Module 3
Objectives and Tasks

Create a Curvature Map and Intersect with a Soil Layer

- Review Slope Curvature Model
- Curvature - Region Group Step 1 Model
- Curvature - Nibble Step 2 Model
- Symbolize & Evaluate Curvature Layer
- Intersect Curvature Shapefile and Soil Layer
- Export Soil\Curvature Intersect Data Table
- Summarize Curvature by Map Units

The directory structure listed below must exist for the Curvature Models to function properly:

1. "C:\WorkSpace\spatial\tmp"
2. "C:\WorkSpace\spatial\curvature"
3. "C:\WorkSpace\spatial\curvature\shapefile"

Review Curvature Model

Layers & data derived from Curvature Analysis provides users with a picture of the overall slope shape -- what areas are convex, concave and linear.

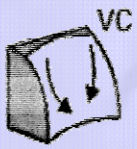
This information allows us to separate erosional and depositional surfaces; this is significant for soil genesis.

The layers created from the Curvature Model can be used to assist in pre-mapping or to adjust existing soil lines.

The intersection of curvature shapefiles and soil polygons provides statistical information on slope shape for each map unit. This could help determine map unit composition.

Review Curvature Model, cont.

The output from the Curvature Model is a grid. Each cell value is a composite of 2 values that represent slope shapes that are the perpendicular (profile) and parallel (planar) to the slope. The composite grid delineates the 9 different slope shapes.

11 = Convex-Concave 

13 = Convex-Linear 

15 = Convex-Convex 

31 = Linear Concave 

33 = Linear-Linear 

35 = Linear-Convex 

51 = Concave-Concave 

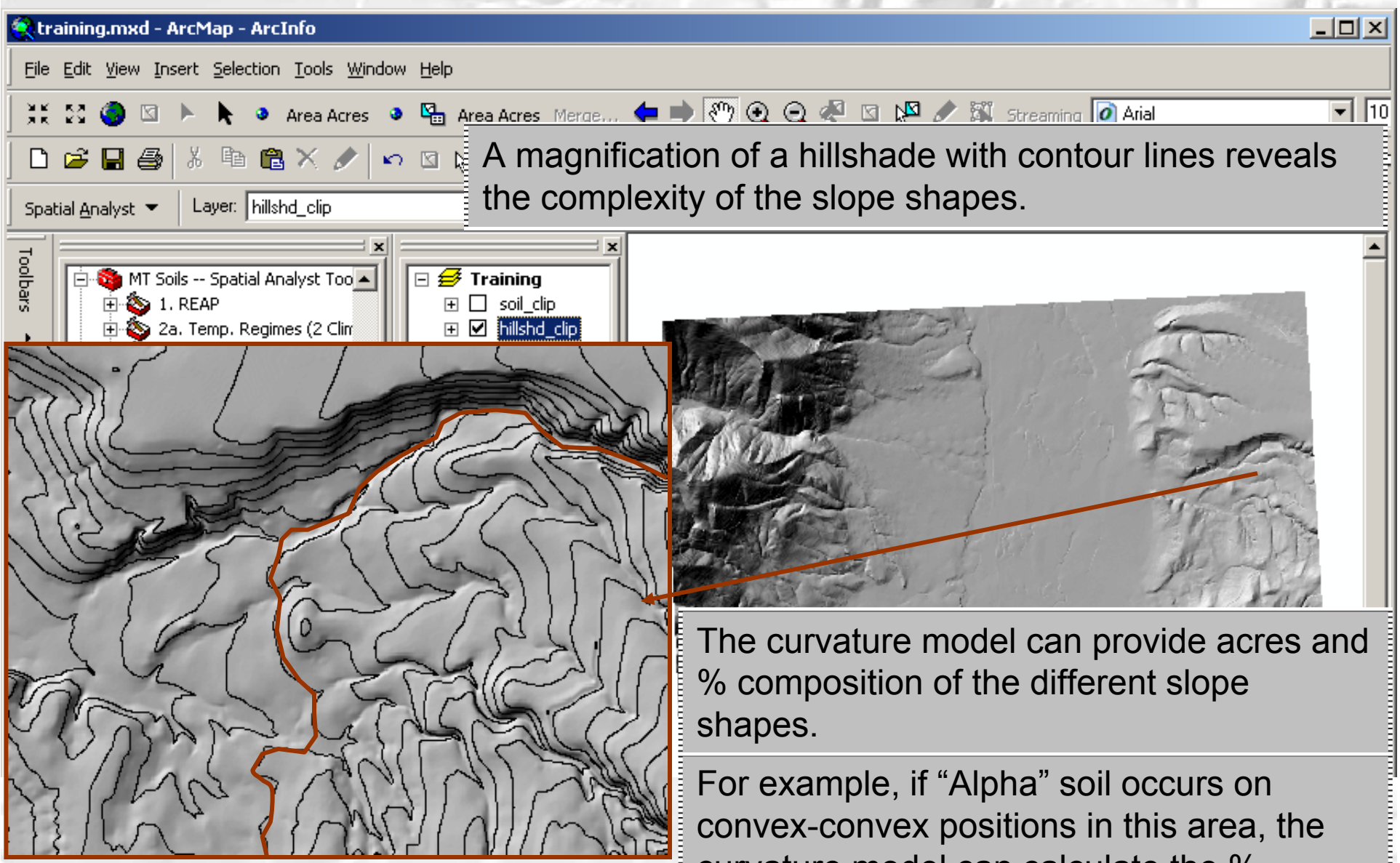
53 = Concave-Linear 

55 = Concave-Convex 

The first number represents values from the profile grid (up slope) and the second number represents the values from the planar grid (across slope).

Profile grid (upslope):	1 = Convex	3 = Linear	5 = Concave
Planar grid (across slope):	1 = Concave	3 = Linear	5 = Convex

Review Curvature Model, cont.



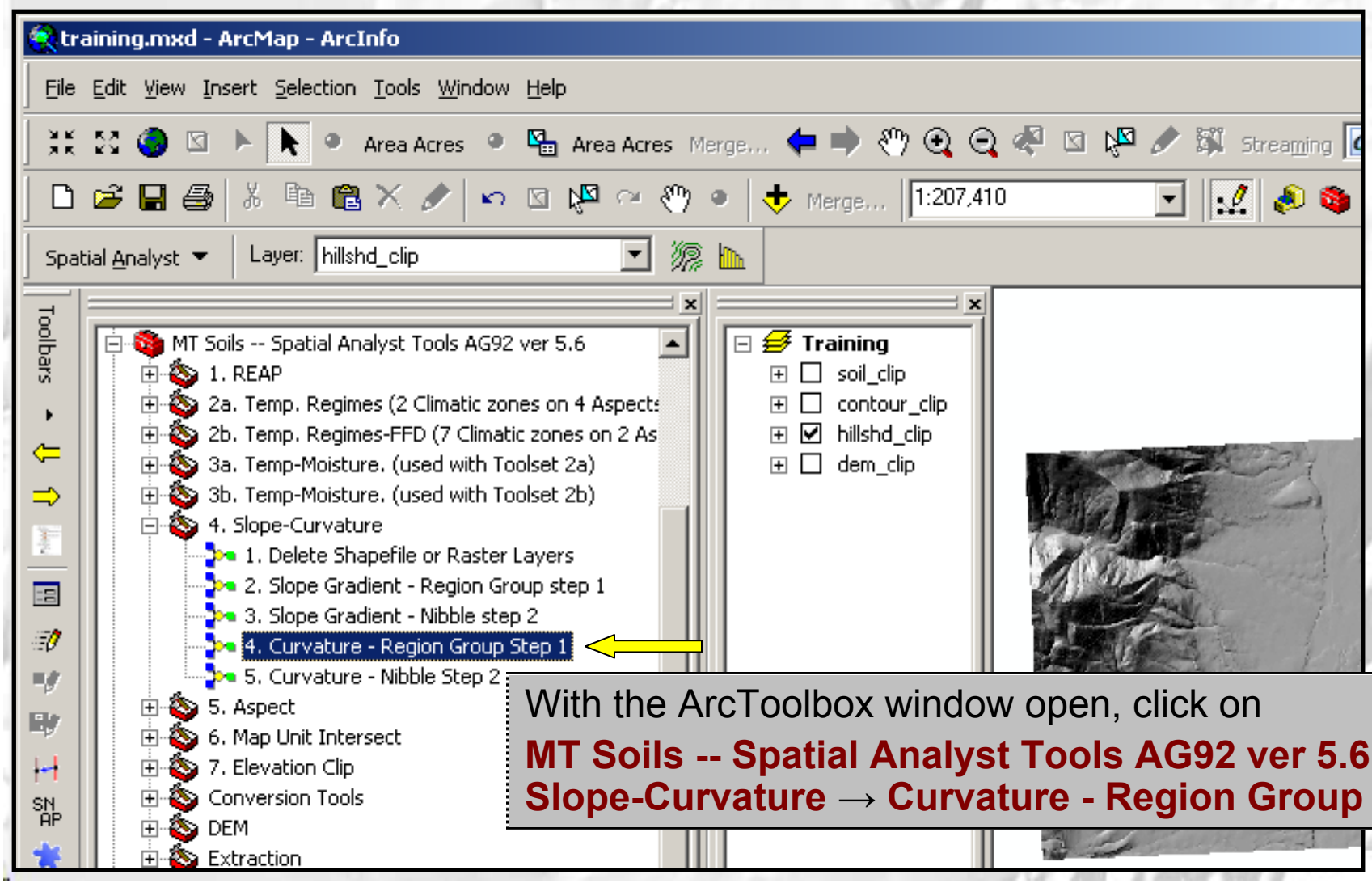
A magnification of a hillshade with contour lines reveals the complexity of the slope shapes.

The curvature model can provide acres and % composition of the different slope shapes.

For example, if “Alpha” soil occurs on convex-convex positions in this area, the curvature model can calculate the % composition of that slope shape.

Curvature - Region Group Step 1

In this exercise, an elevation raster ("***dem_clip***") is used to produce a curvature (slope shape) raster.



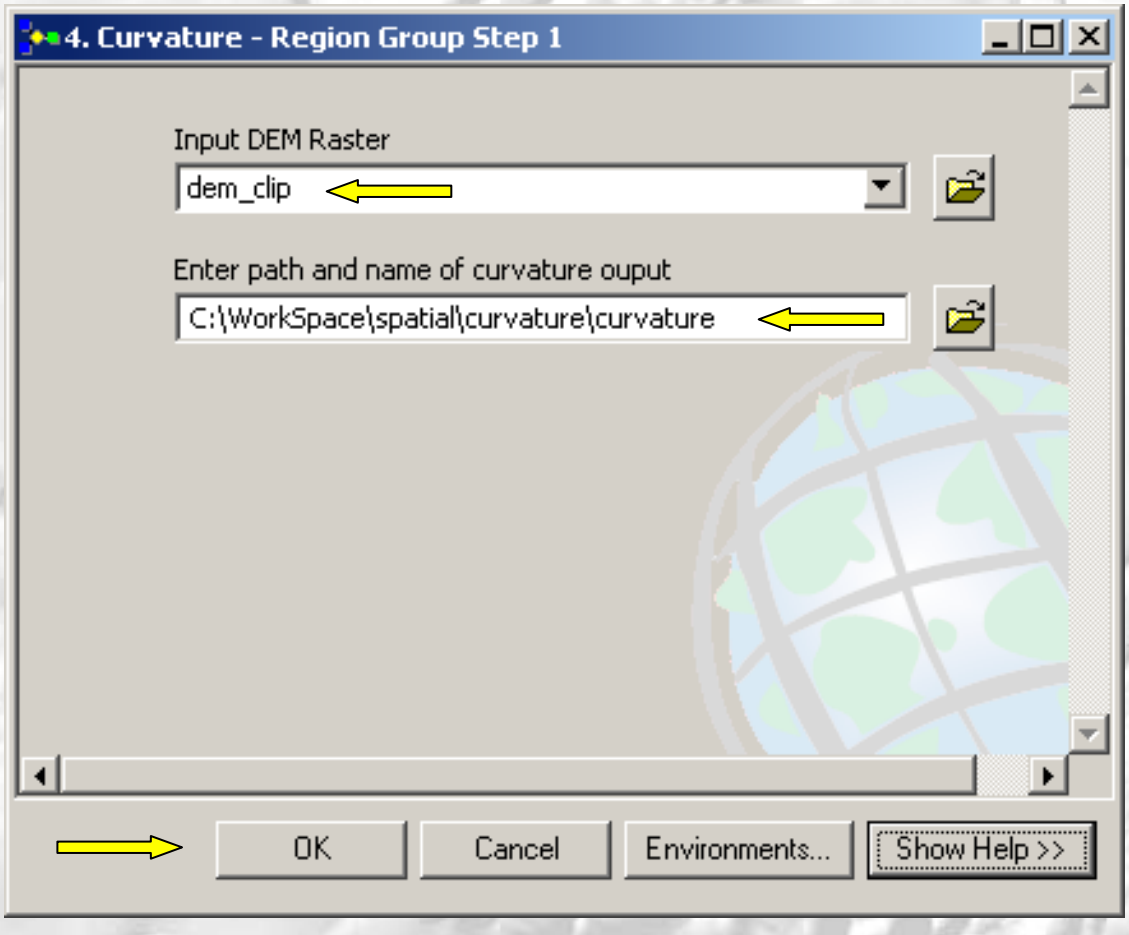
With the ArcToolbox window open, click on

MT Soils -- Spatial Analyst Tools AG92 ver 5.6 → Slope-Curvature → Curvature - Region Group Step 1

Curvature - Region Group Step 1, cont.

In the **Curvature - Region Group Step 1** dialog box:

- Select a DEM for the **Input DEM Raster** field.
- Under the **Enter path and name of curvature output** field, the user can choose their own file name and location or accept the default value.
- Click "**OK**" to run the model.

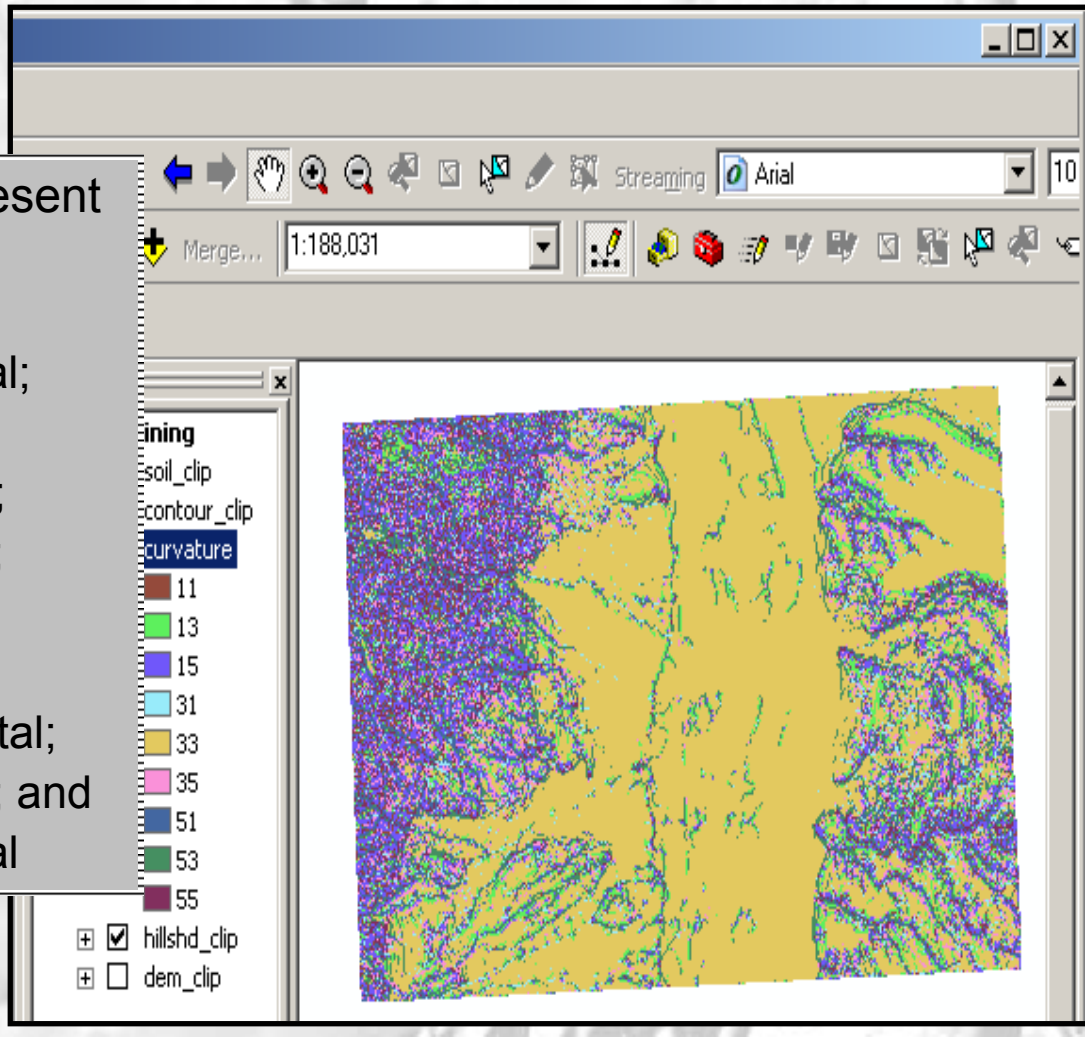


Curvature - Region Group Step 1, cont.

After running the “Curvature - Region Group Step 1” model, a curvature raster is automatically added to the project. This raster will include many small curvature delineations.

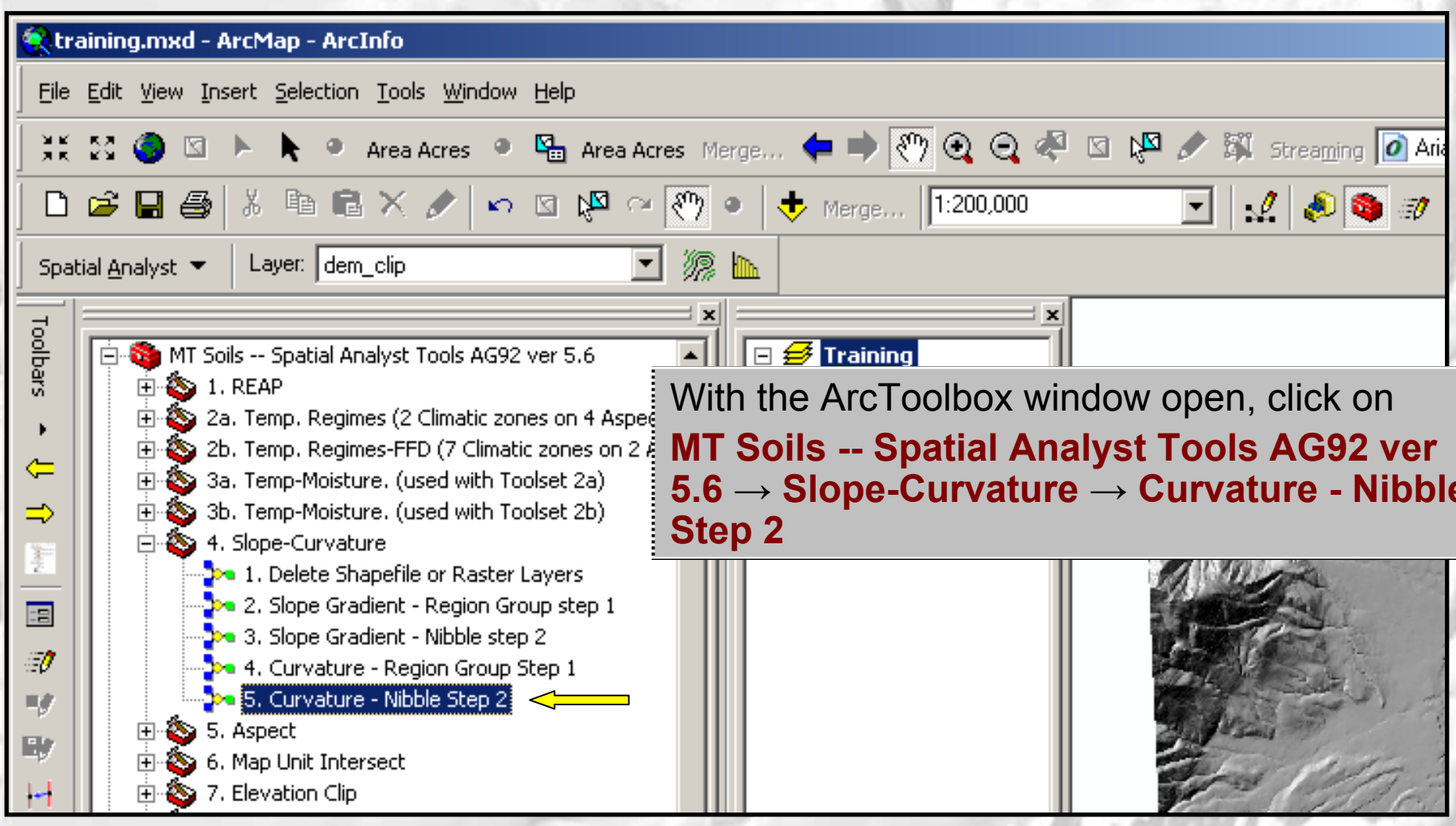
The values from curvature raster represent the following slope shapes:

11 = Convex vertical, Concave horizontal;
13 = Convex vertical, Linear horizontal;
15 = Convex vertical, Convex horizontal;
31 = Linear vertical, Concave horizontal;
33 = Linear vertical, Linear horizontal;
35 = Linear vertical, Convex horizontal;
51 = Concave vertical, Concave horizontal;
53 = Concave vertical, Linear horizontal; and
55 = Concave vertical, Convex horizontal



Curvature - Nibble Step 2

The “Curvature – Nibble Step 2” model creates a curvature raster and shapefile. The nibble function reduces the number of very small slope delineations. This process will allow for faster processing times when intersecting these outputs with a soil layer.



With the ArcToolbox window open, click on **MT Soils -- Spatial Analyst Tools AG92 ver 5.6 → Slope-Curvature → Curvature - Nibble Step 2**

Curvature - Nibble Step 2, cont.

All data entries for this model have been pre-populated with default values. Click **OK** if changes are not required.

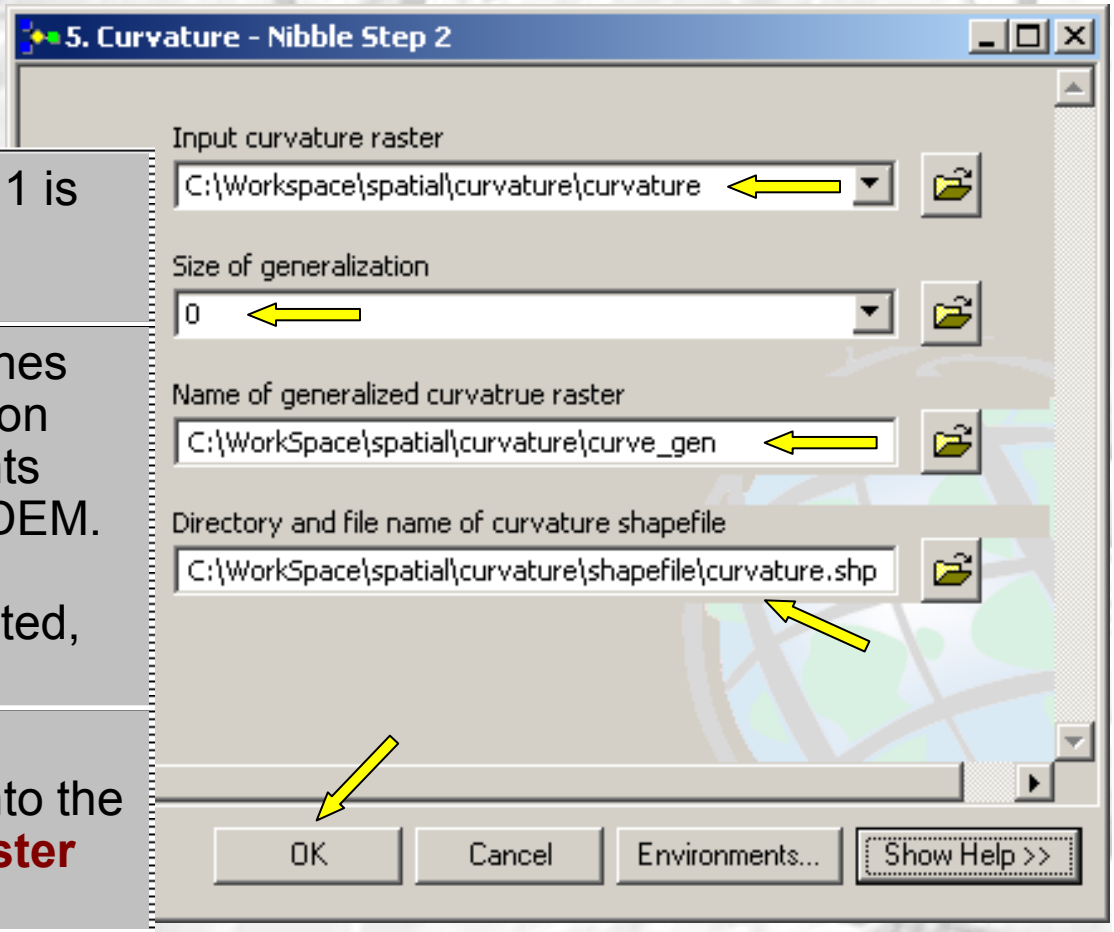
In the **Curvature - Nibble Step 2** dialog box:

The curvature raster created in step 1 is automatically loaded into the **Input curvature raster** field.

The **Size of generalization** determines the degree of filtering or generalization that will occur. A value of 5 represents about 1/8 of an acre for a 10 meter DEM. Values greater than 5 are not recommended. If filtering is not wanted, accept the default value of 0.

A default value for the generalized curvature raster has been entered into the **Name of generalized curvature raster** field.

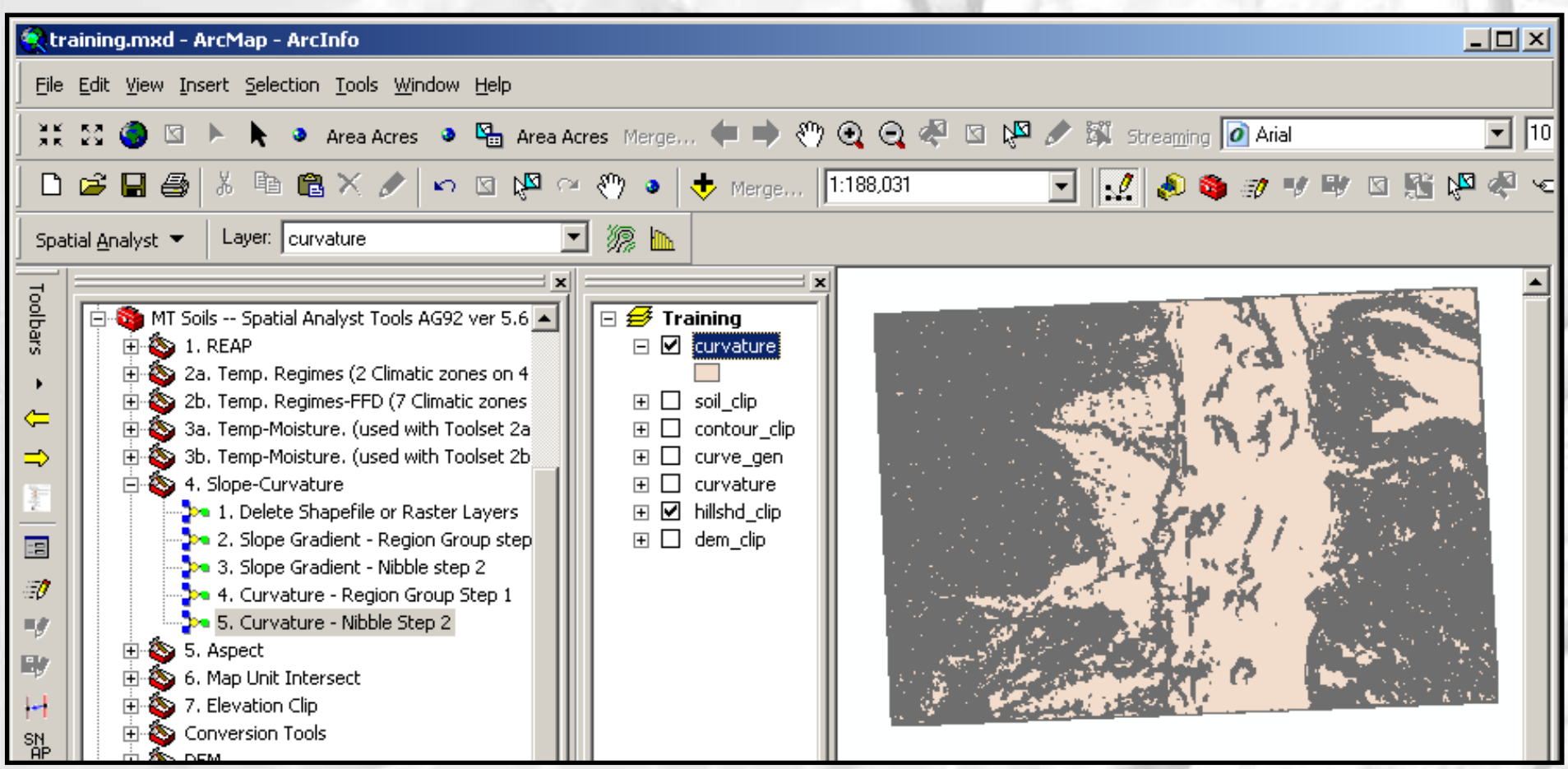
A default value for the curvature shapefile has been entered into the **Directory and name of curvature shapefile** field.



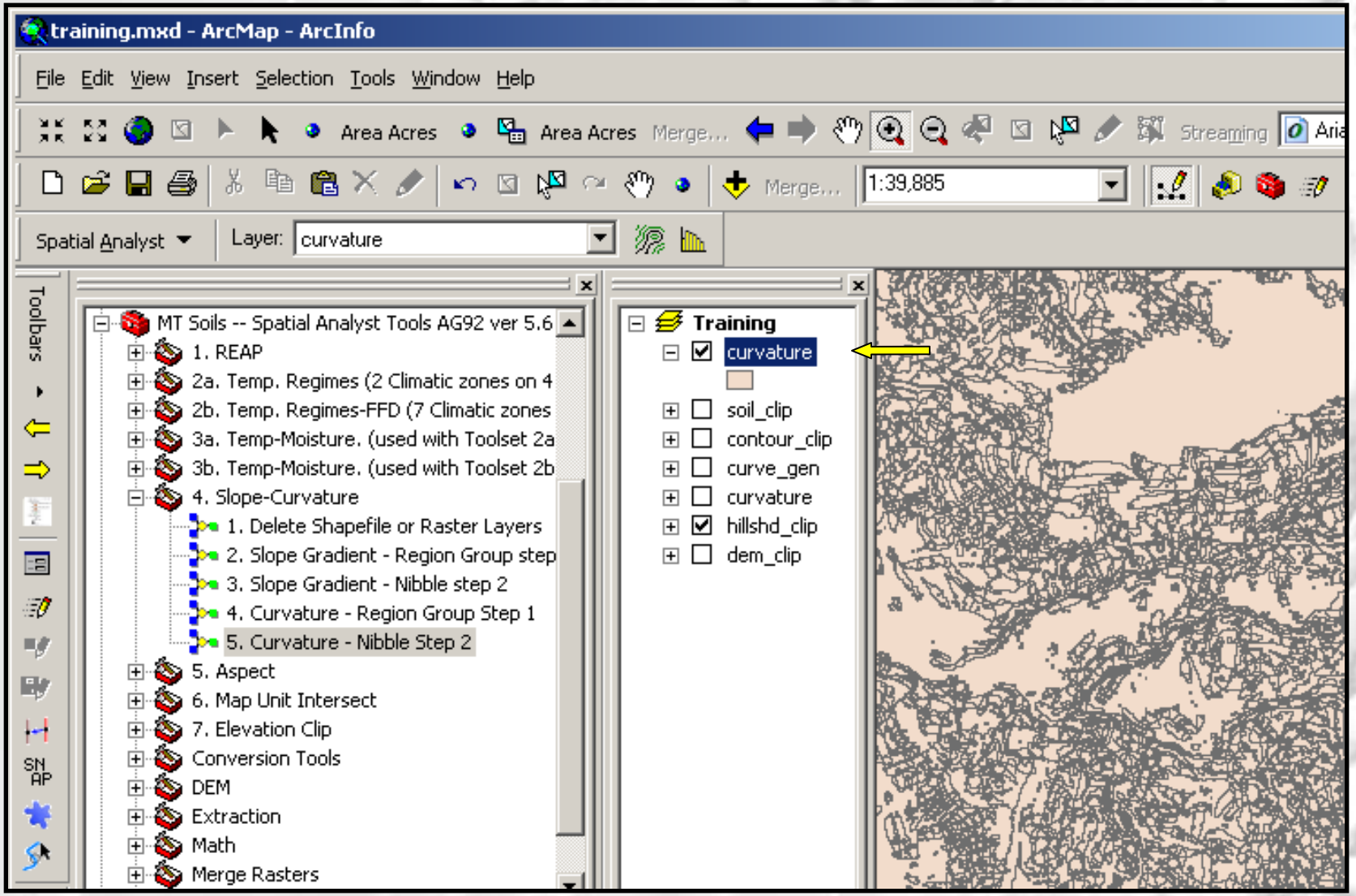
Click "**OK**" to run the model

Curvature - Nibble Step 2, cont.

After running the “Curvature - Nibble Step 2” model, a curvature raster (curve_gen) and a shapefile (curvature) are automatically added to the project.



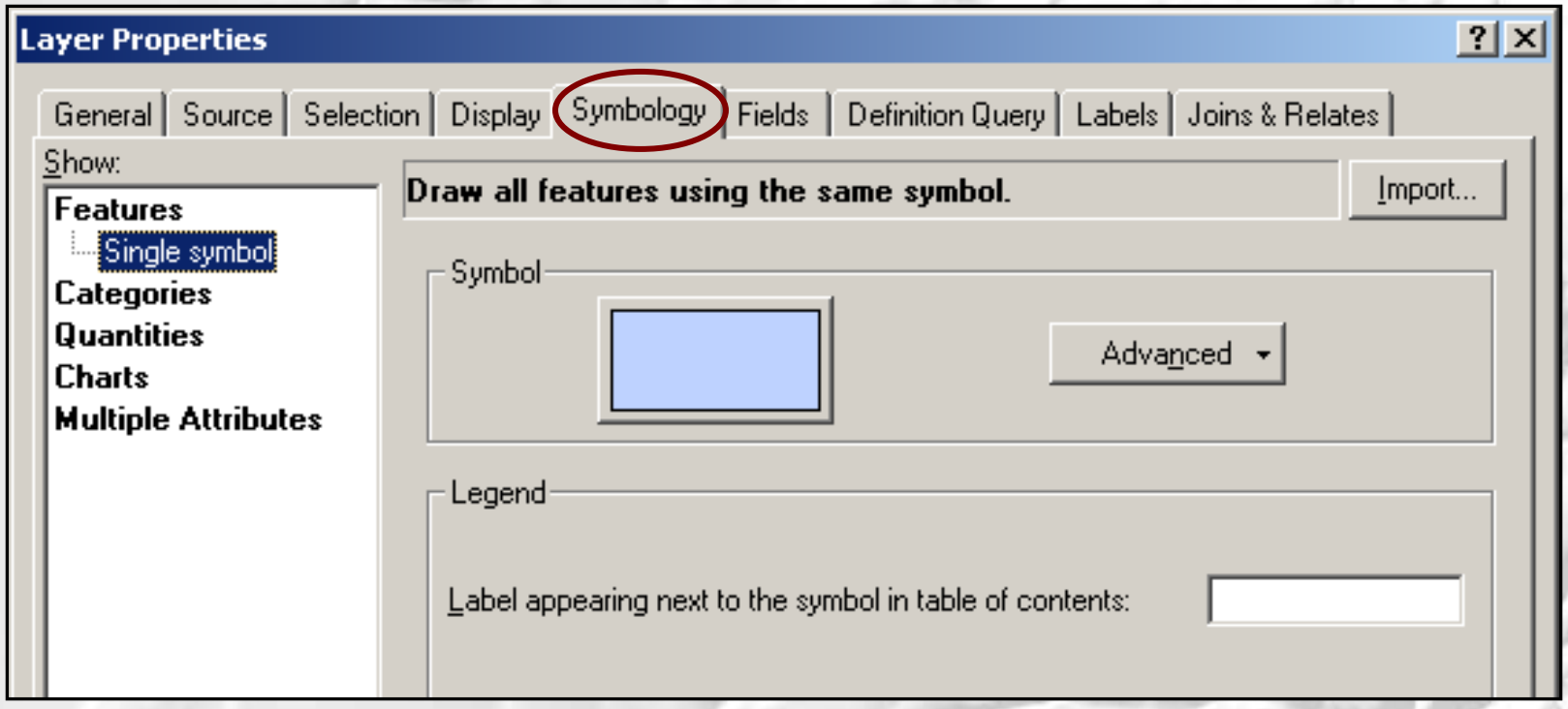
Symbolize & Evaluate Curvature Layer



In the **Data Frame** window, double-click on the curvature shapefile that was created by the "**Curvature - Nibble Step 2**" model. This will open the properties window.

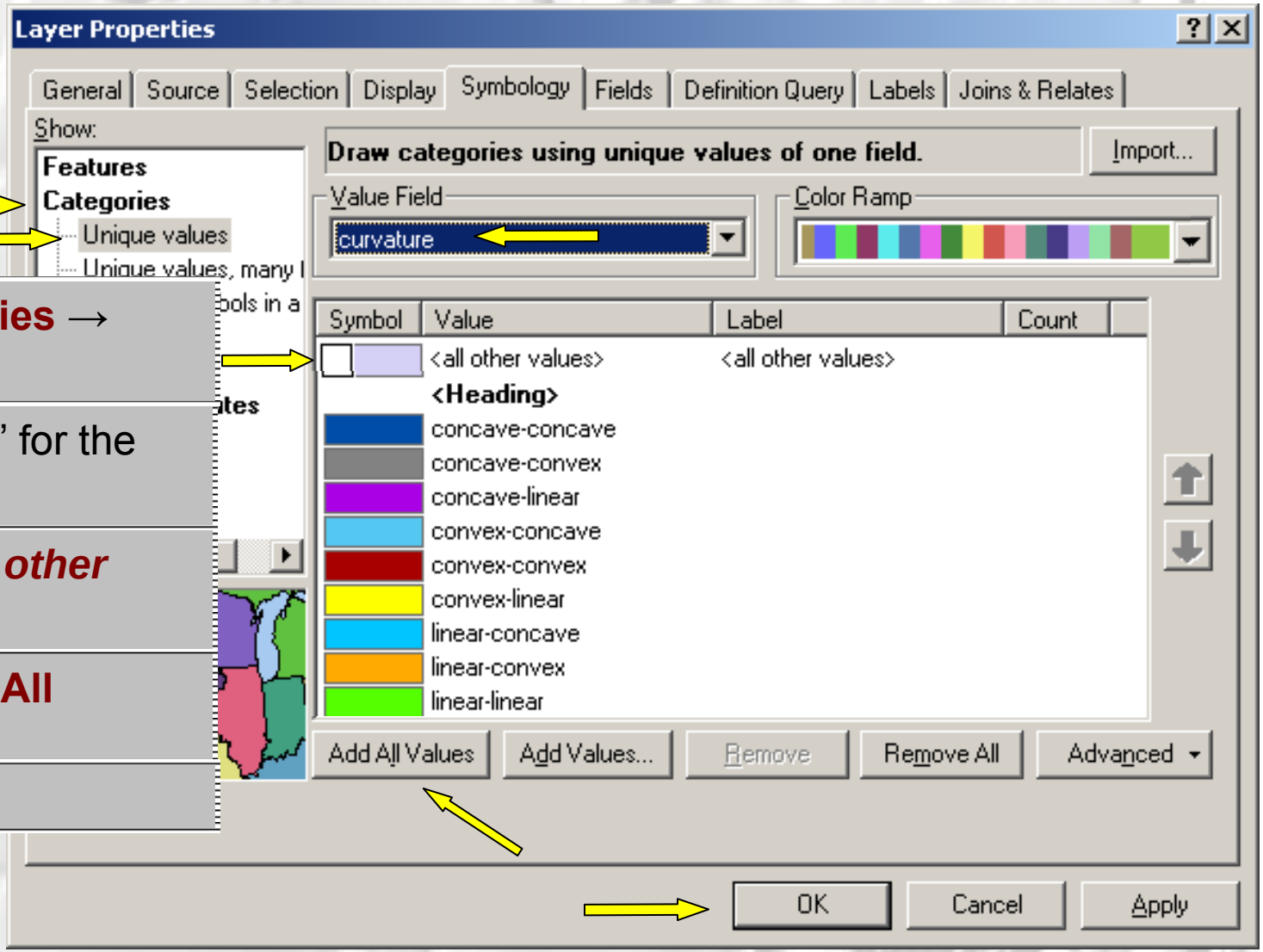
Symbolize & Evaluate Curvature Layer, Cont.

Click on the "Symbology" tab in the **Layers Properties** window



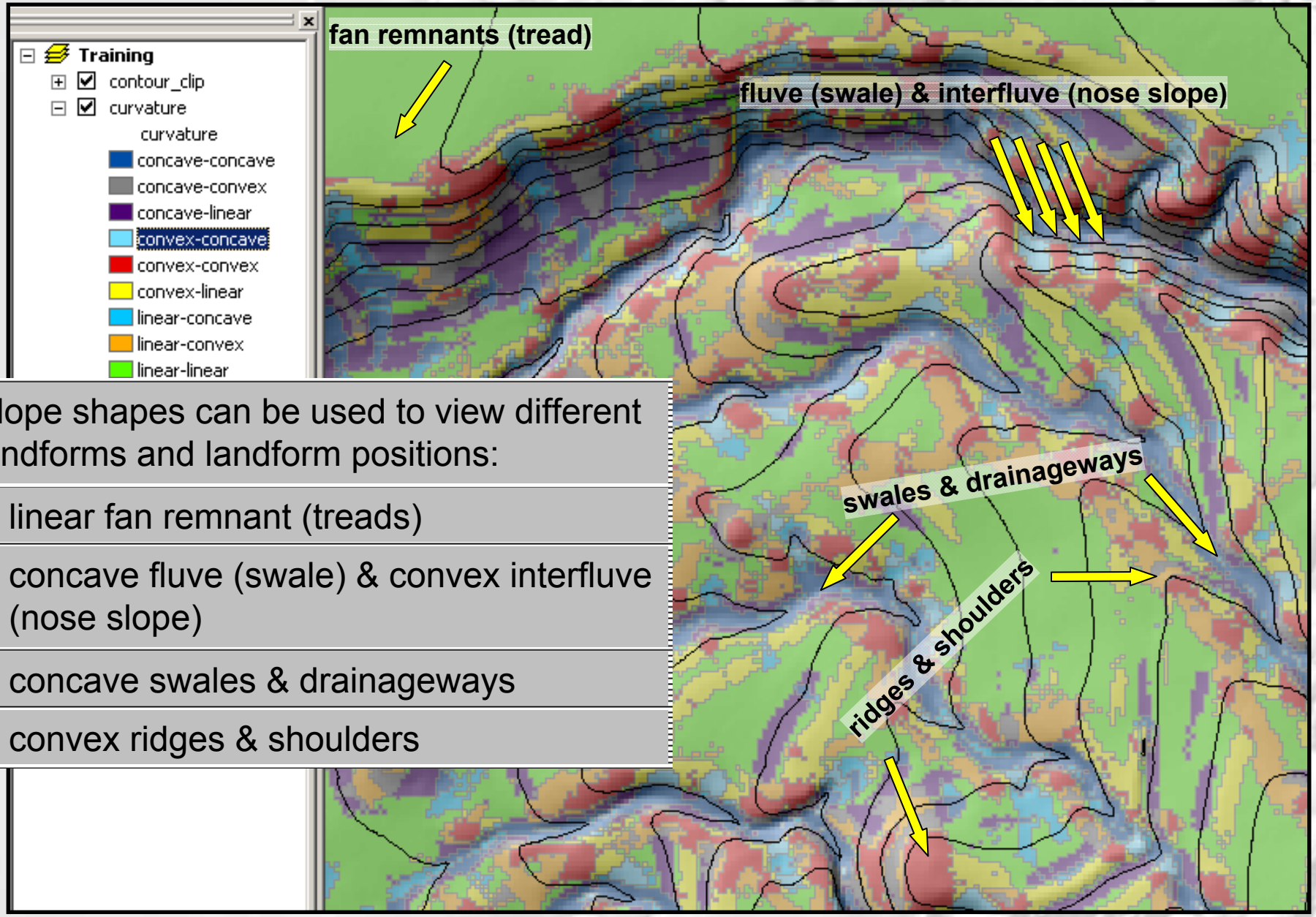
Symbolize & Evaluate Curvature Layer, Cont.

In the Layers Properties window under the **Symbology** tab:



- Click on **Catagories** → **Unique values**.
- Select "*curvature*" for the **Value Field**.
- Uncheck the ***<all other values>*** box.
- Click on the **Add All Values** button.
- Click "**OK**".

Symbolize & Evaluate Curvature Layer, Cont.



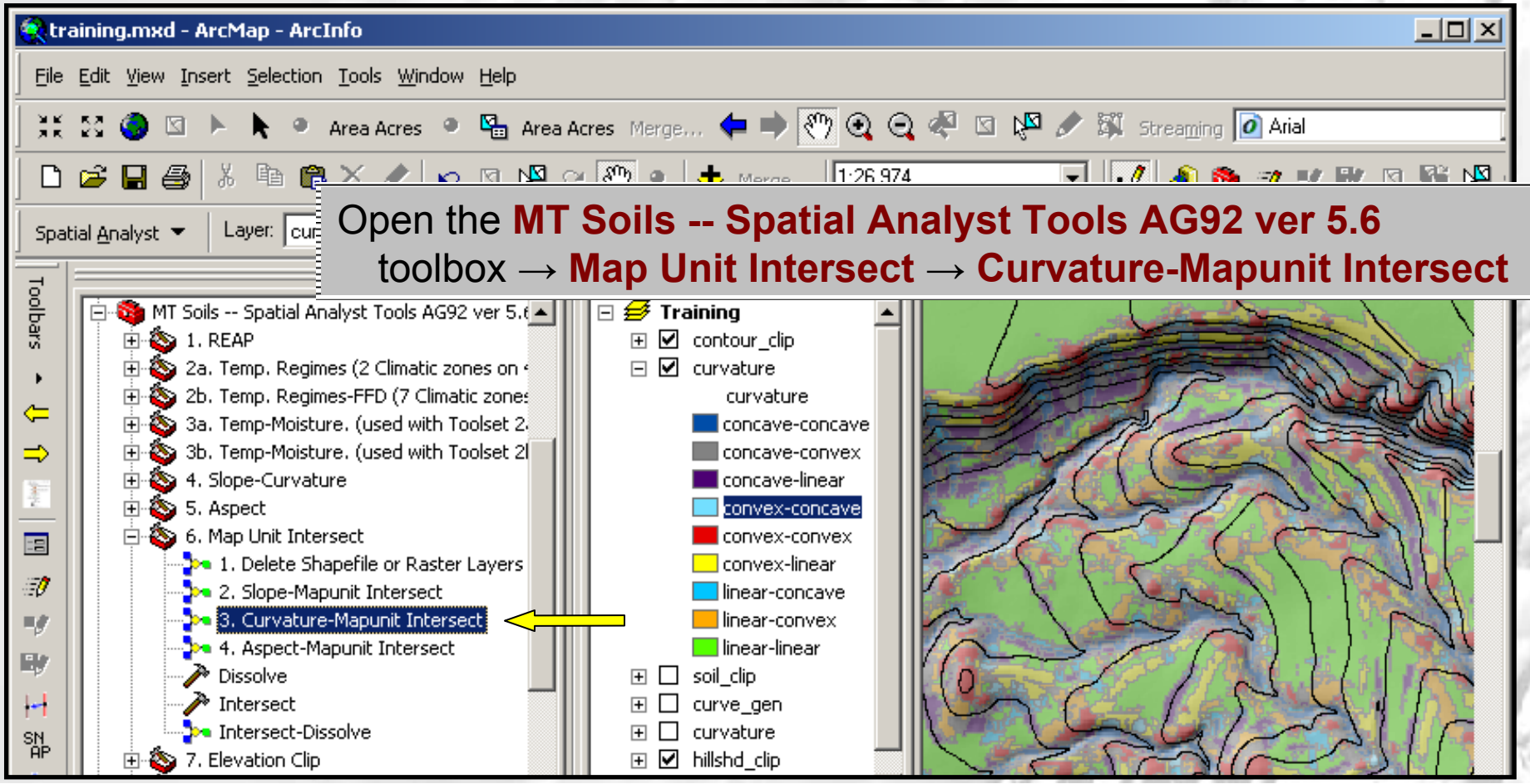
Slope shapes can be used to view different landforms and landform positions:

- linear fan remnant (treads)
- concave fluve (swale) & convex interfluve (nose slope)
- concave swales & drainageways
- convex ridges & shoulders

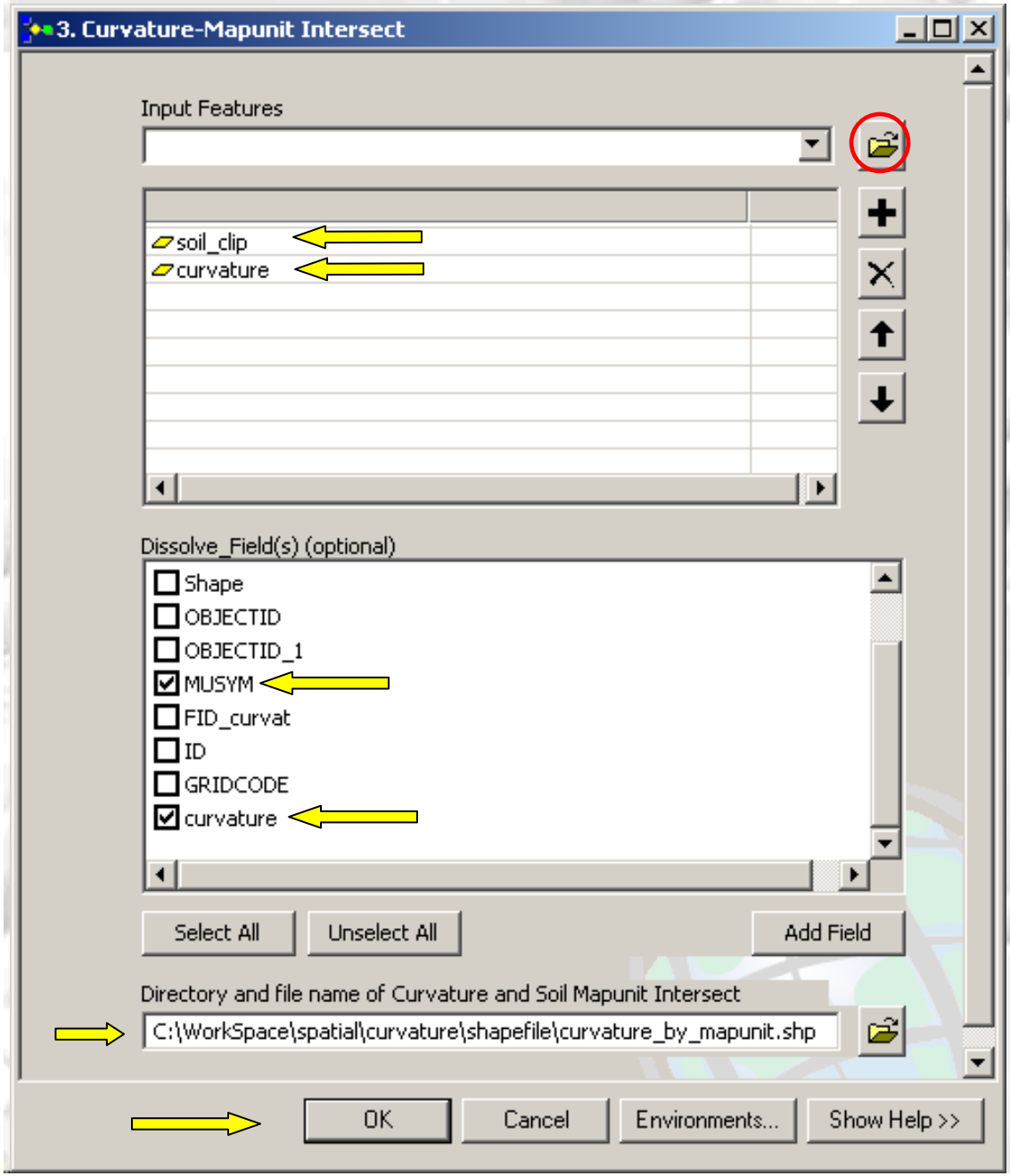
Intersect Curvature Shapefile and Soil Layer

The **Curvature-Mapunit Intersect** model is used to intersect a curvature shapefile with a soil layer. The model also dissolves polygons based on inputs ("MUSYM" and "Curvature").

Note: If the output from this model is used in an Excel worksheet, the dissolve process is needed to reduce the number of records (Excel can only have up to 65,536 rows).



Intersect Curvature Shapefile and Soil Layer, cont.

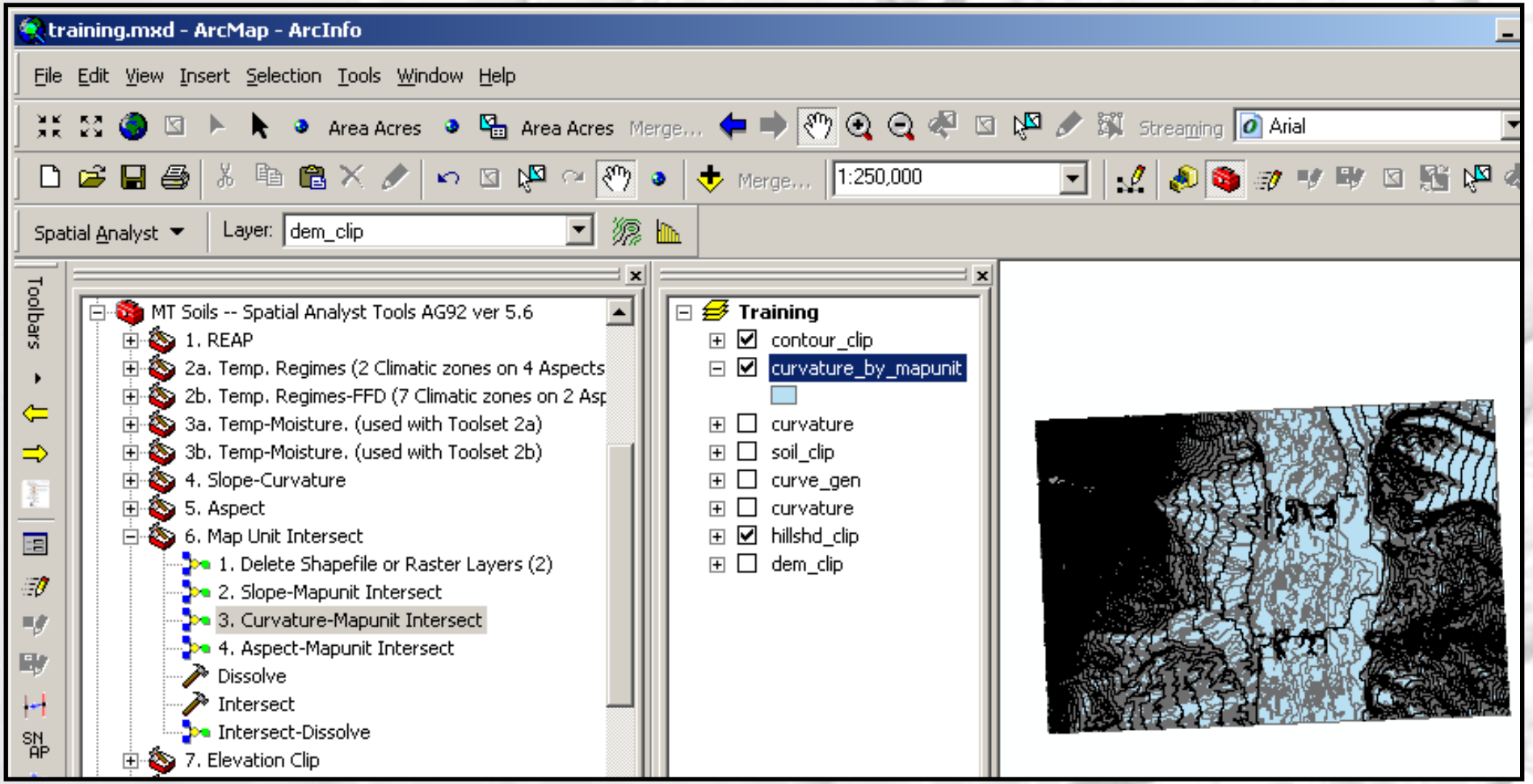


In the **Curvature-Mapunit Intersect** dialog box.

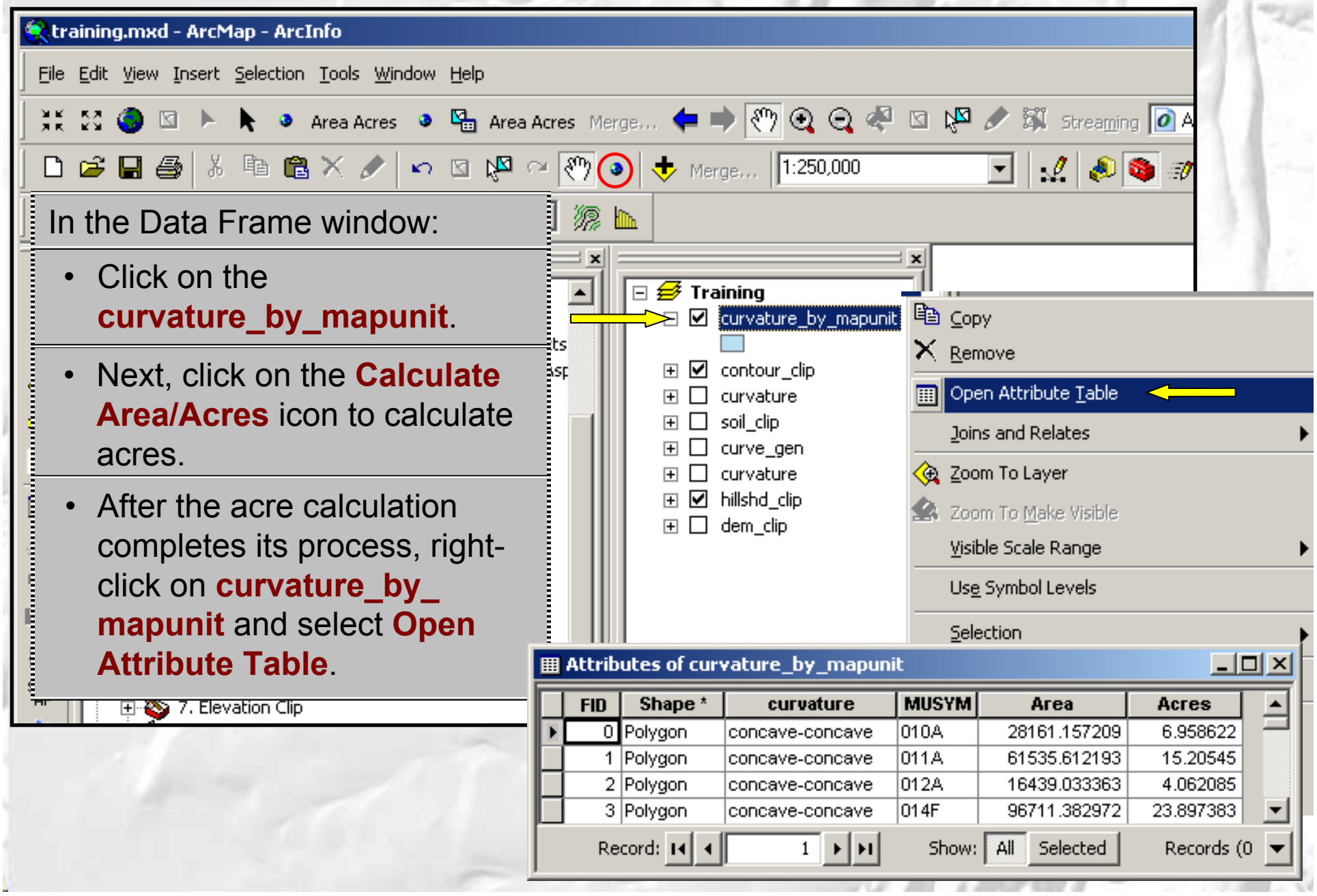
- Under **Input Features**, add a soil layer and a curvature shapefile.
- In the **Dissolve Field** window, check **MUSYM** and **curvature**. This will aggregate data based on map symbol and curvature.
- Click **OK** to begin process.
- The model will create a shapefile named **curvature_by_mapunit.shp**.

Intersect Curvature Shapefile and Soil Layer, cont.

The **curvature_by_mapunit.shp** layer is automatically loaded into the project.



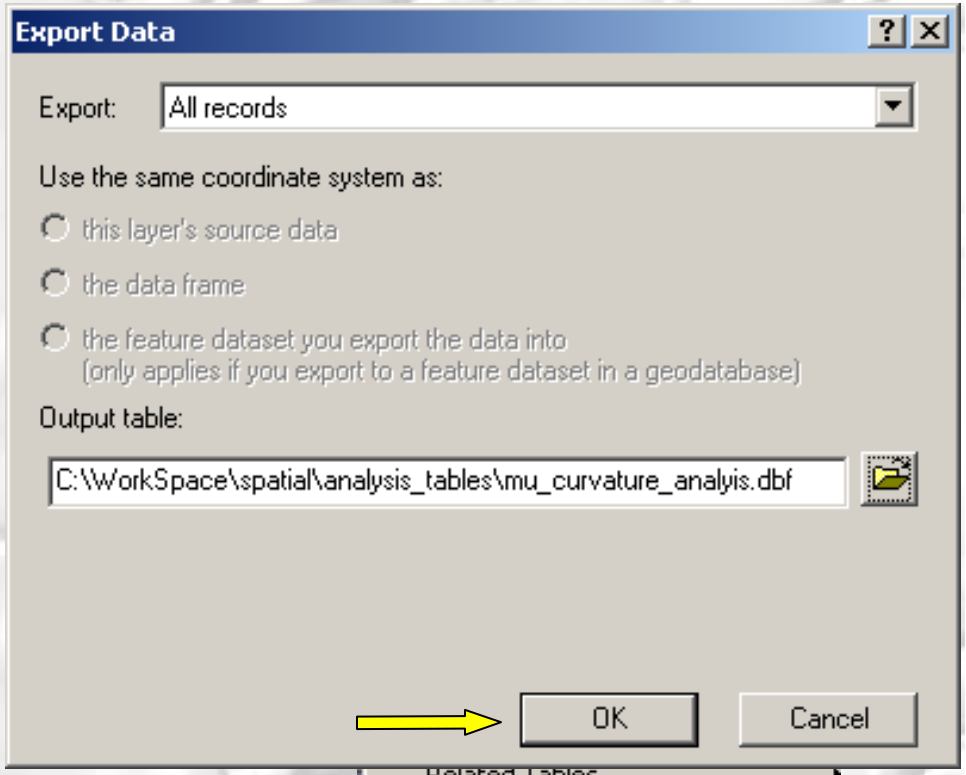
Export Soil\Curvature Intersect Data Table

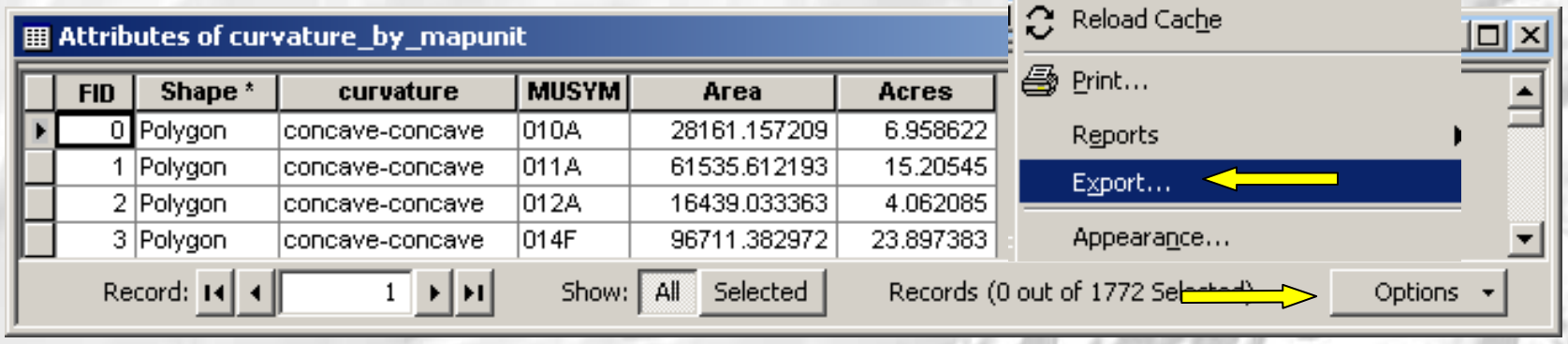


Export Soil\Curvature Intersect Data Table, cont.

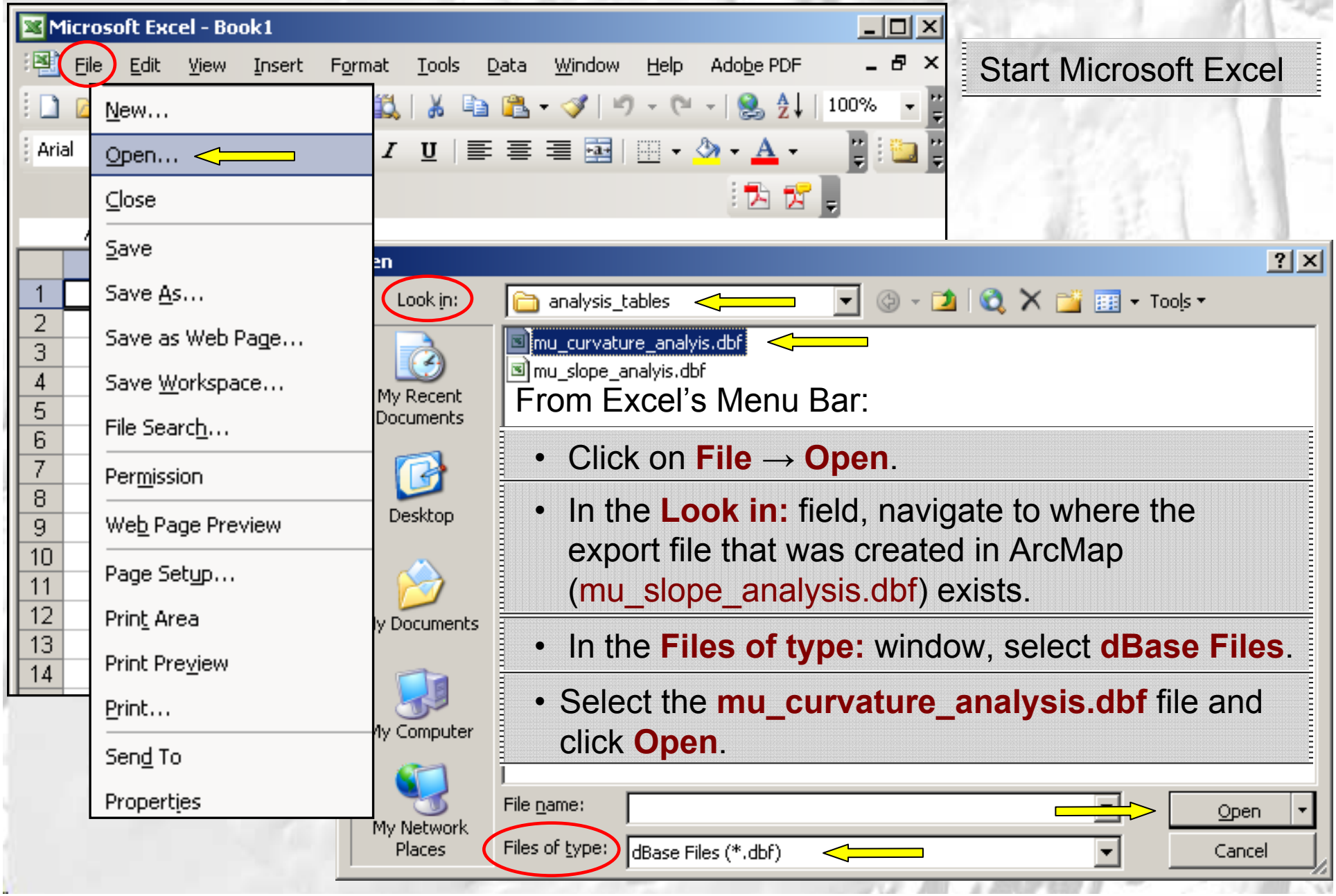
Follow the steps outlined below to analyze data from this table in an Excel Pivot Table.

- To export your table, click on the **Options** button and select **Export**.
- Under **Output table**, the file can be placed in any folder and should be saved to a **dBase Table** file format.
- Click "**OK**".
- In the menu that follows, select "**No**" to add the table to ArcMap.





Summarize Curvature by Map Units

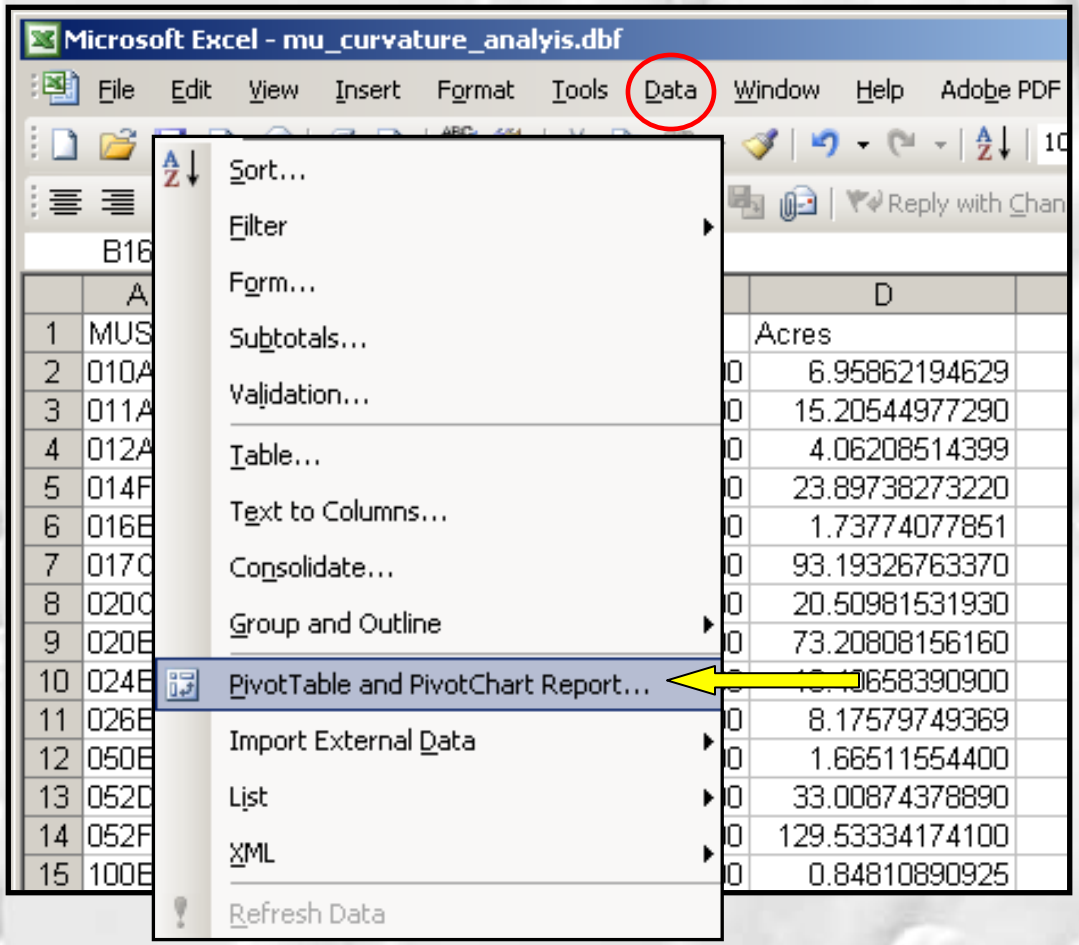


Start Microsoft Excel

From Excel's Menu Bar:

- Click on **File** → **Open**.
- In the **Look in:** field, navigate to where the export file that was created in ArcMap (mu_slope_analysis.dbf) exists.
- In the **Files of type:** window, select **dBase Files**.
- Select the **mu_curvature_analysis.dbf** file and click **Open**.

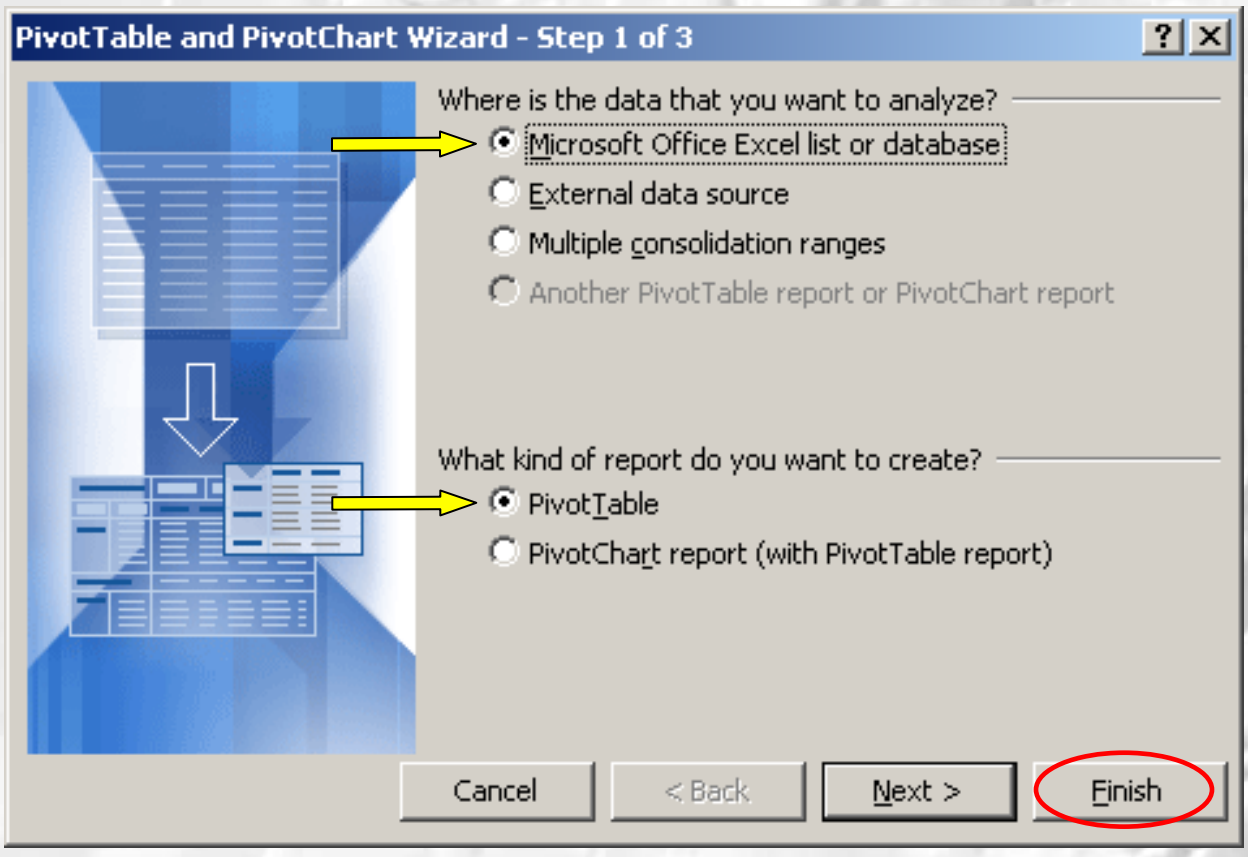
Summarize Curvature by Map Units, cont.



To create a Pivot Table:

- Click on **Data**.
- In the drop down menu, select **Pivot Table and PivotChart Report…**

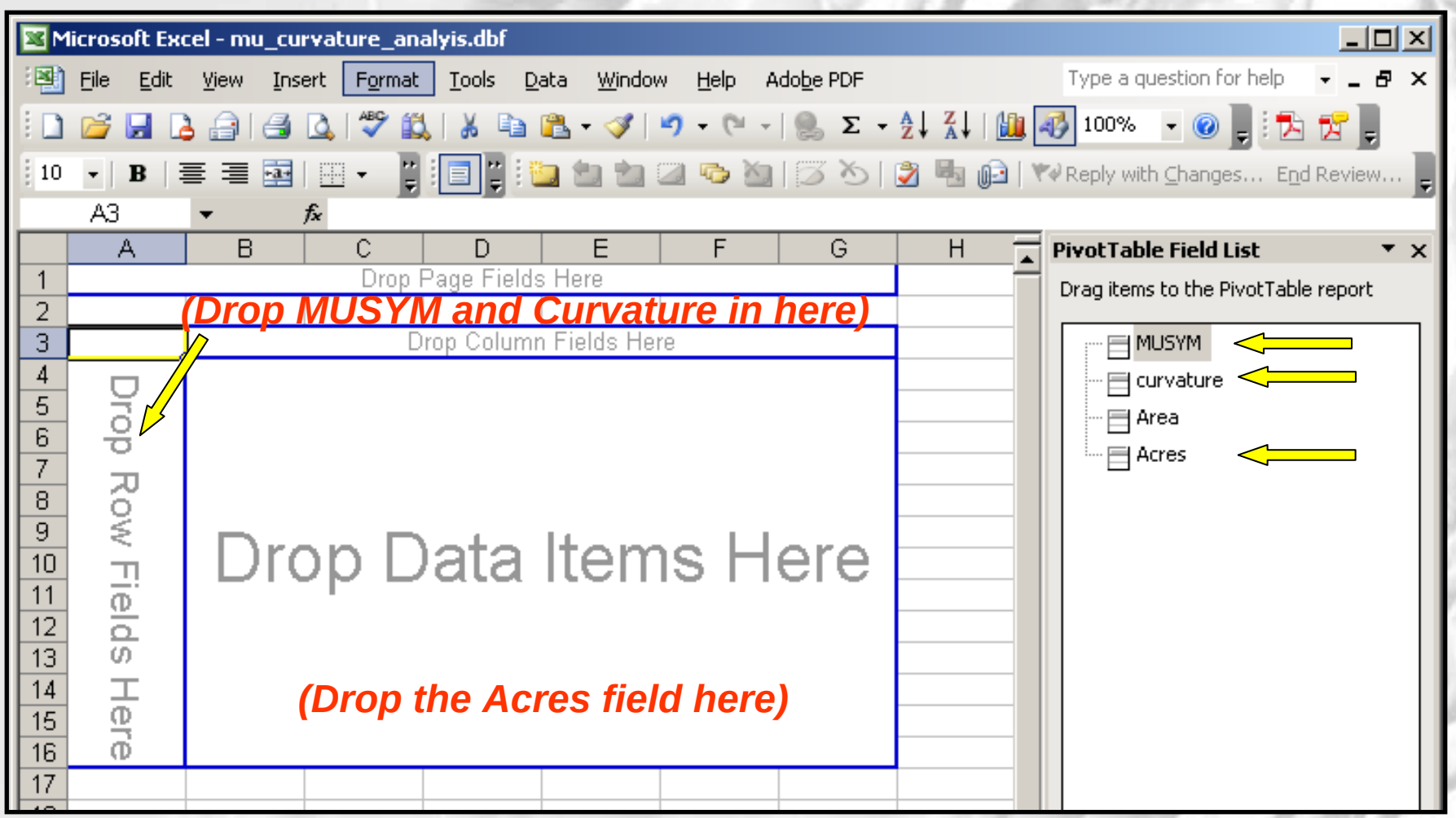
Summarize Curvature by Map Units, cont.



In the **Pivot Table Wizard**:

- Check the radio button for **Microsoft Office Excel list or database**.
- Check the radio button for **Pivot Table**.
- Click "**Finish**".

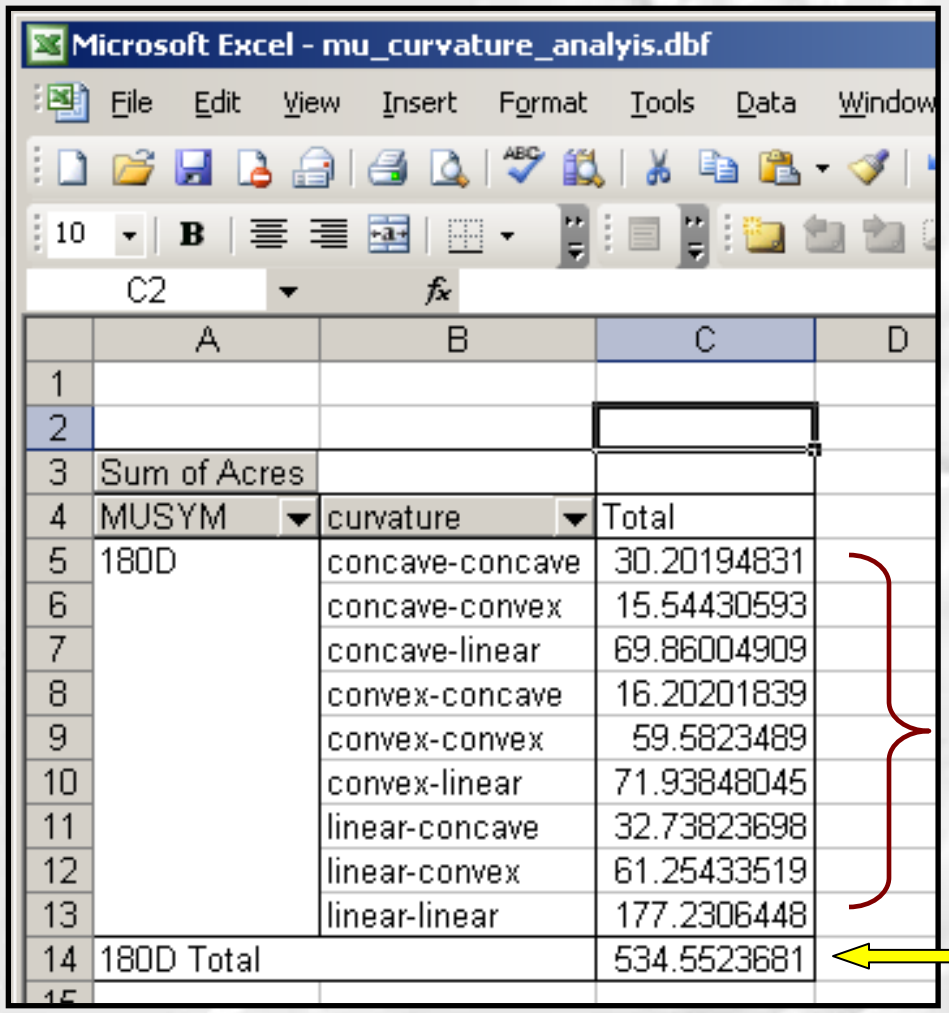
Summarize Curvature by Map Units, cont.



From the PivotTable Field List:

- Drag and drop the "***MUSYM***" and "***Curvature***" fields into the **Drop Row Fields Here** box (make sure the MUSYM field is left of the Curvature field).
- Drag and drop the "***Acres***" field to the **Drop Data Items Here** box.

Summarize Curvature by Map Units, cont.

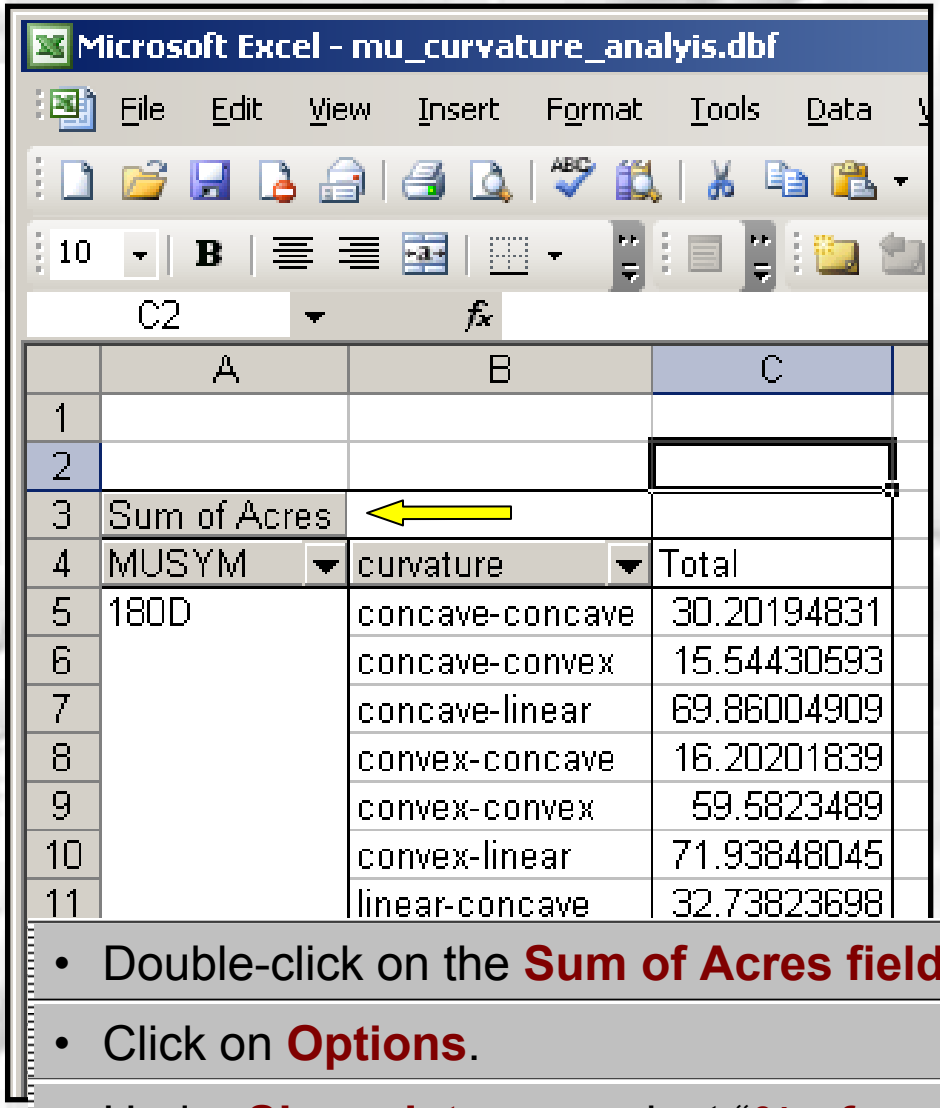


	A	B	C	D
1				
2				
3	Sum of Acres			
4	MUSYM	curvature	Total	
5	180D	concave-concave	30.20194831	
6		concave-convex	15.54430593	
7		concave-linear	69.86004909	
8		convex-concave	16.20201839	
9		convex-convex	59.5823489	
10		convex-linear	71.93848045	
11		linear-concave	32.73823698	
12		linear-convex	61.25433519	
13		linear-linear	177.2306448	
14	180D Total		534.5523681	

The resulting table displays the number of acres by curvature for each map unit.

The table also lists the total acres by map unit.

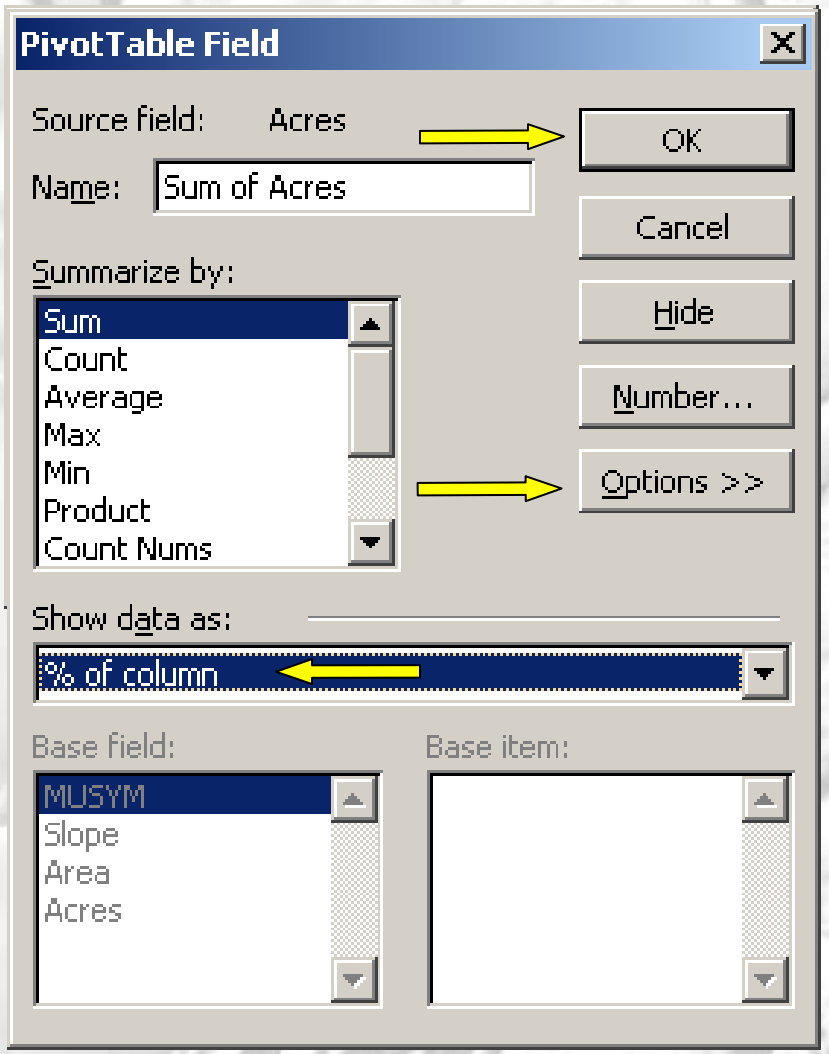
Summarize Curvature by Map Units, cont.



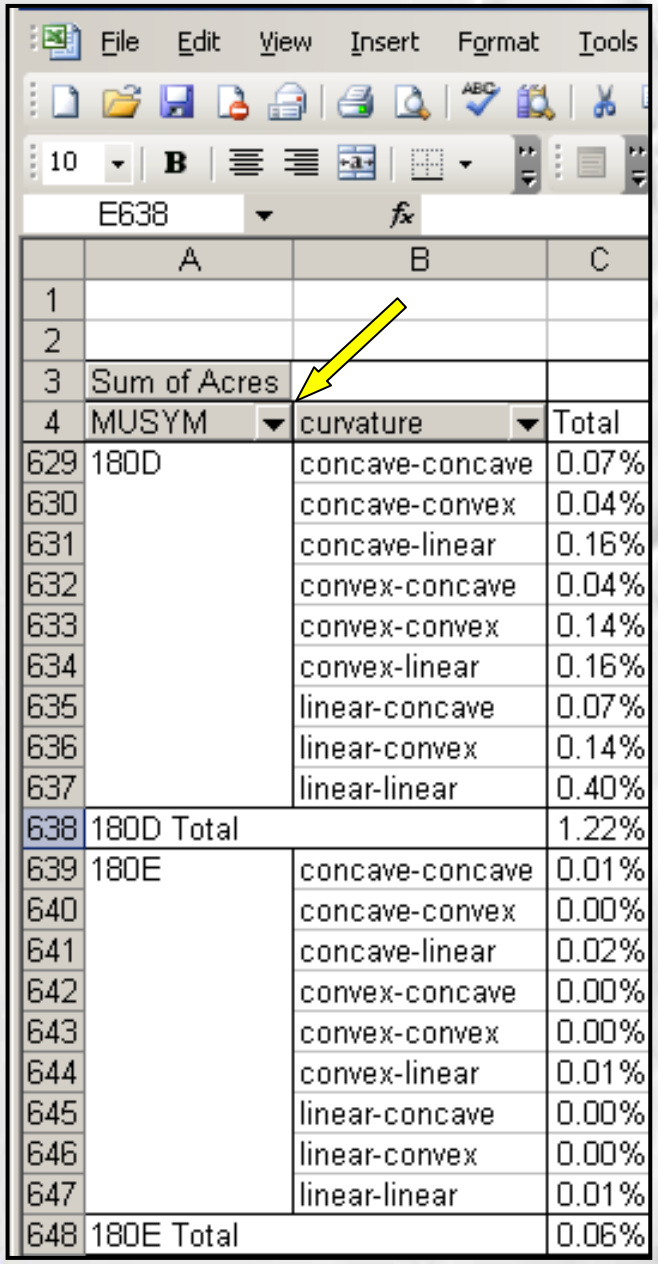
	A	B	C
1			
2			
3	Sum of Acres		
4	MUSYM	curvature	Total
5	180D	concave-concave	30.20194831
6		concave-convex	15.54430593
7		concave-linear	69.86004909
8		convex-concave	16.20201839
9		convex-convex	59.5823489
10		convex-linear	71.93848045
11		linear-concave	32.73823698

- Double-click on the **Sum of Acres field**.
- Click on **Options**.
- Under **Show data as:**, select "***% of column***".
- Click "**OK**" to finish.

To calculate the percent composition for each curvature class by map unit:



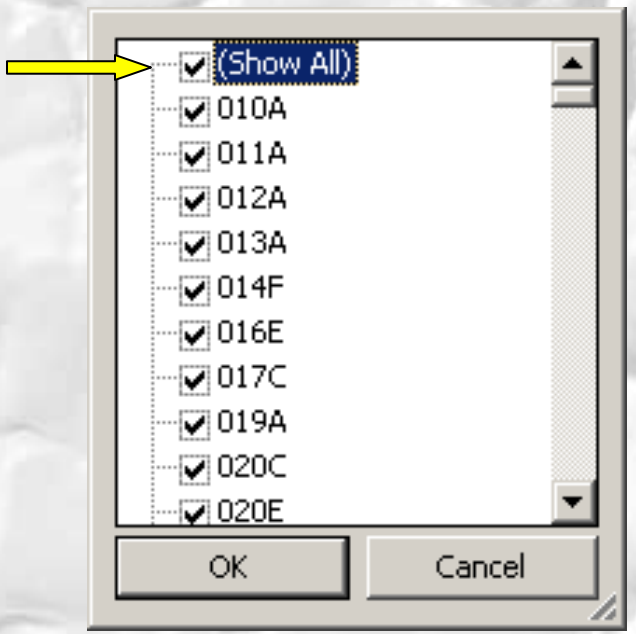
Summarize Curvature by Map Units, cont.

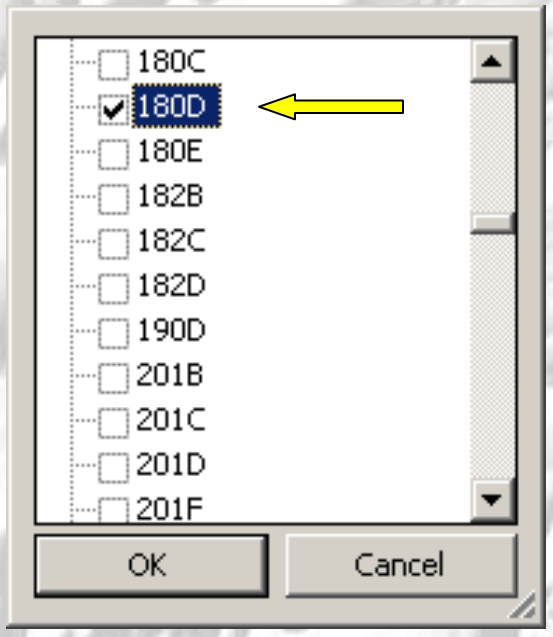


	A	B	C
1			
2			
3	Sum of Acres		
4	MUSYM	curvature	Total
629	180D	concave-concave	0.07%
630		concave-convex	0.04%
631		concave-linear	0.16%
632		convex-concave	0.04%
633		convex-convex	0.14%
634		convex-linear	0.16%
635		linear-concave	0.07%
636		linear-convex	0.14%
637		linear-linear	0.40%
638	180D Total		1.22%
639	180E	concave-concave	0.01%
640		concave-convex	0.00%
641		concave-linear	0.02%
642		convex-concave	0.00%
643		convex-convex	0.00%
644		convex-linear	0.01%
645		linear-concave	0.00%
646		linear-convex	0.00%
647		linear-linear	0.01%
648	180E Total		0.06%

To assess slope for a single map unit:

- Click on the **down arrow** next to **MUSYM**.
- Uncheck the box next to **(Show All)**.
- Next, place a check next to any single map unit and click "**OK**".

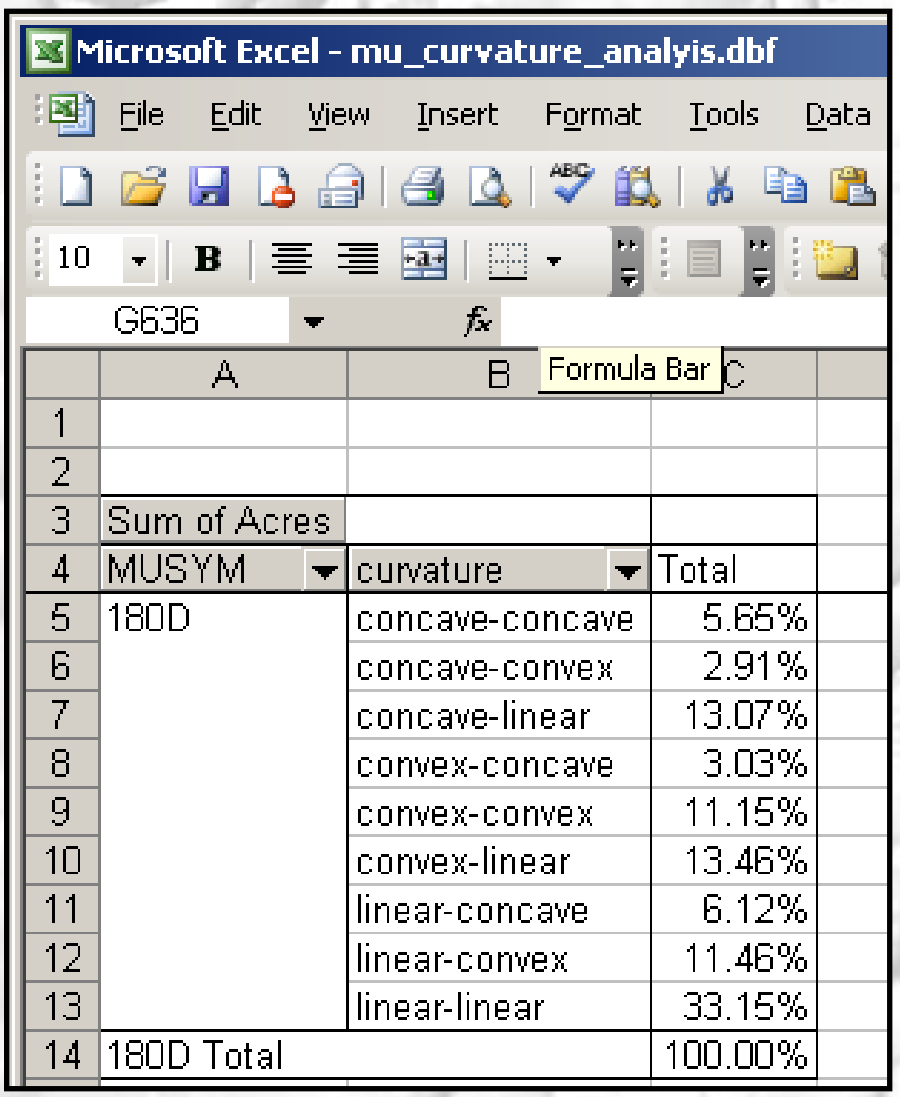




Summarize Curvature by Map Units, cont.

The results show the % composition for each curvature class in map unit 180D.

To view results for other map units, click on the down arrow, uncheck the current map unit and place a check next to a different map unit.



	A	B	C
1			
2			
3	Sum of Acres		
4	MUSYM	curvature	Total
5	180D	concave-concave	5.65%
6		concave-convex	2.91%
7		concave-linear	13.07%
8		convex-concave	3.03%
9		convex-convex	11.15%
10		convex-linear	13.46%
11		linear-concave	6.12%
12		linear-convex	11.46%
13		linear-linear	33.15%
14	180D Total		100.00%