a region).
  - Sequestration potential over multiple depths and datasets within a particular region (buffer around a power plant).
- Integrated but Distributed
  - Across Regions
  - Across Data Types

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## Partners

- DOE
- DOE-EIA
- EPA (Database on Emissions)
- Department of Agriculture
- USGS
- Partnerships
- Industry
- Universities

National Databases - Partnerships can correct, update, enhance and pass corrections back to the source.

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## Conclusions

- Distributed National Database of Carbon Sequestration
  - National databases and local databases
- Federation of IMS Servers
  - Distribute management
  - Distribute computer resources
  - Distribute metadata
- Intelligent Portal
  - IMS Interoperability
  - Tools that can access/analyze/display distributed data
- Partners
  - Increased synergy and communication

**Online at the Booth**



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