Distributed Computational Systems in Support of Environmentally-Sustainable Testing and Training

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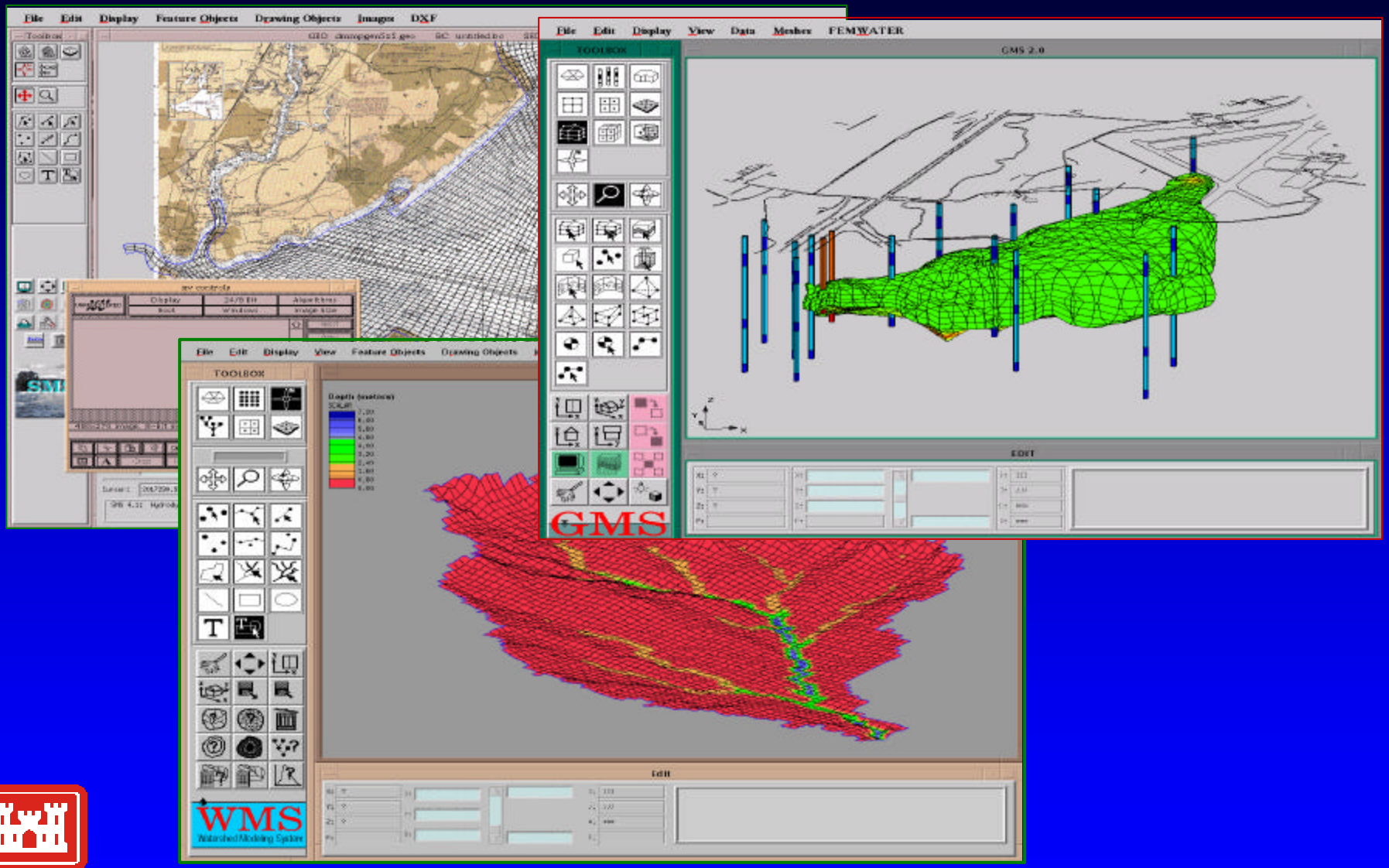
Vicksburg, MS

DoD Environmental Concerns

- **Stewardship** - responsible for environmental management of present and formerly-used sites.
- **Money** - environmental restoration is expensive ($Bs) and diverts funding.
- **Access** - use of facilities and training grounds can be restricted. Mass. Military Reservation is recent example.

Full Range of Capabilities



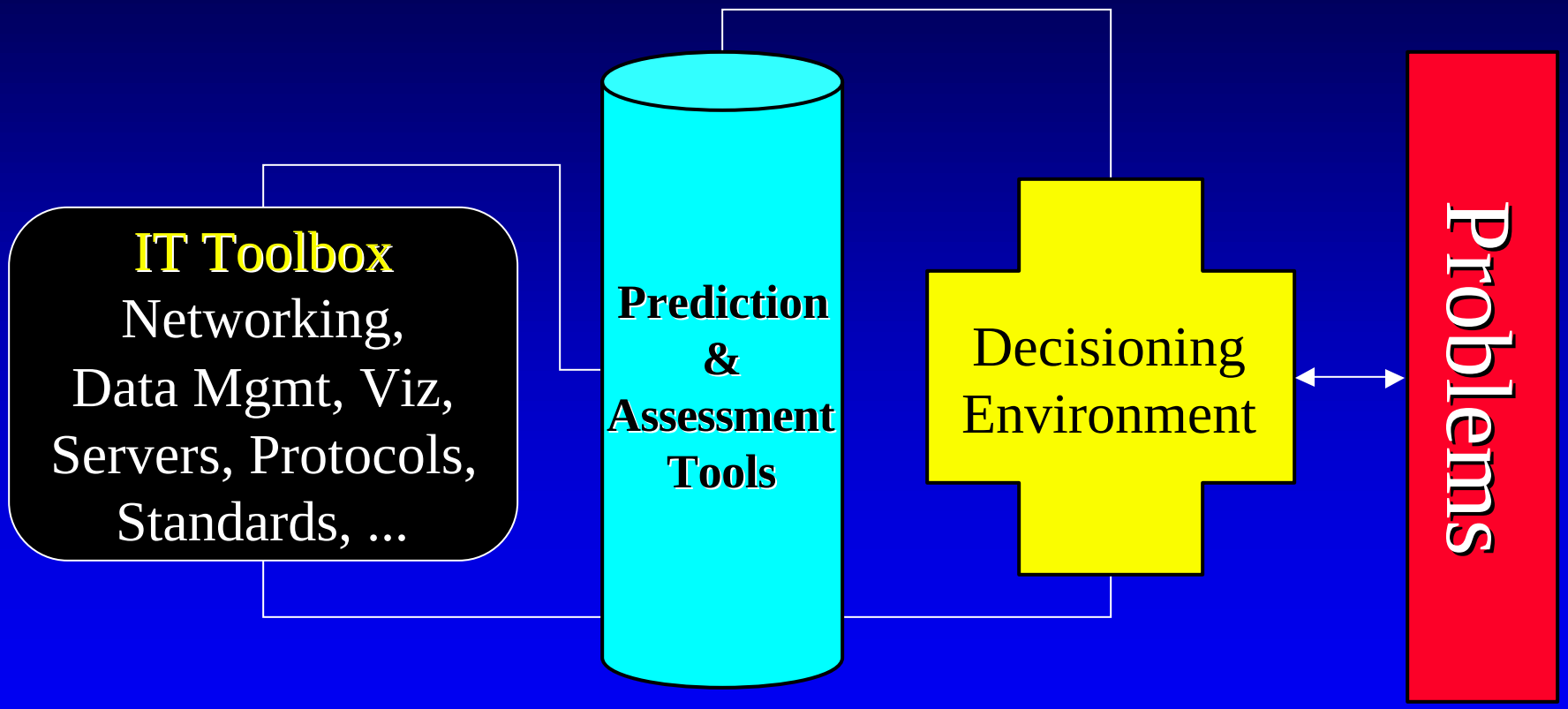
Technology Challenge

Bringing Capabilities Together to Reduce End User Workload and Adding Capability to Legacy and New Systems

Goals

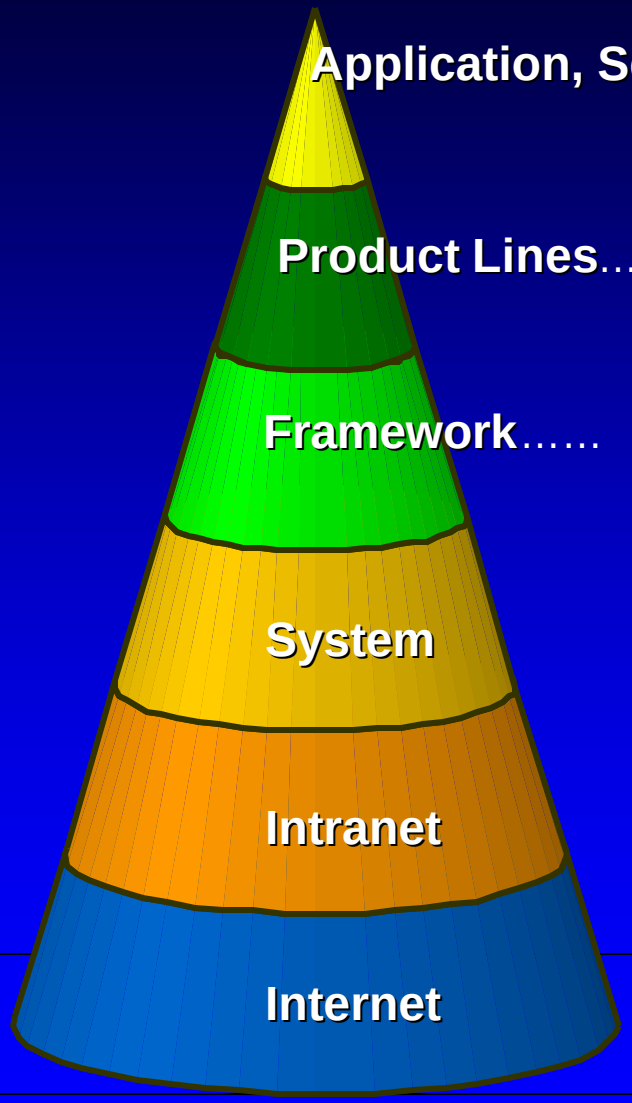
- Seamless access to distributed resources (models, data, computing environments)
- User-friendly graphical user interface (GUI)
- Ability to readily incorporate legacy and new models
- Presentation of information via the Internet in terms differing “users” understand
- Ability to readily integrate evolving linkage and coupling protocols
- Ability to archive selected site and model data
- Support both local and distributed application(s)
- Rigorous information security
- Maximum use of industry standards and COTS

Development Approach



Reusable | Reusable and Specific | Specific

Building Blocks of Interoperable Development and Delivery



Application, Services, and Information
Problem-specific applications of technology
- Word, Excel, PowerPoint

Product Lines… Integration/coupling of multiple tools or products that support an applications area
- Microsoft Office

Framework…… Its services establish the rules of engagement for linking/coupling components and content

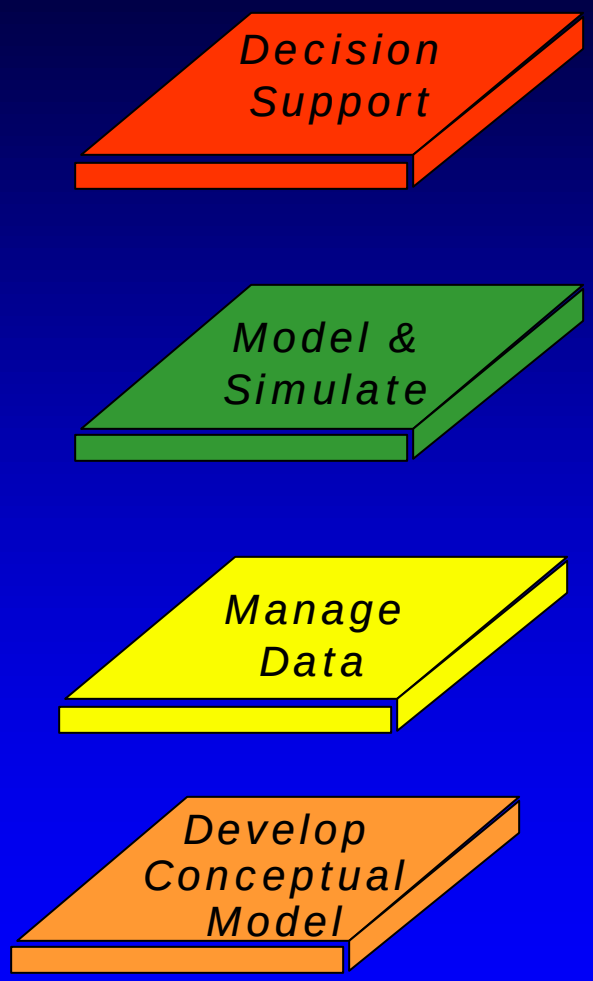
All built on industry standards and protocols for operating systems, intranet, and internet activities

Department of Defense
Land Management System (LMS)

US Army Corps
of Engineers

Engineer Research and Development Center

Functional Levels



Provides

– Query archived data
– Modify/execute models
– Visualization Capabilities
– Remote and local access
– Provide collaborative tools

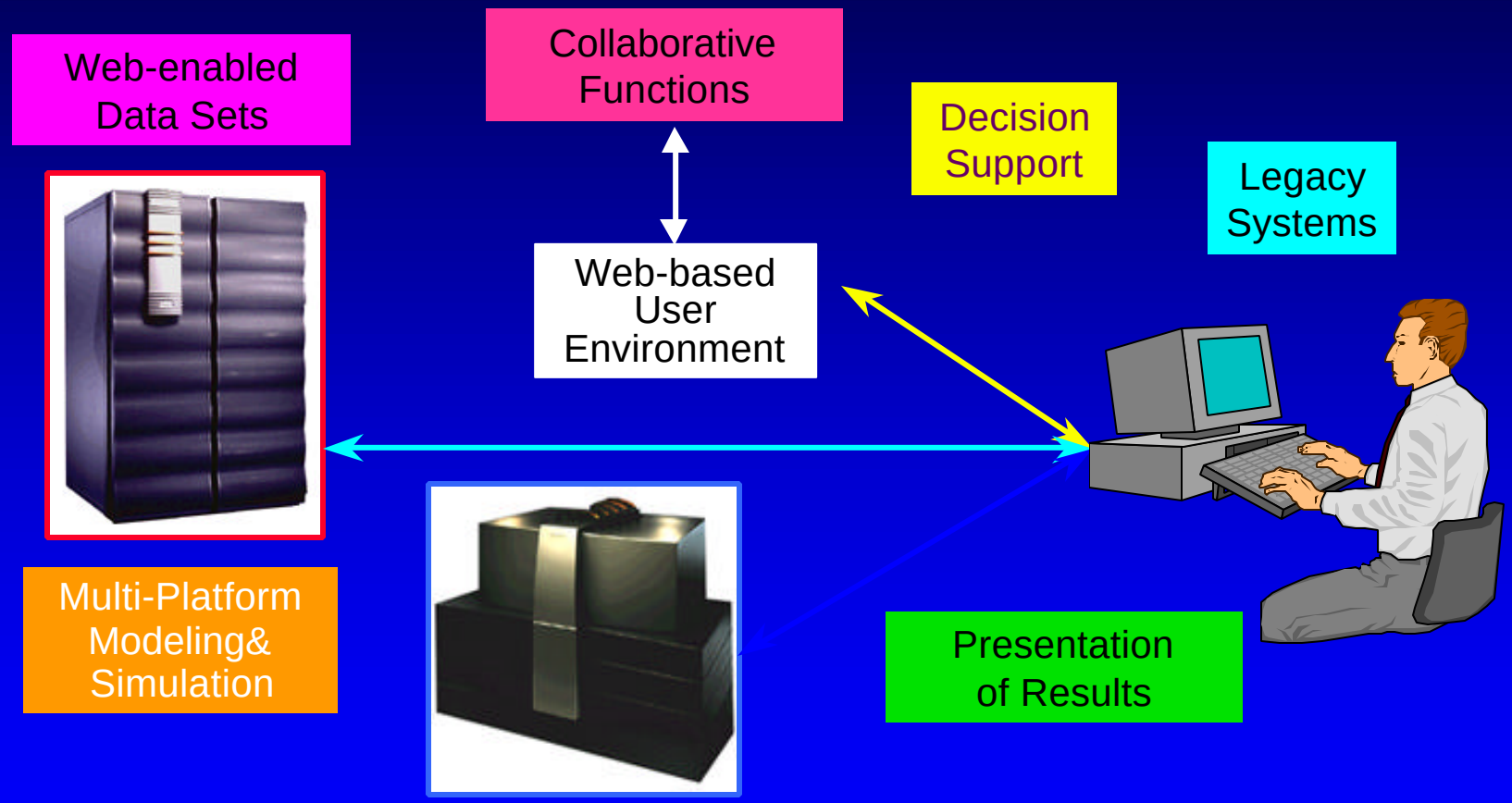
– State-of-the-art modeling systems
– Model calibration/verification
– Uncertainty analysis tools
– Model capabilities catalog

– Navigate to servers and download
– Archive data across the network
– Establish common data formatting
– Integrate parameter databases

– Set up user-specific problems
– Compose problem-specific models
– Develop model-to-model protocols

LMS Functionality

Seamless Use of Networks and Multi-Platform Computing

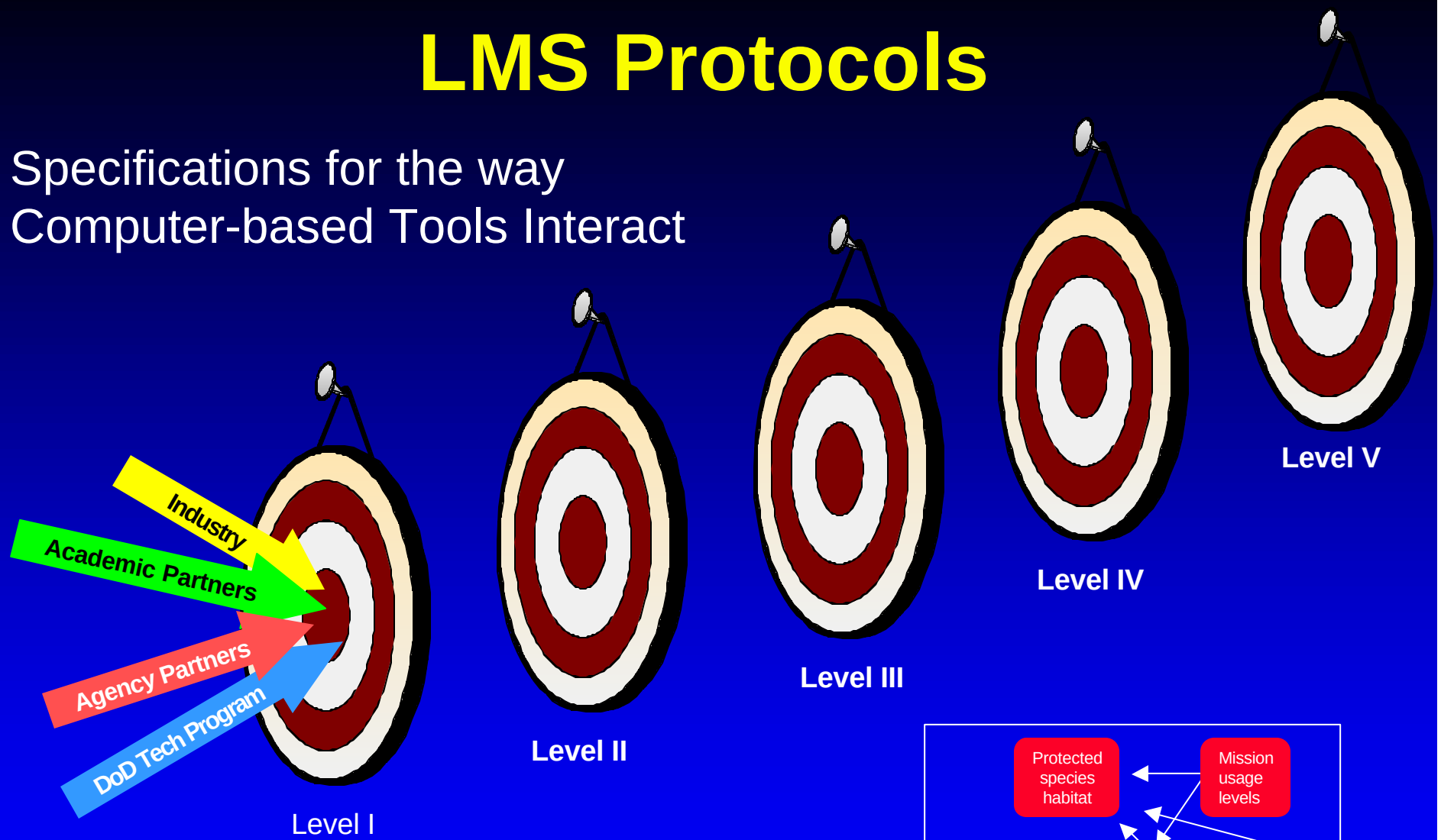


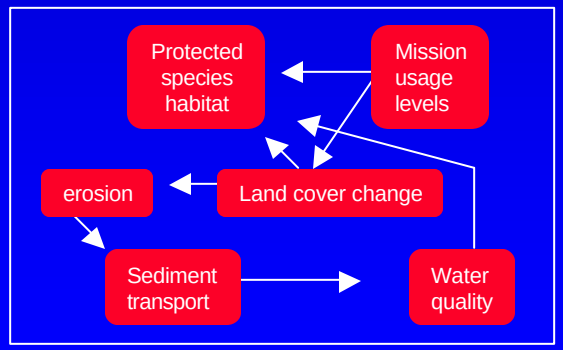
LMS Software Components

- Current Development Environment
  - CORBA
  - MS Visual Basic
  - MS C++
  - Java
  - Oracle
- Exploring New Technologies
  - SOAP (Simple Object Access Protocol)
  - XML
  - .NET
  - J2EE (Java 2, Enterprise Edition)
- COTS
  - ArcView

LMS Protocols

Specifications for the way
Computer-based Tools Interact





Data Repository

Decision Support

Local Data Repository for Resource Data

Data Advisor- Data Evaluation for Specific applications

On-line Catalog

Characteristics

- Tools for data discovery, access and archiving
- Seamless, web-based, Oracle linked with ArcSDE and ArcIMS
- Standards for data formats, data models and metadata

Coordination and Technology Sharing for Interoperability

Open GIS Consortium Web Mapping Technologies

Fetch Routines, Coordination, Active Partnerships

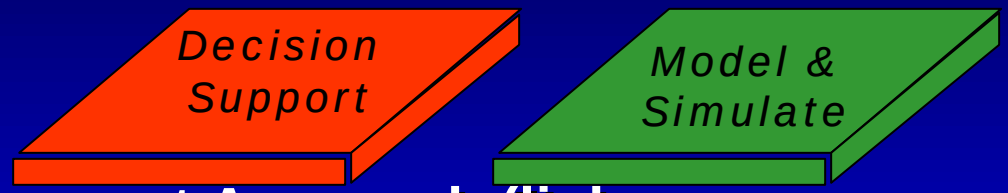
Other Repositories

State, Corps, Other Federal

Manage Data

Multi-media Planning Tools

- **Major Interface with End-users**
- **Embedded Linkages to other LMS Assets and Learning Tools**



- **Knowledge Management Approach (links across business processes)**

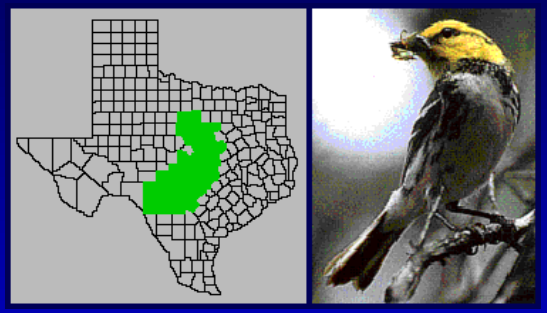
Planning	Inventory & Monitoring	Land/ Resource Use	Land/ Resource Mgmt & Repair	Data Mgmt/ Analysis	Obtaining Resources/ Budget	Reporting, Assessment & Communication

- **Projects Underway at Fort Benning and Fort Hood**

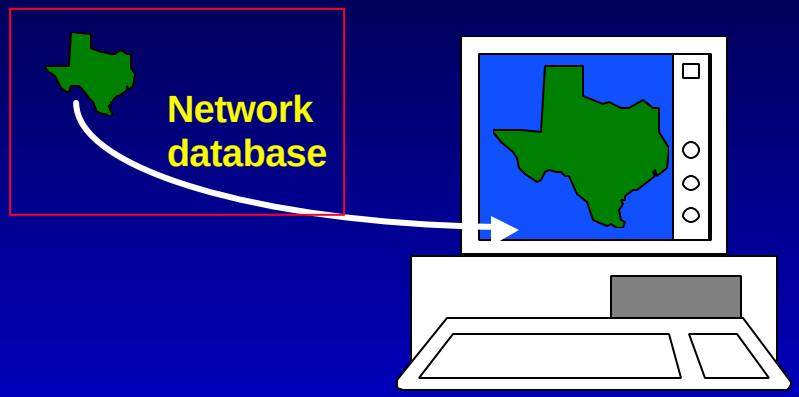
Ft. Hood, Texas

LMS Applications

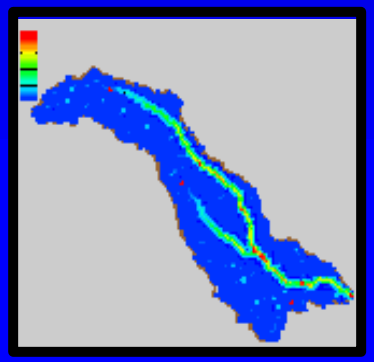
TES Modeling



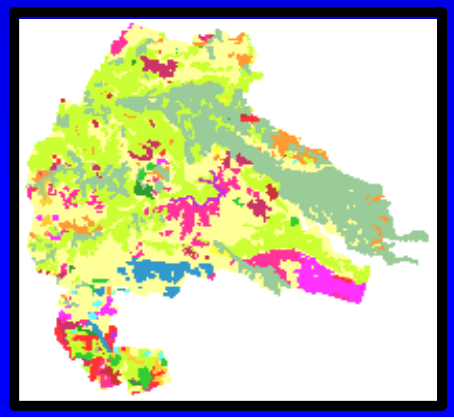
Web Map Dissemination



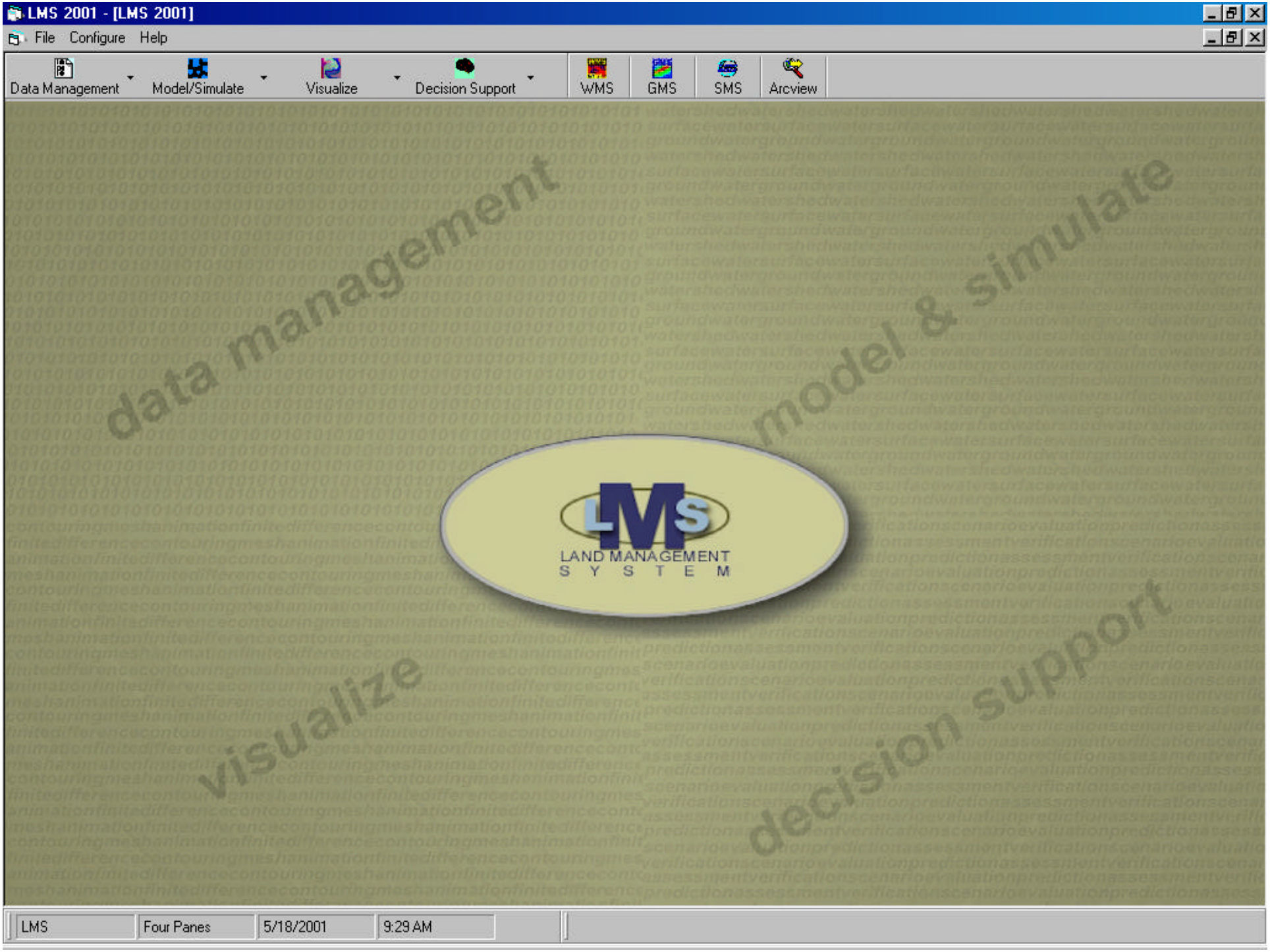
Stage-Stream/Soil Moisture Forecasting



Test of Multi-Tiered Vegetation Mapping Protocols for Ft. Hood



US Army Corps
of Engineers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File Configure Help
Data Management
Model/Simulate
Visualize
Decision Support
WMS
GMS
SMS
Arcview
data management
model & simulate
visualize
decision support
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LAND MANAGEMENT
SYSTEM
LMS
Four Panes
5/18/2001
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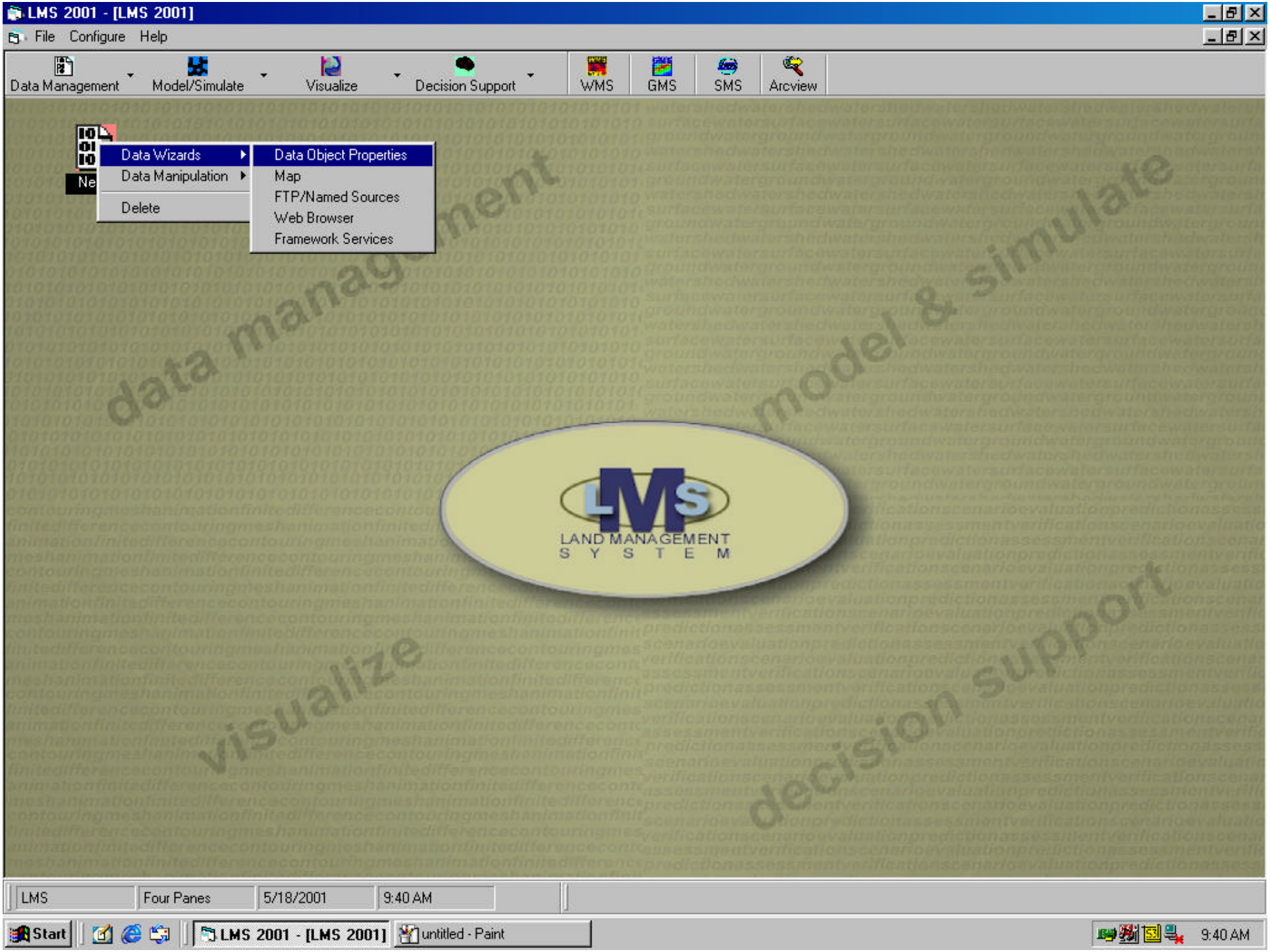
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Data Wizards
Data Manipulation
Delete
Data Object Properties
Map
FTP/Named Sources
Web Browser
Framework Services
data management
model & simulate
visualize
decision support
LMS
LAND MANAGEMENT
SYSTEM
LMS
Four Panes
5/18/2001
9:40 AM
Start
LMS 2001 - [LMS 2001]
untitled - Paint
9:40 AM

LMS 2001 - [LMS 2001]

File Configure Help

Data Management | Model/Simulate | Visualize | Decision Support | WMS | GMS | SMS | Arcview

TXstudy

Data Object Properties

Data Object Name: TXstudy

File Path/ HTTP Link:

Description:

Add | Browse

File/Links Added

Description	Path/Link
AccuWeather site	http://wwwa.accuweather.com
Hydrological Forecast	http://iwin.nws.noaa.gov/iwin/tx/hydro.html
DEM of study area	C:\topomaps\waco-w

Remove File/Link

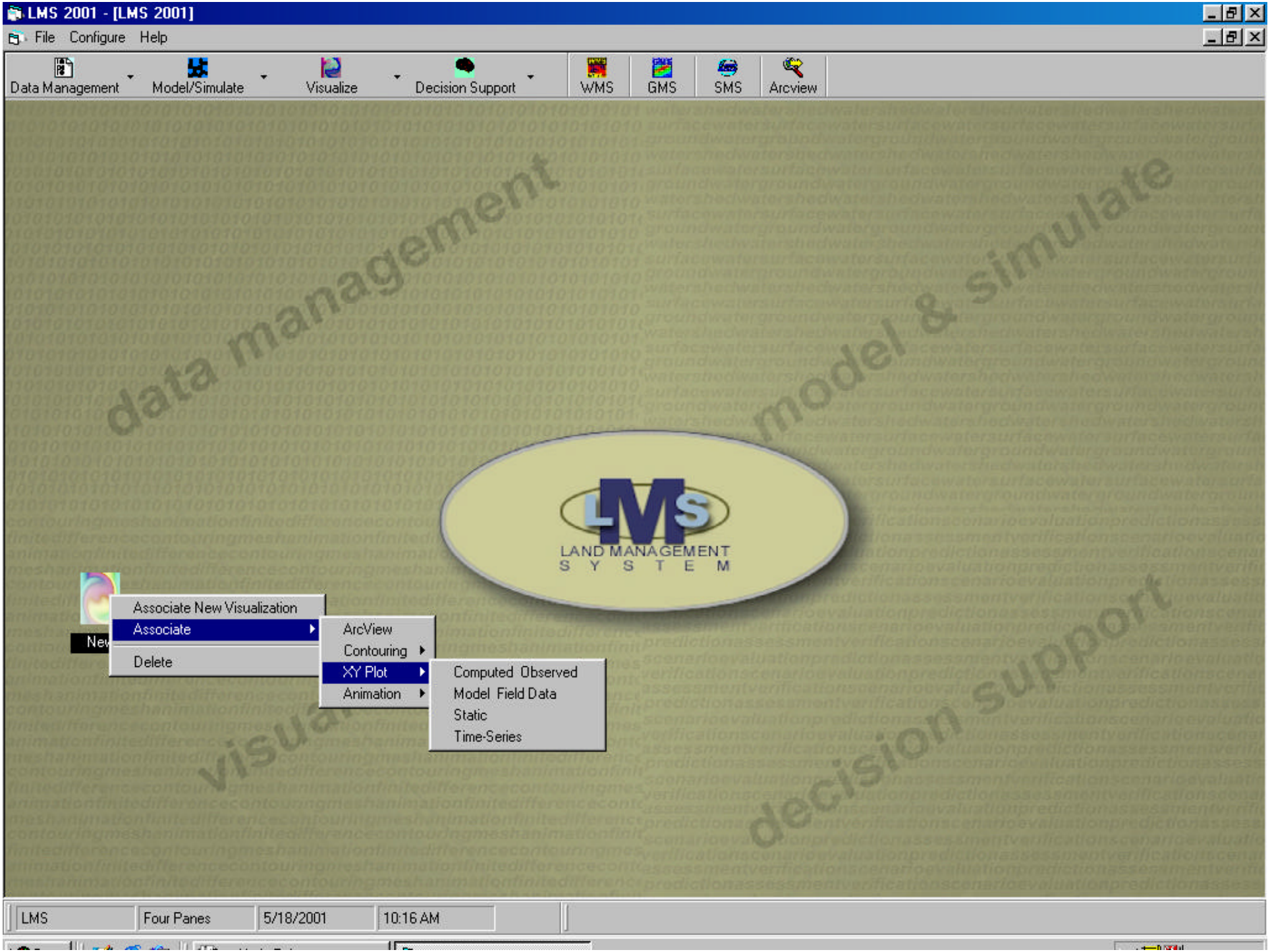
☐ Database

DataSource:

SQL Statement:

OK | Cancel

data management visualization model & simulate decision support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File Configure Help
Data Management
Model/Simulate
Visualize
Decision Support
WMS
GMS
SMS
Arcview
data management
model & simulate
visualize
decision support
LMS
LAND MANAGEMENT
SYSTEM
Associate New Visualization
Associate
Delete
ArcView
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XY Plot
Animation
Computed Observed
Model Field Data
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Time-Series
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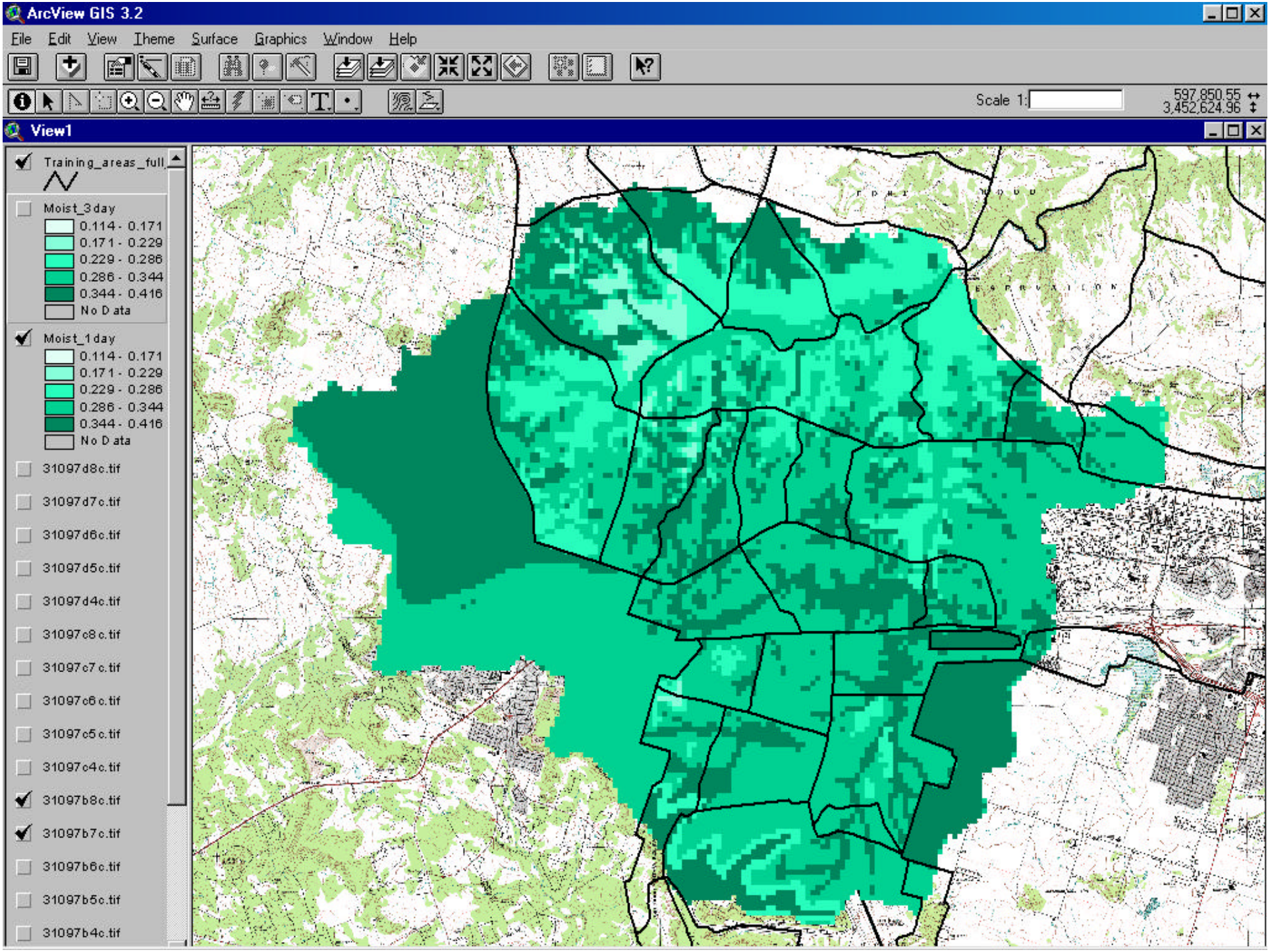
ArcView GIS 3.2
File Edit View Theme Surface Graphics Window Help
Scale 1:
597,850.55
3,452,624.96
View1
Training_areas_full
Moist_3day
0.114 - 0.171
0.171 - 0.229
0.229 - 0.286
0.286 - 0.344
0.344 - 0.416
No Data
Moist_1day
0.114 - 0.171
0.171 - 0.229
0.229 - 0.286
0.286 - 0.344
0.344 - 0.416
No Data
31097d8c.tif
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31097b5c.tif
31097b4c.tif

LMS 2001

File Configure Help

Data Management | Model/Simulate | Visualize | Decision Support | WMS | GMS | SMS | Arcview

TXdata

Weather

Topos

Layers

DSS Project Builder

Drag and Drop the associated Data Objects onto the related display boxes below to begin building your project.

Project Name Ft Hood - Owl Creek

Maps

Name	Path
Owl Creek overview	C:\Robs\Data\wallace\LMS\F
training area topo maps	C:\TX\DRG_5m\31097a4c.tif

Remove Map

Web Links

Name	Http Path
TXweatherdata	http://www.accuweather.com

Remove Web Link

Associated Background Map

Zip

Layer Maps

Name	Path
training are...	C:\FtHood\training_areas_full_line.sbx
training are...	C:\FtHood\training_areas_full_line.shp

Remove Map

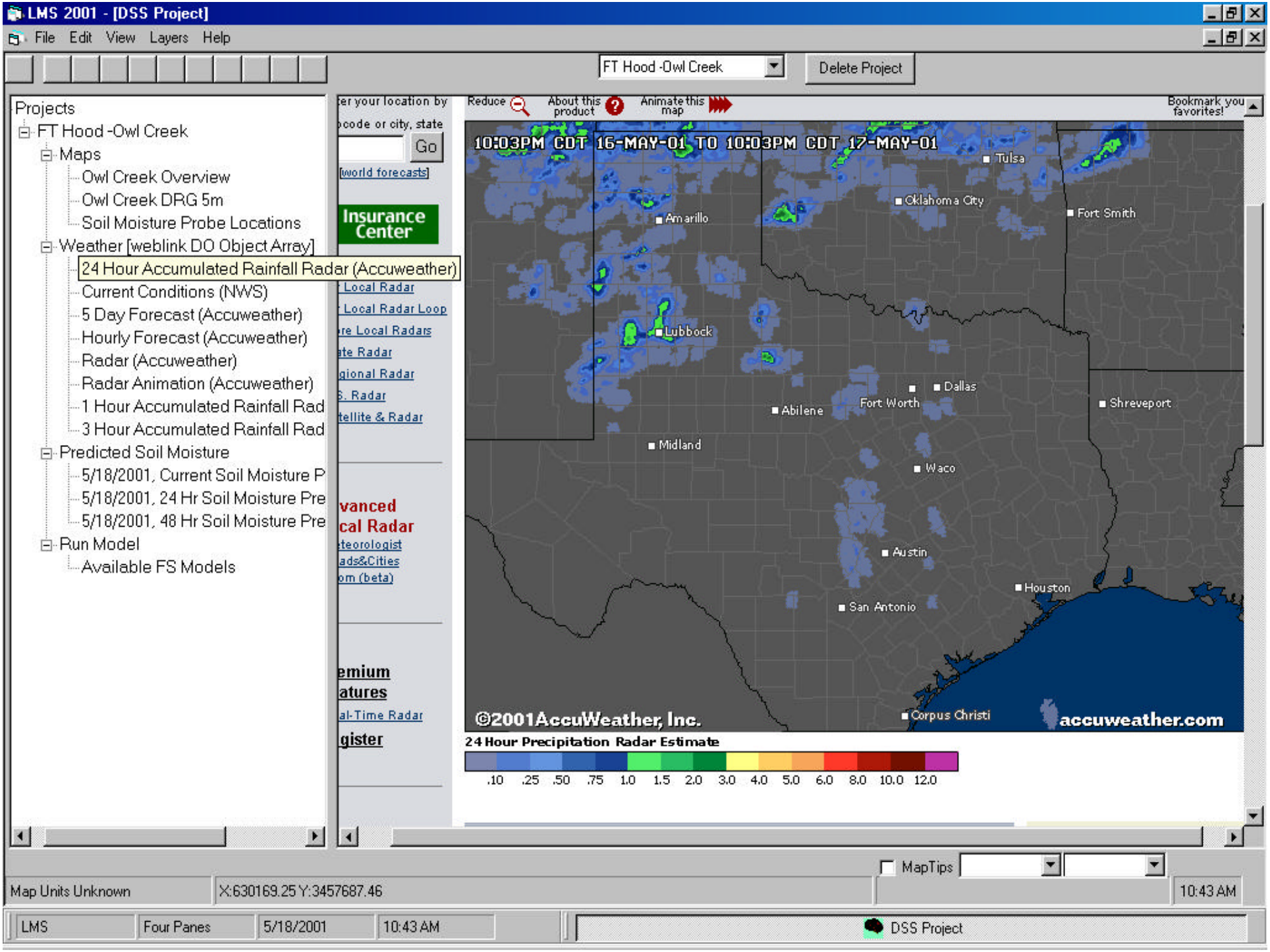
Database Plots

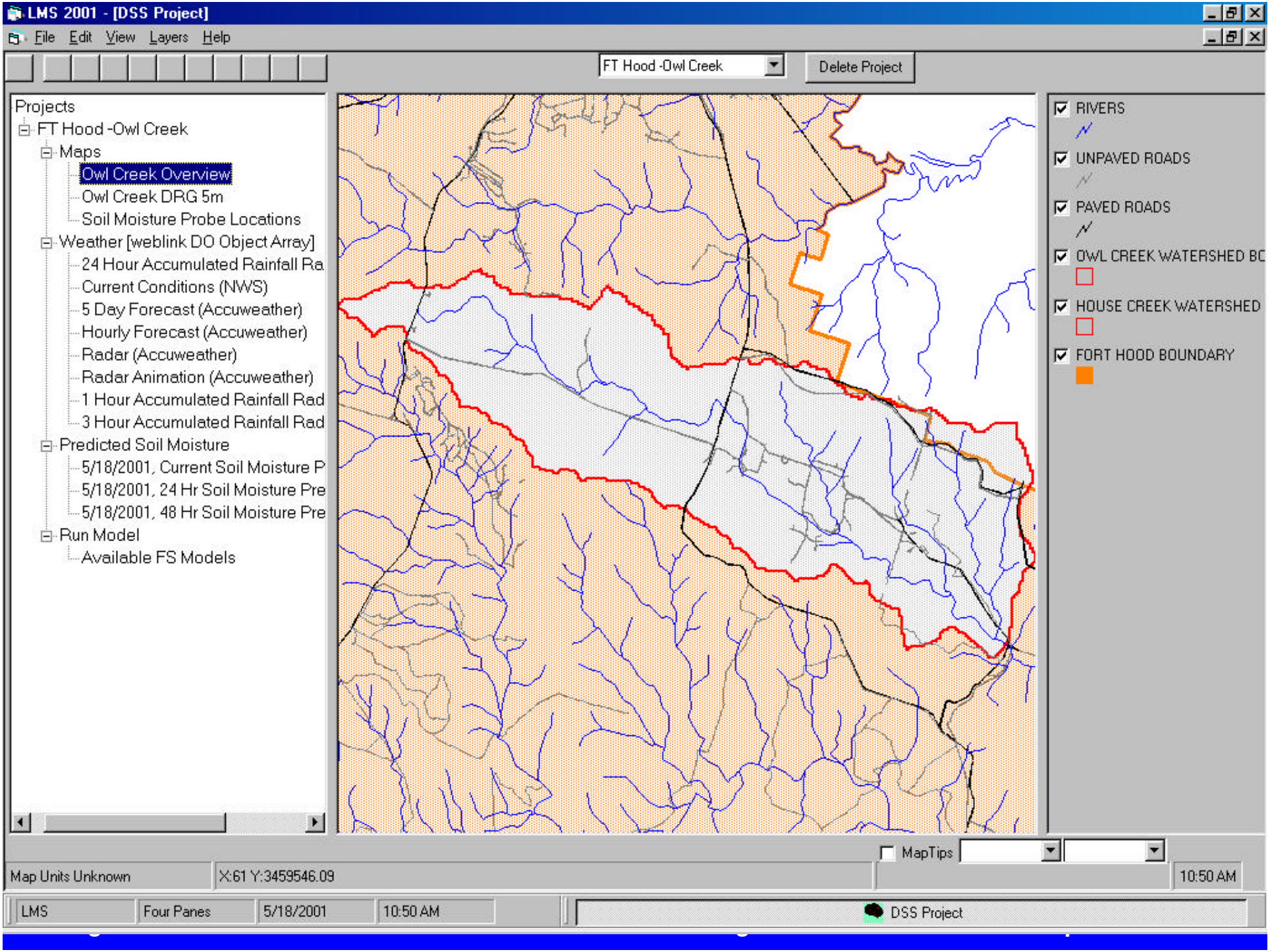
Name	Connection String	SQL Query

Remove Plot

Save | Cancel

LMS | Four Panes | 5/18/2001 | 12:22 PM | DSS Project Wizard


LMS 2001 - [DSS Project]
File Edit View Layers Help
FT Hood -Owl Creek
Delete Project
Projects
FT Hood -Owl Creek
Maps
Owl Creek Overview
Owl Creek DRG 5m
Soil Moisture Probe Locations
Weather [weblink DO Object Array]
24 Hour Accumulated Rainfall Radar (Accuweather)
Current Conditions (NWS)
5 Day Forecast (Accuweather)
Hourly Forecast (Accuweather)
Radar (Accuweather)
Radar Animation (Accuweather)
1 Hour Accumulated Rainfall Rad
3 Hour Accumulated Rainfall Rad
Predicted Soil Moisture
5/18/2001, Current Soil Moisture P
5/18/2001, 24 Hr Soil Moisture Pre
5/18/2001, 48 Hr Soil Moisture Pre
Run Model
Available FS Models
Go
Insurance Center
Reduce
About this product
Animate this map
Bookmark you favorites!
10:03PM CDT 16-MAY-01 TO 10:03PM CDT 17-MAY-01
Tulsa
Oklahoma City
Fort Smith
Amarillo
Lubbock
Dallas
Fort Worth
Abilene
Shreveport
Midland
Waco
Austin
Houston
San Antonio
Corpus Christi
©2001AccuWeather, Inc.
accuweather.com
24 Hour Precipitation Radar Estimate
.10 .25 .50 .75 1.0 1.5 2.0 3.0 4.0 5.0 6.0 8.0 10.0 12.0
MapTips
Map Units Unknown
X:630169.25 Y:3457687.46
10:43 AM
LMS
Four Panes
5/18/2001
10:43 AM
DSS Project


LMS 2001 - [DSS Project]
File Edit View Layers Help
FT Hood -Owl Creek
Delete Project
Projects
FT Hood -Owl Creek
Maps
Owl Creek Overview
Owl Creek DRG 5m
Soil Moisture Probe Locations
Weather [weblink DO Object Array]
24 Hour Accumulated Rainfall Ra
Current Conditions (NWS)
5 Day Forecast (Accuweather)
Hourly Forecast (Accuweather)
Radar (Accuweather)
Radar Animation (Accuweather)
1 Hour Accumulated Rainfall Rad
3 Hour Accumulated Rainfall Rad
Predicted Soil Moisture
5/18/2001, Current Soil Moisture P
5/18/2001, 24 Hr Soil Moisture Pre
5/18/2001, 48 Hr Soil Moisture Pre
Run Model
Available FS Models
RIVERS
UNPAVED ROADS
PAVED ROADS
OWL CREEK WATERSHED BC
HOUSE CREEK WATERSHED
FORT HOOD BOUNDARY
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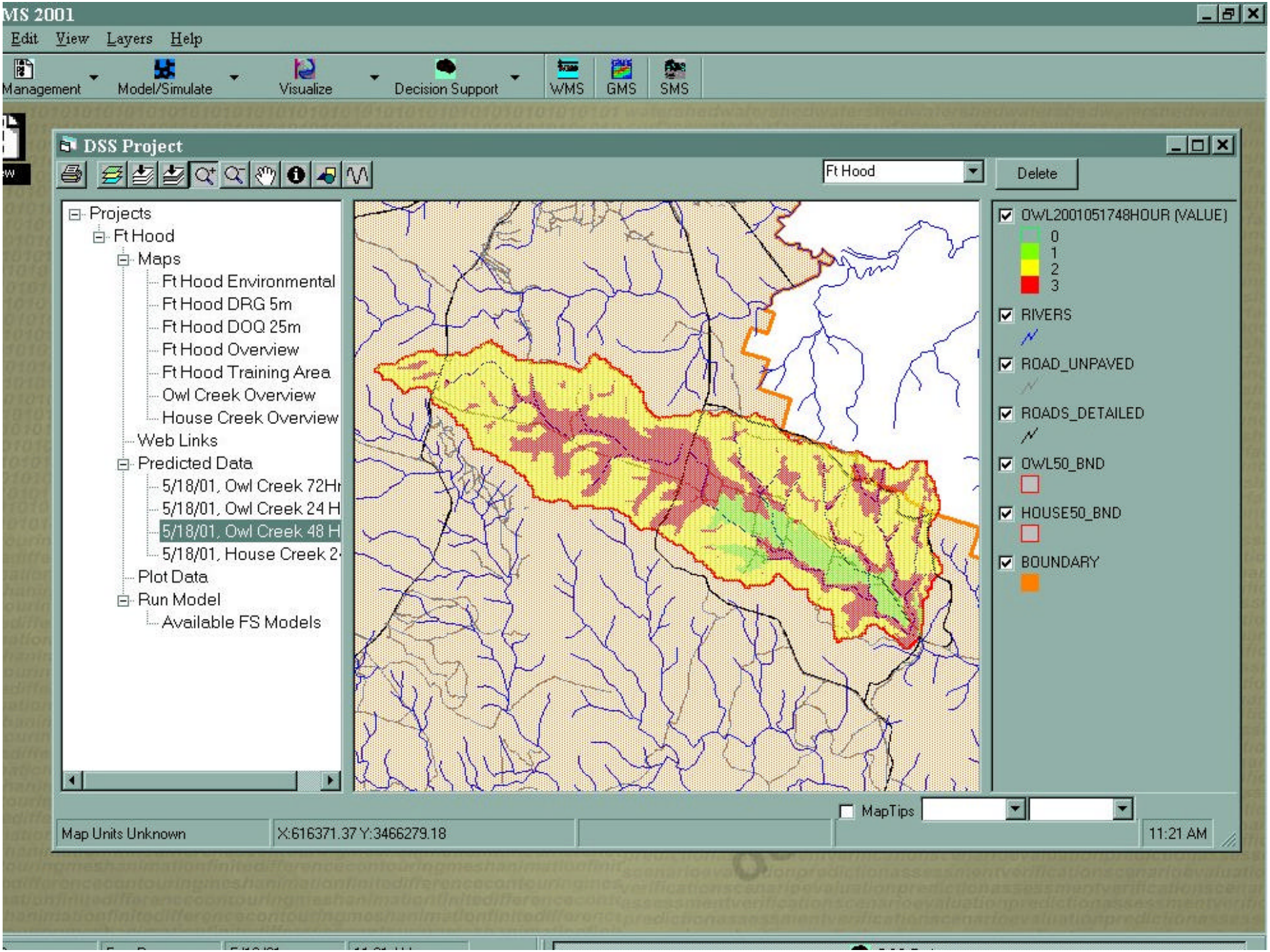
DSS Project


MS 2001
Edit View Layers Help
Management
Model/Simulate
Visualize
Decision Support
WMS
GMS
SMS
DSS Project
Ft Hood
Delete
Projects
Ft Hood
Maps
Ft Hood Environmental
Ft Hood DRG 5m
Ft Hood DOQ 25m
Ft Hood Overview
Ft Hood Training Area
Owl Creek Overview
House Creek Overview
Web Links
Predicted Data
5/18/01, Owl Creek 72Hr
5/18/01, Owl Creek 24 H
5/18/01, Owl Creek 48 H
5/18/01, House Creek 2
Plot Data
Run Model
Available FS Models
OWL2001051748HOUR (VALUE)
0
1
2
3
RIVERS
ROAD_UNPAVED
ROADS_DETAILED
OWL50_BND
HOUSE50_BND
BOUNDARY
MapTips
Map Units Unknown
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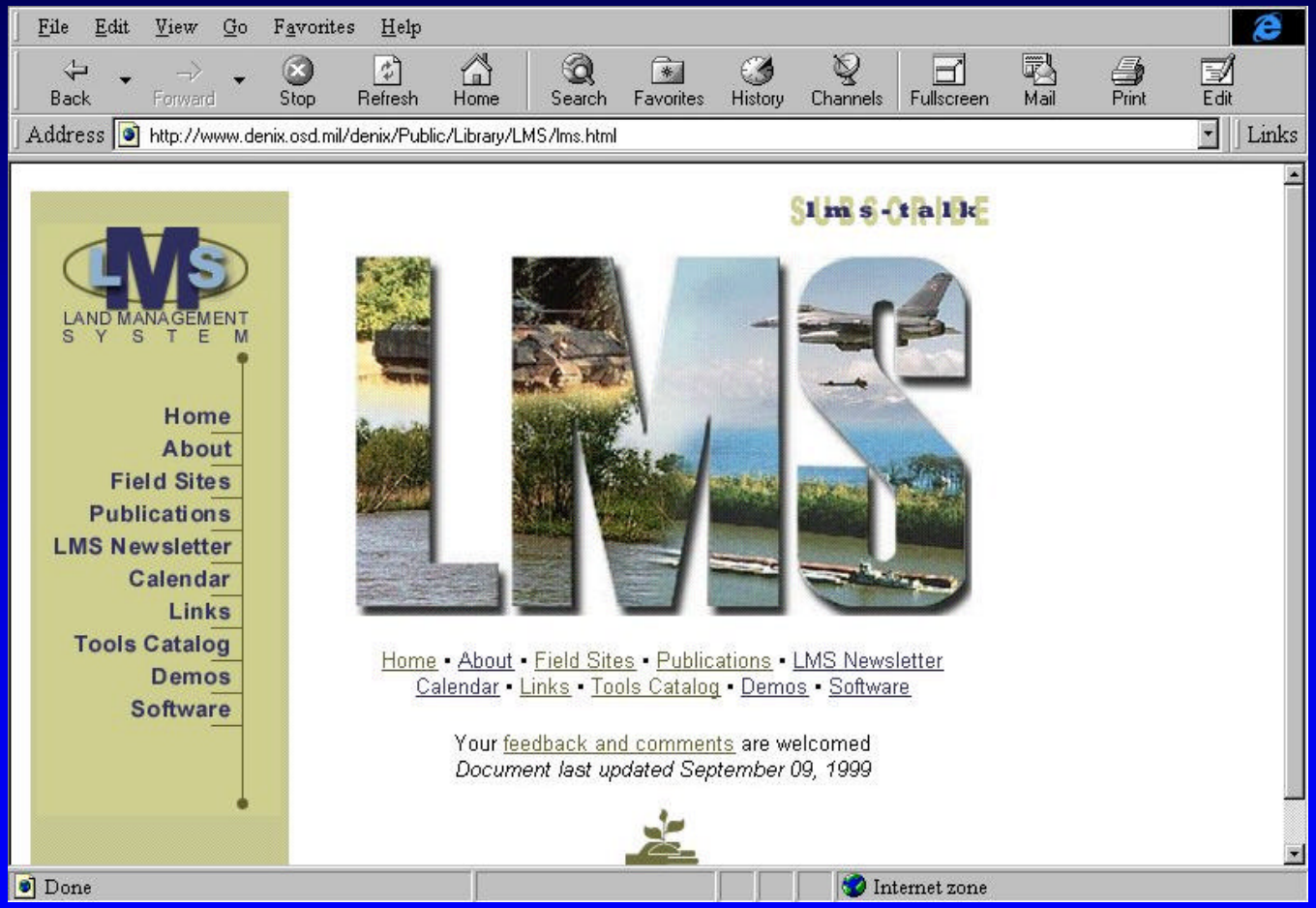
11:21 AM

LMS Website (http://www.denix.osd.mil/LMS)



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  - U.S. Army Corps of Engineers Environmental Quality RDT&E Program
  - DoD High Performance Computing Modernization Program
    - PET and CHSSI
  - Department of Energy
  - U.S. Army Corps of Engineers Civil Works R&D Program
  - Environmental Protection Agency