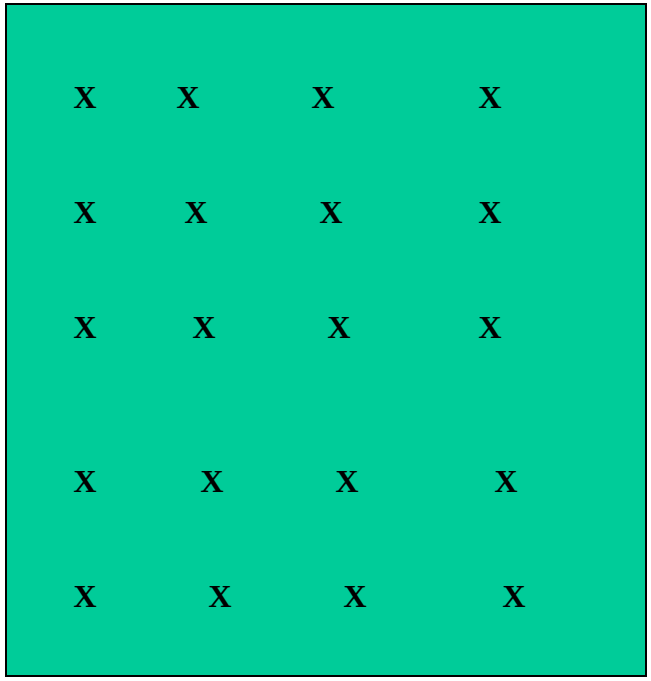
North Dakota Terrain Modeling Project

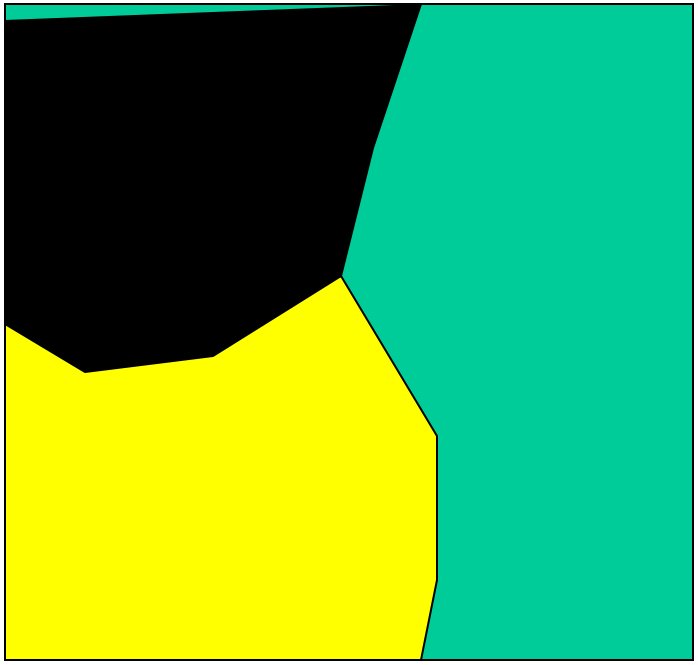
Dr. Dave Franzen

Extension Soil Specialist, NDSU,
Fargo, ND

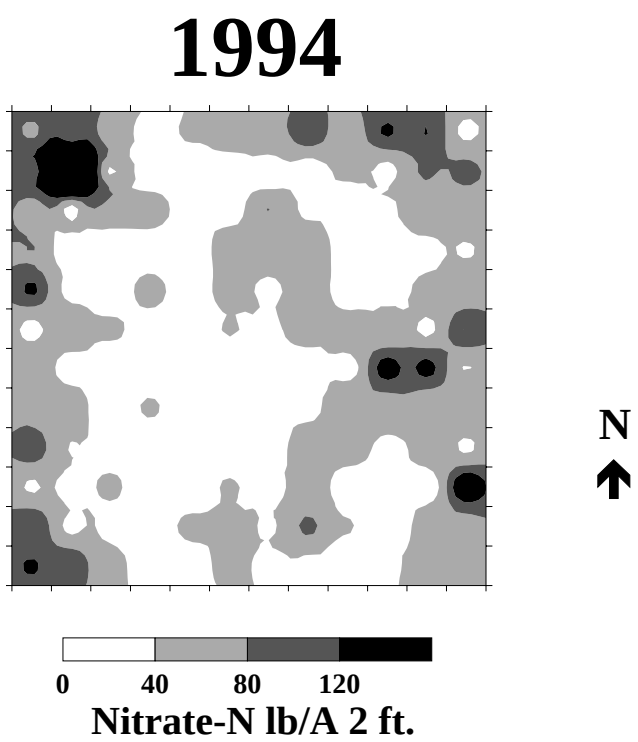
Grid sampling



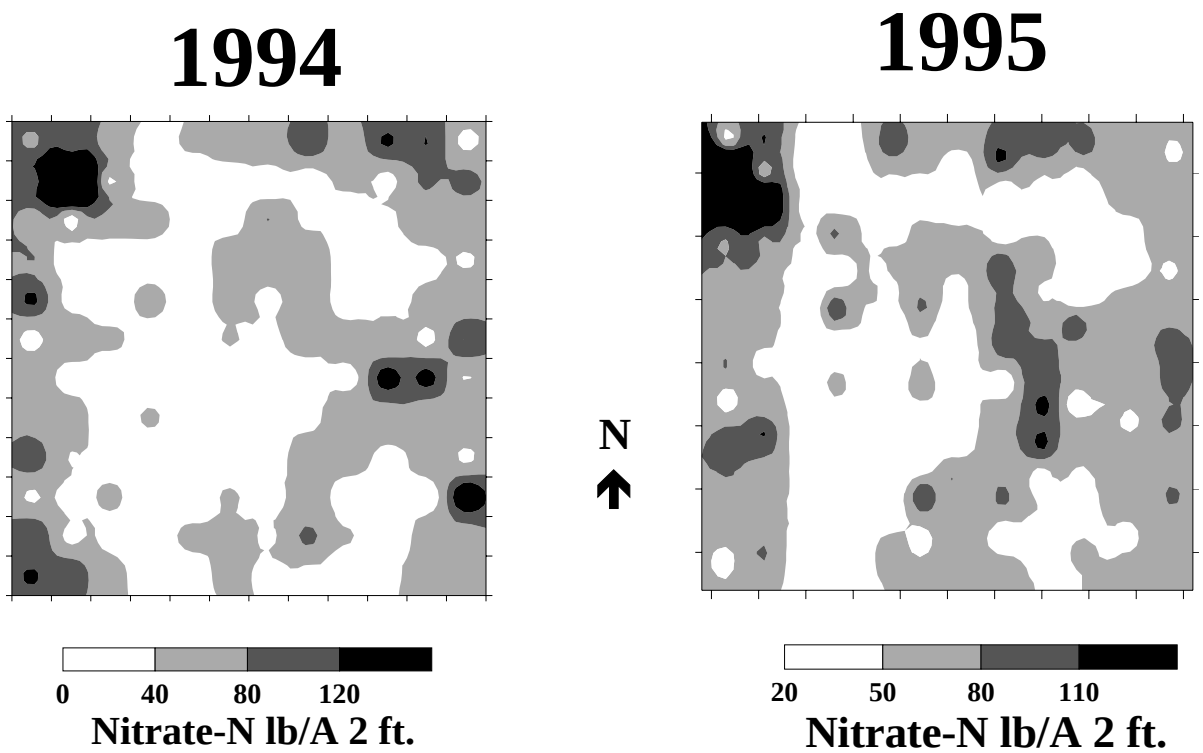
Zone sampling



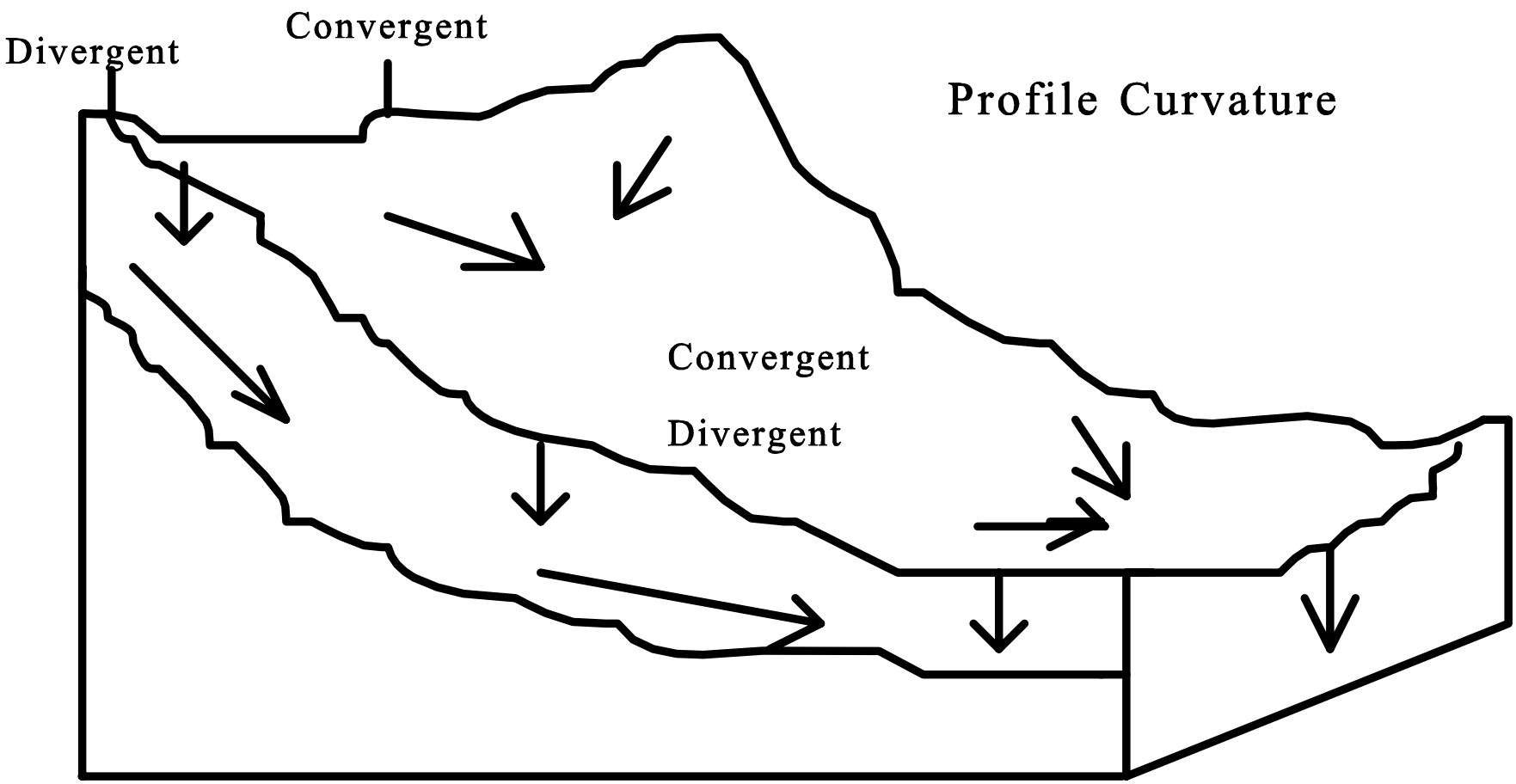
Patterns of residual nitrate tend to be stable between years due to influence of topography.



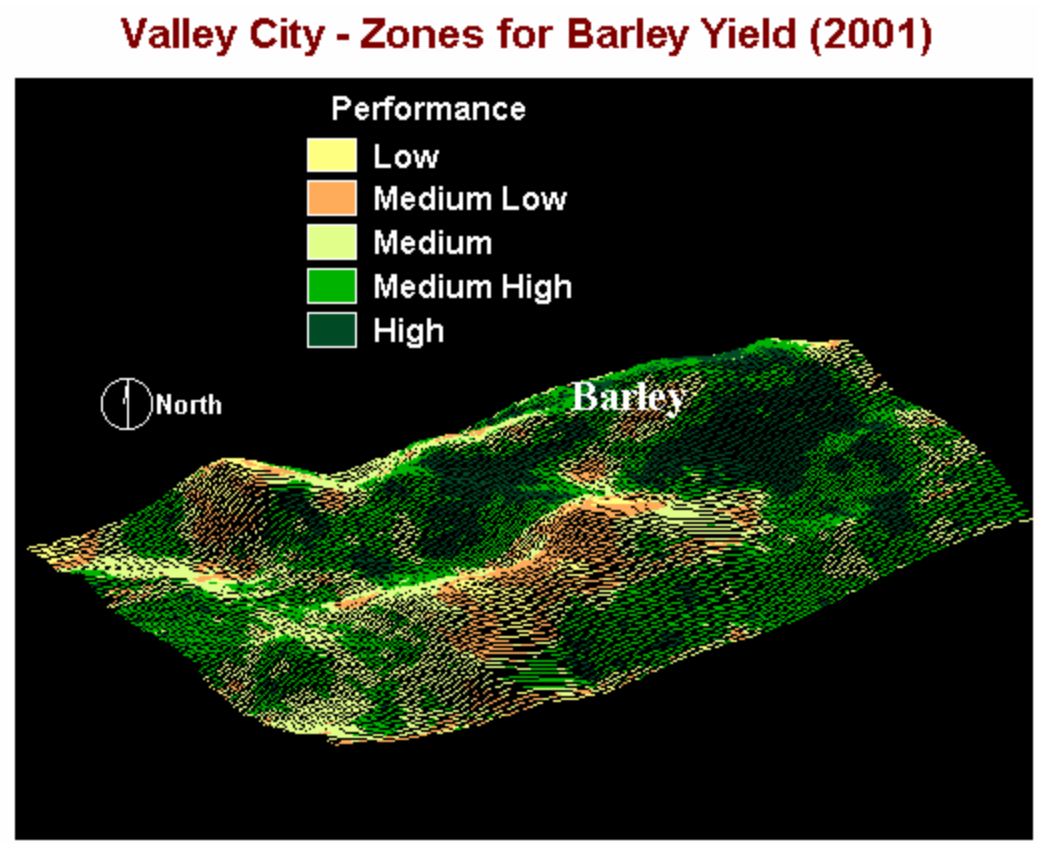
Patterns of residual nitrate tend to be stable between years due to influence of topography.



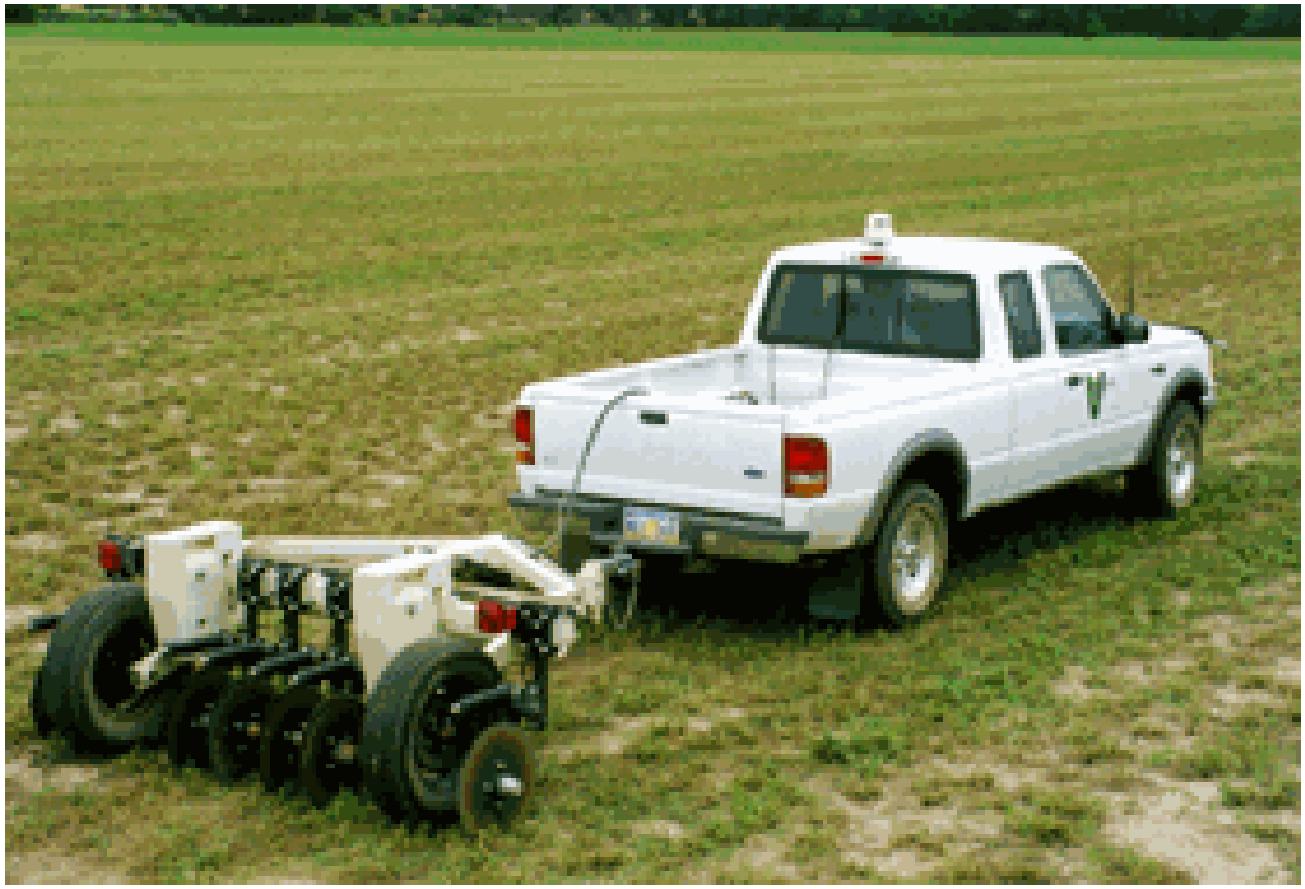
TOPOGRAPHY


Divergent
Convergent
Profile Curvature
Convergent
Divergent

Yield and Relief

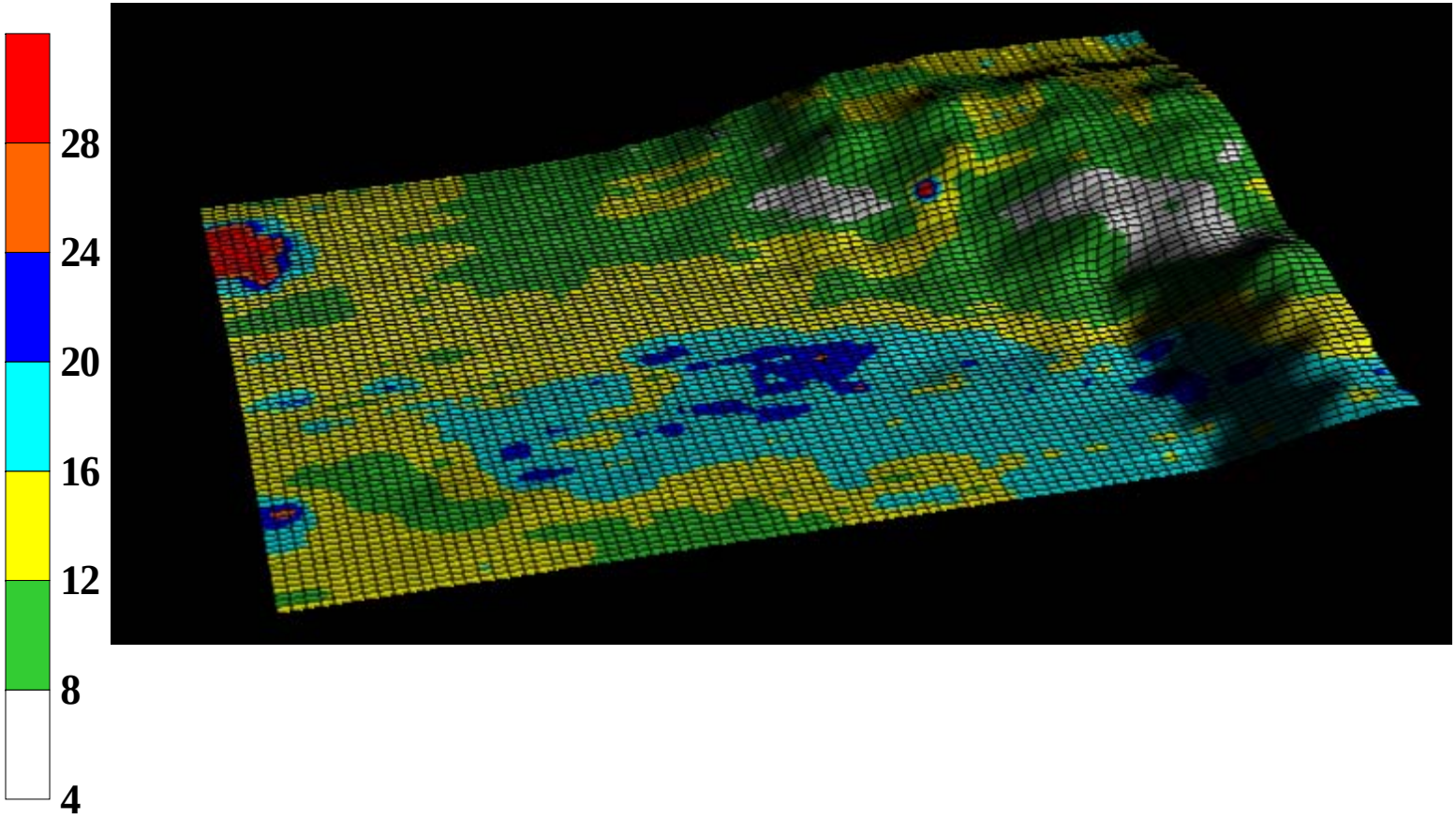


Electrical conductivity



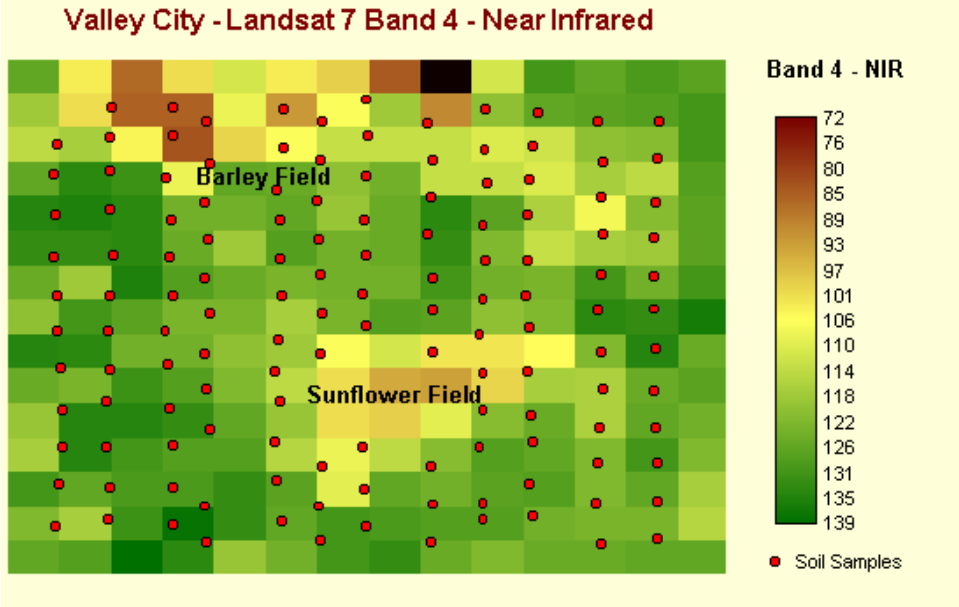
Electrical conductivity, EM-38

Shallow Veris EC over topography, Beach, ND, October, 2004

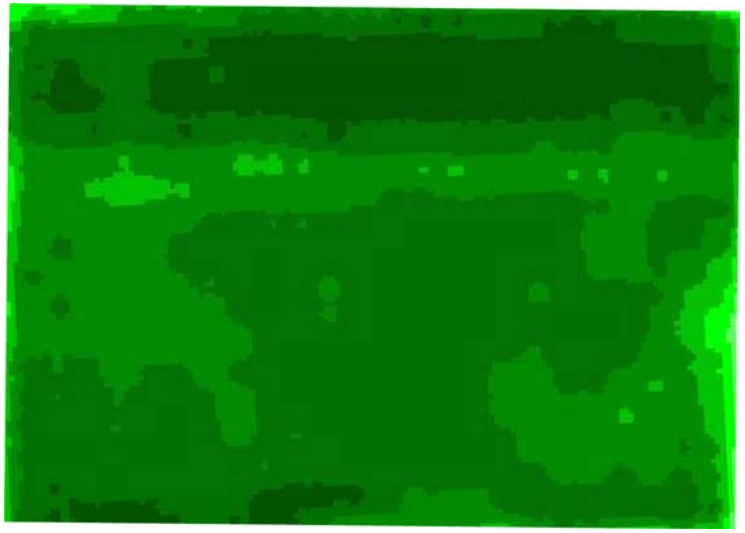


Remotely Sensed Images (RSI)

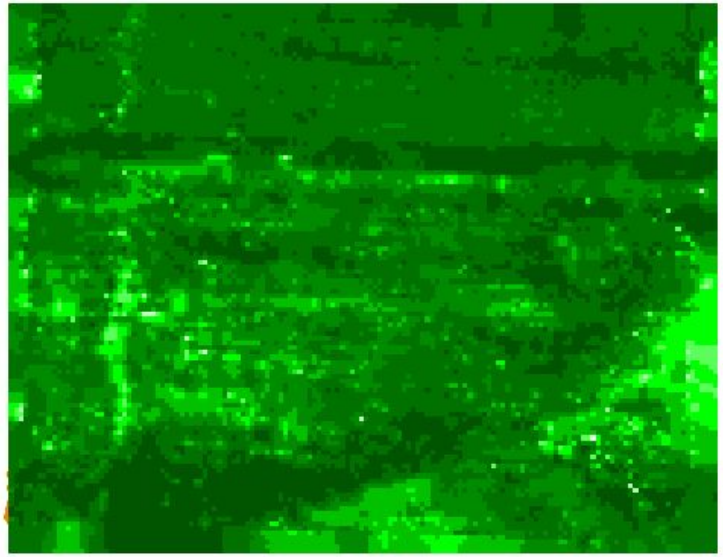
- Landsat 7 satellite pictures
- Aerial photos: Ektochrome color film.
- Good correlation, but need some ground truthing
- Consider crop development stage.



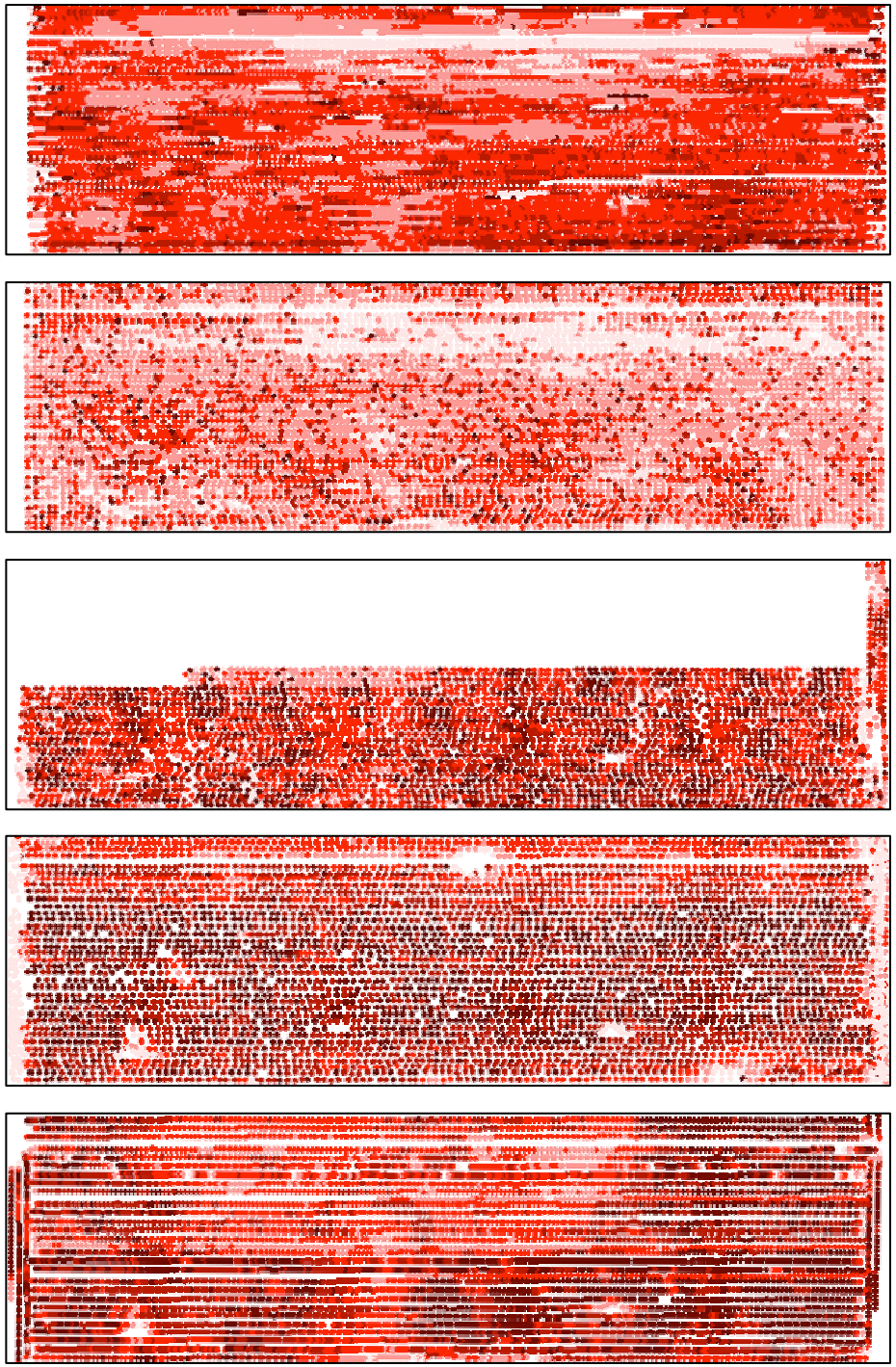
Satellite



Greenseeker sensor



How do you manage multiple years of yield data?



1994 Yield

1995 Yield

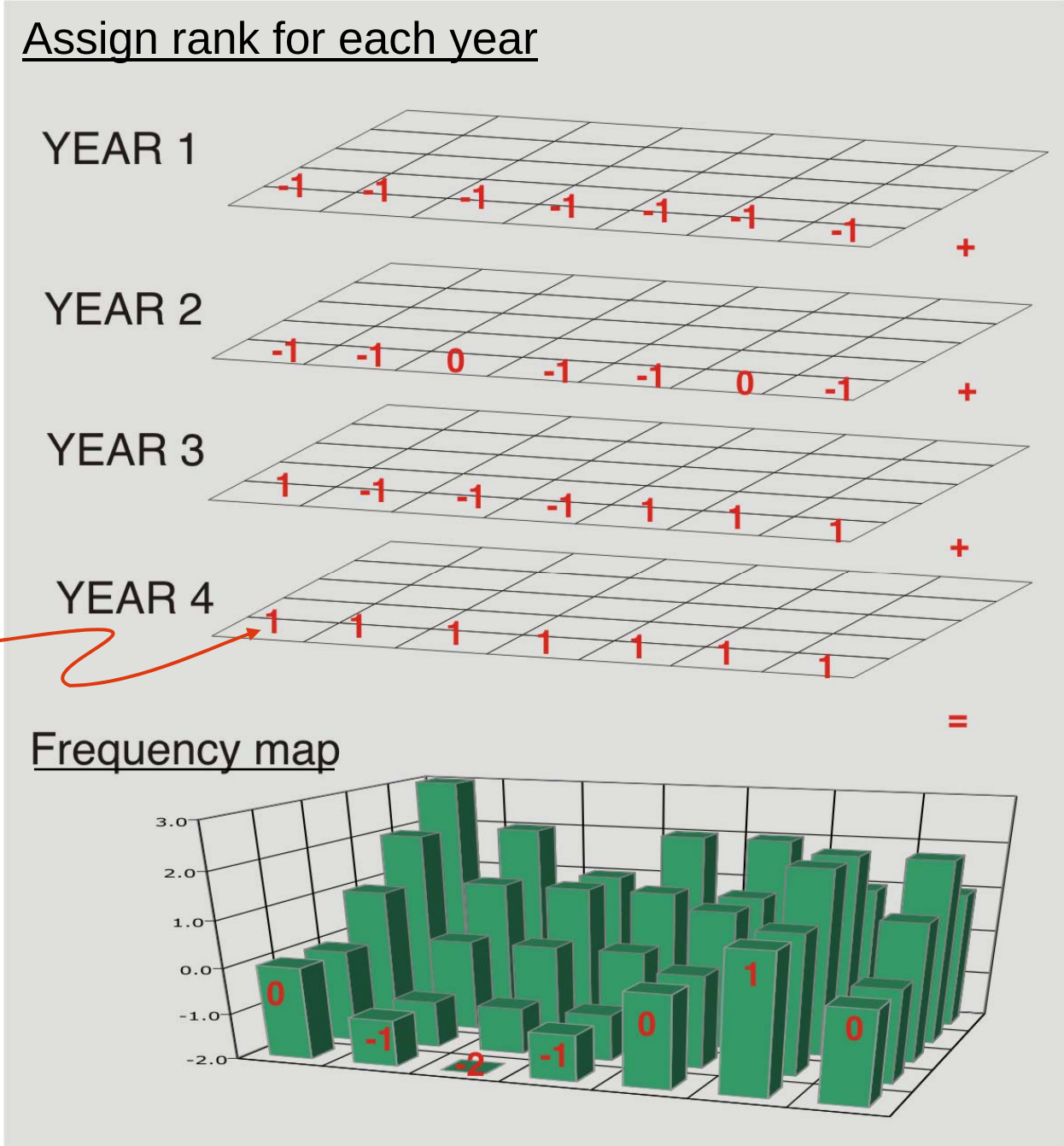
1997 Yield

1998 Yield

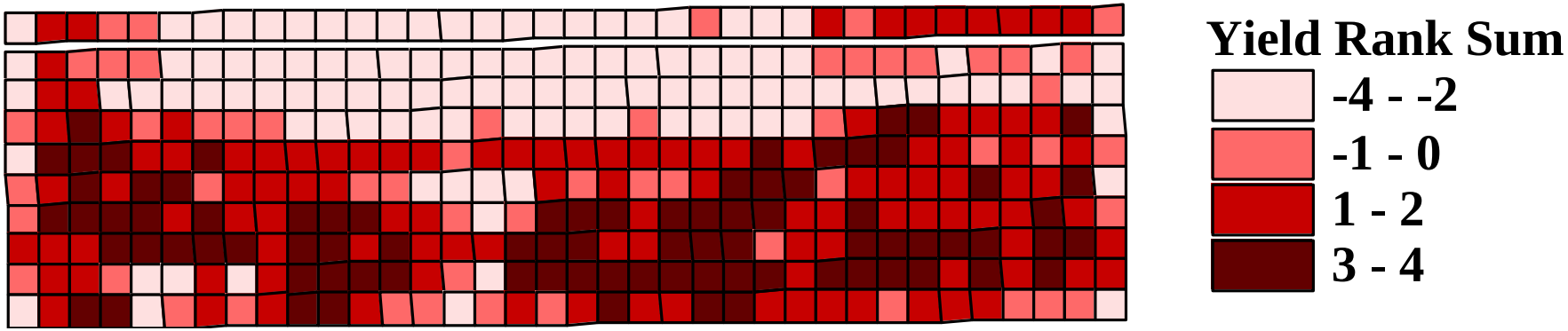
2000 Yield

Managing multiple yield data using rank & frequency

Assign rank:
1 if > average yield
0 if = average yield
-1 if < average yield

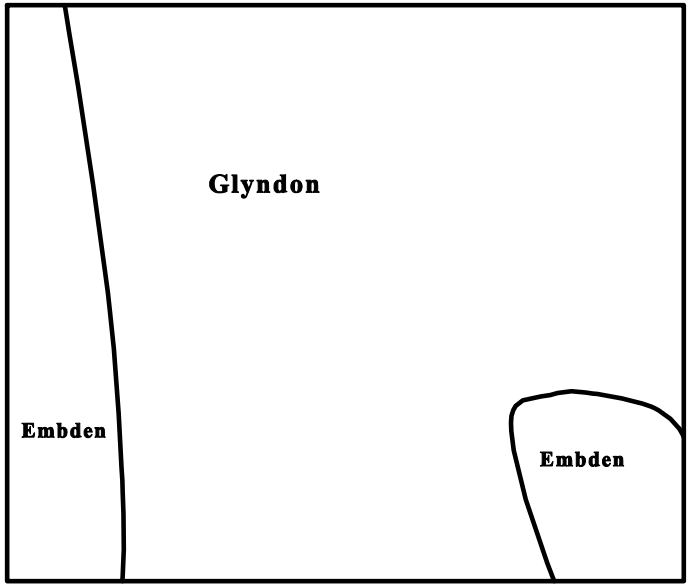


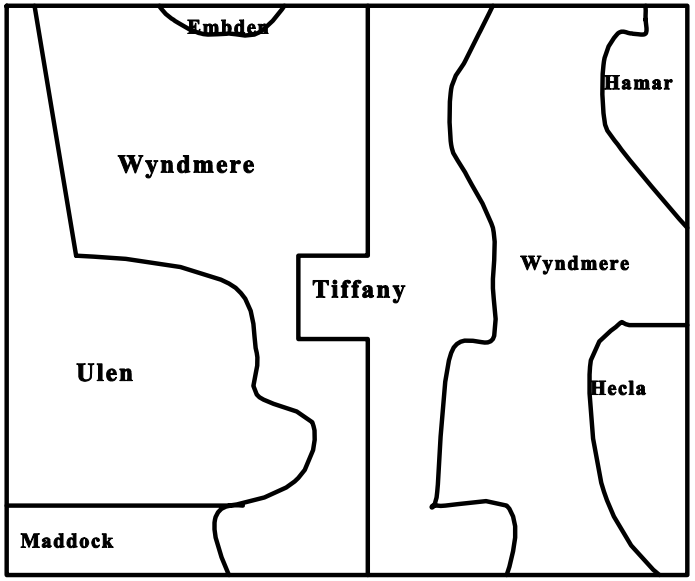
Yield frequency result for 1994-2000



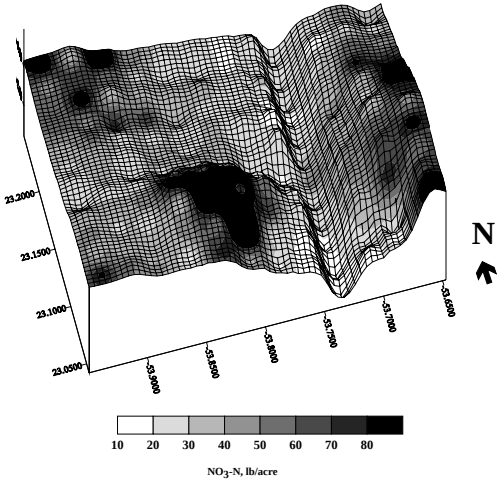
Soil survey

Order 1 1:8,000

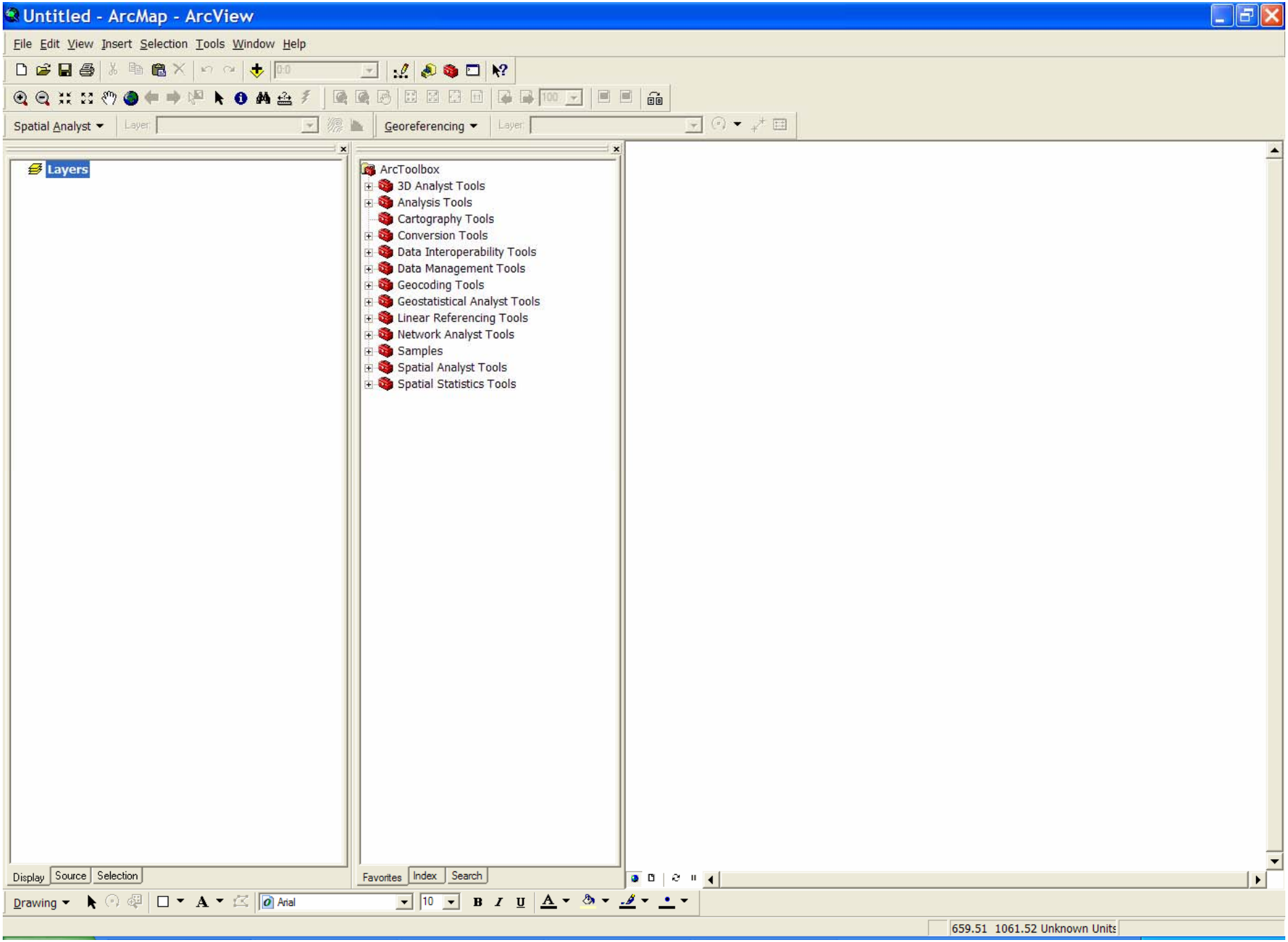




Order 2 1:20,000



Since soil series are often related to landscape, and other soil attributes that divide a landscape into another soil series (high lime, salts, etc.), can we use terrain modeling, layered with satellite imagery and/or another easily obtained data set and make an Order 1 survey from our Order 2 knowledge base?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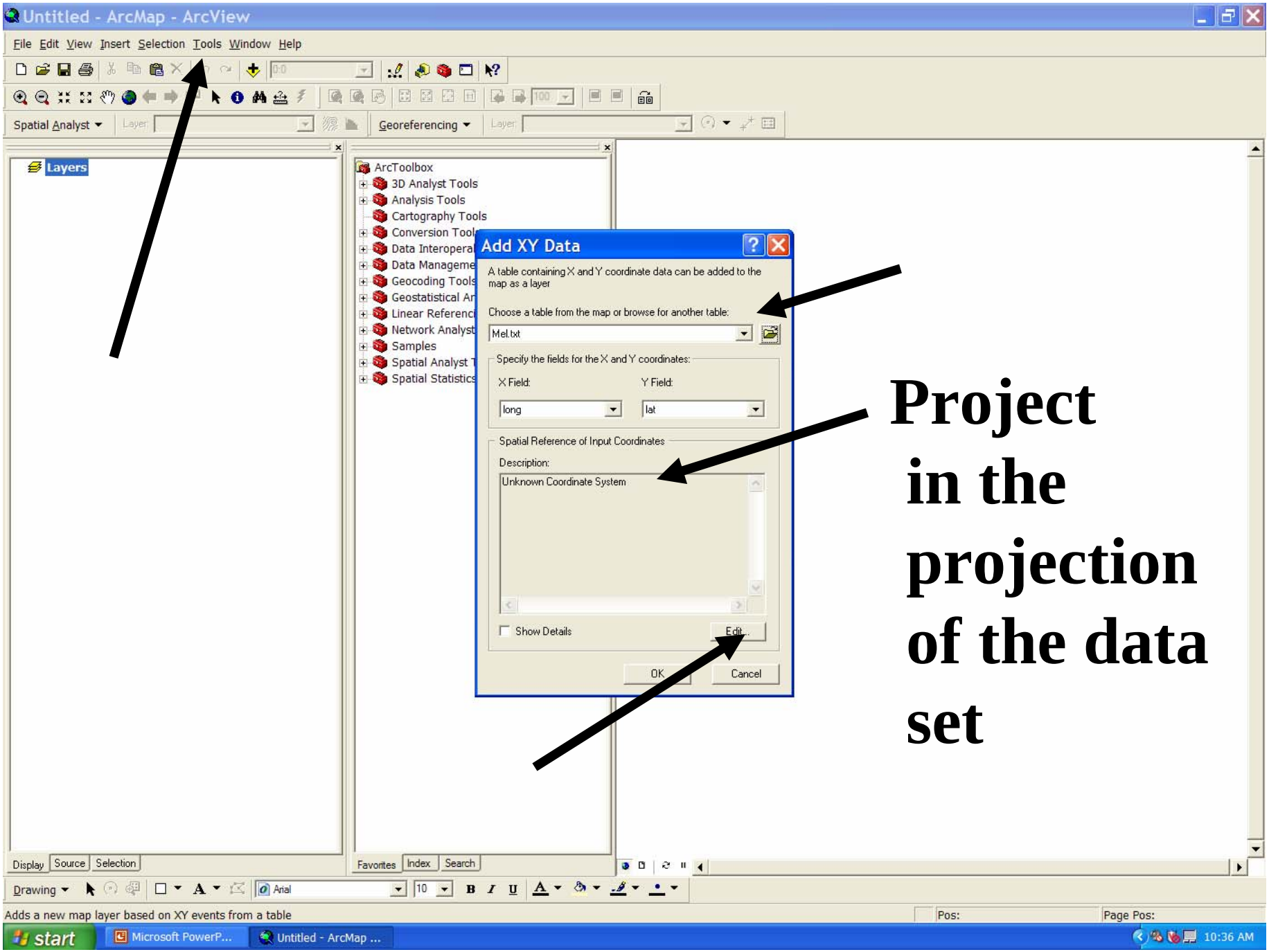
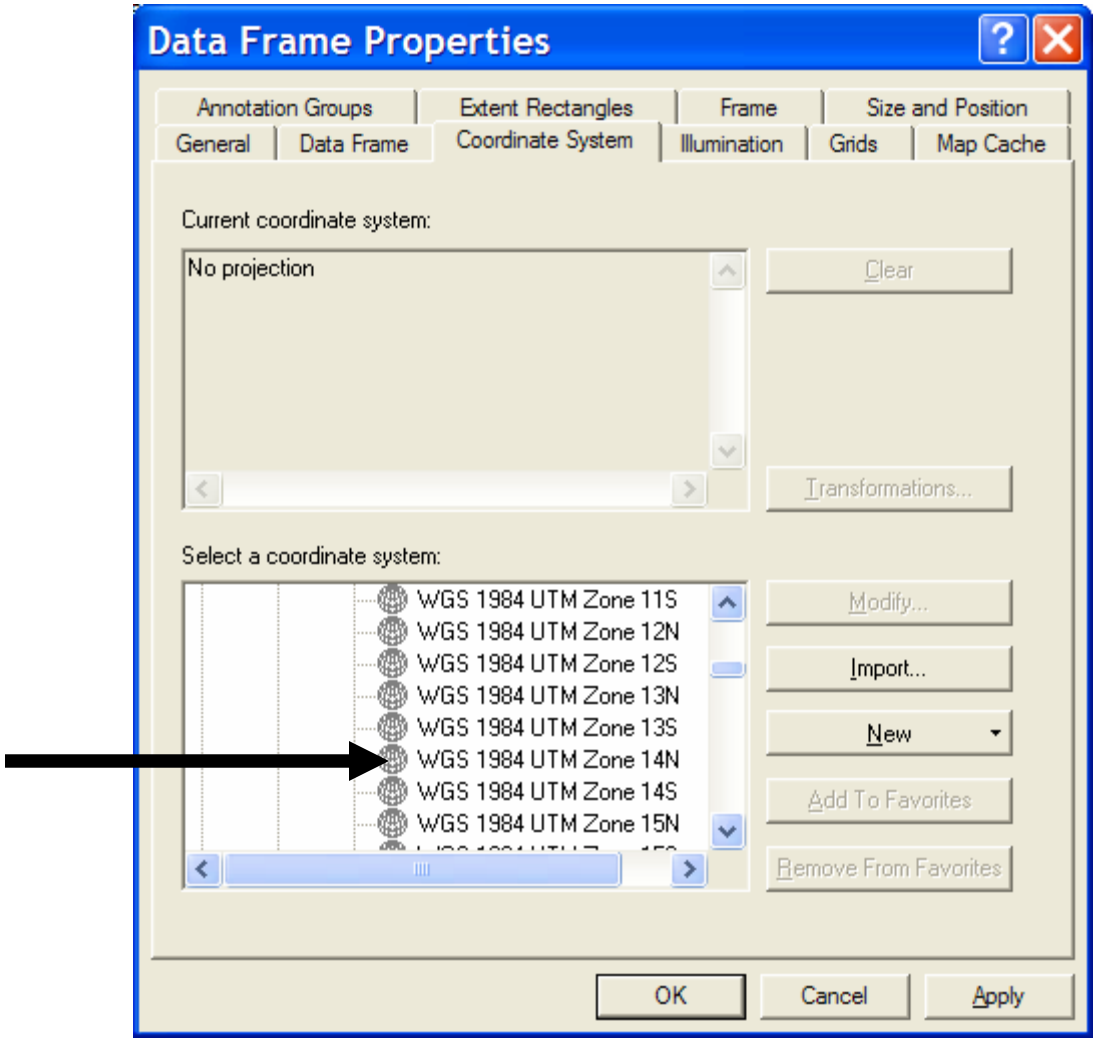
File Edit View Insert Selection Tools Window Help
Spatial Analyst
Layer:
Georeferencing
Layer:
Layers
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Network Analyst Tools
Samples
Spatial Analyst Tools
Spatial Statistics Tools
Display
Source
Selection
Favorites
Index
Search
Drawing
Arial
10
659.51 1061.52 Unknown Units

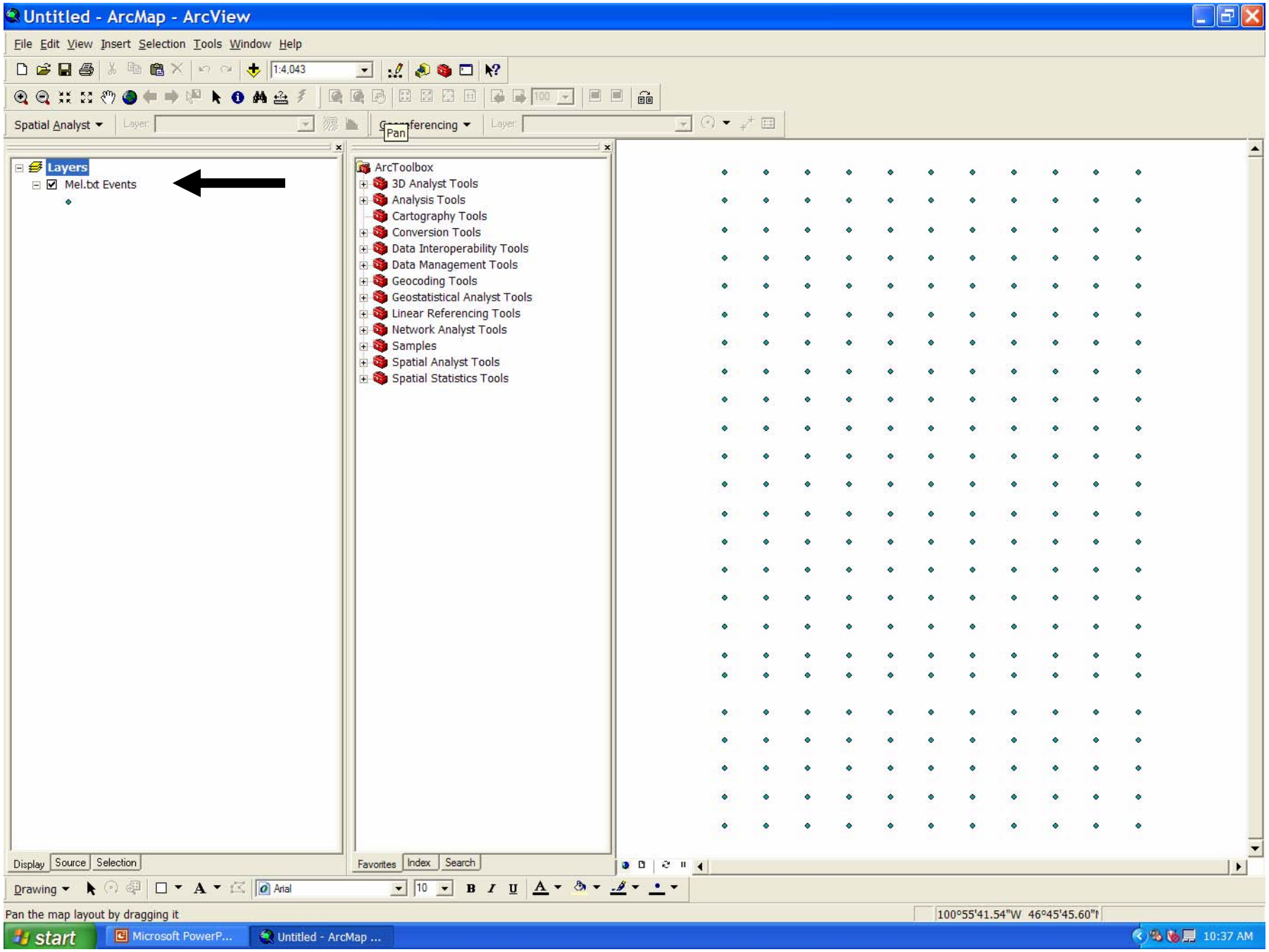
There are 2 ways to import data into ArcView and manipulate them.

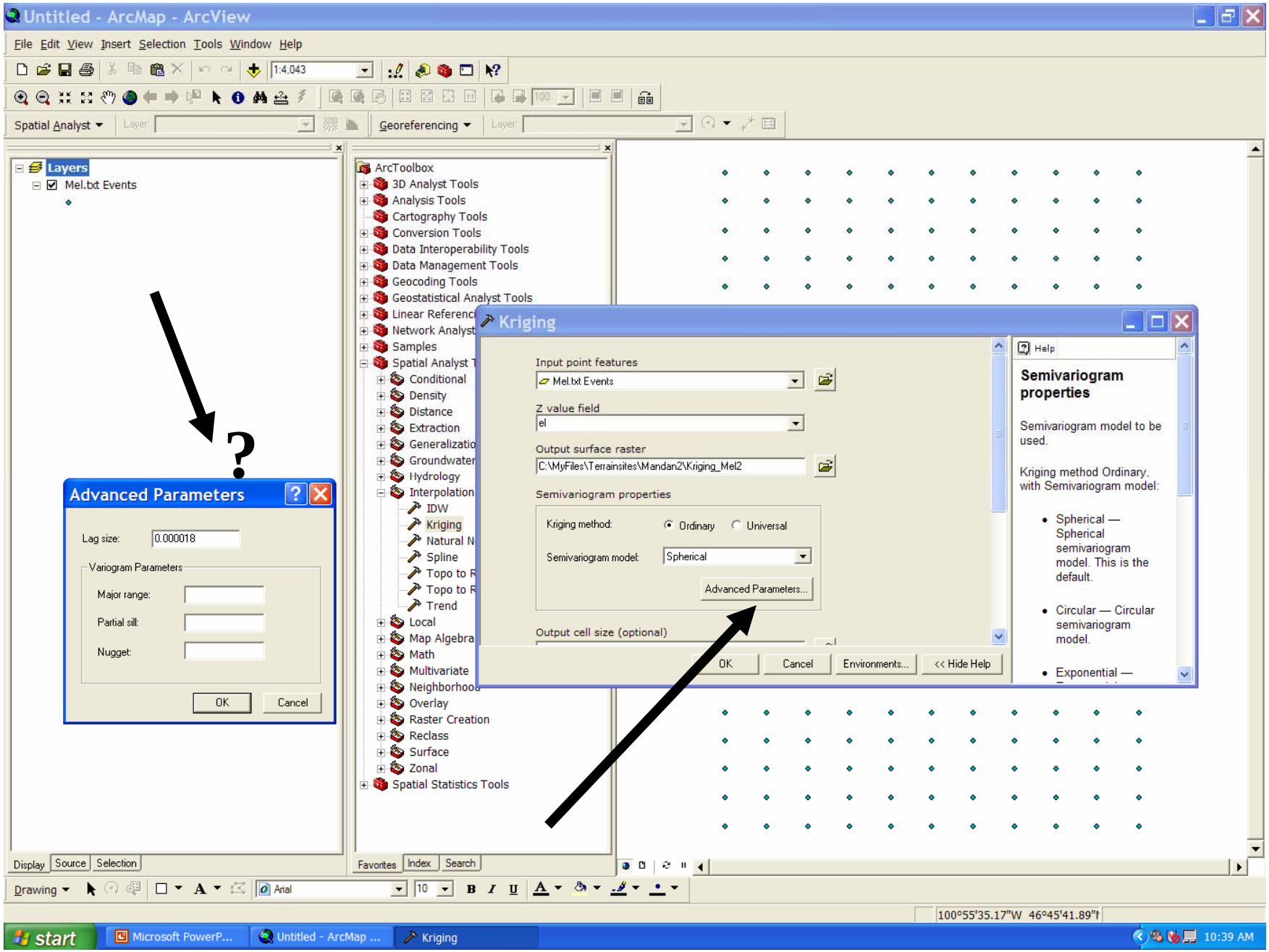
If you have x,y, z data (yield data, EC data, elevation data, any kind of sampling data), you must add the data as follows:



Project in the projection of the data set


Data Frame Properties
Annotation Groups
Extent Rectangles
Frame
Size and Position
General
Data Frame
Coordinate System
Illumination
Grids
Map Cache
Current coordinate system:
No projection
Clear
Transformations...
Select a coordinate system:
WGS 1984 UTM Zone 11S
WGS 1984 UTM Zone 12N
WGS 1984 UTM Zone 12S
WGS 1984 UTM Zone 13N
WGS 1984 UTM Zone 13S
WGS 1984 UTM Zone 14N
WGS 1984 UTM Zone 14S
WGS 1984 UTM Zone 15N
Modify...
Import...
New
Add To Favorites
Remove From Favorites
OK
Cancel
Apply


Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:4,043
Spatial Analyst
Layer:
Georeferencing
Pan
Layers
Mel.txt Events
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Network Analyst Tools
Samples
Spatial Analyst Tools
Spatial Statistics Tools
Display Source Selection
Favorites Index Search
Drawing
Arial
10
Pan the map layout by dragging it
100°55'41.54"W 46°45'45.60"N
start
Microsoft PowerP...
Untitled - ArcMap ...
10:37 AM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File Edit View Insert Selection Tools Window Help
Spatial Analyst
Georeferencing
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Mel.txt Events
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
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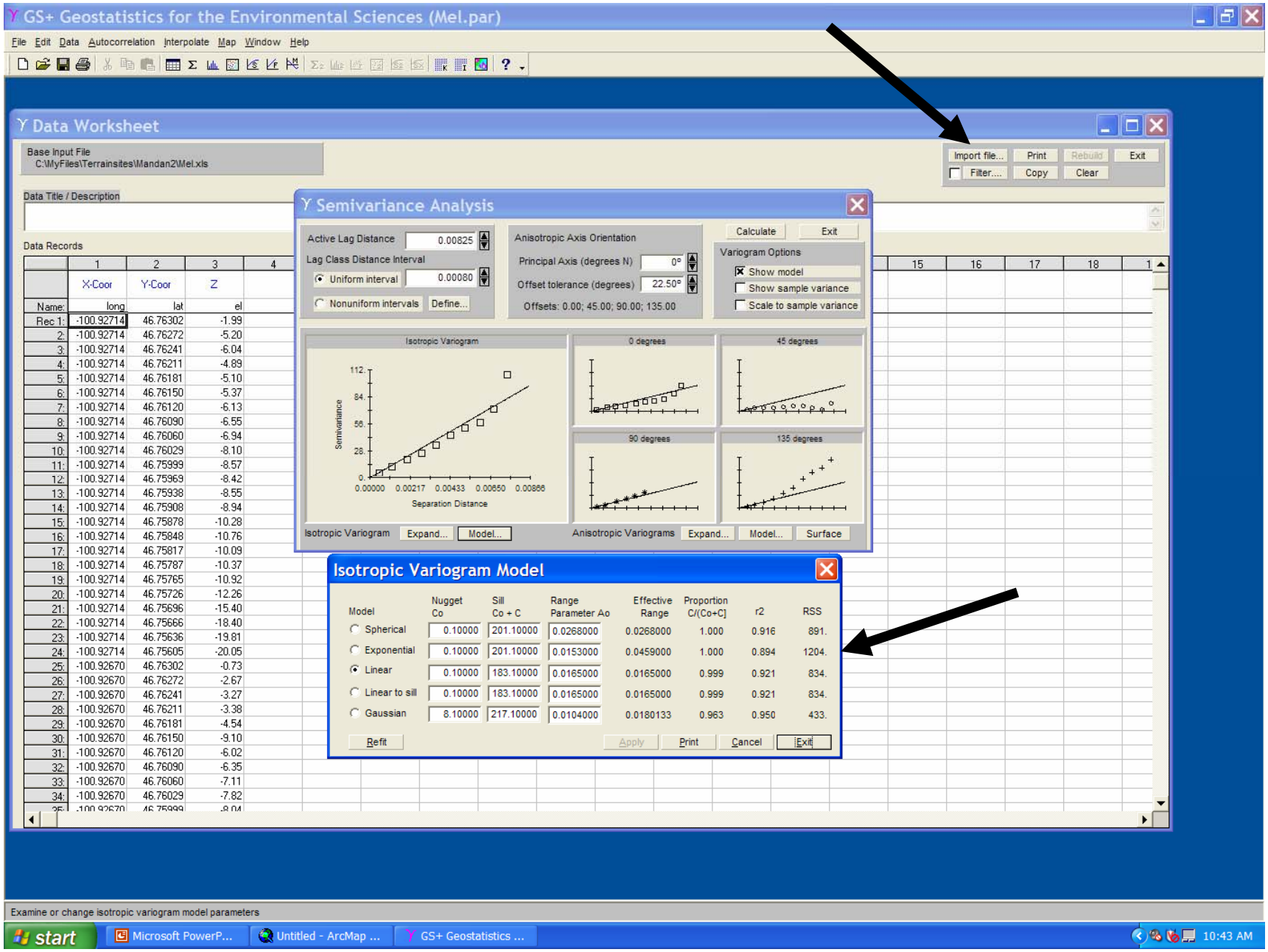
Spatial Analyst
Conditional
Density
Distance
Extraction
Hydrology
Interpolation
IDW
Kriging
Spline
Trend
Local
Math
Multivariate
Overlay
Raster Creation
Reclass
Surface
Zonal
Spatial Statistics Tools
Kriging
Input point features
Mel.txt Events
Z value field
el
Output surface raster
C:\MyFiles\Terrainsites\Mandan2\Kriging_Mel2
Semivariogram properties
Kriging method:
Ordinary
Universal
Semivariogram model:
Spherical
Advanced Parameters...
Output cell size (optional)
OK
Cancel
Environments...
<< Hide Help
Help
Semivariogram properties
Semivariogram model to be used.
Kriging method Ordinary, with Semivariogram model:
Spherical — Spherical semivariogram model. This is the default.
Circular — Circular semivariogram model.
Exponential —
Advanced Parameters
Lag size:
0.000018
Variogram Parameters
Major range:
Partial sill:
Nugget:
OK
Cancel
Display
Source
Selection
Favorites
Index
Search
Drawing
Arial
10
100°55'35.17"W 46°45'41.89"
start
Microsoft PowerP...
Untitled - ArcMap ...
Kriging
10:39 AM


GS+ Geostatistics for the Environmental Sciences (Mel.par)
File Edit Data Autocorrelation Interpolate Map Window Help
Data Worksheet
Base Input File
C:\MyFiles\Terrainsites\Mandan2\Mel.xls
Import file... Print Rebuild Exit
Filter.... Copy Clear
Data Title / Description
Data Records
Semivariance Analysis
Active Lag Distance 0.00825
Lag Class Distance Interval
Uniform interval 0.00080
Nonuniform intervals Define...
Anisotropic Axis Orientation
Principal Axis (degrees N) 0°
Offset tolerance (degrees) 22.50°
Offsets: 0.00; 45.00; 90.00; 135.00
Calculate Exit
Variogram Options
Show model
Show sample variance
Scale to sample variance
Isotropic Variogram
Semivariance
Separation Distance
0 degrees
45 degrees
90 degrees
135 degrees
Isotropic Variogram Expand... Model...
Anisotropic Variograms Expand... Model... Surface
Isotropic Variogram Model
Model Nugget Co Sill Co + C Range Parameter Ao Effective Range Proportion C/(Co+C) r2 RSS
Spherical 0.10000 201.10000 0.0268000 0.0268000 1.000 0.916 891.
Exponential 0.10000 201.10000 0.0153000 0.0459000 1.000 0.894 1204.
Linear 0.10000 183.10000 0.0165000 0.0165000 0.999 0.921 834.
Linear to sill 0.10000 183.10000 0.0165000 0.0165000 0.999 0.921 834.
Gaussian 8.10000 217.10000 0.0104000 0.0180133 0.963 0.950 433.
Refit Apply Print Cancel Exit
Examine or change isotropic variogram model parameters
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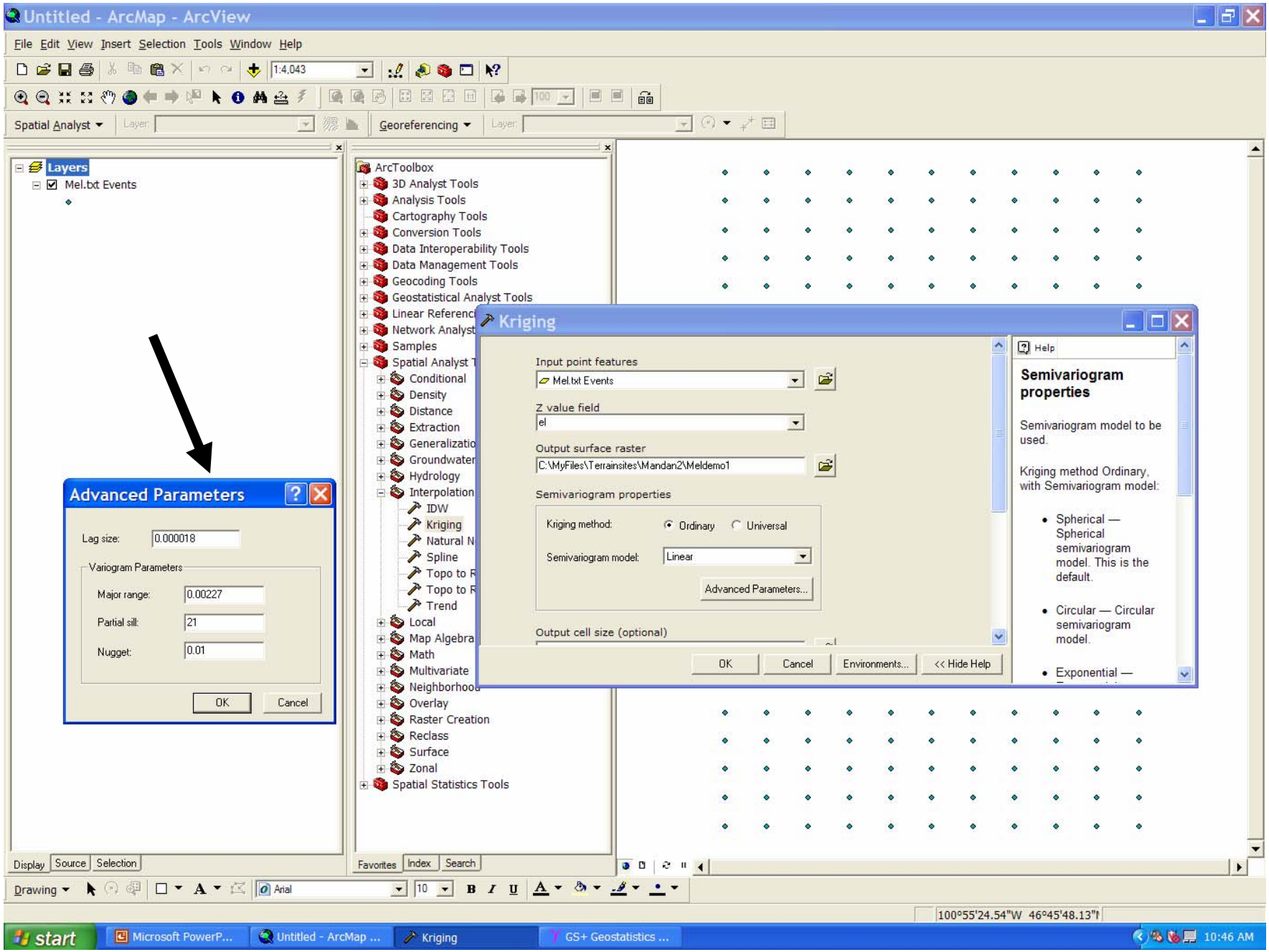
GS+ Geostatistics ...
10:43 AM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File Edit View Insert Selection Tools Window Help
Spatial Analyst
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Mel.txt Events
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
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Data Management Tools
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Interpolation
IDW
Kriging
Spline
Trend
Local
Math
Multivariate
Overlay
Raster Creation
Reclass
Surface
Zonal
Spatial Statistics Tools
Kriging
Input point features
Mel.txt Events
Z value field
el
Output surface raster
C:\MyFiles\Terrainsites\Mandan2\Meldemo1
Semivariogram properties
Kriging method:
Ordinary
Universal
Semivariogram model:
Linear
Advanced Parameters...
Output cell size (optional)
OK
Cancel
Environments...
<< Hide Help
Help
Semivariogram properties
Semivariogram model to be used.
Kriging method Ordinary, with Semivariogram model:
Spherical — Spherical semivariogram model. This is the default.
Circular — Circular semivariogram model.
Exponential —
Advanced Parameters
Lag size:
0.000018
Variogram Parameters
Major range:
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Partial sill:
21
Nugget:
0.01
OK
Cancel
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Source
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Favorites
Index
Search
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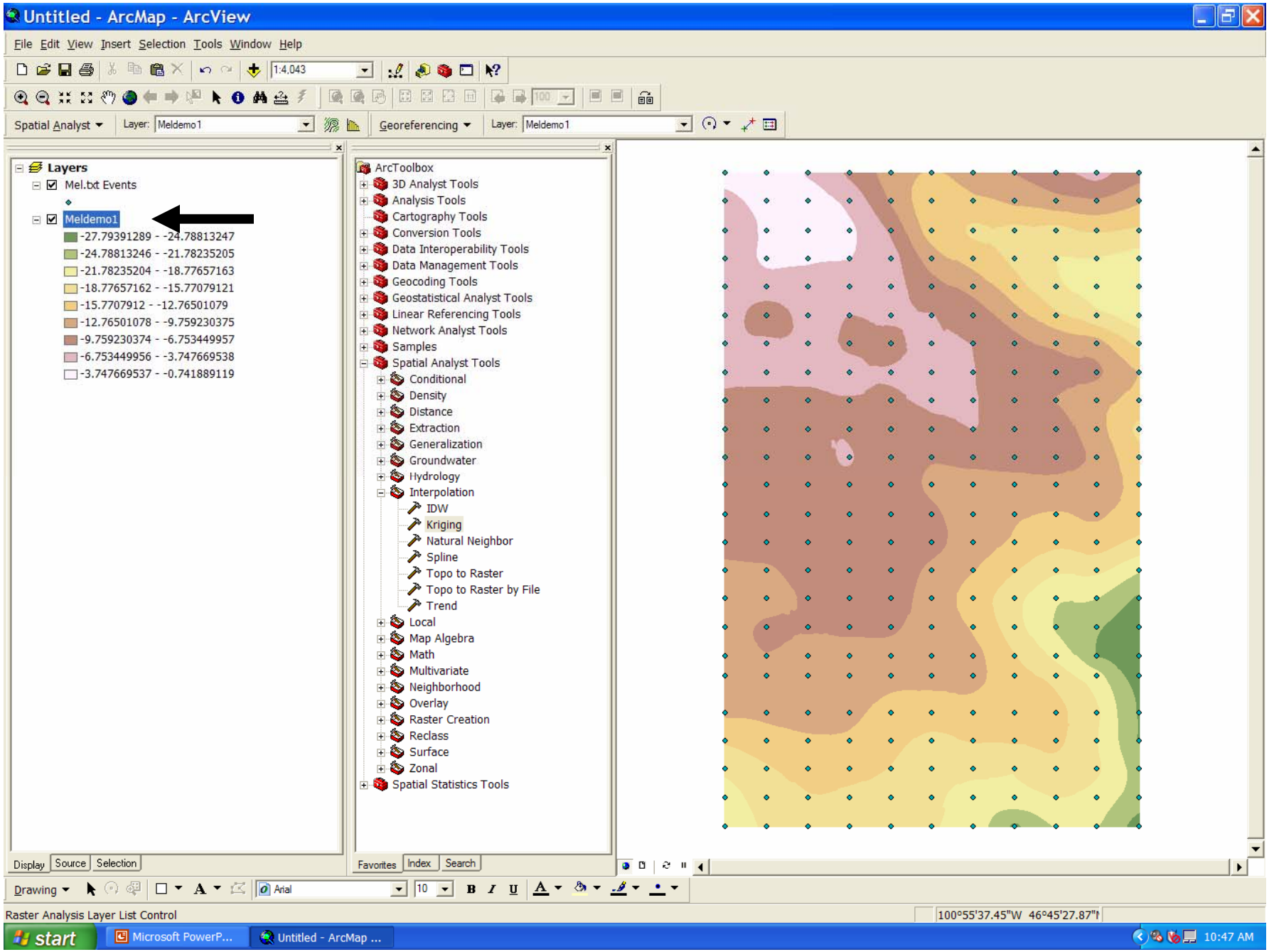
Kriging
GS+ Geostatistics ...
10:46 AM


Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:4,043
Spatial Analyst
Layer: Meldemo1
Georeferencing
Layer: Meldemo1
Layers
Mel.txt Events
Meldemo1
-27.79391289 - -24.78813247
-24.78813246 - -21.78235205
-21.78235204 - -18.77657163
-18.77657162 - -15.77079121
-15.7707912 - -12.76501079
-12.76501078 - -9.759230375
-9.759230374 - -6.753449957
-6.753449956 - -3.747669538
-3.747669537 - -0.741889119
Display
Source
Selection
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
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Generalization
Groundwater
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Interpolation
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Natural Neighbor
Spline
Topo to Raster
Topo to Raster by File
Trend
Local
Map Algebra
Math
Multivariate
Neighborhood
Overlay
Raster Creation
Reclass
Surface
Zonal
Spatial Statistics Tools
Favorites
Index
Search
Drawing
Arial
10
Raster Analysis Layer List Control
100°55'37.45"W 46°45'27.87"N
start
Microsoft PowerP...
Untitled - ArcMap ...
10:47 AM

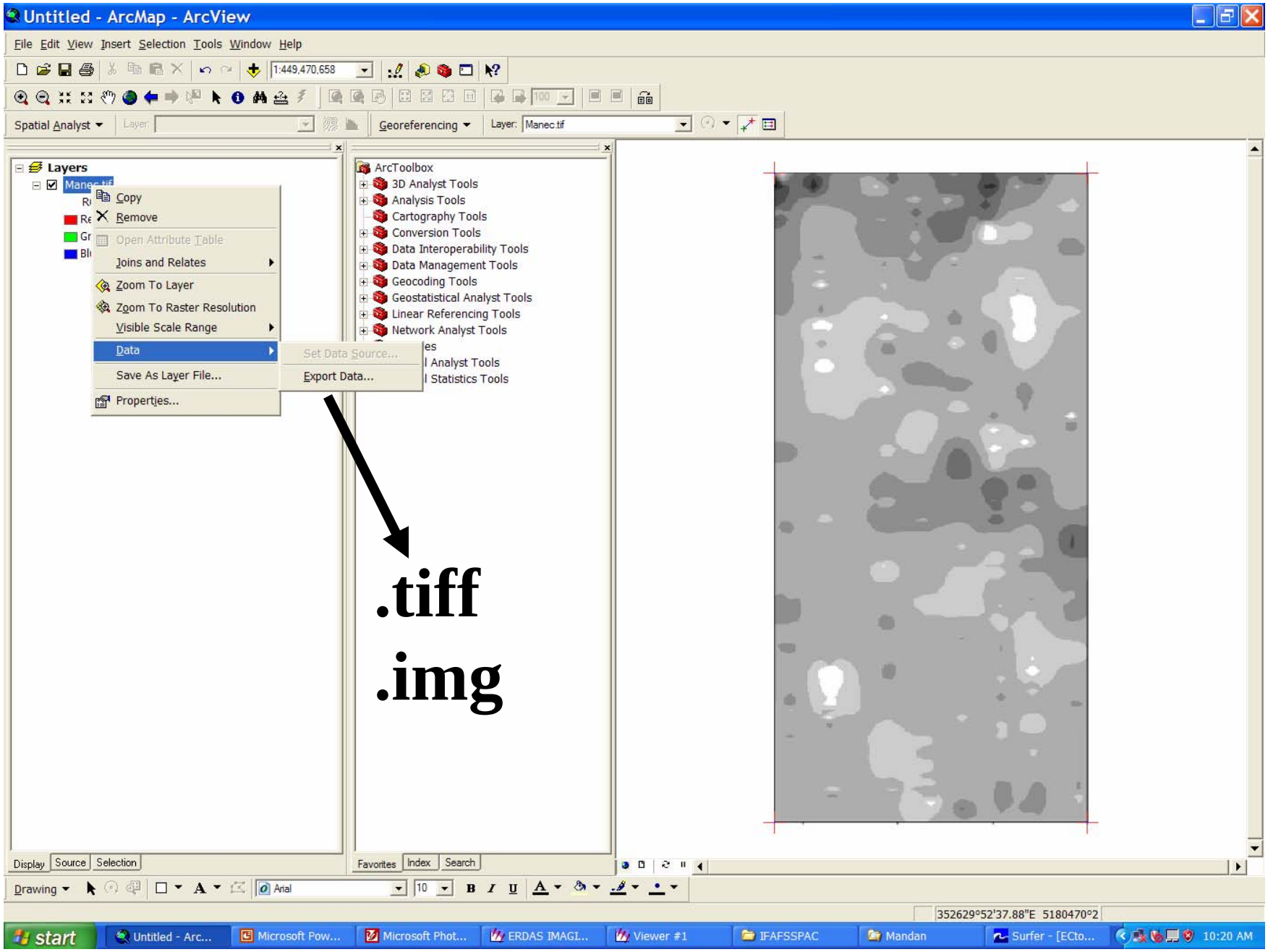
Once you get a kriged interpolated map, you can go at least two directions.

1. **Use the “hydrology” toolbox to get a watershed classified map. Save as an image file. (I’ll show you in a minute.)**
2. **Use another toolbox, such as a slope gradient model, to provide more landscape information.**

If you are unlucky enough to have data that is in a different projection than the ultimate output (degrees, but need UTM coordinates), you need to do more than ArcView alone can do.

Treat the odd projection as an image and register the UTM's on the corners.

1. Save the odd projection file as a tif


Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:449,470,658
Spatial Analyst
Georeferencing
Layer: Manec.tif
Layers
Manec.tif
Copy
Remove
Open Attribute Table
Joins and Relates
Zoom To Layer
Zoom To Raster Resolution
Visible Scale Range
Data
Save As Layer File...
Properties...
Set Data Source...
Export Data...
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Network Analyst Tools
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Favorites Index Search
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Microsoft Phot...
ERDAS IMAGI...
Viewer #1
IFAFSSPAC
Mandan
Surfer - [ECto...
10:20 AM

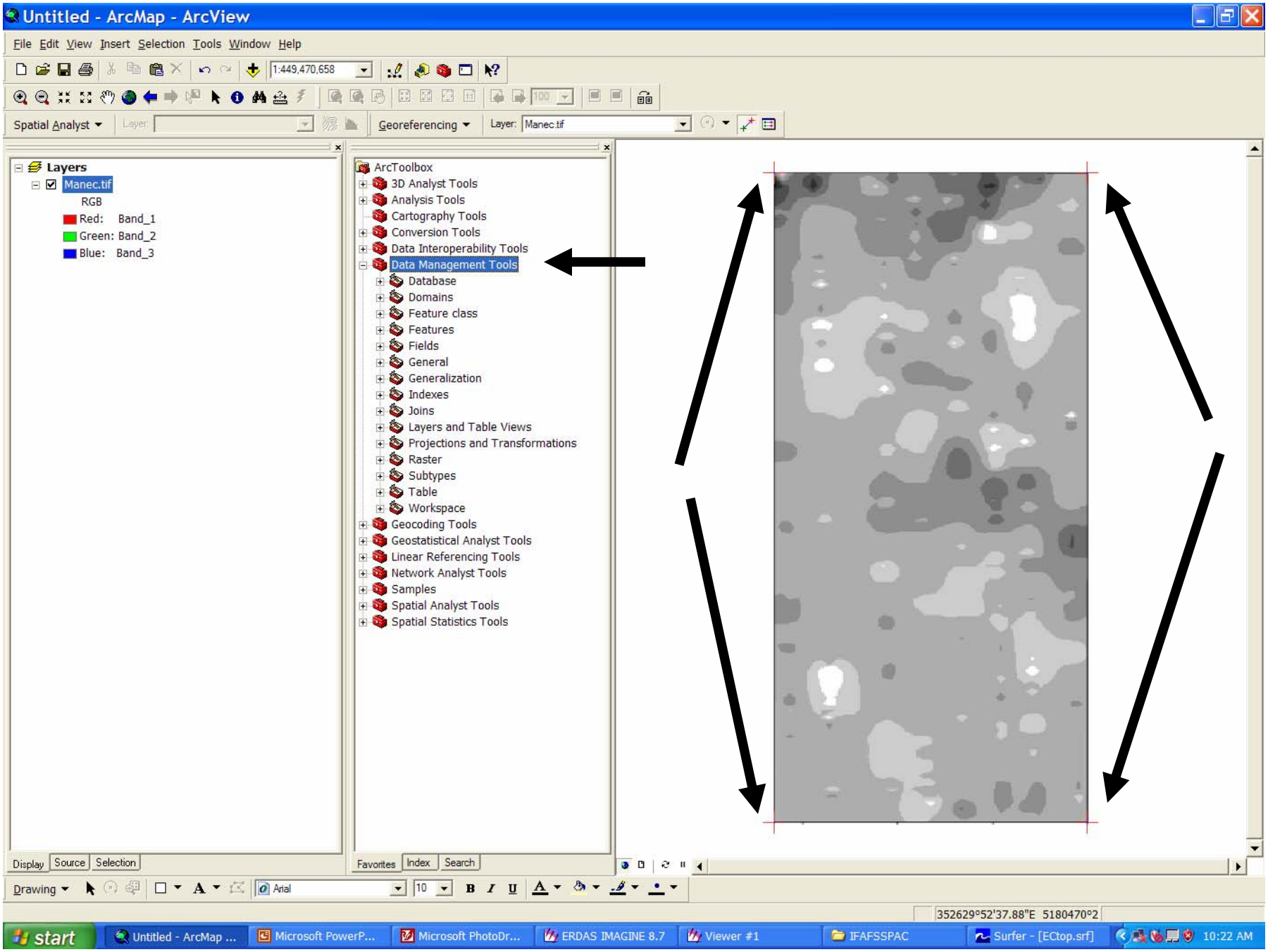
.tiff

.img

2. Open the saved tif in Photoshop or a similar program. Crop or enhance as you see fit, then save as a tif.

This erases all vestiges of georeferencing.

Bring the image into ArcView using the "add data" tool bar option.


Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:449,470,658
Spatial Analyst
Georeferencing
Layer: Manec.tif
Layers
Manec.tif
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Database
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Feature class
Features
Fields
General
Generalization
Indexes
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Projections and Transformations
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Subtypes
Table
Workspace
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Network Analyst Tools
Samples
Spatial Analyst Tools
Spatial Statistics Tools
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Favorites
Index
Search
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Arial
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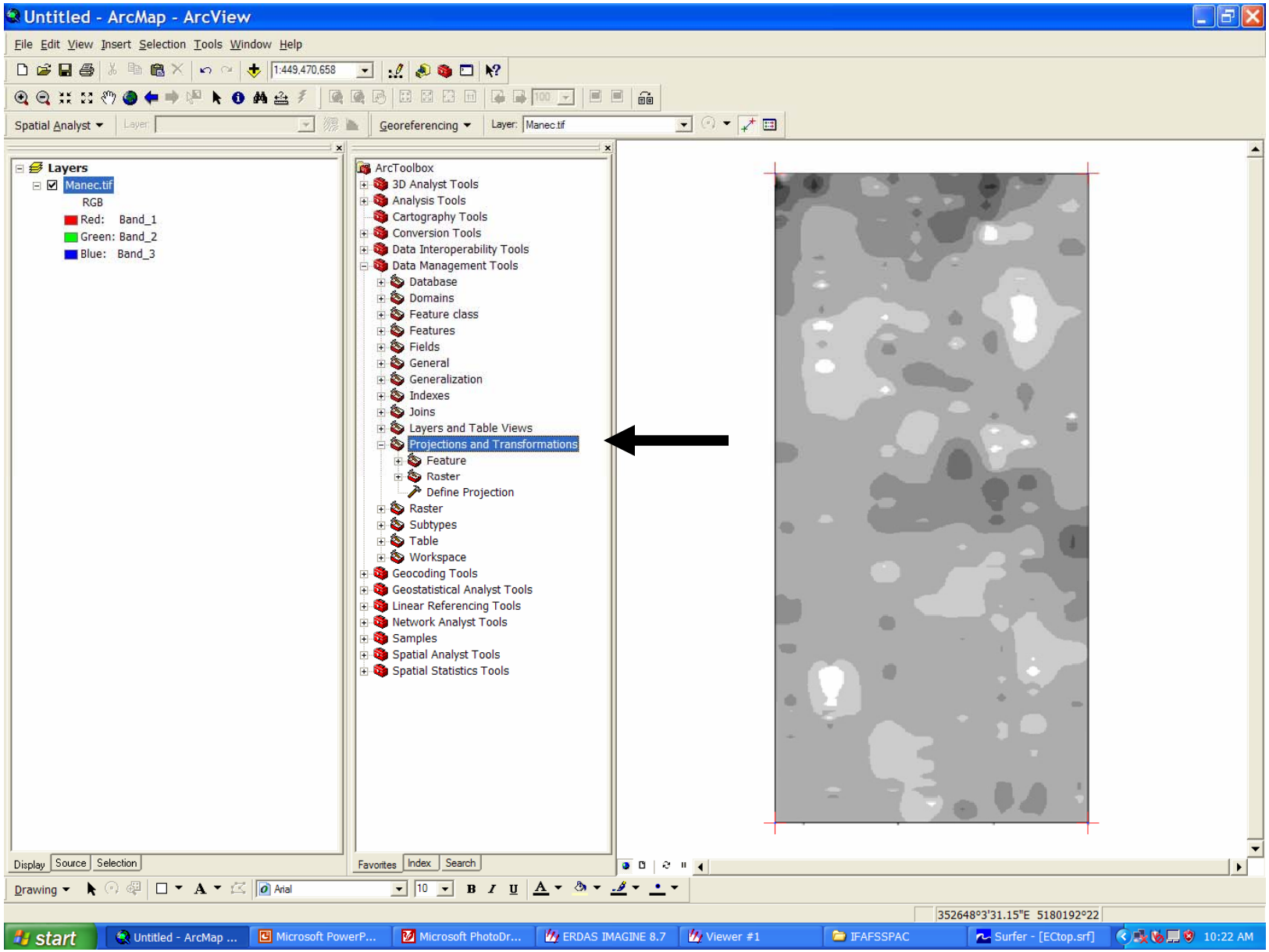
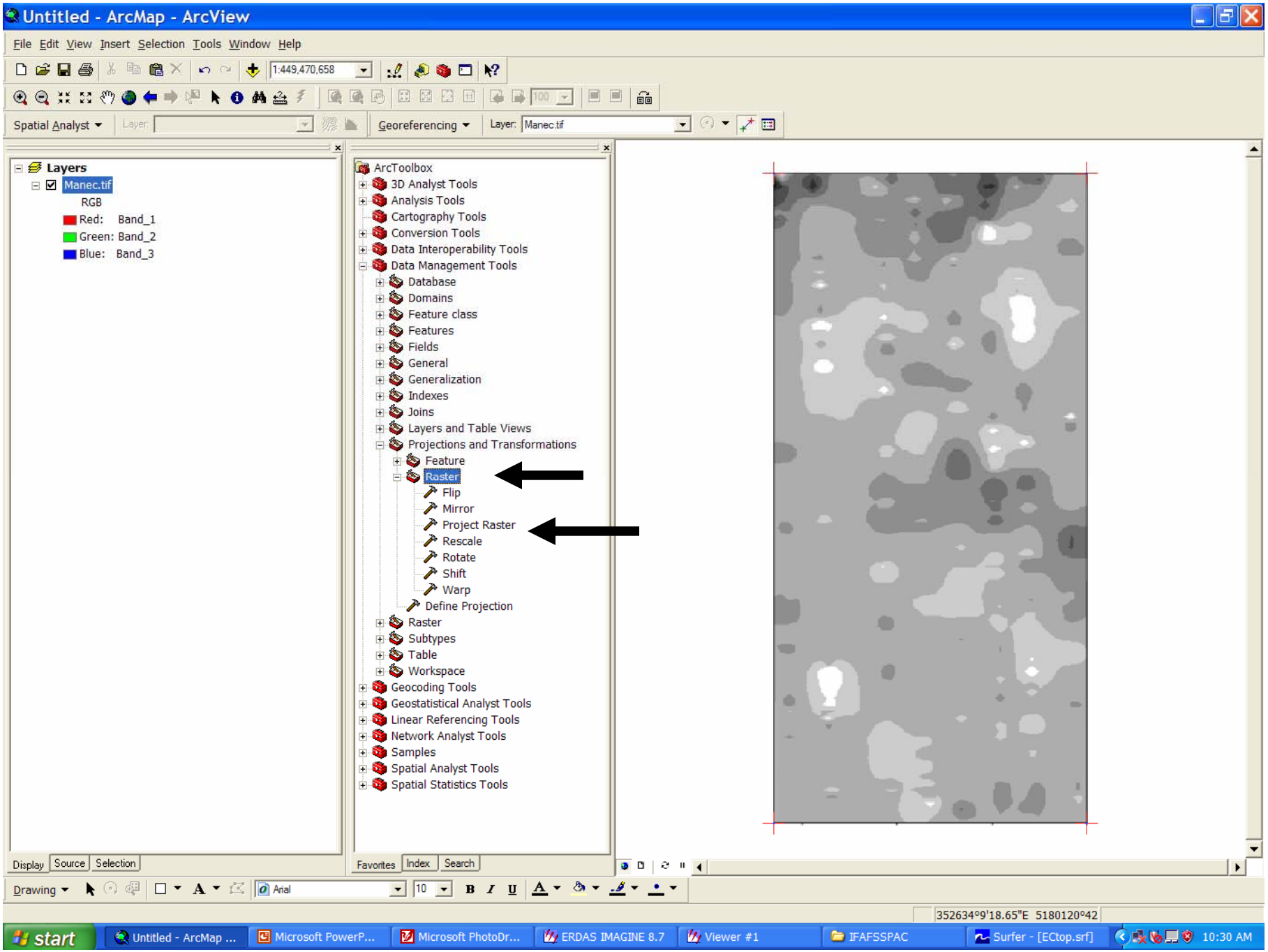
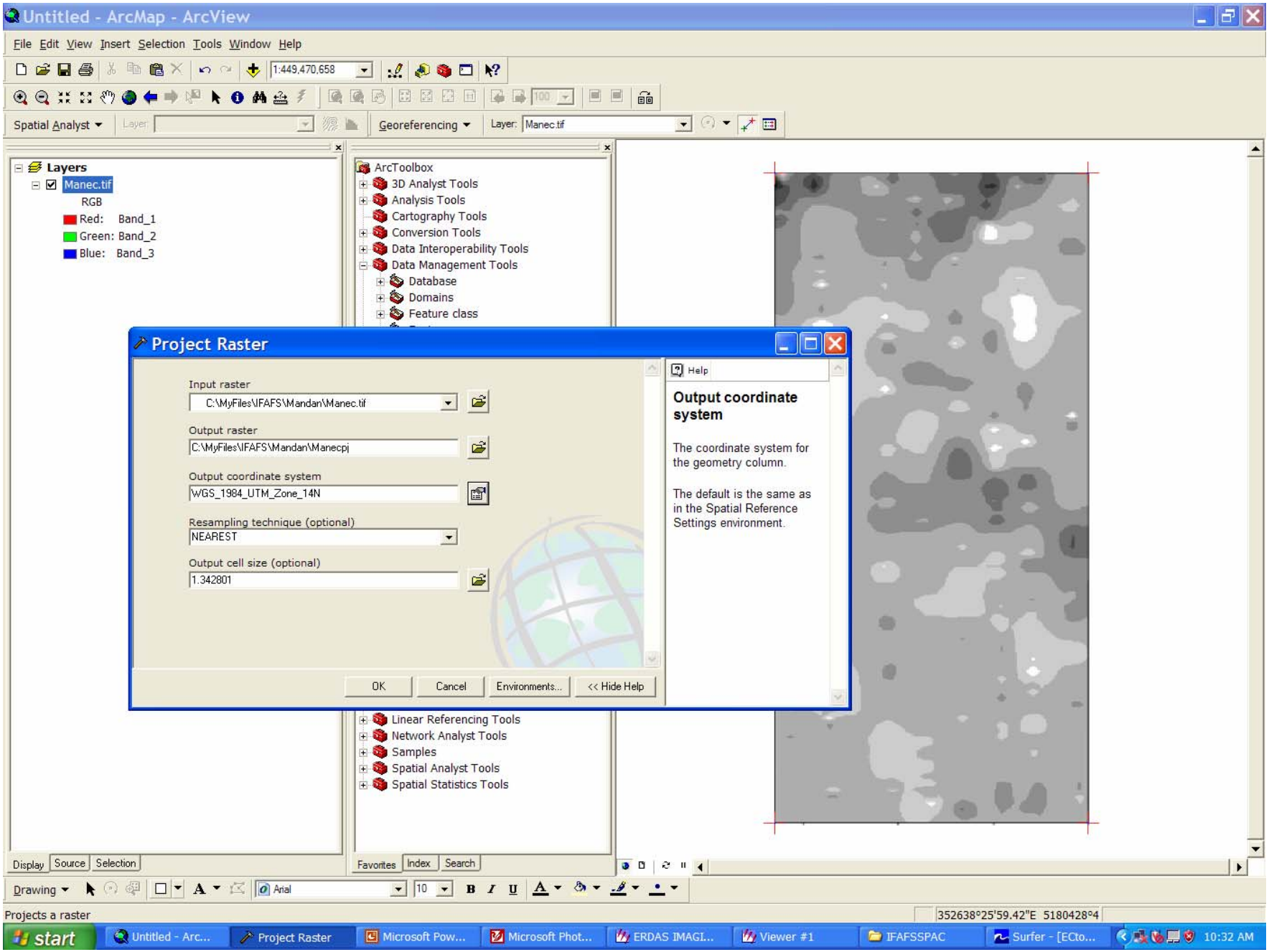
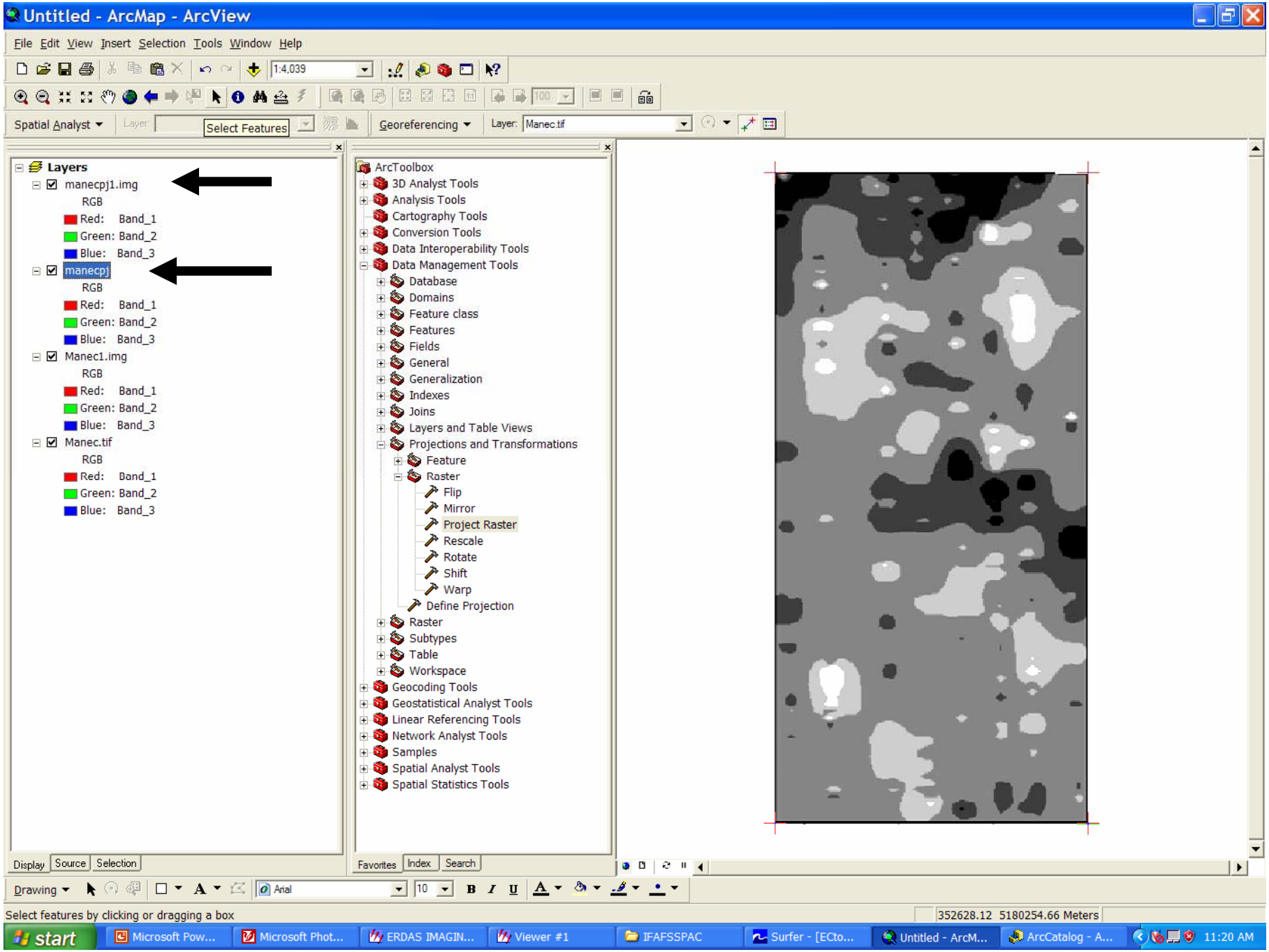
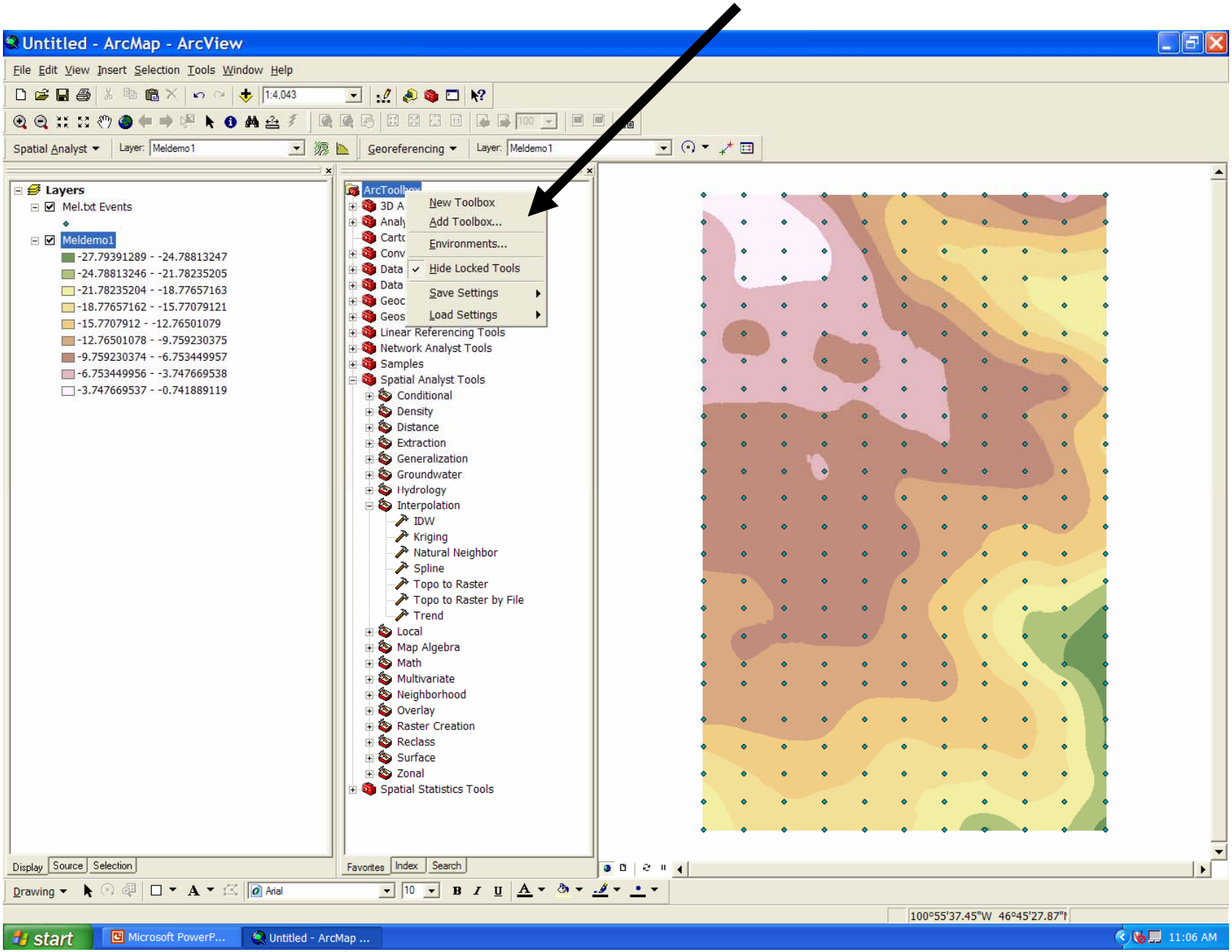
352629°52'37.88"E 5180470°2
start
Untitled - ArcMap ...
Microsoft PowerP...
Microsoft PhotoDr...
ERDAS IMAGINE 8.7
Viewer #1
IFAFSSPAC
Surfer - [ECtop.srf]
10:22 AM

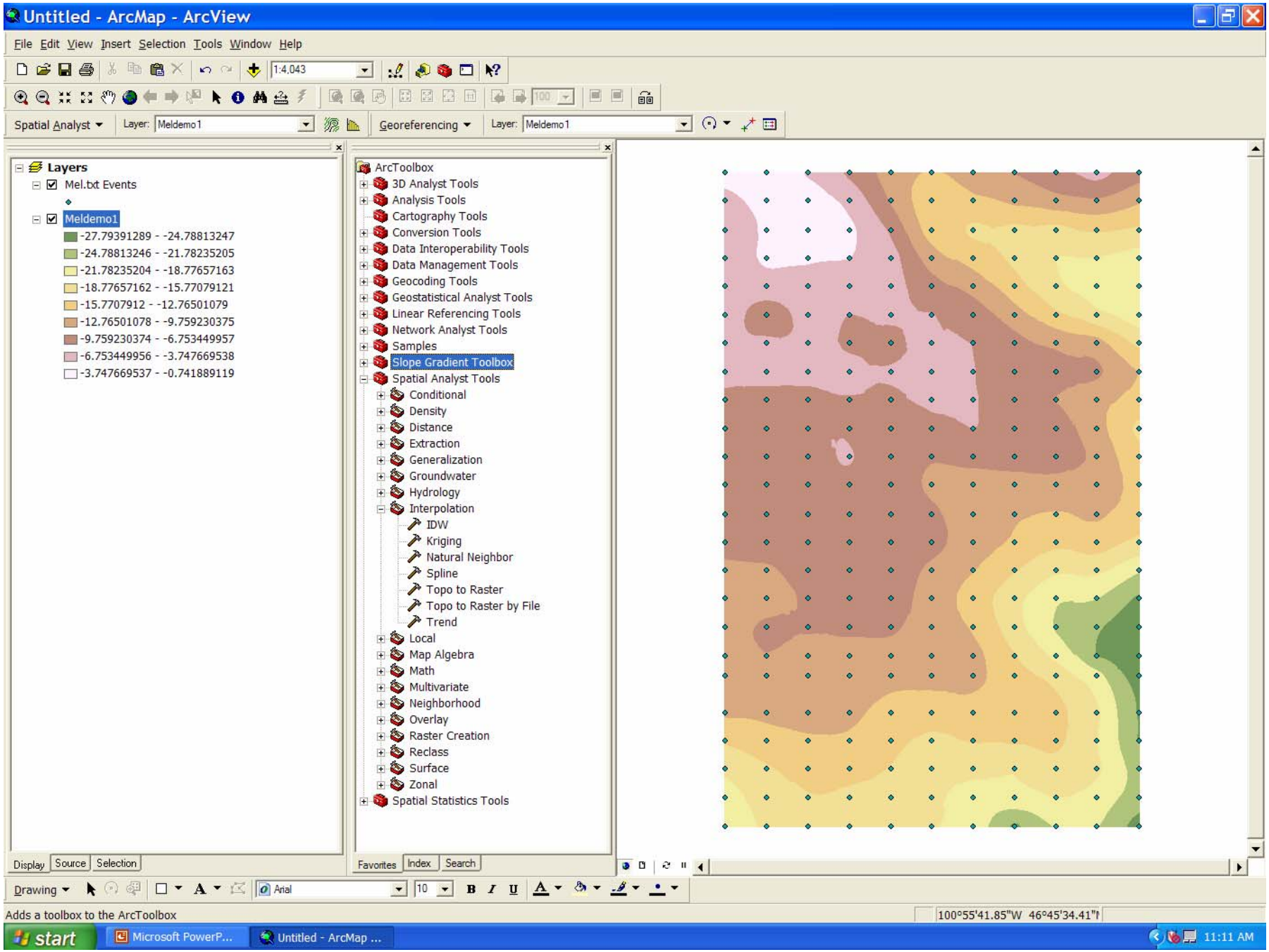

Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:449,470,658
Spatial Analyst
Georeferencing
Layer: Manec.tif
Layers
Manec.tif
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Database
Domains
Feature class
Features
Fields
General
Generalization
Indexes
Joins
Layers and Table Views
Projections and Transformations
Feature
Raster
Define Projection
Raster
Subtypes
Table
Workspace
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Network Analyst Tools
Samples
Spatial Analyst Tools
Spatial Statistics Tools
Display
Source
Selection
Favorites
Index
Search
Drawing
Arial
10
352648°3'31.15"E 5180192°22
start
Untitled - ArcMap ...
Microsoft PowerP...
Microsoft PhotoDr...
ERDAS IMAGINE 8.7
Viewer #1
IFAFSSPAC
Surfer - [ECtop.srf]
10:22 AM

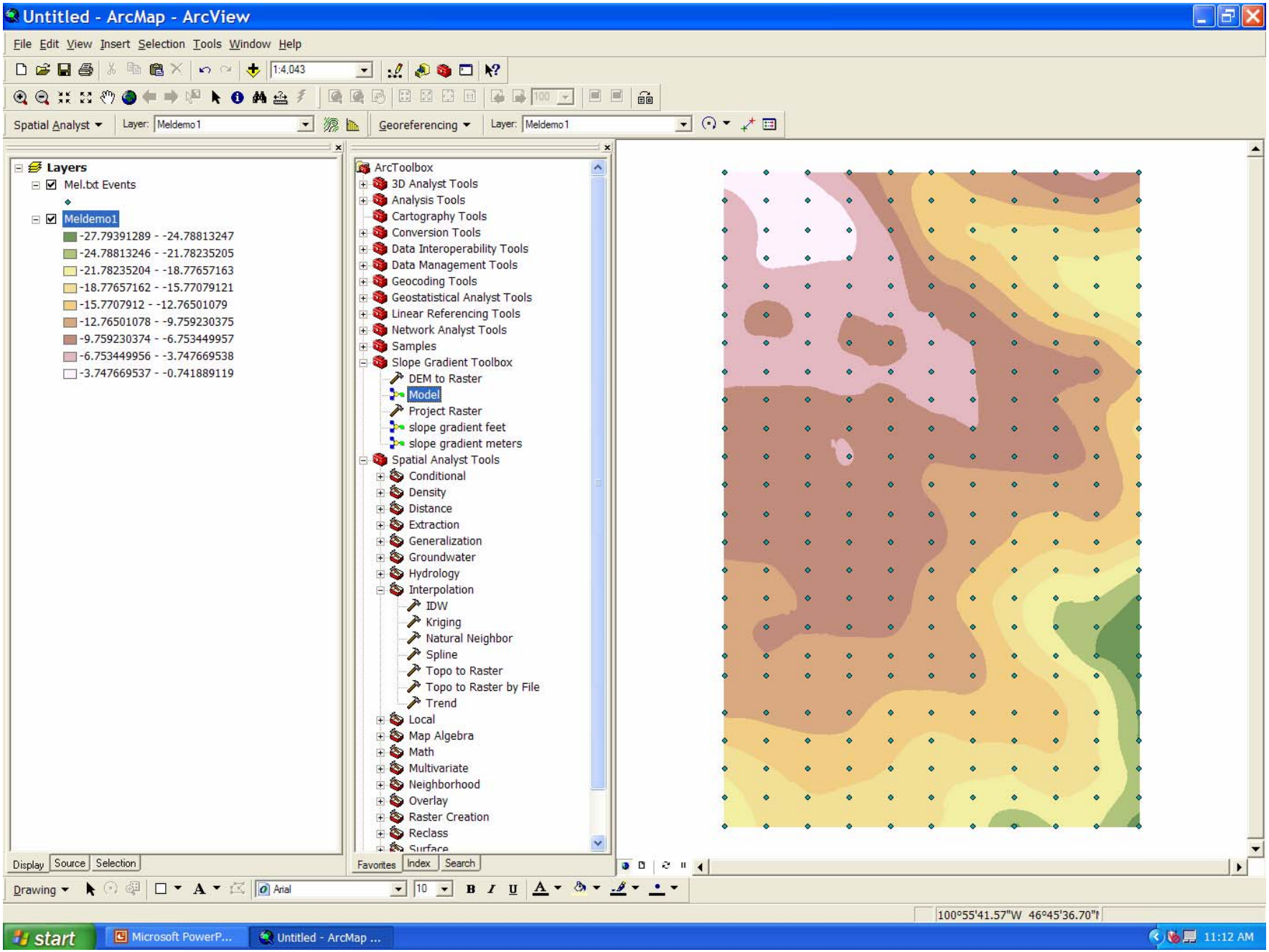

Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:449,470,658
Spatial Analyst
Georeferencing
Layer: Manec.tif
Layers
Manec.tif
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Database
Domains
Feature class
Features
Fields
General
Generalization
Indexes
Joins
Layers and Table Views
Projections and Transformations
Feature
Raster
Flip
Mirror
Project Raster
Rescale
Rotate
Shift
Warp
Define Projection
Raster
Subtypes
Table
Workspace
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Network Analyst Tools
Samples
Spatial Analyst Tools
Spatial Statistics Tools
Display Source Selection
Favorites Index Search
Drawing
Arial
10
352634°9'18.65"E 5180120°42
start
Untitled - ArcMap ...
Microsoft PowerP...
Microsoft PhotoDr...
ERDAS IMAGINE 8.7
Viewer #1
IFAFSSPAC
Surfer - [ECtop.srf]
10:30 AM

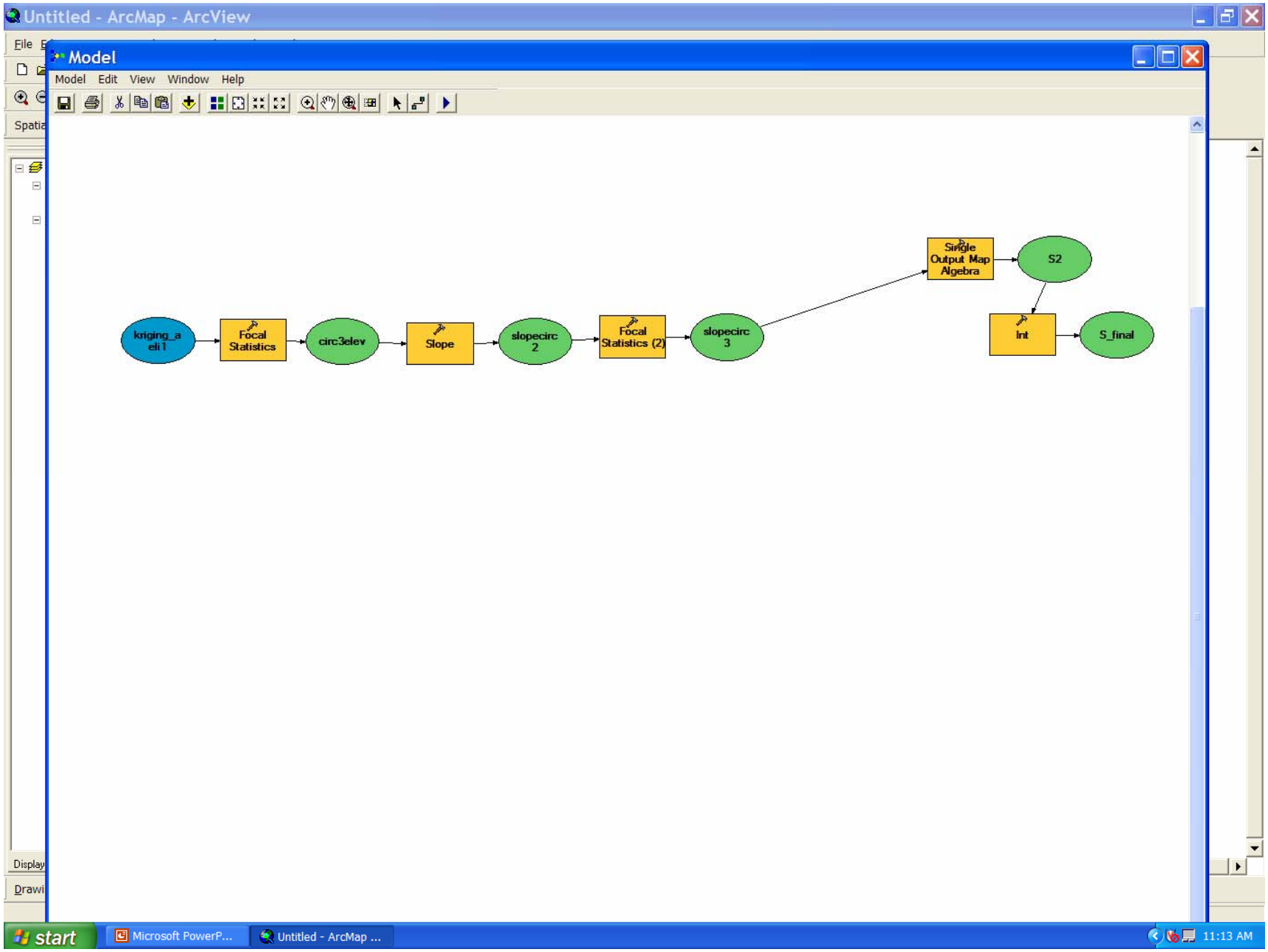

Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:449,470,658
Spatial Analyst
Georeferencing
Layer: Manec.tif
Layers
Manec.tif
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Database
Domains
Feature class
Project Raster
Input raster
C:\MyFiles\IFAFS\Mandan\Manec.tif
Output raster
C:\MyFiles\IFAFS\Mandan\Manecpj
Output coordinate system
WGS_1984_UTM_Zone_14N
Resampling technique (optional)
NEAREST
Output cell size (optional)
1.342801
OK
Cancel
Environments...
<< Hide Help
Help
Output coordinate system
The coordinate system for the geometry column.
The default is the same as in the Spatial Reference Settings environment.
Linear Referencing Tools
Network Analyst Tools
Samples
Spatial Analyst Tools
Spatial Statistics Tools
Display
Source
Selection
Favorites
Index
Search
Drawing
Arial
10
Projects a raster
352638°25'59.42"E 5180428°4
start
Untitled - Arc...
Project Raster
Microsoft Pow...
Microsoft Phot...
ERDAS IMAGI...
Viewer #1
IFAFSSPAC
Surfer - [ECto...
10:32 AM

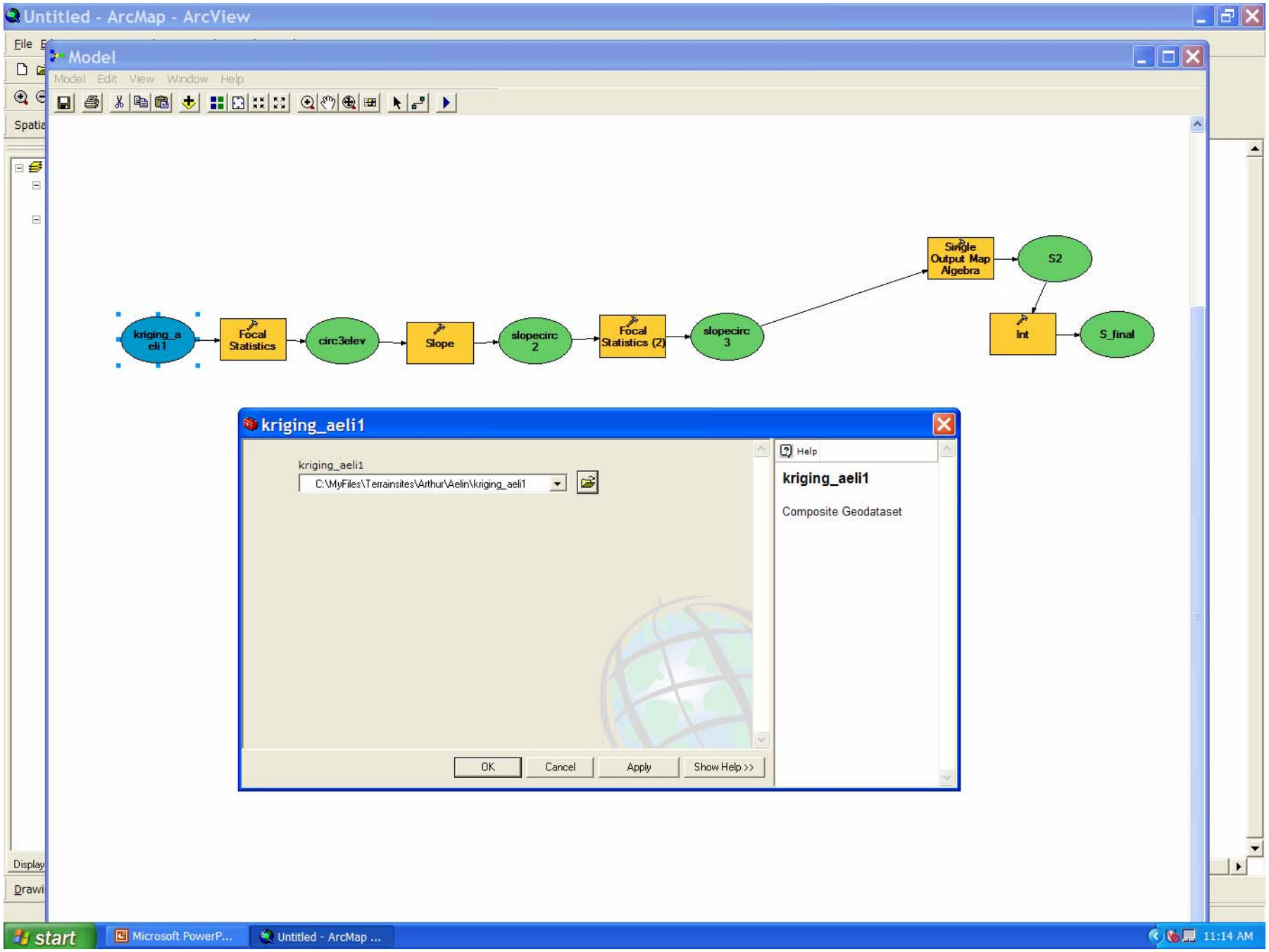

Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:4,039
Spatial Analyst
Select Features
Georeferencing
Layer: Manec.tif
Layers
manecpj1.img
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
manecpj
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
Manec1.img
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
Manec.tif
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
Display Source Selection
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Database
Domains
Feature class
Features
Fields
General
Generalization
Indexes
Joins
Layers and Table Views
Projections and Transformations
Feature
Raster
Flip
Mirror
Project Raster
Rescale
Rotate
Shift
Warp
Define Projection
Raster
Subtypes
Table
Workspace
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Network Analyst Tools
Samples
Spatial Analyst Tools
Spatial Statistics Tools
Favorites Index Search
Drawing
Arial
10
Select features by clicking or dragging a box
352628.12 5180254.66 Meters
start
Microsoft Pow...
Microsoft Phot...
ERDAS IMAGIN...
Viewer #1
IFAFSSPAC
Surfer - [ECto...
Untitled - ArcM...
ArcCatalog - A...
11:20 AM


Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:4,043
Spatial Analyst
Layer: Meldemo1
Georeferencing
Layer: Meldemo1
Layers
Mel.txt Events
Meldemo1
-27.79391289 - -24.78813247
-24.78813246 - -21.78235205
-21.78235204 - -18.77657163
-18.77657162 - -15.7707912
-15.7707912 - -12.76501079
-12.76501078 - -9.759230375
-9.759230374 - -6.753449957
-6.753449956 - -3.747669538
-3.747669537 - -0.741889119
Display
Source
Selection
ArcToolbox
New Toolbox
Add Toolbox...
Environments...
Hide Locked Tools
Save Settings
Load Settings
Linear Referencing Tools
Network Analyst Tools
Samples
Spatial Analyst Tools
Conditional
Density
Distance
Extraction
Generalization
Groundwater
Hydrology
Interpolation
IDW
Kriging
Natural Neighbor
Spline
Topo to Raster
Topo to Raster by File
Trend
Local
Map Algebra
Math
Multivariate
Neighborhood
Overlay
Raster Creation
Reclass
Surface
Zonal
Spatial Statistics Tools
Favorites
Index
Search
Drawing
Arial
10
100°55'37.45"W 46°45'27.87"
start
Microsoft PowerP...
Untitled - ArcMap ...
11:06 AM


Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:4,043
Spatial Analyst
Layer: Meldemo1
Georeferencing
Layer: Meldemo1
Layers
Mel.txt Events
Meldemo1
-27.79391289 - -24.78813247
-24.78813246 - -21.78235205
-21.78235204 - -18.77657163
-18.77657162 - -15.77079121
-15.7707912 - -12.76501079
-12.76501078 - -9.759230375
-9.759230374 - -6.753449957
-6.753449956 - -3.747669538
-3.747669537 - -0.741889119
Display
Source
Selection
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Network Analyst Tools
Samples
Slope Gradient Toolbox
Spatial Analyst Tools
Conditional
Density
Distance
Extraction
Generalization
Groundwater
Hydrology
Interpolation
IDW
Kriging
Natural Neighbor
Spline
Topo to Raster
Topo to Raster by File
Trend
Local
Map Algebra
Math
Multivariate
Neighborhood
Overlay
Raster Creation
Reclass
Surface
Zonal
Spatial Statistics Tools
Favorites
Index
Search
Drawing
Arial
10
Adds a toolbox to the ArcToolbox
100°55'41.85"W 46°45'34.41"N
start
Microsoft PowerP...
Untitled - ArcMap ...
11:11 AM


Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:4,043
Spatial Analyst
Layer: Meldemo1
Georeferencing
Layer: Meldemo1
Layers
Mel.txt Events
Meldemo1
-27.79391289 - -24.78813247
-24.78813246 - -21.78235205
-21.78235204 - -18.77657163
-18.77657162 - -15.77079121
-15.7707912 - -12.76501079
-12.76501078 - -9.759230375
-9.759230374 - -6.753449957
-6.753449956 - -3.747669538
-3.747669537 - -0.741889119
Display
Source
Selection
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Network Analyst Tools
Samples
Slope Gradient Toolbox
DEM to Raster
Model
Project Raster
slope gradient feet
slope gradient meters
Spatial Analyst Tools
Conditional
Density
Distance
Extraction
Generalization
Groundwater
Hydrology
Interpolation
IDW
Kriging
Natural Neighbor
Spline
Topo to Raster
Topo to Raster by File
Trend
Local
Map Algebra
Math
Multivariate
Neighborhood
Overlay
Raster Creation
Reclass
Favorites
Index
Search
Drawing
Arial
10
100°55'41.57"W 46°45'36.70"
start
Microsoft PowerP...
Untitled - ArcMap ...
11:12 AM

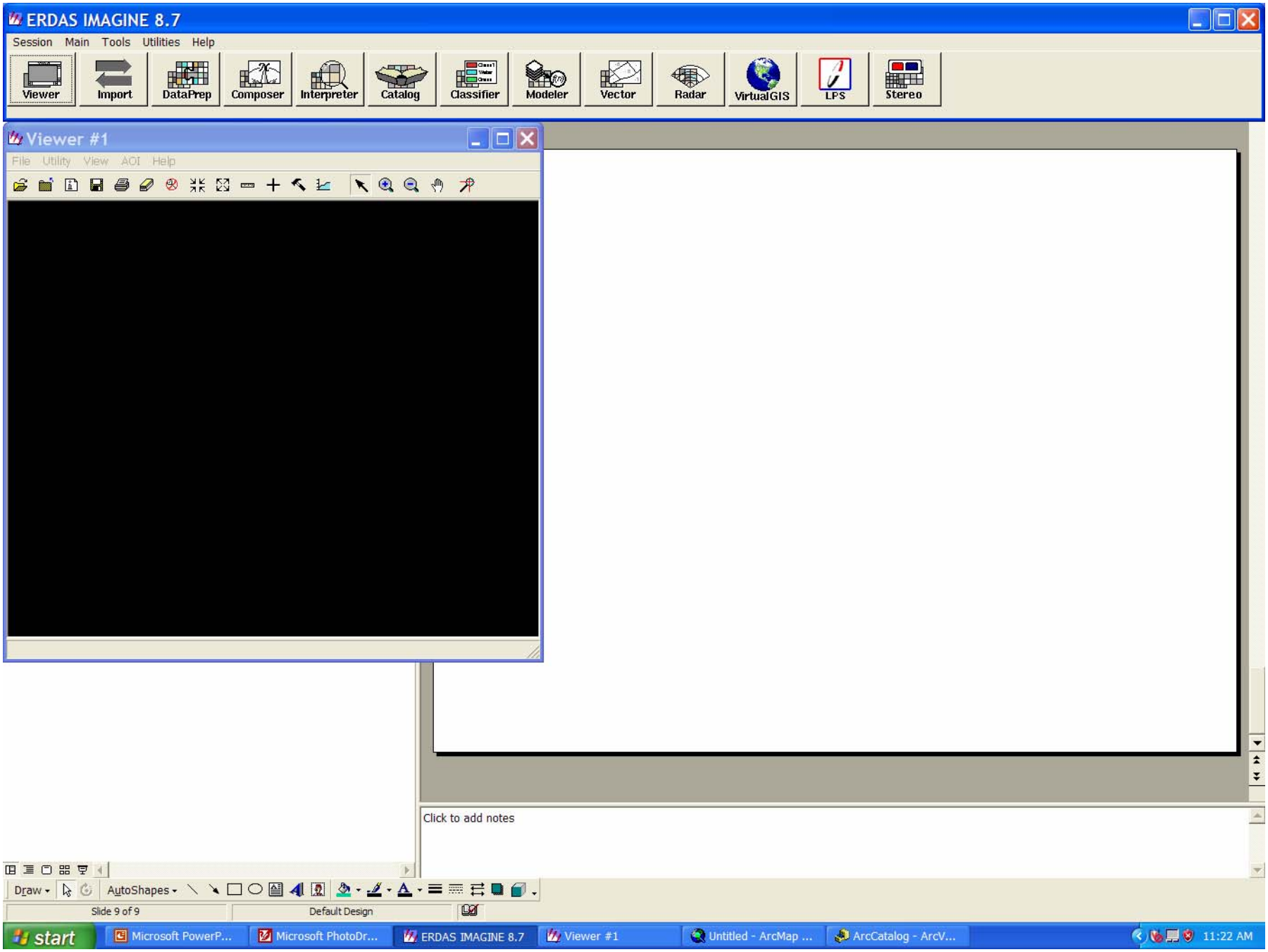

Untitled - ArcMap - ArcView
Model
Model Edit View Window Help
kriging_a eli1
Focal Statistics
circ3elev
Slope
slopecirc 2
Focal Statistics (2)
slopecirc 3
Single Output Map Algebra
S2
Int
S_final
start
Microsoft PowerP...
Untitled - ArcMap ...
11:13 AM

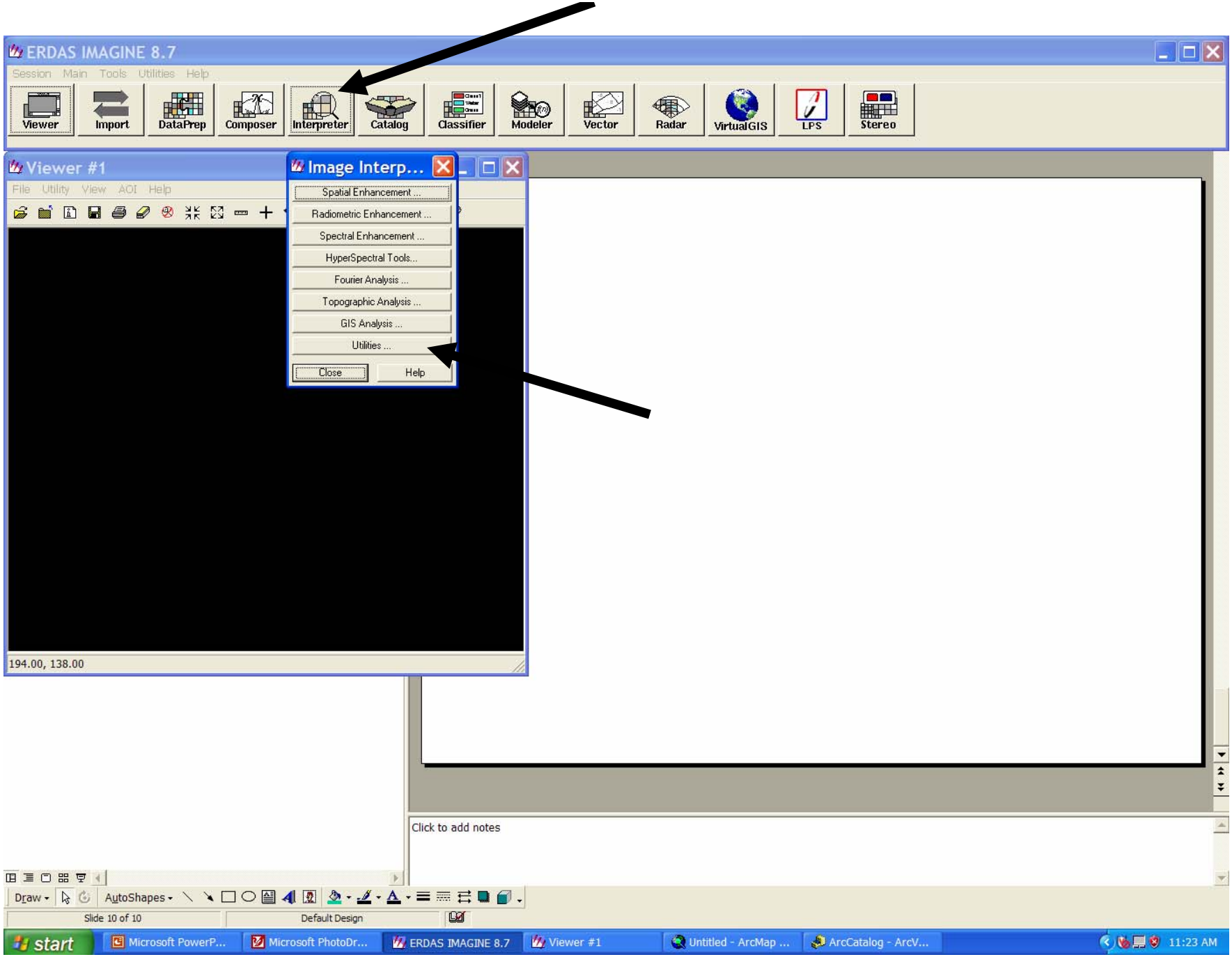

Untitled - ArcMap - ArcView
Model
Model Edit View Window Help
kriging_aeli1
Focal Statistics
circ3elev
Slope
slopecirc 2
Focal Statistics (2)
slopecirc 3
Single Output Map Algebra
S2
Int
S_final
kriging_aeli1
kriging_aeli1
C:\MyFiles\Terrainsites\Arthur\Aelin\kriging_aeli1
OK
Cancel
Apply
Show Help >>
Help
kriging_aeli1
Composite Geodataset
start
Microsoft PowerP...
Untitled - ArcMap ...
11:14 AM

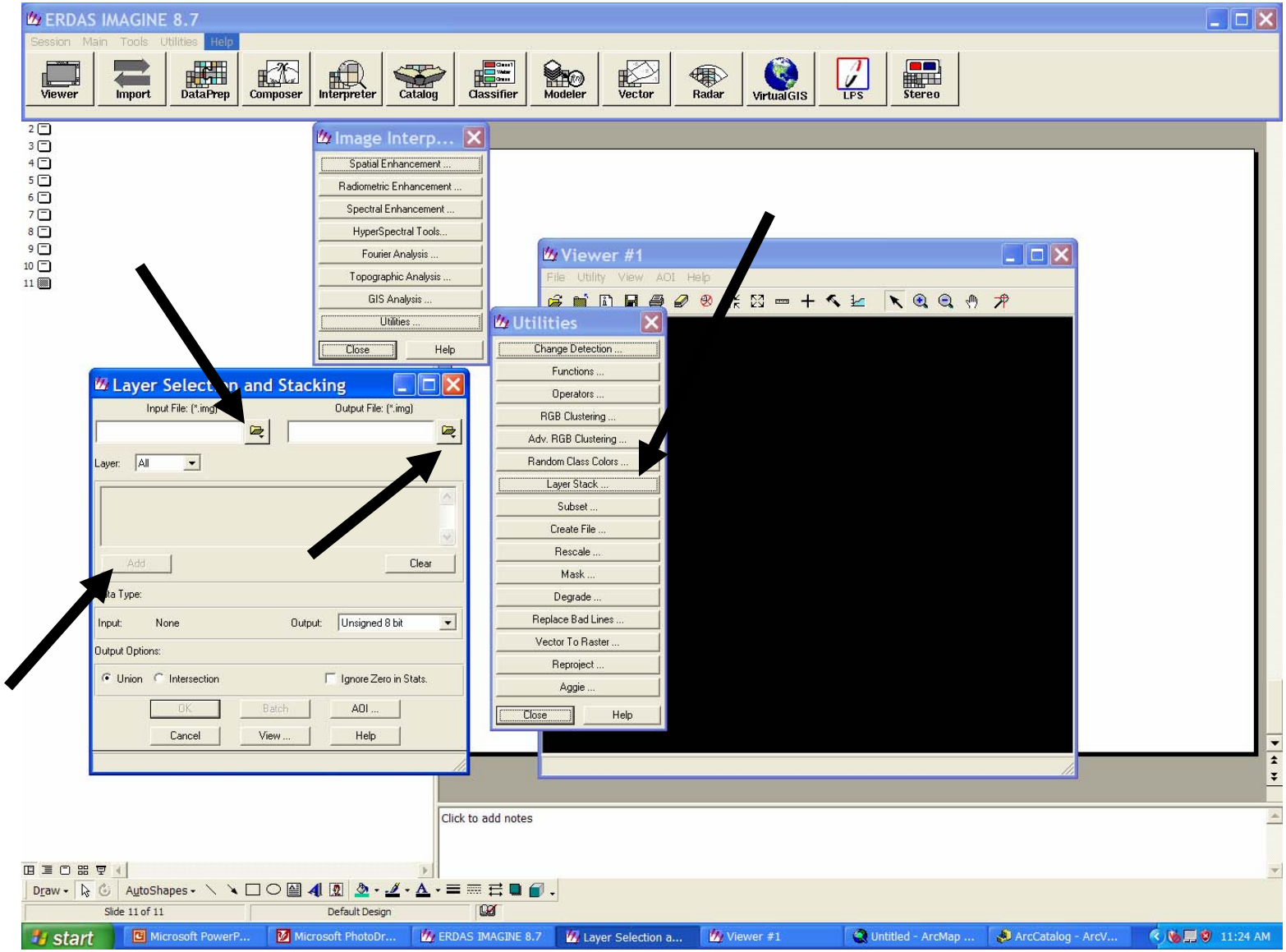
Once all parameters for the slope gradient model are completed, the slope gradient for the field will be computed and plotted. Save the image created as a .img file.

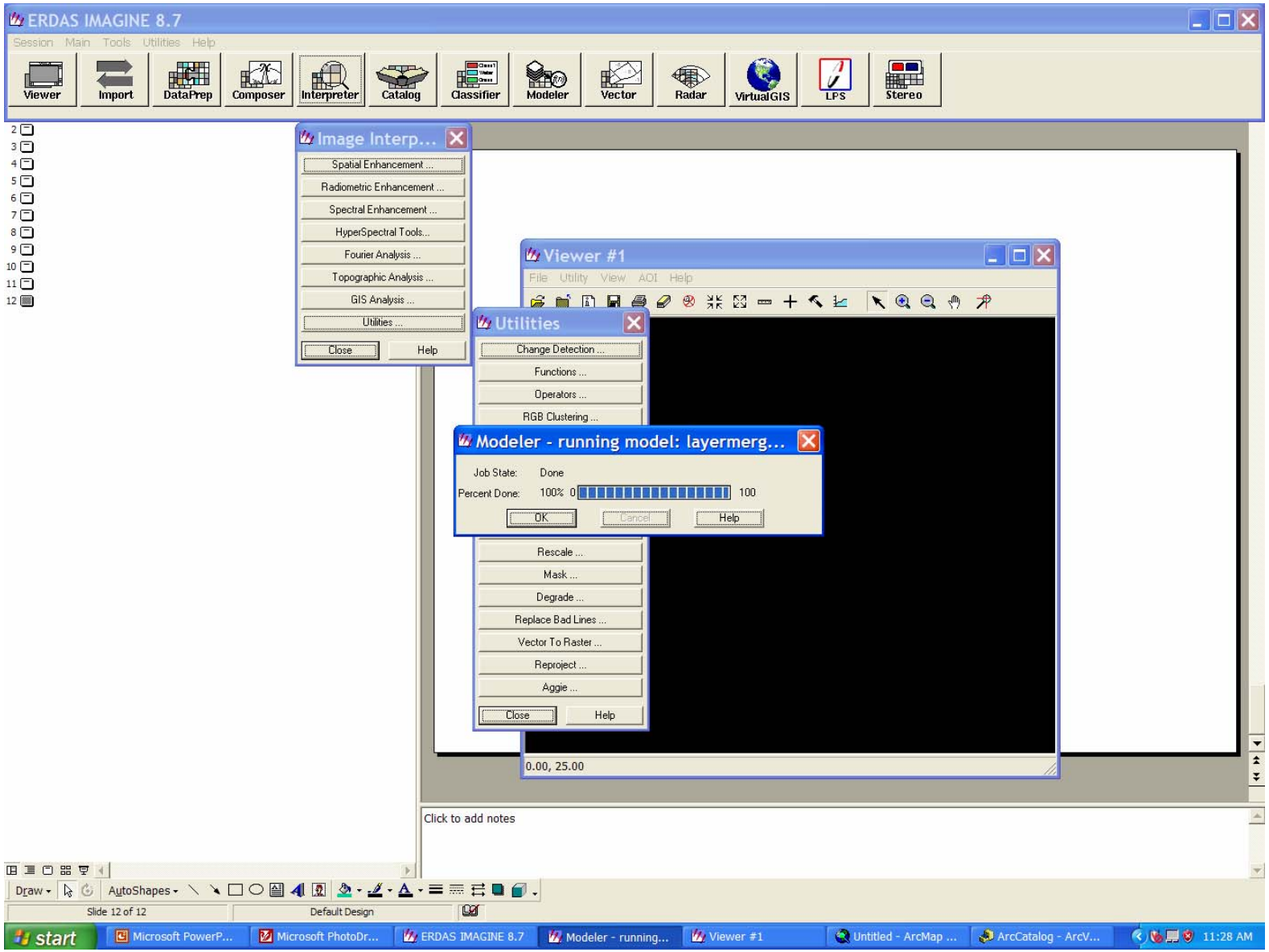
If we decide to look at one data layer, such as satellite imager, or relief, ArcView can classify alone. X, Y, Z data classifies well, imagery much less so.

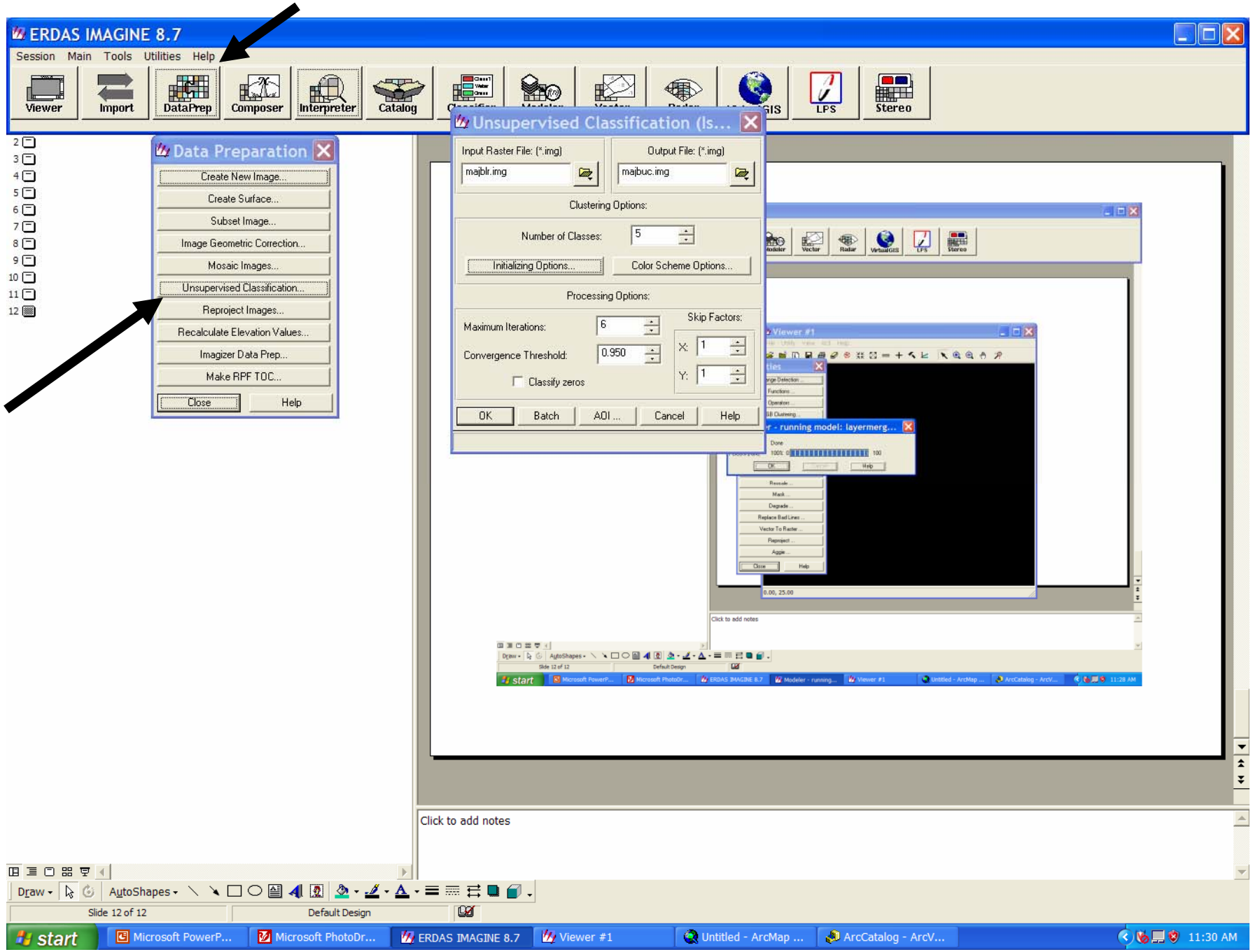
However, if we decide we want to merge or layer more than one data set, ArcView is not good at that. Erdas Imagine is much better, although its blackbox approach bothers me.

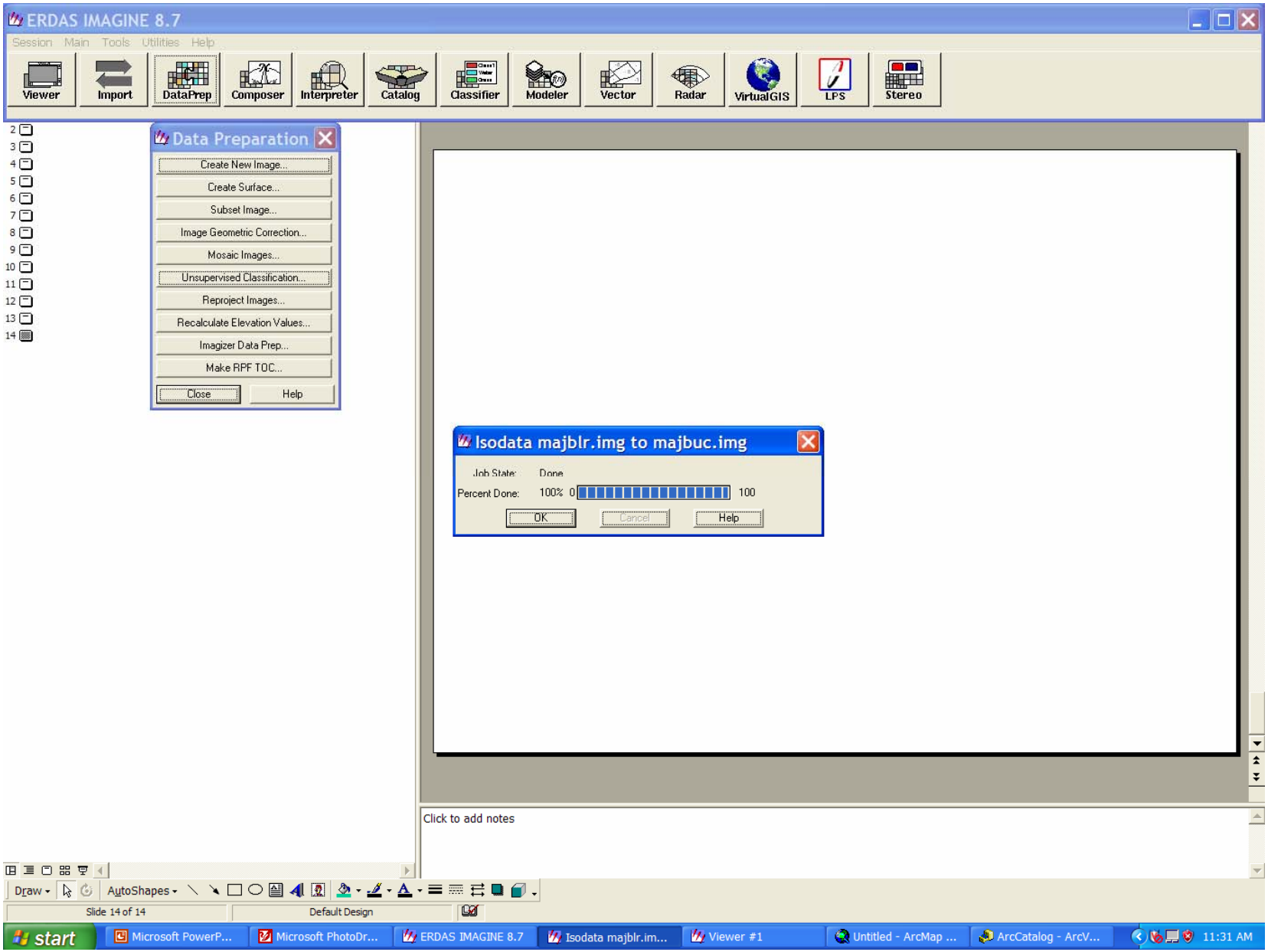

ERDAS IMAGINE 8.7
Session Main Tools Utilities Help
Viewer
Import
DataPrep
Composer
Interpreter
Catalog
Classifier
Modeler
Vector
Radar
VirtualGIS
LPS
Stereo
Viewer #1
File Utility View AOI Help
Click to add notes
Draw
AutoShapes
Slide 9 of 9
Default Design
start
Microsoft PowerP...
Microsoft PhotoDr...
ERDAS IMAGINE 8.7
Viewer #1
Untitled - ArcMap ...
ArcCatalog - ArcV...
11:22 AM

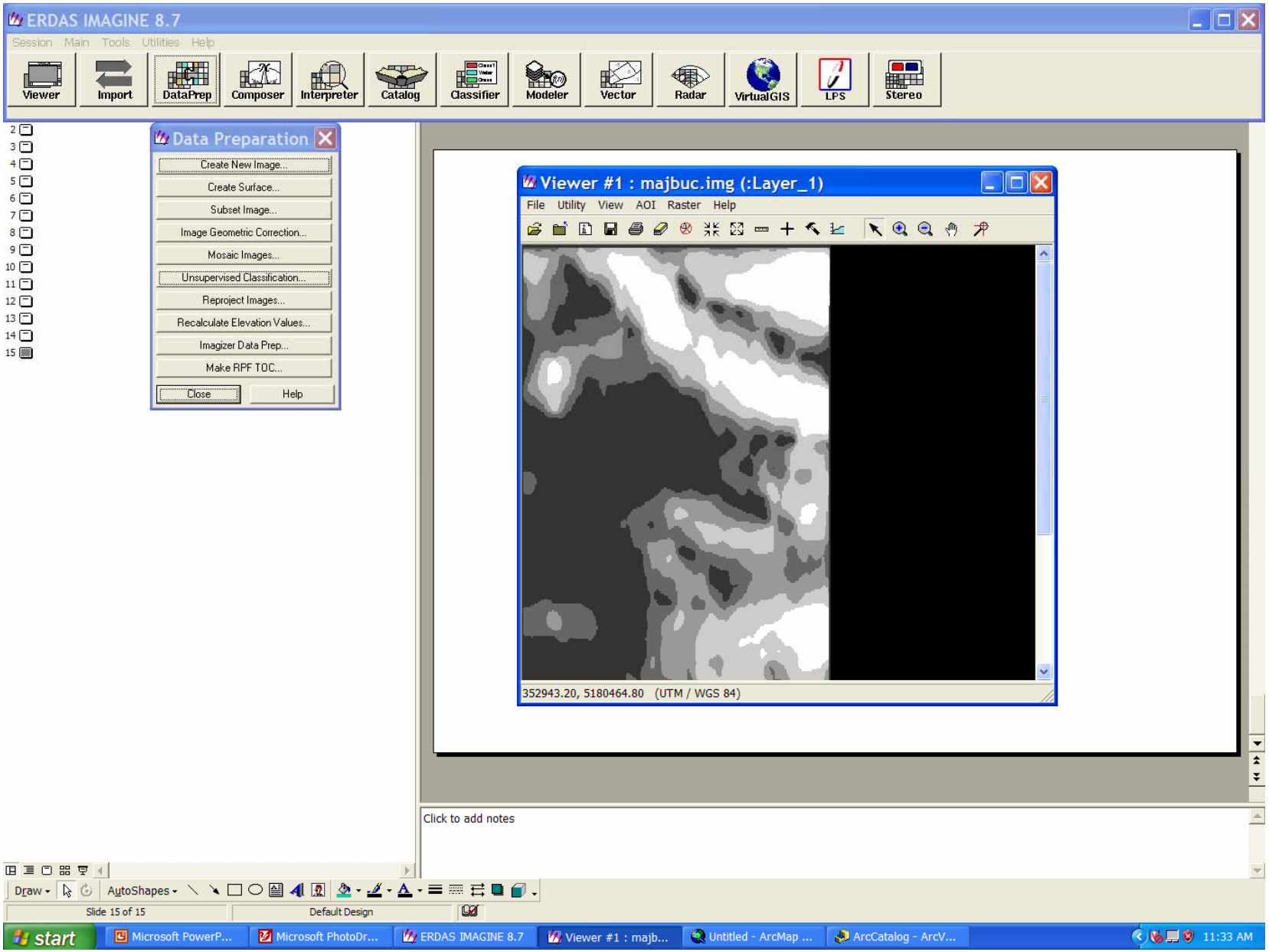

ERDAS IMAGINE 8.7
Session Main Tools Utilities Help
Viewer
Import
DataPrep
Composer
Interpreter
Catalog
Classifier
Modeler
Vector
Radar
VirtualGIS
LPS
Stereo
Viewer #1
File Utility View AOI Help
194.00, 138.00
Image Interp...
Spatial Enhancement ...
Radiometric Enhancement ...
Spectral Enhancement ...
HyperSpectral Tools...
Fourier Analysis ...
Topographic Analysis ...
GIS Analysis ...
Utilities ...
Close
Help
Click to add notes
Draw
AutoShapes
Slide 10 of 10
Default Design
start
Microsoft PowerP...
Microsoft PhotoDr...
ERDAS IMAGINE 8.7
Viewer #1
Untitled - ArcMap ...
ArcCatalog - ArcV...
11:23 AM

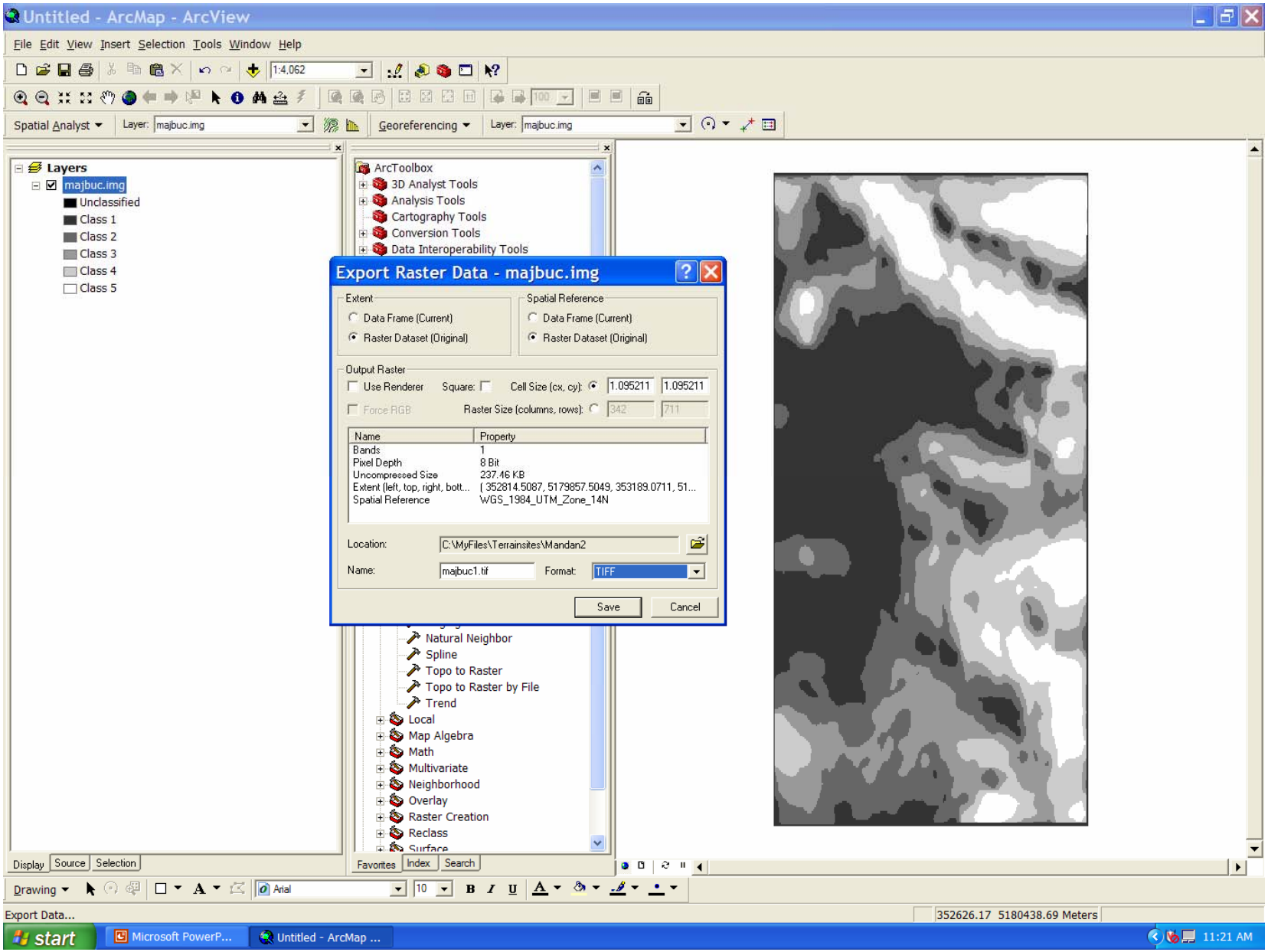

ERDAS IMAGINE 8.7
Session Main Tools Utilities Help
Viewer
Import
DataPrep
Composer
Interpreter
Catalog
Classifier
Modeler
Vector
Radar
VirtualGIS
LPS
Stereo
Image Interp...
Spatial Enhancement ...
Radiometric Enhancement ...
Spectral Enhancement ...
HyperSpectral Tools...
Fourier Analysis ...
Topographic Analysis ...
GIS Analysis ...
Utilities ...
Close
Help
Viewer #1
File Utility View AOI Help
Utilities
Change Detection ...
Functions ...
Operators ...
RGB Clustering ...
Adv. RGB Clustering ...
Random Class Colors ...
Layer Stack ...
Subset ...
Create File ...
Rescale ...
Mask ...
Degrade ...
Replace Bad Lines ...
Vector To Raster ...
Reproject ...
Aggie ...
Close
Help
Layer Selection and Stacking
Input File: (*.img)
Output File: (*.img)
Layer: All
Add
Clear
Input: None
Output: Unsigned 8 bit
Output Options:
Union
Intersection
Ignore Zero in Stats.
OK
Batch
AOI ...
Cancel
View ...
Help
Click to add notes
Draw
AutoShapes
Slide 11 of 11
Default Design
start
Microsoft PowerP...
Microsoft PhotoDr...
ERDAS IMAGINE 8.7
Layer Selection a...
Viewer #1
Untitled - ArcMap ...
ArcCatalog - ArcV...
11:24 AM

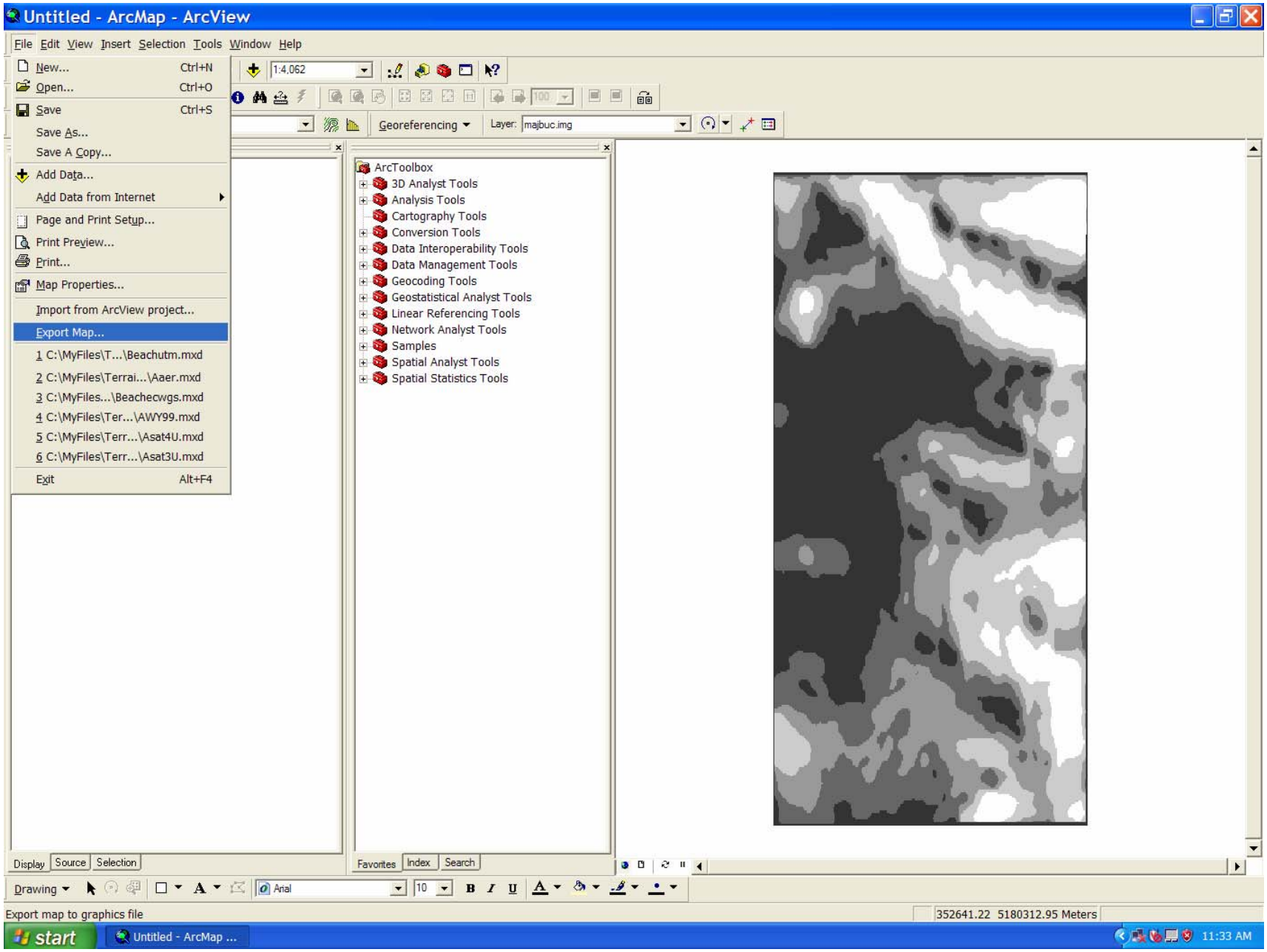

ERDAS IMAGINE 8.7
Session Main Tools Utilities Help
Viewer
Import
DataPrep
Composer
Interpreter
Catalog
Classifier
Modeler
Vector
Radar
VirtualGIS
LPS
Stereo
Image Interp...
Spatial Enhancement ...
Radiometric Enhancement ...
Spectral Enhancement ...
HyperSpectral Tools...
Fourier Analysis ...
Topographic Analysis ...
GIS Analysis ...
Utilities ...
Close
Help
Viewer #1
File Utility View AOI Help
Utilities
Change Detection ...
Functions ...
Operators ...
RGB Clustering ...
Modeler - running model: layermerg...
Job State: Done
Percent Done: 100% 0 100
OK
Cancel
Help
Rescale ...
Mask ...
Degrade ...
Replace Bad Lines ...
Vector To Raster ...
Reproject ...
Aggie ...
Close
Help
0.00, 25.00
Click to add notes
Draw
AutoShapes
Slide 12 of 12
Default Design
start
Microsoft PowerP...
Microsoft PhotoDr...
ERDAS IMAGINE 8.7
Modeler - running...
Viewer #1
Untitled - ArcMap ...
ArcCatalog - ArcV...
11:28 AM

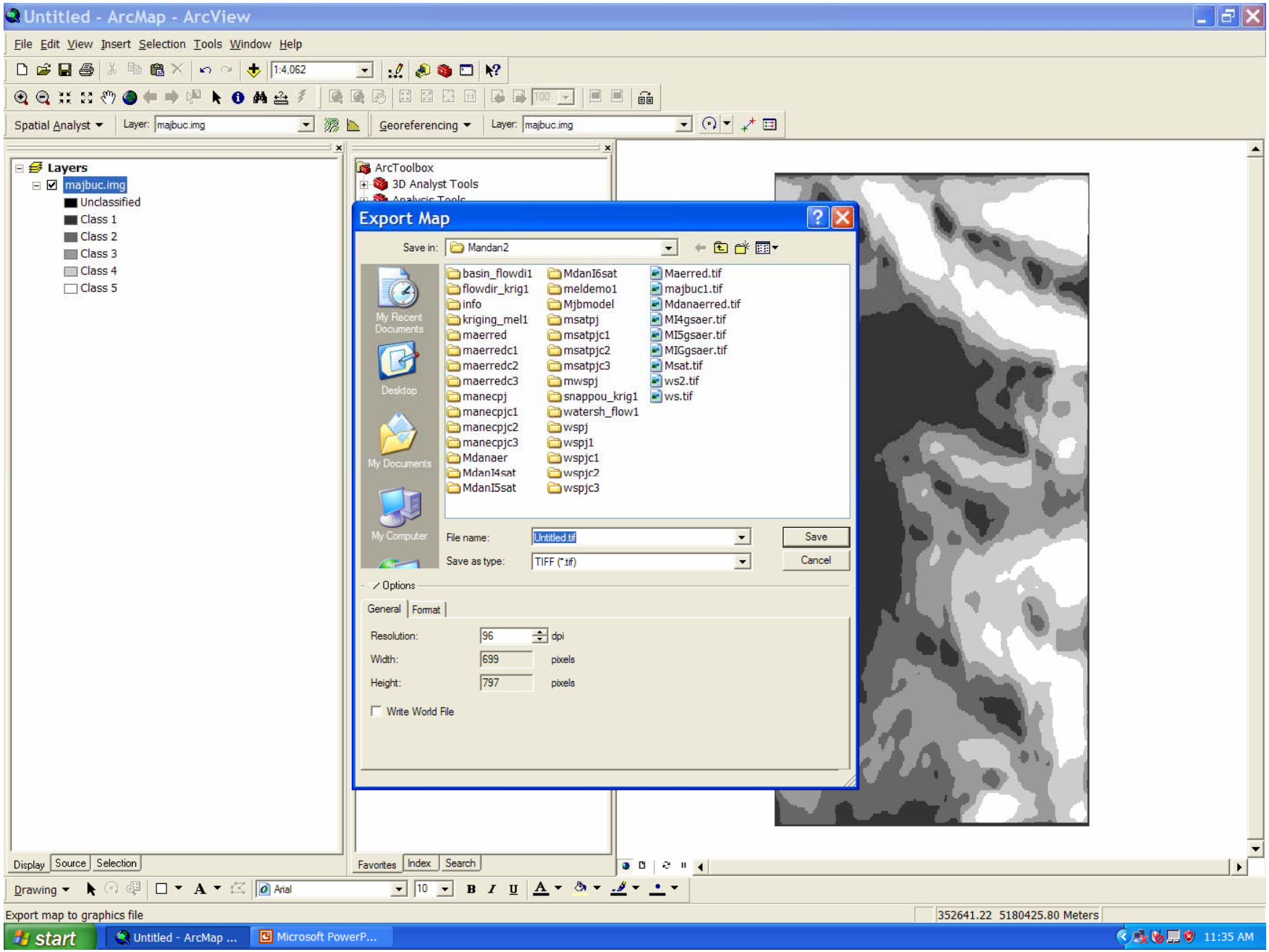

ERDAS IMAGINE 8.7
Session Main Tools Utilities Help
Viewer
Import
DataPrep
Composer
Interpreter
Catalog
LPS
Stereo
Data Preparation
Create New Image...
Create Surface...
Subset Image...
Image Geometric Correction...
Mosaic Images...
Unsupervised Classification...
Reproject Images...
Recalculate Elevation Values...
Imagizer Data Prep...
Make RPF TOC...
Close
Help
Unsupervised Classification (Is...
Input Raster File: (*.img)
majblr.img
Output File: (*.img)
majbuc.img
Clustering Options:
Number of Classes:
5
Initializing Options...
Color Scheme Options...
Processing Options:
Maximum Iterations:
6
Convergence Threshold:
0.950
Classify zeros
Skip Factors:
X:
1
Y:
1
OK
Batch
AOI ...
Cancel
Help
Click to add notes
Draw
AutoShapes
Slide 12 of 12
Default Design
start
Microsoft PowerP...
Microsoft PhotoDr...
ERDAS IMAGINE 8.7
Viewer #1
Untitled - ArcMap ...
ArcCatalog - ArcV...
11:30 AM


ERDAS IMAGINE 8.7
Session Main Tools Utilities Help
Viewer
Import
DataPrep
Composer
Interpreter
Catalog
Classifier
Modeler
Vector
Radar
VirtualGIS
LPS
Stereo
Data Preparation
Create New Image...
Create Surface...
Subset Image...
Image Geometric Correction...
Mosaic Images...
Unsupervised Classification...
Reproject Images...
Recalculate Elevation Values...
Imagizer Data Prep...
Make RPF TOC...
Close
Help
Isodata majblr.img to majbuc.img
Job State: Done
Percent Done: 100% 0 100
OK
Cancel
Help
Click to add notes
Draw
AutoShapes
Slide 14 of 14
Default Design
start
Microsoft PowerP...
Microsoft PhotoDr...
ERDAS IMAGINE 8.7
Isodata majblr.im...
Viewer #1
Untitled - ArcMap ...
ArcCatalog - ArcV...
11:31 AM


ERDAS IMAGINE 8.7
Session Main Tools Utilities Help
Viewer
Import
DataPrep
Composer
Interpreter
Catalog
Classifier
Modeler
Vector
Radar
VirtualGIS
LPS
Stereo
Data Preparation
Create New Image...
Create Surface...
Subset Image...
Image Geometric Correction...
Mosaic Images...
Unsupervised Classification...
Reproject Images...
Recalculate Elevation Values...
Imagizer Data Prep...
Make RPF TOC...
Close
Help
Viewer #1 : majbuc.img (:Layer_1)
File Utility View AOI Raster Help
352943.20, 5180464.80 (UTM / WGS 84)
Click to add notes
Draw
AutoShapes
Slide 15 of 15
Default Design
start
Microsoft PowerP...
Microsoft PhotoDr...
ERDAS IMAGINE 8.7
Viewer #1 : majb...
Untitled - ArcMap ...
ArcCatalog - ArcV...
11:33 AM

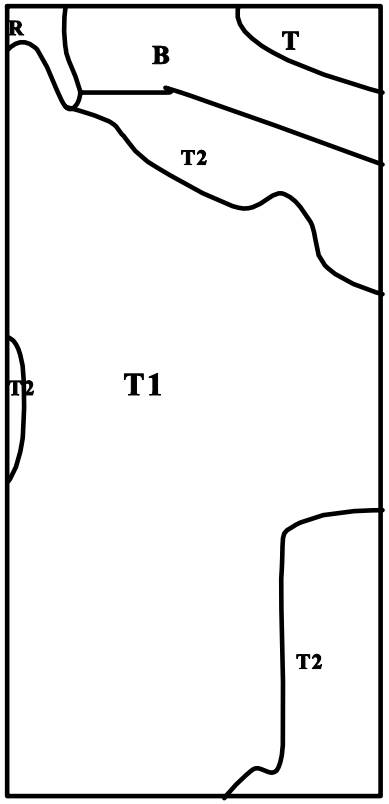

Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:4,062
Spatial Analyst
Layer: majbuc.img
Georeferencing
Layer: majbuc.img
Layers
majbuc.img
Unclassified
Class 1
Class 2
Class 3
Class 4
Class 5
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Export Raster Data - majbuc.img
Extent
Data Frame (Current)
Raster Dataset (Original)
Spatial Reference
Data Frame (Current)
Raster Dataset (Original)
Output Raster
Use Renderer
Square:
Cell Size (cx, cy):
1.095211
1.095211
Force RGB
Raster Size (columns, rows):
342
711
Name
Property
Bands
1
Pixel Depth
8 Bit
Uncompressed Size
237.46 KB
Extent (left, top, right, bott...
(352814.5087, 5179857.5049, 353189.0711, 51...
Spatial Reference
WGS_1984_UTM_Zone_14N
Location:
C:\MyFiles\Terrainsites\Mandan2
Name:
majbuc1.tif
Format:
TIFF
Save
Cancel
Natural Neighbor
Spline
Topo to Raster
Topo to Raster by File
Trend
Local
Map Algebra
Math
Multivariate
Neighborhood
Overlay
Raster Creation
Reclass
Display
Source
Selection
Favorites
Index
Search
Drawing
Arial
10
Export Data...
352626.17 5180438.69 Meters
start
Microsoft PowerP...
Untitled - ArcMap ...
11:21 AM


Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
New... Ctrl+N
Open... Ctrl+O
Save Ctrl+S
Save As...
Save A Copy...
Add Data...
Add Data from Internet
Page and Print Setup...
Print Preview...
Print...
Map Properties...
Import from ArcView project...
Export Map...
1 C:\MyFiles\T...\Beachutm.mxd
2 C:\MyFiles\Terrai...\Aaer.mxd
3 C:\MyFiles...\Beachecwgs.mxd
4 C:\MyFiles\Ter...\AWY99.mxd
5 C:\MyFiles\Terr...\Asat4U.mxd
6 C:\MyFiles\Terr...\Asat3U.mxd
Exit Alt+F4
1:4,062
Georeferencing
Layer: majbuc.img
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Network Analyst Tools
Samples
Spatial Analyst Tools
Spatial Statistics Tools
Display Source Selection
Favorites Index Search
Drawing
Arial
10
Export map to graphics file
352641.22 5180312.95 Meters
start
Untitled - ArcMap ...
11:33 AM

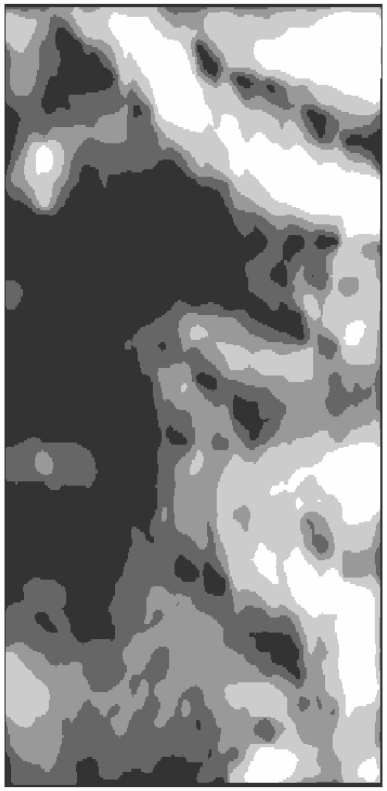

Untitled - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
1:4,062
Spatial Analyst
Layer: majbuc.img
Georeferencing
Layer: majbuc.img
Layers
majbuc.img
Unclassified
Class 1
Class 2
Class 3
Class 4
Class 5
ArcToolbox
3D Analyst Tools
Export Map
Save in: Mandan2
basin_flowdi1
flowdir_krig1
info
kriging_mel1
maerred
maerredc1
maerredc2
maerredc3
manecpj
manecpjc1
manecpjc2
manecpjc3
Mdanaer
MdanI4sat
MdanI5sat
MdanI6sat
meldemo1
Mjbmodel
msatpj
msatpjc1
msatpjc2
msatpjc3
mwspj
snappou_krig1
watersh_flow1
wspj
wspj1
wspjc1
wspjc2
wspjc3
Maerred.tif
majbuc1.tif
Mdanaerred.tif
MI4gsaer.tif
MI5gsaer.tif
MIGgsaer.tif
Msat.tif
ws2.tif
ws.tif
My Recent Documents
Desktop
My Documents
My Computer
File name: Untitled.tif
Save as type: TIFF (*.tif)
Save
Cancel
Options
General
Format
Resolution: 96 dpi
Width: 699 pixels
Height: 797 pixels
Write World File
Display
Source
Selection
Favorites
Index
Search
Drawing
Arial
10
Export map to graphics file
352641.22 5180425.80 Meters
start
Untitled - ArcMap ...
Microsoft PowerP...
11:35 AM

Hydrology
and imagery

Order 2



Slope
gradient
and
imagery



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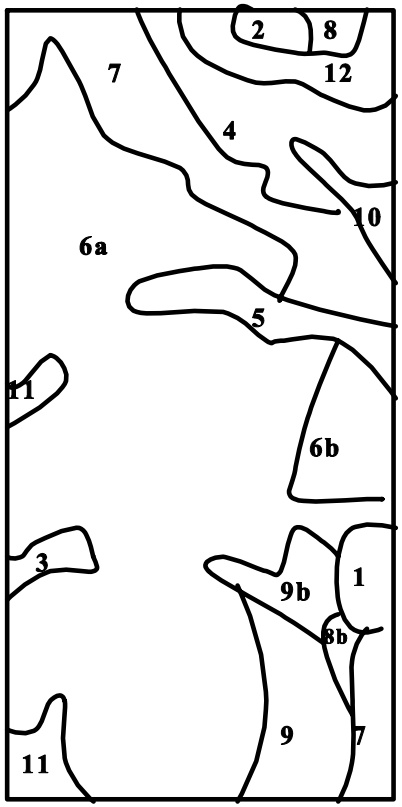
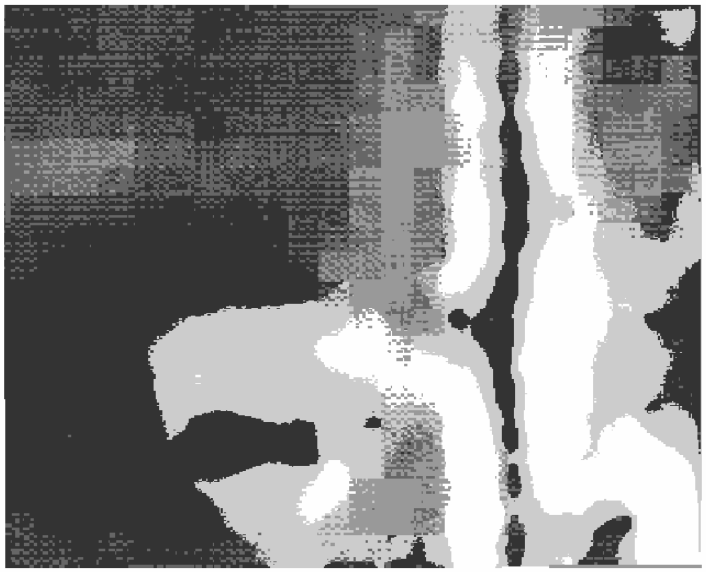
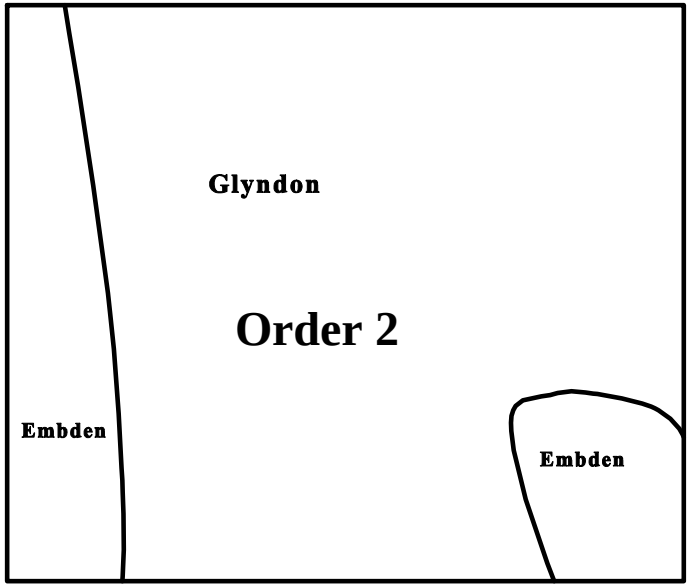


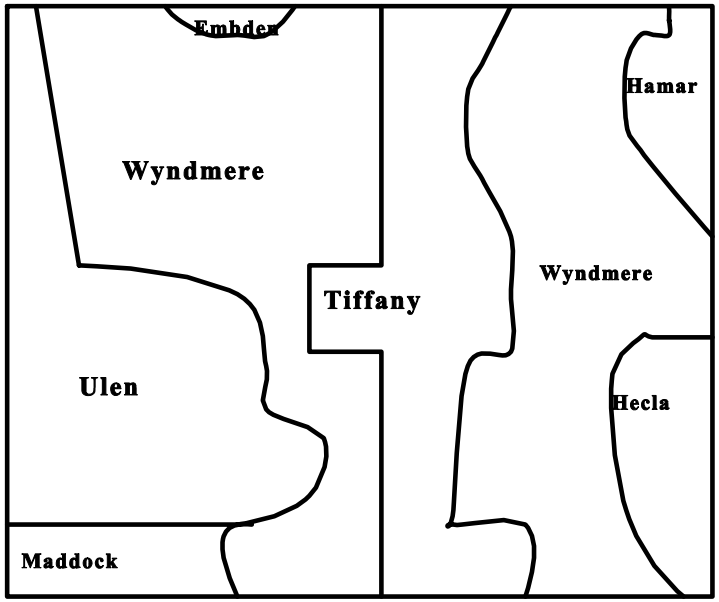
Hydrology and satellite image

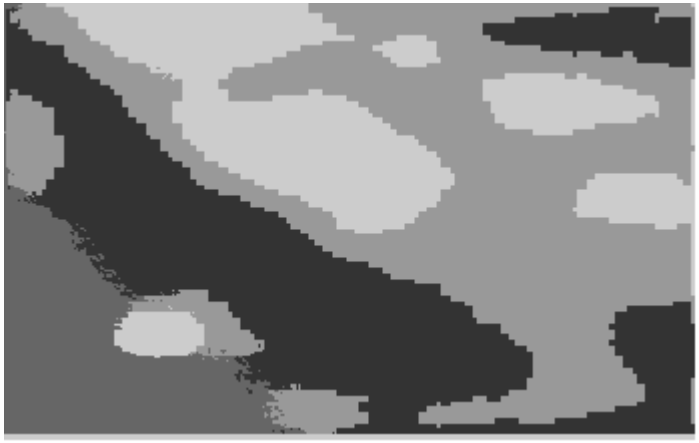


Slope gradient and satellite image

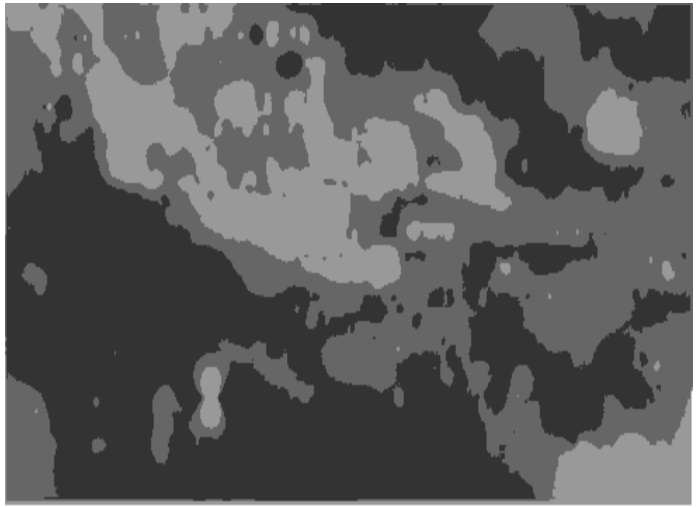


Order 1





Beach, hydrology, satellite

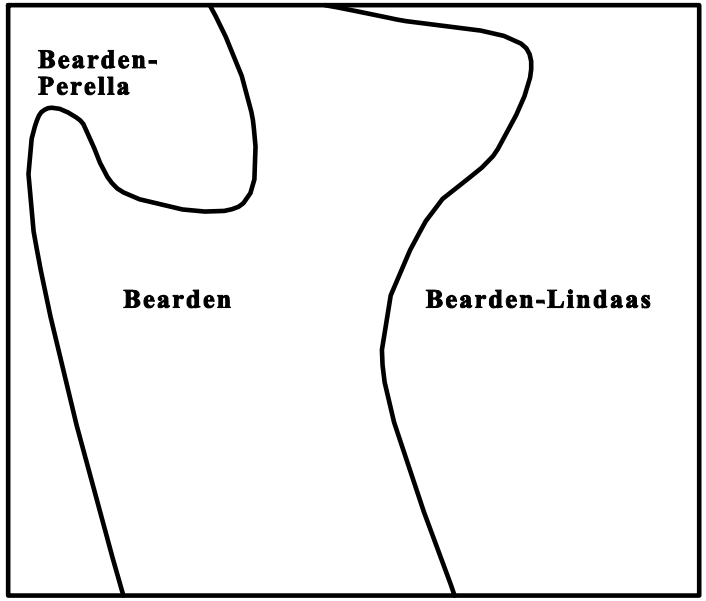


Beach, hydrology, satellite, EC.

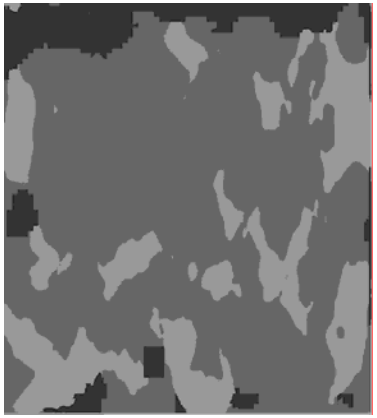
Arthur site

Satellite,
watershed

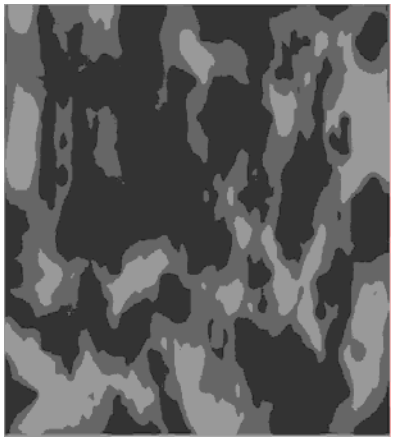
Order 2

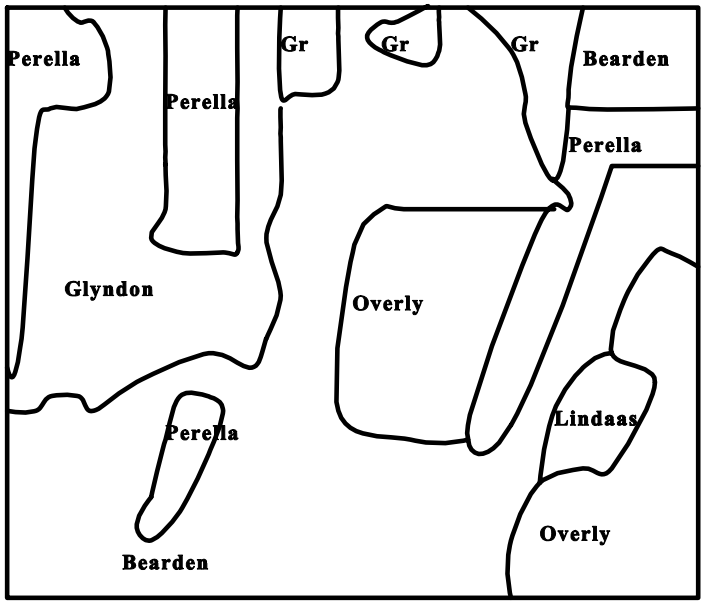


Satellite,
Slope gradient



Aerial,
Slope gradient





Summary-

- **I am using a modified PURC model with elevation as both watershed, and a structured slope gradient**

- **layers include aerial photography and/or satellite imagery (Landsat) and EC when available.**

Results appear positive.

In some fields with small relief differences or gradual fall, structured relief interpretation software is important.

Some sort of additional small-scale data layer, such as EC, may be important to separate out small inclusions.