

i-Tree Eco Random Plots Workbook:

No Stratification

These instructions help users of all skill levels create random UFORE sample points and their associated UFORE-required data within a defined UFORE project area. **NO** stratification of sample plots is performed. ESRI ArcGIS v9.x software is used.

These instructions are composed of four basic steps:

1. Project Area Data Preparation
2. Sample Plot Generation
3. Create UFORE-ready Output

These instructions result in these items:

- Projected Area-of-Interest map layer composed of a single (multi-part) POLYGON.
- Random Sample Plots POINT map layer with UFORE-required fields added and populated.
- Sample Plot Areas POLYGON map layer.
- UFORE Strata Area report text file.
- UFORE Plot List report text file.
- UFORE PRJ file.

Tips

- These instructions require use of a few simple i-Tree tools within the iTree.mxd ArcMap project file that can be downloaded from the i-Tree website.
- Advanced GIS users: primarily follow the bulleted Overviews with attention given to the Detailed Instructions in areas such as field names and types.
- Obtain projection/coordinate system and map unit information from the map data provider.
- Final map units must be either Feet or Meters.
- Area-of-Interest (AOI) examples are large polygons such as: city boundary, park areas, or a management zone(s).
- ESRI Shapefiles, Coverages, or Geodatabases can be used; shapefiles are easiest.
- Practice good file management using folders to hold copies of original data, folders to hold output, employ logical file naming, etc.
- Save the iTree.mxd project periodically through all steps.
- Actions in **red** represent standard ArcGIS operations.
- Actions in **green** represent iTree.mxd toolbar operations.



Project Area Data Preparation

Overview:

- Obtain a GIS map layer representing the Area-of-Interest (AOI) polygon(s) for your project area.
- Launch the ArcMap application of ArcGIS at the ArcView, ArcEditor, or ArcInfo level.
- Open and 'Save As' the **iTree.mxd** project with a new user-defined name at a user-defined location.
- Load the Area-of-Interest (AOI) map layer into the view.
- **Define the projection**/coordinate system of the AOI.
- **Reproject** the AOI to a system using feet or meters if needed.
- **Dissolve** the AOI into a single polygon (single,multi-part polygon if more than one polygon).
- **Add** UFORE-required fields and **Calculate** appropriate values for them

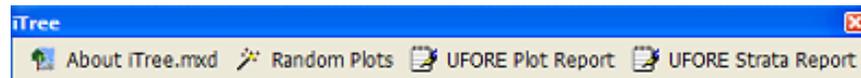
Results:

- Projected AOI map layer composed of a single (possibly multi-part) polygon with UFORE-required fields added and populated.
-

Detailed Instructions:

1. Obtain an Area-of-Interest (AOI) polygon from your GIS Department or an online resource such as ESRI's Geography Network (<http://www.geographynetwork.com/>).
2. Launch ESRI's ArcMap application at the ArcView (or ArcEditor or ArcInfo) level.

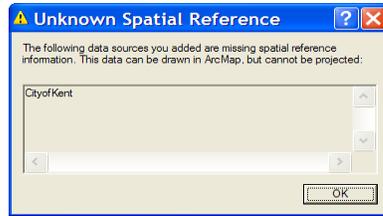
3. Use the open button  to browse for the iTree.mxd downloaded from the i-Tree site.
 - a. The **iTree.mxd** project file contains a custom toolbar for random sample generation and UFORE report output:



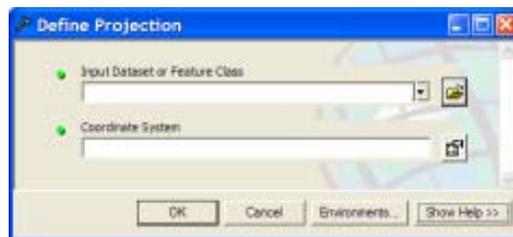
4. Save a copy of the iTree.mxd project with a new name at a new location via the File>Save As menu.

5. Open ArcToolbox  if necessary.

6. Use the Add Data button  to navigate to and load the AOI polygon map layer to the current view.
 - a. An “Unknown Spatial Reference” message may appear; click OK to move past it.



7. Use ArcToolbox to **Define the Projection** of the AOI map layer per your data provider's specifications (*If a projection is already defined, skip to Step 8*):
 - a. Navigate to ArcToolbox>Data Management Tools>Projections and Transformations>Define Projection
 - b. Fill out the Define Projection form:

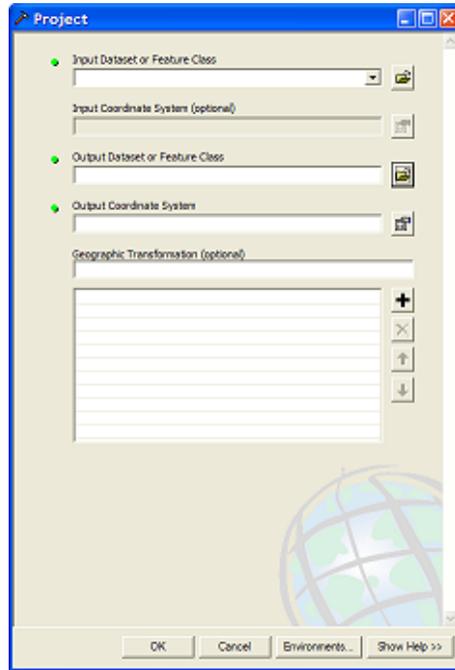


- i. Input Dataset: choose the **AOI map layer** from the drop down.
- ii. Coordinate System: click the properties button  at right and use the ensuing “Spatial Reference Properties” dialog window to navigate to the proper coordinate system via the Select button.



Proper coordinate system is determined by your data provider.

8. If needed, use ArcToolbox to **Reproject** your AOI map layer to a system using feet or meters:
 - a. This system would ideally be one already in use by your organization or a commonly used system such as State Plane or UTM in the United States.
 - b. Navigate to ArcToolbox>Data Management Tools>Projections and Transformations>Feature>Project
 - c. Fill out the ensuing Project form:



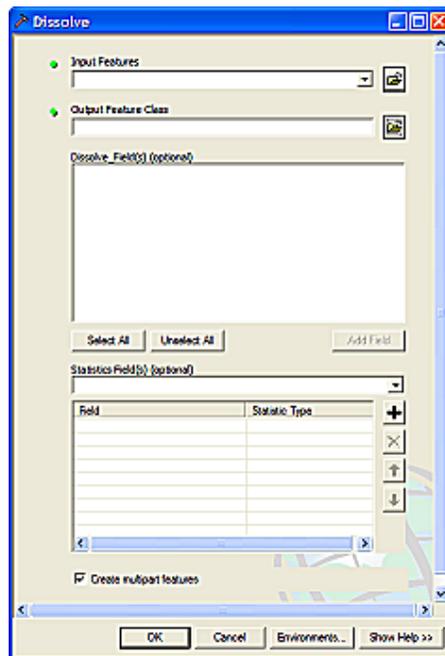
- i. Input Dataset: choose the **AOI map layer** from the drop down.
- ii. Input Coordinate System: Based on Step 7 above, this should be grayed out with the previously defined projection system.
- iii. Output Dataset or Feature Class: use the browse button  to locate a suitable location and filename for the resulting map layer.
- iv. Output Coordinate System: click the properties button  at right and use the ensuing "Spatial Reference Properties" dialog window to navigate to the proper coordinate system via the Select button.



Choose a coordinate system employing either feet or meters.

- v. Geographic Transformation: while marked as “Optional”, select the first choice in the drop down if prompted with an “Undefined Geographic Transformation” message.
- vi. Click OK.

9. If your AOI has more than one polygon, use ArcToolbox to **Dissolve** the them:
 - a. Navigate to ArcToolbox>Data Management Tools>Generalization>Dissolve
 - b. Fill out the ensuing Dissolve form:

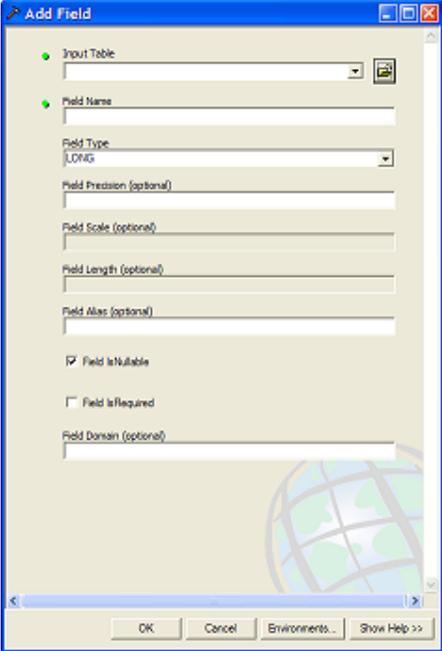


- i. Input Features: choose the projected **AOI map layer** from the drop down list.

- ii. Output Feature Class: use the browse button  to locate a suitable location and filename for the resulting map layer.
- iii. Dissolve Field(s): check the data field whose attribute value unifies the AOI. *Example: a "Name" field containing the city name of an AOI, even across physically separate city sections.*
- iv. Statistics Field(s) : Leave blank.
- v. Create Multipart Features: ensure this option is checked.
- vi. Click OK

10. Use ArcToolbox to **Add** UFORE-required fields to the projected, dissolved, **AOI map layer**:

- a. Navigate to ArcToolbox>Data Management Tools>Fields>Add Field
- b. Fill out the ensuing Add Field form:



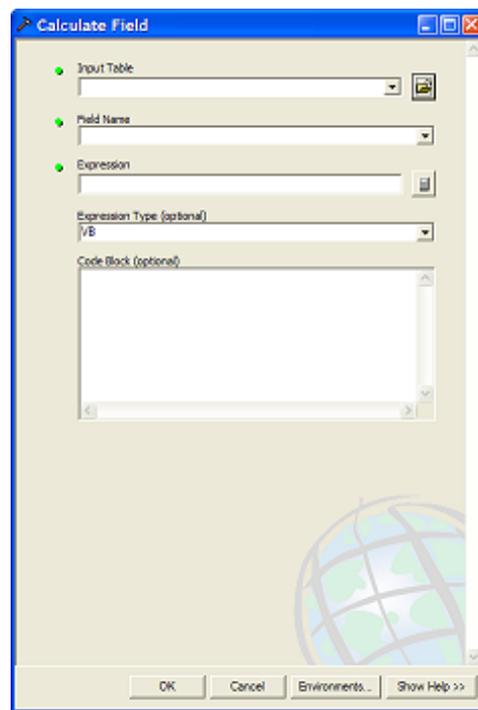
For experienced users, fields could be added via the ArcMap table view as well.

- i. Input Table: select the AOI map layer from the dropdown list.
- ii. Field Name: Enter "Strat_ID" (**no quotes**)
- iii. Field Type: Select LONG from the dropdown list
- iv. Field Precision: Skip this entry
- v. Field Scale: Skip this entry
- vi. Field Length: Skip this entry
- vii. Field Alias: Skip this entry
- viii. Field IsNullable: Skip this entry

- ix. Field IsRequired: Skip this entry
 - x. Field Domain: Skip this entry
 - xi. Click OK
- c. Repeat as follows for these THREE additional fields:
- i. Field Name: "Strata" (**no quotes**)
Field Type: TEXT
 - ii. Field Name: "Strat_Area" (**no quotes**)
Field Type: DOUBLE
 - iii. Field Name: "No_Plots1" (**no quotes**)
Field Type: LONG

11. Use ArcToolbox to **Calculate** values for the UFORE-specific fields added to the projected, dissolved, **AOI map layer**:

- a. Navigate to ArcToolbox>Data Management Tools>Fields>Calculate Field
- b. Fill out the ensuing Calculate Field form:



For experienced users, the *Field Calculator* could be used via the ArcMap table view.

Also, later versions of ArcGIS have a "Calculate Geometry" option available via a right-click on the field name in the table.

- i. Input Table: select the AOI polygon map layer from the dropdown list.
- ii. Field Name: Select "Strat_ID"
- iii. Expression: enter this expression: **1**
- iv. Expression Type: Skip this entry (default is typically VB)
- v. Code Block: Skip the entry

- vi. Click OK
- c. Repeat for the "Strata" field:
 - i. Input Table: select the AOI polygon map layer from the dropdown list.
 - ii. Field Name: Select "Strata"
 - iii. Expression: enter this expression, **INCLUDING quotes**: "Single Strata"
- d. Repeat for the "Strat_Area" field:
 - i. Input Table: select the AOI polygon map layer from the dropdown list.
 - ii. Field Name: Select "Strat_Area"
 - iii. Expression: enter this expression: Output
 - iv. Expression Type: VB
 - v. Code Block: enter this code (*hint – copy and paste from here*):

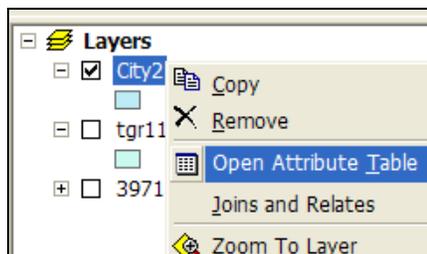

```
Dim Output as double
Dim pArea as Iarea
Set pArea = [shape]
Output = pArea.area
```
- e. Repeat for the "No_Plots1" field:
 - i. Input Table: select the AOI polygon map layer from the dropdown list.
 - ii. Field Name: Select "No_Plots1"
 - iii. Expression: enter the equivalent of this expression:


```
<< the number of random sample plots to be generated >>
```

(*hint: this **MUST** match the number of sample plots to be generated below*)

12. Final results:

- a. Area-of-Interest (AOI) POLYGON map layer with UFORE-required fields added and populated.
 - i. Verify AOI map layer is loaded into the map view. (It may be necessary to right-click the new AOI layer and select "Zoom to Layer".)
 - ii. It should have one record present in its table. (Right-click the new AOI layer name in the map layers list, and choose "Open Attribute Table")



The AOI polygon map layer is now ready to be used for Plot Generation.

Instructions continue below.

Sample Plot Generation

Overview:

- **Run** the Random Plots tool from the i-Tree toolbar.
- **Add** Fields to the Random Plots data
- **Calculate** field values for Random Plots data
- **Buffer** the Random Plots point data to form plot areas

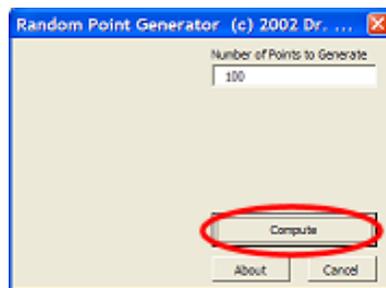
Results:

- Random Sample Plots POINT map layer in ESRI GIS format with UFORE-required fields added and populated.
 - Sample Plot Areas POLYGON map layer in ESRI GIS format.
-

Detailed Instructions:

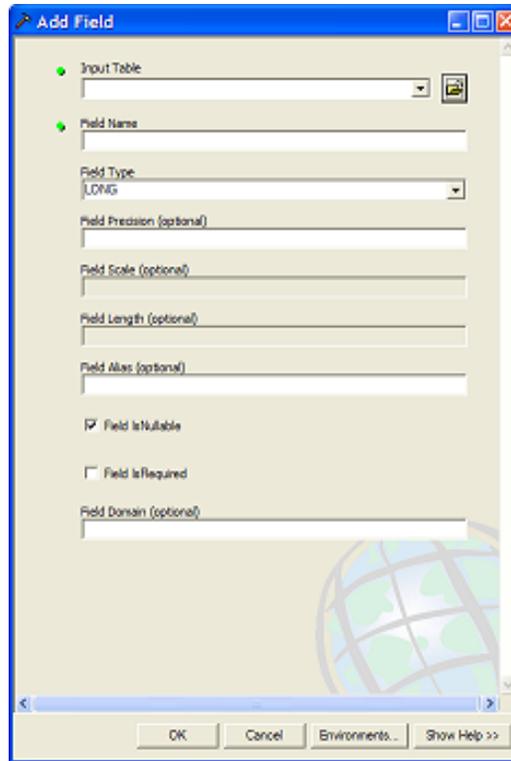
1. Click to select the AOI polygon layer in the map layers list and click the **Random Plots Tool**  **Random Plots** in the i-Tree toolbar.

- a. Enter the desired number of sample points in the ensuing Random Point Generator dialog:



If post-stratification is to be performed, a minimum of 20 plots is recommended per stratum.

- b. Click Compute and then select a location and filename for the sample plots point map layer to be created.
 - c. Click Close to exit the Random Point Generator dialog.
2. Use ArcToolbox to **Add** UFORE-required fields to the newly created **sample plots point map layer**:
 - a. Navigate to ArcToolbox>Data Management Tools>Fields>Add Field
 - b. Fill out the ensuing Add Field form:



For experienced users, fields could be added via the ArcMap table view as well.

- i. Input Table: select the sample plots point map layer from the dropdown list.
 - ii. Field Name: Enter "ID" (no quotes)
 - iii. Field Type: Select LONG from the dropdown list
 - iv. Field Precision: Skip this entry
 - v. Field Scale: Skip this entry
 - vi. Field Length: Skip this entry
 - vii. Field Alias: Skip this entry
 - viii. Field IsNullable: Skip this entry
 - ix. Field IsRequired: Skip this entry
 - x. Field Domain: Skip this entry
 - xi. Click OK
- c. Repeat as follows for these additional FIVE fields:
- i. Field Name: "LCCode" (no quotes)
Field Type: SHORT
 - ii. Field Name: "X_Coord" (no quotes)
Field Type: DOUBLE
 - iii. Field Name: "Y_Coord" (no quotes)
Field Type: DOUBLE

- iv. Field Name: "LCType" (no quotes)
Field Type: TEXT
 - v. Field Name: "MapUnits" (no quotes)
Field Type: TEXT
3. Use ArcToolbox to **Calculate** values for the UFORE-specific fields added to the **sample plots point map layer** in step 2:
- a. Navigate to ArcToolbox>Data Management Tools>Fields>Calculate Field
 - b. Fill out the ensuing Calculate Field form:

For experienced users, the *Field Calculator* could be used via the ArcMap table view.

- i. Input Table: select the sample plots point map layer from the dropdown list.
 - ii. Field Name: Select "ID"
 - iii. Expression: enter this expression: **[FID]+1**
 - iv. Expression Type: Skip this entry
 - v. Code Block: Skip the entry
 - vi. Click OK
- c. Repeat for the "LCCode" field:
- i. Input Table: select the sample plots point map layer from the dropdown list.
 - ii. Field Name: Select "LCCode"

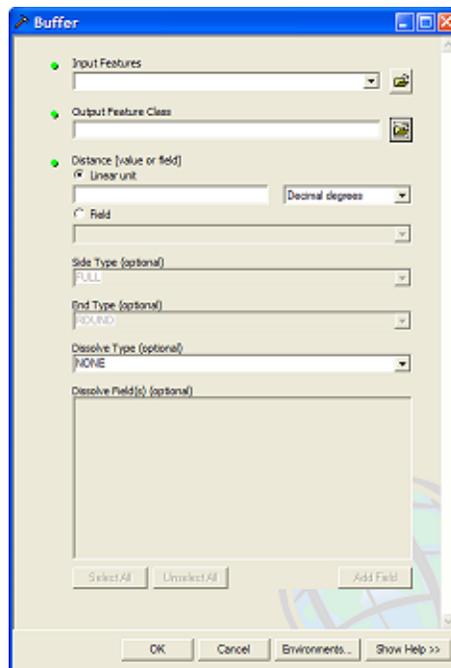
- iii. Expression: enter this expression: **1**
- d. Repeat for the "X_Coord" field:
- i. Input Table: select the sample plots point map layer from the dropdown list.
 - ii. Field Name: Select "X_Coord"
 - iii. Expression: enter this expression: **Output**
 - iv. Expression Type: **VB**
 - v. Code Block: enter this code (*hint – copy and paste from here*):


```
Dim Output As Double
Dim pPoint As IPoint
Set pPoint = [Shape]
Output = pPoint.X
```
- e. Repeat for the "Y_Coord" field:
- i. Input Table: select the sample plots point map layer from the dropdown list.
 - ii. Field Name: Select "Y_Coord"
 - iii. Expression: enter this expression: **Output**
 - iv. Expression Type: **VB**
 - v. Code Block: enter this code (*hint – copy and paste from here*):


```
Dim Output As Double
Dim pPoint As IPoint
Set pPoint = [Shape]
Output = pPoint.Y
```
- f. Repeat for the "LCType" field:
- i. Input Table: select the sample plots point map layer from the dropdown list.
 - ii. Field Name: Select "LCType"
 - iii. Expression: enter this expression, INCLUDING quotes: **"Single Strata"**
- g. Repeat for the "MapUnits" field:
- i. Input Table: select the sample plots point map layer from the dropdown list.
 - ii. Field Name: Select "MapUnits"
 - iii. Expression: enter one of these expressions, INCLUDING quotes:
 - "Foot_US"** if map units are feet or
 - "Meters"** if map units are meters

Map units are determined by your data provider.

- h. Verify the attributes have been correctly modified in the sample plots point map layer:
- Right-click the new, sample plots point map layer in the map layers list, and choose "Open Attribute Table".
 - Scan through the fields and their values to verify they are correct.
 - Note that no projection system is assigned to the plots layer. If desired, it can be defined using steps similar to those for defining the AOI projection system above.
4. Use ArcToolbox to **Buffer** the **sample plots point map layer**:
- Navigate to ArcToolbox>Analysis Tools> Proximity>Buffer
 - Fill out the ensuing Buffer form:



- Input Features: select the **sample plots point map layer** from the dropdown list.
- Output Feature Class: use the browse button  to locate a suitable location and filename for the resulting map layer.
- Distance: Ensure that "Linear unit" is selected and the appropriate units are chosen. Enter the desired Distance value from this list:

Map units in FEET:

- | | |
|---------------------|--------------|
| 1. 1/5 acre plot: | Enter: 52.66 |
| 2. 1/10 acre plot: | Enter: 37.24 |
| 3. 1/20 acre plot: | Enter: 26.33 |
| 4. 1/100 acre plot: | Enter: 11.78 |

Map units in METERS:

- | | |
|------------------------|--------------|
| 1. 1/5 hectare plot: | Enter: 25.23 |
| 2. 1/10 hectare plot: | Enter: 17.84 |
| 3. 1/20 hectare plot: | Enter: 12.62 |
| 4. 1/100 hectare plot: | Enter: 5.64 |
- iv. Side Type: Skip this entry
 - v. End Type: Skip this entry
 - vi. Dissolve Type: Skip this entry
 - vii. Dissolve Field(s): Skip this entry
 - viii. Click OK
- c. The buffered sample points layer is added to the map view automatically; zoom in to examine individual plot areas.
5. Final Results
- a. Sample Plots POINT map layer
 - i. User-defined number of plots randomly spread throughout AOI
 - ii. UFORE-required fields added and populated
 - b. Sample Plot Areas POLYGON map layer

Create UFORE-ready Output

Overview:

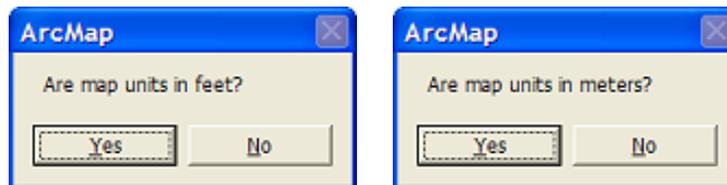
- **Run** the UFORE Strata Area Report tool
- **Run** the UFORE Plot List Report tool

Results:

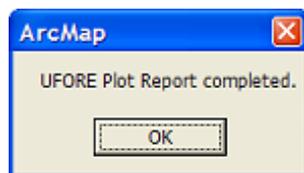
- UFORE Strata Area report text file
 - UFORE Plot List report text file
 - UFORE PRJ file
-

1. Select the **sample plots point map layer** in the map layers list and click the UFORE Plot Report tool  **UFORE Plot Report** in the i-Tree toolbar to create the UFORE Plot Report:

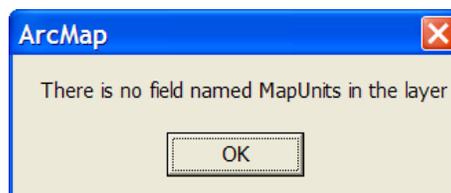
- a. Answer the following question to confirm the map units of the sample plots point map layer.



- b. In the ensuing dialog window, select a location and filename for the UFORE Plot Report.
 - i. Report is finished with the following prompt:



- c. If a field is missing, or incorrectly named, an error message will appear:



- i. Even though the output will be completed, it is necessary to revisit the preceding instructions to correct the mistake.
- ii. Repeat this step to output a new, corrected UFORE Plot Report.

2. Select the **AOI polygon layer** in the map layers list and click the UFORE Strata Report tool  in the i-Tree toolbar to create the UFORE Strata Report:

a. Answer the following question to confirm the map units of the sample plots point map layer.

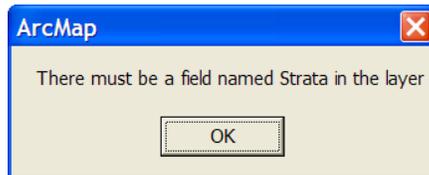


b. In the ensuing dialog window, select a location and filename for the UFORE Strata Report.

c. Report is finished with the following prompt:



d. If a field is missing, or mis-named, an error message will appear:



i. Even though the output will be completed, it is necessary to revisit the preceding instructions to correct the mistake.

ii. Repeat this step to output a new, corrected UFORE Strata Report.

3. Final Results:

a. UFORE Reports

i. Plot Listing

ii. Strata Listing

iii. PRJ file (automatically created in the Define Projection/Reprojection steps above as part of the AOI Shapefile)