

# **GNN Ancillary Data**

## **Overview**

This document describes the format and appropriate applications of the ancillary plot and spatial data that is available for use in conjunction with Gradient Nearest Neighbor (GNN) models produced by the LEMMA team.

For more information about the GNN method, please refer to the following document:

Ohmann, JL, and MJ Gregory. 2002. Predictive mapping of forest composition and structure with direct gradient analysis and nearest neighbor imputation in coastal Oregon. *Ecological Applications*: 17:18-33.

The above document and all of the data described below can be downloaded from the LEMMA website at: <http://www.fsl.orst.edu/lemma>

## **Spatial Data**

Since the GNN method only applies to forested areas of the landscape, it should not be used to characterize nonforested areas (agriculture, urban areas, lakes, etc.). Therefore, a nonforest mask should be applied to the models to mask out these areas where the GNN predictions are not valid. The draft 2006 Northwest Forest Plan (NWFP) models use a nonforest mask based on maps of Ecological Systems developed for the USGS Gap Analysis Program (<http://gapanalysis.nbii.gov/portal/server.pt>).

LEMMA distributes GNN models with the nonforest mask already applied, so the models are ready for use right away. However, we've identified issues with our nonforest masks where parts of the landscape are incorrectly identified as forest or nonforest. An example of this often happens when recent forest harvests are identified as nonforest, since there are no trees or very few trees remaining. Conversely, areas with dense canopy cover from shrubs are often confused for forest land. Finally, issues can also arise due to varying definitions of what constitutes forest land (LEMMA uses the definition of 10% canopy cover). In these areas, sparse forest may be mapped as nonforest.

### **Unmasked GNN map**

Due to the limitations with the nonforest masks, some users may want to apply their own nonforest mask (provided that they have one available). LEMMA provides unmasked GNN grids for download for just this purpose. Users need to be aware that these maps should not be used without first applying a nonforest mask.

## Plot Data

The plot data used in GNN models come from a variety of sources: Forest Inventory and Analysis (FIA) Periodic and Annual plots, USFS Region 6 Current Vegetation Survey (R6-CVS), USFS Region 5 Inventory (R5), Bureau of Land Management Current Vegetation Survey (BLM-CVS), and Bureau of Land Management Fire Effects Monitoring and Inventory Protocol (FIREMON) plots. While there are differences in plot size and sampling procedures between data sources, the data collected are similar enough to be summarized and used as input into the GNN models.

### Scaling plot data for GNN modeling

The inventory plot data can be used at any of several nested scales or summary levels. Entire plots can be used, or plots can be divided into their component condition classes or subplots. (Subplots are sometimes referred to as stake-positions or points.) For FIA plots (both periodic and Annual), condition classes are coded in the field to indicate different land cover classes (forest vs. nonforest), owner classes, and forest conditions, and are used in compiling the inventories. For CVS plots, condition classes are identified by LEMMA but are limited to forest vs. nonforest and ownership.

For GNN modeling, we use the entire *forested* portion of a plot, which can consist of multiple forest condition classes. We refer to this as the ‘forest class’ level, abbreviated ‘FC’ in our database fields. Only plots that contain 50% or more forested area are used in GNN models (i.e. we exclude plots that have a majority of nonforest or nonsampled area).

*Some examples of plot layouts can be found in the ‘Plot Diagrams.pdf’ file included in the download package with this document.*

*For more information about plot installation and design please visit these websites:*

FIA field guides: <http://fia.fs.fed.us/library/field-guides-methods-proc>

FIA database documentation: <http://fia.fs.fed.us/library/database-documentation>

R6 CVS field guides & database documentation:

<http://www.fs.fed.us/r6/survey/document.htm>

### LEMMA Database Tables

Some of the ancillary tables provide piece-level data from field plot assessments, which can be used to summarize the data at any scale (plot [PLT], forest class [FC], condition class [CC], subplot [PNT]). Other ancillary tables provide data summarized at the forest class level and can be joined directly to the GNN grids. Only the most commonly used FC summary variables are joined to the GNN grids by default, but all of the FC summary variables calculated by LEMMA are available for joining.

*The tables that can be joined to the GNN grids all have ‘VALUE’ as the first field, since this field is necessary for joining at the ArcInfo prompt. The ‘VALUE’ field contains the same data as the ‘FCID’ field, which is the unique plot identifier in the LEMMA database.*

<b>Name</b>	<b>Description</b>	<b>Use</b>
SPECIES_CLASS	Species classification (family, genus, etc.)	Reference table
TREE_BA_CROSSTAB	Plot by tree species basal area cross-tabulation table	Join to GNN models
TREE_COV_CROSSTAB	Plot by tree species percent cover cross-tabulation table	Join to GNN models
SHRUB_COV_CROSSTAB	Plot by shrub species percent cover cross-tabulation table	Join to GNN models
SPPSZ_ATTR_ALL	All attributes for GNN sppsz grids (summary variables and plot information)	Join to GNN models
TREE_LIVE	Live tree piece-level data (one record per tree)	Can be used to summarize data at different levels (PNT, CC, PLT) or summarize differently at FC level (e.g. change size class breaks)
TREE_SNAG	Standing dead (snag) piece-level data (one record per snag)	Can be used to summarize data at different levels (PNT, CC, PLT) or summarize differently at FC level
TREE_CWD	Coarse woody debris piece-level data (one record per piece)	Can be used to summarize data at different levels (PNT, CC, PLT) or summarize differently at FC level
UNDERSTORY	Understory (non-tree) tally data (cover by species on plots)	Can be used to summarize data at different levels (PNT, CC, PLT) or summarize differently at FC level

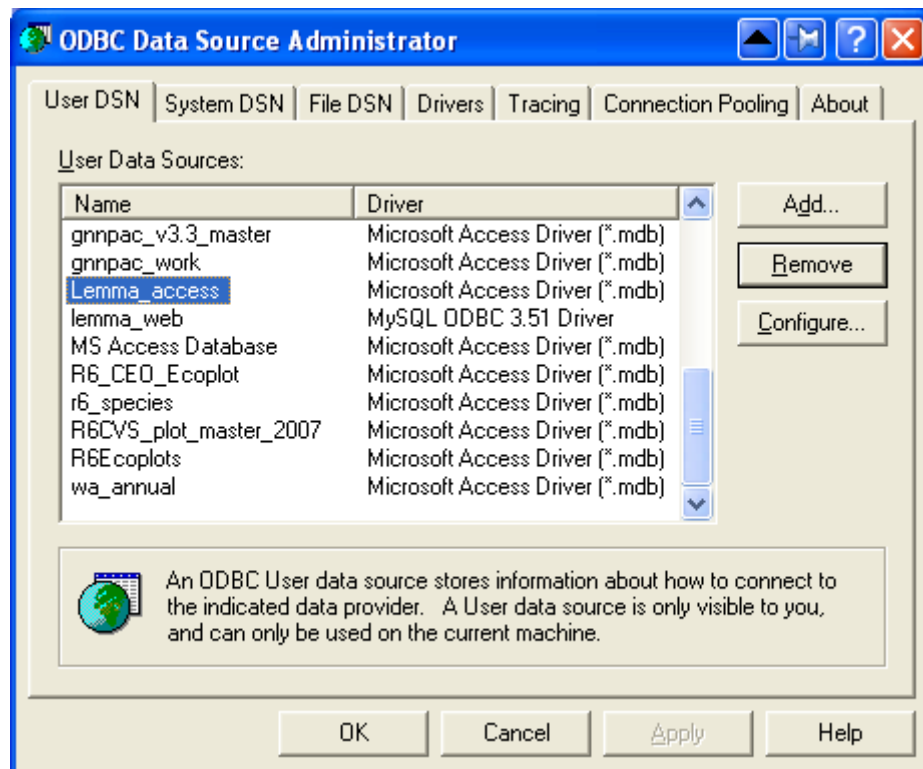
## Joining Data to GNN Maps

There are a number of scenarios where users will need to join data to GNN maps. Obviously, users will need to join data to add attributes that are not included in the standard distribution. Additionally, users will need to re-attach the attributes after executing certain grid processing functions (e.g. clip) since the value attribute table (VAT) will be reduced to contain only VALUE and COUNT after such operations.

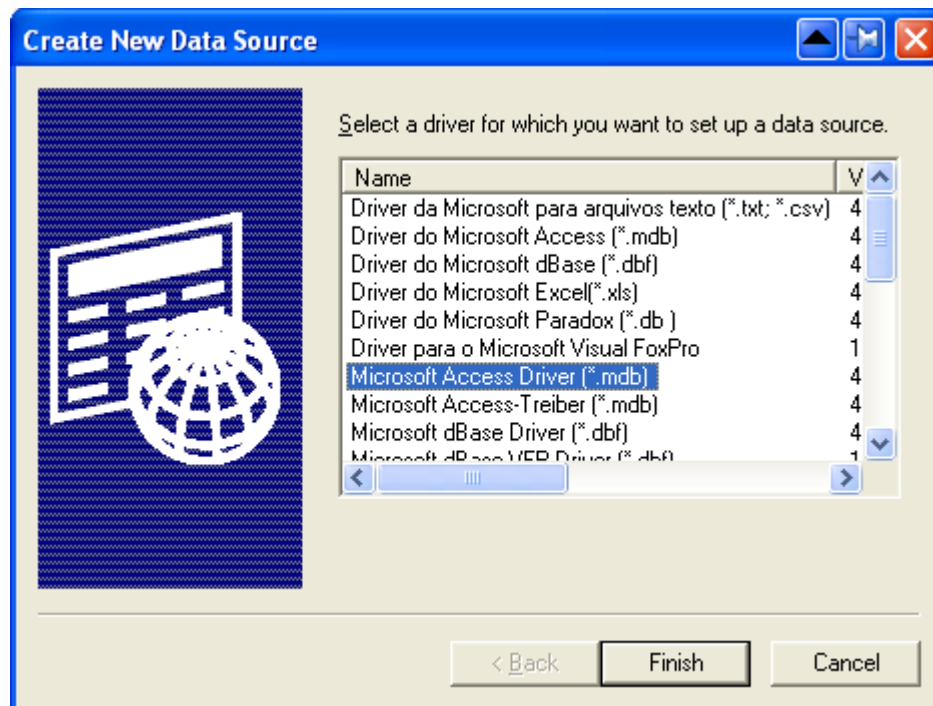
There are a few different methods available for joining additional data to ArcInfo grids. The following instructions describe how to join data from a table in an Access database, since that is the format that LEMMA uses to distribute ancillary data. While there are a few steps involved, each step is pretty straightforward and should be fairly simple to complete.

*The following example shows how to join the attributes in the SPPSZ\_ATTR\_ALL table to the mr204\_sppsz06 grid.*

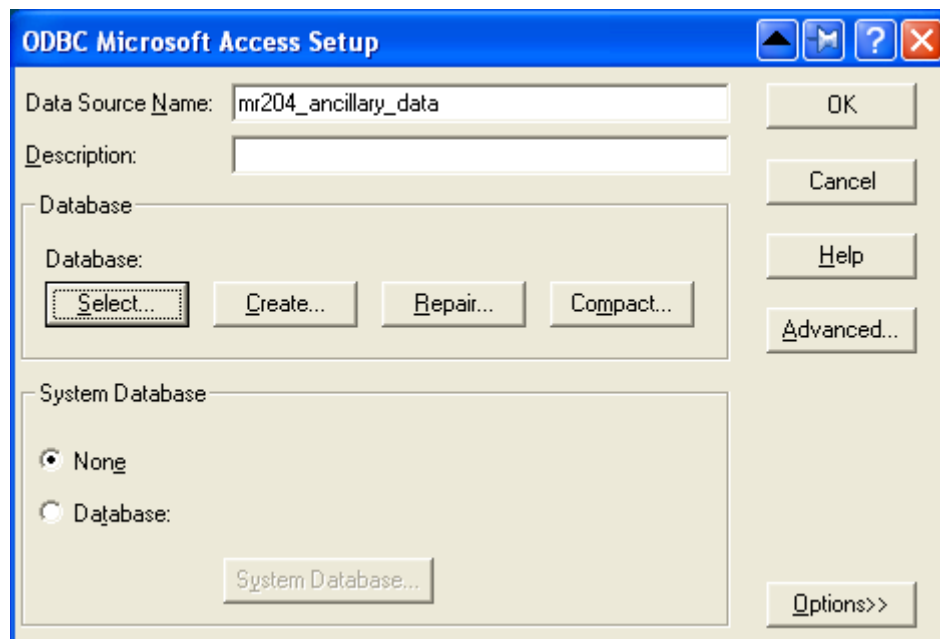
1. Create a Data Source Name (DSN) for the Access database.
  - a. Open Control Panel > Administrative Tools > Data Sources (ODBC)
  - b. With the User DSN tab activated, click on the Add button to the right.



- c. Select Microsoft Access Driver (\*.mdb) and click Finish.

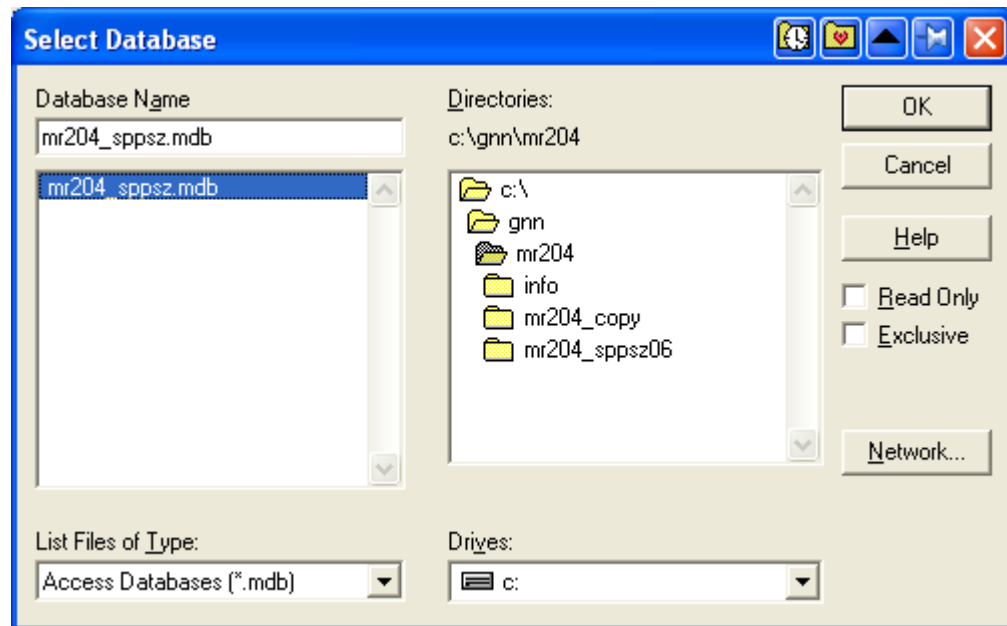


- d. Enter a name in the Data Source Name input box and optionally enter a description in the Description input box. Then click the Select button under the Database heading.

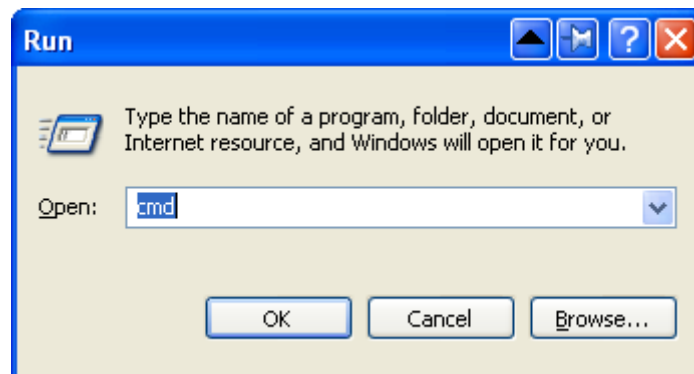


- e. Select the drive that contains the Access database with GNN data by expanding the options under the Drives heading in the lower right.

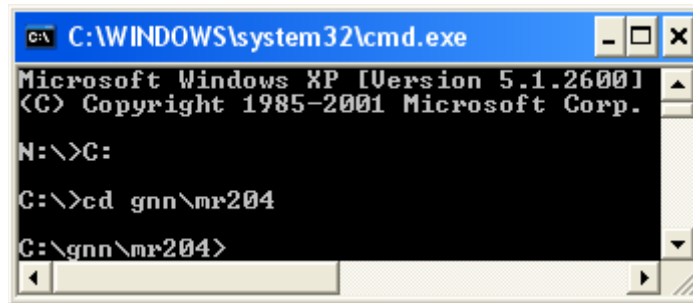
- f. Once the correct drive is selected, navigate to the folder containing the Access database under the Directories heading.
- g. Finally, select the database from the list under the Database Name heading and click OK (keep clicking OK to close all open dialog boxes). Your DSN should now be complete.



2. Open an Arc command prompt and join the data from the Access table to the grid.
  - a. Go to Start > Run; type 'cmd' (without the quotes) in the Open input box and select OK.

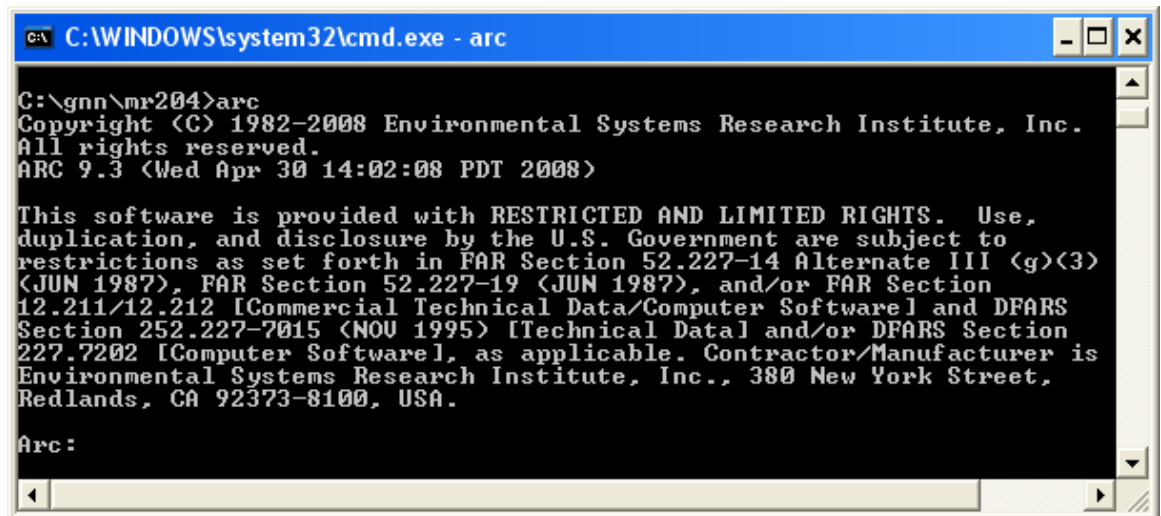


- b. Navigate to the directory where the GNN grid is stored. If the grid is stored under a different drive type the drive letter followed by a colon. Once you're in the correct drive, use the 'cd' command to change the directory.



```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
Copyright 1985-2001 Microsoft Corp.
N:\>C:
C:\>cd gnn\mr204
C:\gnn\mr204>
```

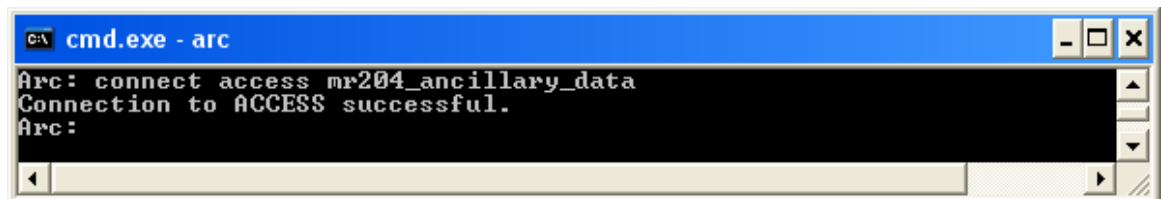
- c. Once you have navigated to the directory with the GNN grid, type 'arc' to open the Arc command prompt.



```
C:\WINDOWS\system32\cmd.exe - arc
C:\gnn\mr204>arc
Copyright (C) 1982-2008 Environmental Systems Research Institute, Inc.
All rights reserved.
ARC 9.3 (Wed Apr 30 14:02:08 PDT 2008)

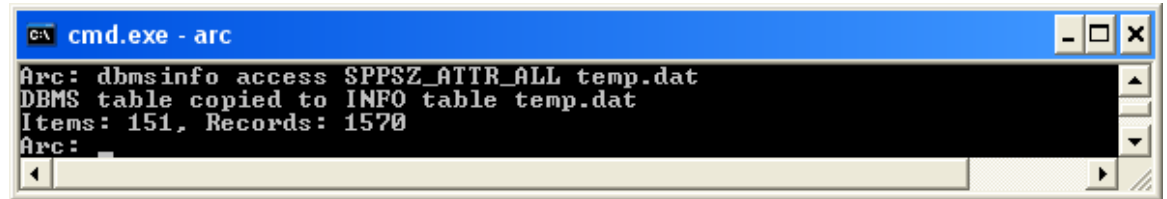
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(JUN 1987), FAR Section 52.227-19 (JUN 1987), and/or FAR Section
12.211/12.212 [Commercial Technical Data/Computer Software] and DFARS
Section 252.227-7015 (NOV 1995) [Technical Data] and/or DFARS Section
227.7202 [Computer Software], as applicable. Contractor/Manufacturer is
Environmental Systems Research Institute, Inc., 380 New York Street,
Redlands, CA 92373-8100, USA.
Arc:
```

- d. Connect to the DSN that you created in Step 1. Type 'connect access <DSN name>'.



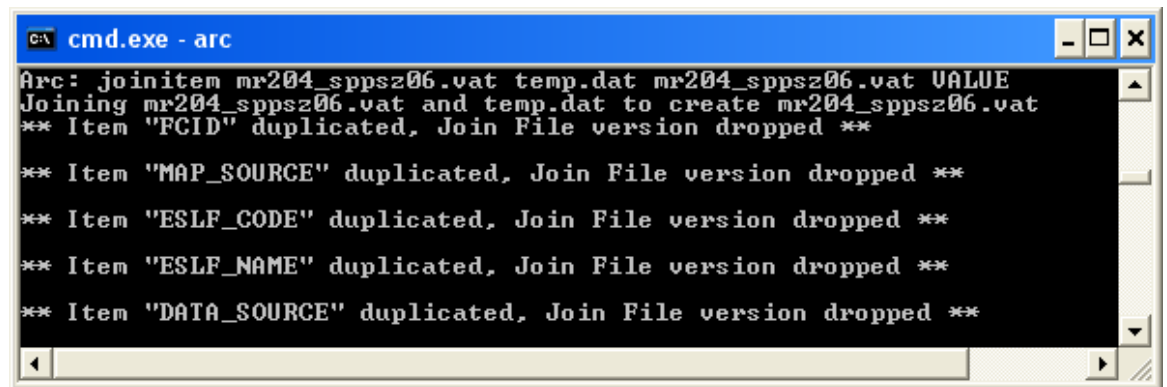
```
C:\> cmd.exe - arc
Arc: connect access mr204_ancillary_data
Connection to ACCESS successful.
Arc:
```

- e. Create a temporary INFO table with the attributes to attach to the GNN grid. Type 'dbmsinfo access <table name> temp.dat'



```
C:\> cmd.exe - arc
Arc: dbmsinfo access SPPSZ_ATTR_ALL temp.dat
DBMS table copied to INFO table temp.dat
Items: 151, Records: 1570
Arc: 
```

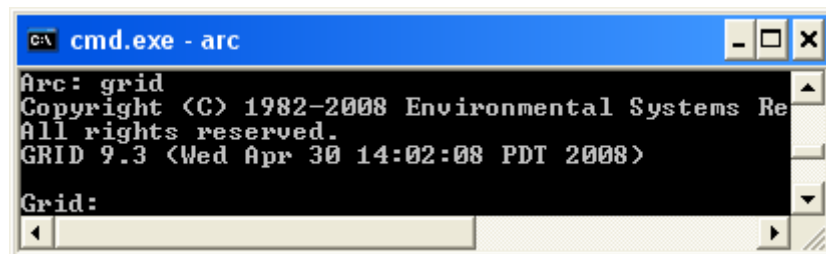
- f. Use the joinitem command to join the data from the INFO table to the grid. Type 'joinitem <grid\_name>.vat temp.dat <grid\_name>.vat VALUE'



```
C:\> cmd.exe - arc
Arc: joinitem mr204_sppsz06.vat temp.dat mr204_sppsz06.vat VALUE
Joining mr204_sppsz06.vat and temp.dat to create mr204_sppsz06.vat
** Item "PCID" duplicated, Join File version dropped **
** Item "MAP_SOURCE" duplicated, Join File version dropped **
** Item "ESLF_CODE" duplicated, Join File version dropped **
** Item "ESLF_NAME" duplicated, Join File version dropped **
** Item "DATA_SOURCE" duplicated, Join File version dropped **
Arc: 
```

You'll notice quite a few fields were already joined to the grid, so those fields were simply ignored. However, all of the new fields are appended after the existing fields, so the fields will not be in the same order as they appear in the Access database table. There's an easy work-around if you want the fields to appear in the same order as they are in the table. If you make a copy of the original grid at the grid prompt, the attributes will be dropped in the copy. Then you can join the new attributes in the correct order.

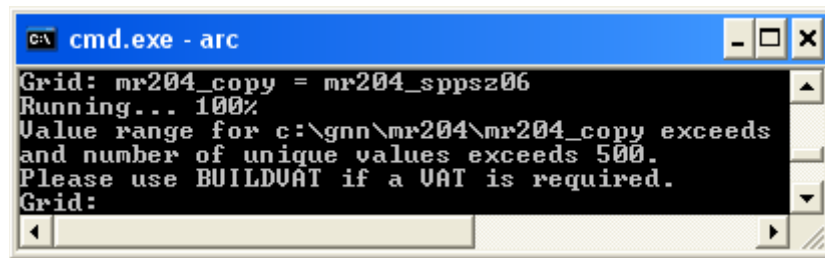
- i. Type 'grid' to open the grid prompt.



```
C:\> cmd.exe - arc
Arc: grid
Copyright (C) 1982-2008 Environmental Systems Research, Inc.
All rights reserved.
GRID 9.3 (Wed Apr 30 14:02:08 PDT 2008)
Grid: 
```

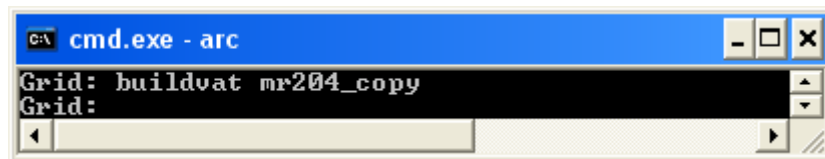


- ii. Type <new grid name> = <existing grid name> to create the copy.




```
C:\> cmd.exe - arc
Grid: mr204_copy = mr204_spps06
Running... 100%
Value range for c:\gmn\mr204\mr204_copy exceeds
and number of unique values exceeds 500.
Please use BUILDVAT if a VAT is required.
Grid:
```

- iii. In this case, the number of unique values (for GNN grids, this is the number of plots in the model) exceeds 500 so Arc does not create the VAT. You'll have to use the buildvat function to create the VAT before you can join the attributes.



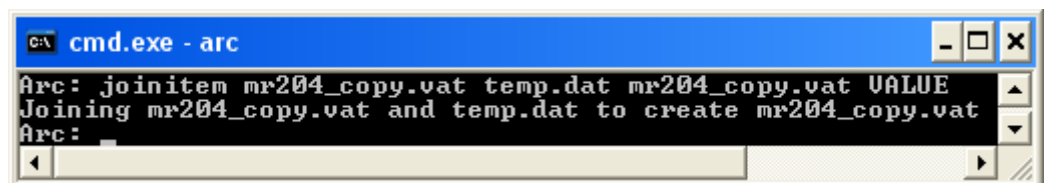
```
C:\> cmd.exe - arc
Grid: buildvat mr204_copy
Grid:
```

- iv. Type 'q' or 'quit' to exit the grid prompt and return to the Arc prompt.



```
C:\> cmd.exe - arc
Grid: q
Leaving GRID...
Arc:
```

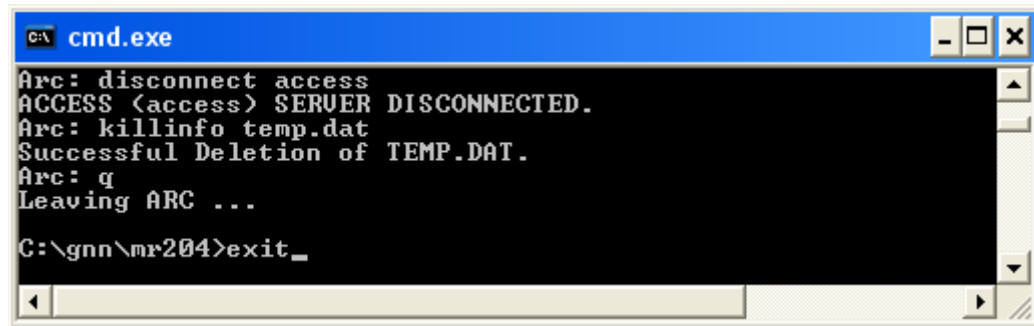
- v. Finally, we can join the attributes to the new grid.



```
C:\> cmd.exe - arc
Arc: joinitem mr204_copy.vat temp.dat mr204_copy.vat VALUE
Joining mr204_copy.vat and temp.dat to create mr204_copy.vat
Arc:
```

You'll notice there are no messages this time about fields that were duplicated since we started with a VAT that only contained the VALUE and COUNT fields.

- g. Cleanup the workspace by disconnecting from the Access database and deleting the temp.dat INFO table. Type 'disconnect access'. Type 'killinfo temp.dat'. Type 'q' to quit out of the Arc prompt, then type 'exit' to close the command window.



```
C:\gmn\mr204>exit_
```

Please check out the ArcDoc documentation for more information about the functions used in this example (Program Files > ArcGIS > ArcInfo Workstation > ArcDoc).

**Note:** One of the advantages to creating a DSN to an Access database for joining attributes is that you can use queries as well as tables for the input source. For database savvy users, this means you can create a query in the database that grabs just the fields you want to join to the GNN grid (just be sure to include the VALUE field). When you run the 'dbmsinfo' command, enter the query name for the <table name> parameter and only the fields in the query will be joined to the grid. This could be useful if you want some (but not all) of the fields in the SPPSZ\_ATTR\_ALL table that are not included in the standard distribution.

(For those unfamiliar with creating Access database queries, there is a query wizard that will do most of the work for you, which is especially easy to use if you are just selecting fields from one table. Open the query wizard by opening the Access database, clicking on the query tab and then double-clicking 'Create query by using wizard').

Now that new attributes have been attached to the grid, you'll want to update the metadata to include these attributes. The following section describes how to import metadata from an XML file.

## Importing Metadata to GNN Maps

Sometimes users will need to import metadata to the GNN maps. Users will want to import metadata when they attach additional variables to the grids, since only the variables in the standard distribution are included in the metadata by default.

Additionally, some grid processing functions have a side-effect of removing the metadata so the metadata will need to be imported again.

1. Open ArcCatalog and navigate to the grid for which you want to import metadata.
2. With the grid selected in the left pane, click on the Metadata tab in the right pane.
3. Click on the Import Metadata button on the Metadata toolbar (If the Metadata toolbar is not already displayed, you'll need to activate it by going to View > Toolbars > Metadata).



- a. Click on the Browse button next to the Location box to navigate to the folder containing the XML metadata file that you want to import. Double-click on the XML file to select it.
- b. Choose XML as the format for the metadata.
- c. Make sure that the box next to the 'Enable automatic update of metadata' is selected.

