

Lake Vegetation Index (LVI) Mapping With Data Driven Pages

A Python scripting approach at the Southwest District

by: Keith Reynolds, Southwest District FDEP, Keith.Reynolds@dep.state.fl.us (813) 293-1510

Introduction

Lake Vegetation Index (LVI) involves the sampling of vegetation along the perimeter of selected lakes. The resultant vegetative samples provide indicators of the relative health of the lake's waters. This process involves dividing the lake perimeter into twelve (12) equal segments. A number from 1 to 3, inclusive, is randomly chosen.

The resulting number determines the 4 perimeter segments to be sampled for the LVI study:

if the number is 1, segments 1, 4, 7 and 10

if the number is 2, segments 2, 5, 8 and 11

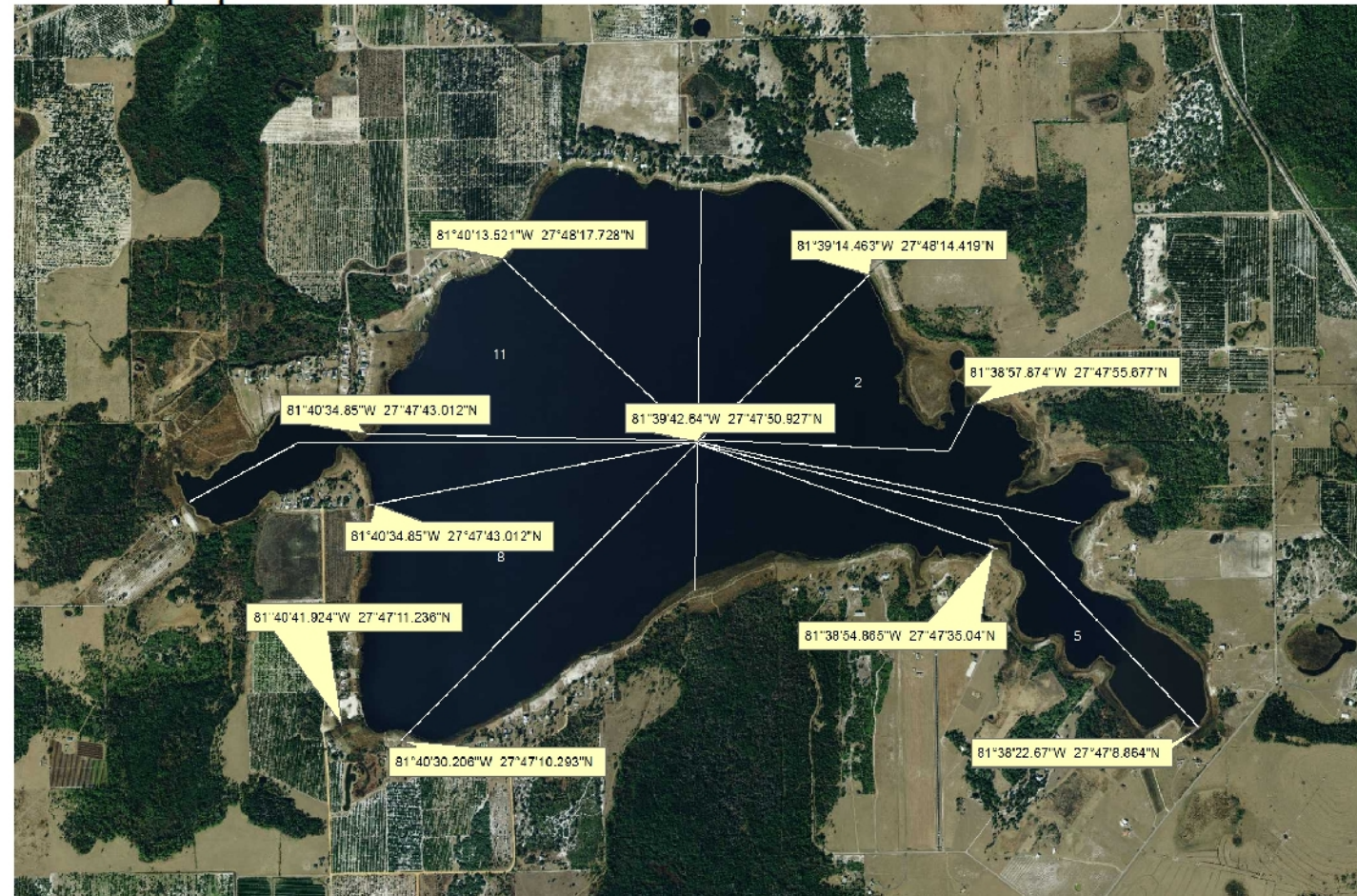
if the number is 3, segments 3, 6, 9 and 12

Manual mapping of lake segments

The process for creating the lake segments in ArcGIS manually involves the following steps:

- Locate the approximant center of the lake polygon
- Determine the perimeter length of the lake polygon and create 12 equal perimeter line segments.
- Draw lines from the center of the lake polygon to the endpoints of the 12 perimeter segments, which are manually drawn in the map
 - *The first line should be oriented toward the north so that the result is consistent and duplicative.
- A random number is selected, from 1 to 3 inclusive, such that the segments to be sampled could be defined
- Label the point coordinates of the lake perimeter segments to enable field GPS referencing.

Manual map representation



For lakes whose shape is longer in one direction, a central line is drawn bisecting the lake polygon through the longest dimension and additional lines are drawn cross ways of the central line, creating the 12 approximately equal perimeter line segments.

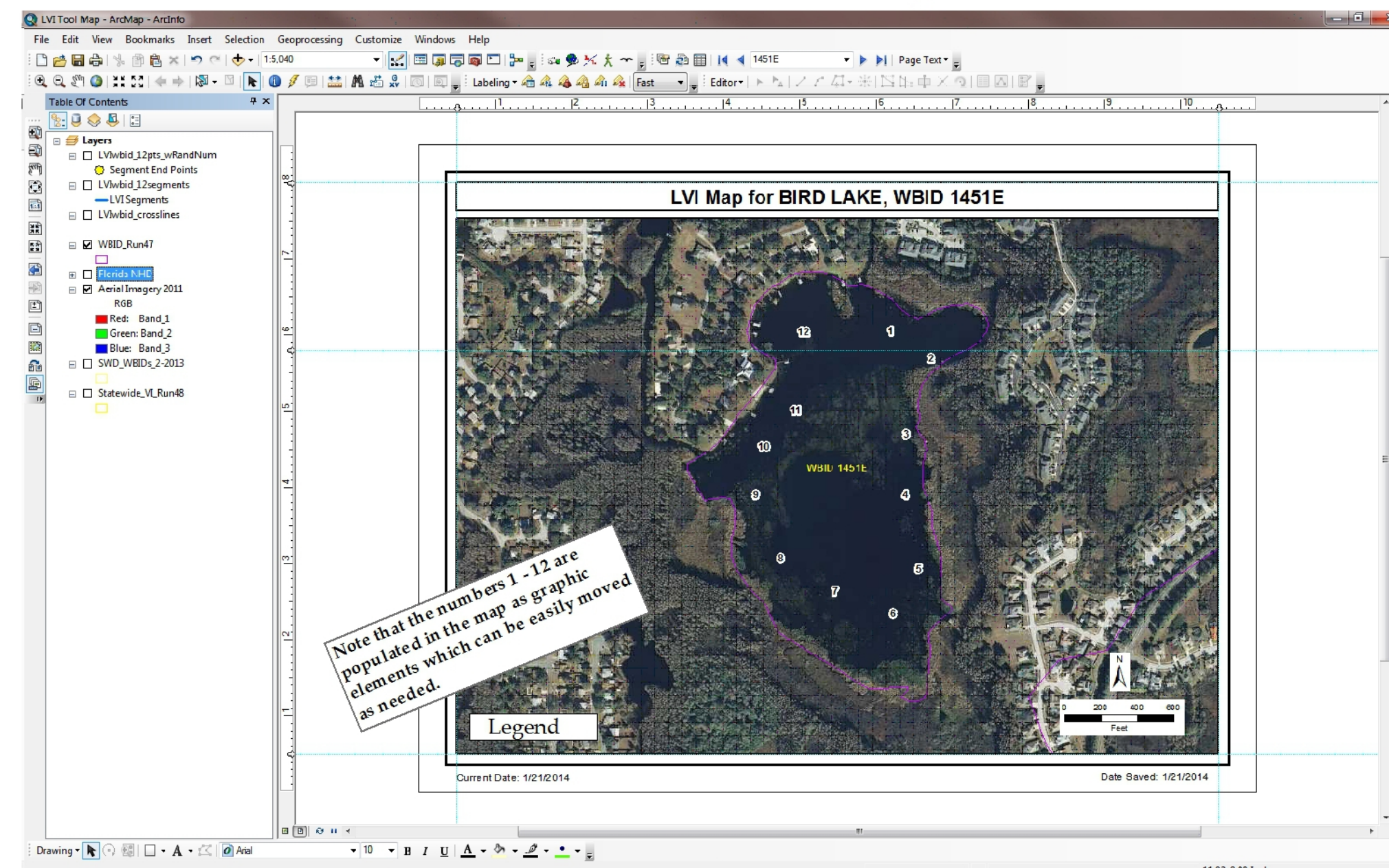
Sampling and Use of the LVI for Assessing Lake Plant Communities: A Primer



Figure 2. LVI sampling map of an irregularly shaped lake

LVI Map creation with Data Driven Pages and Python script tools

The default LVI Map



Map Interface

The Data Driven Pages toolbar is enabled with the most recent run, WBID_Run47, shapefile as the primary index layer, indexed on the "WBID" column.

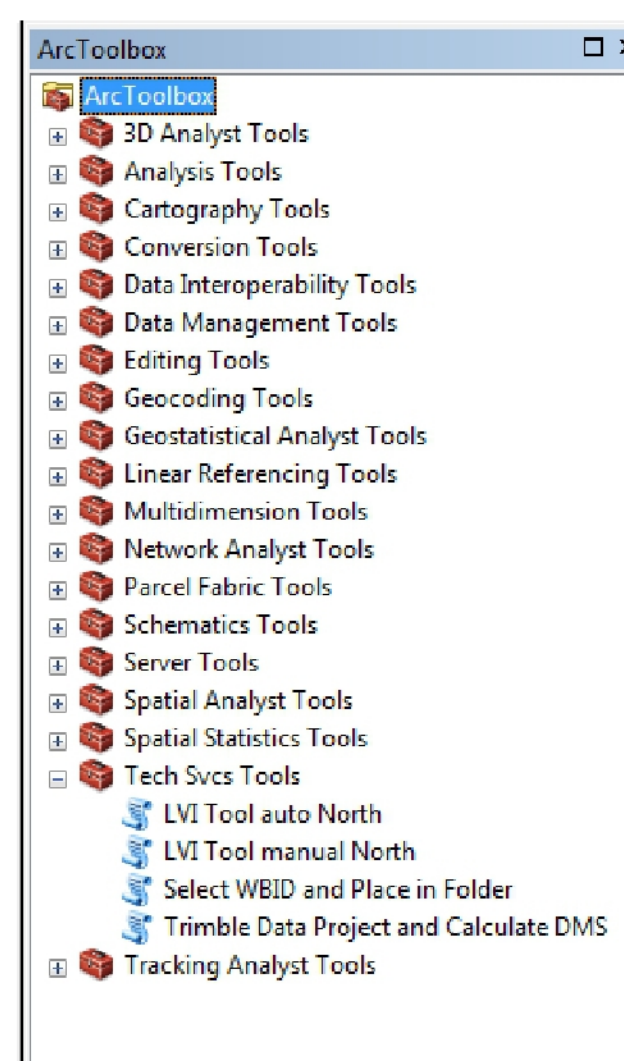
- A default title for the map is provided with the WBID number dynamically updated
- The "WBID" label is updated in the map for the lake which is the current page focus
- The legend identifies symbology for the default layers provided in the table of contents
- A north arrow and scale bar are included
 - The scale bar will need resized depending on the scale needed for the lake

Map Table of Contents (TOC)

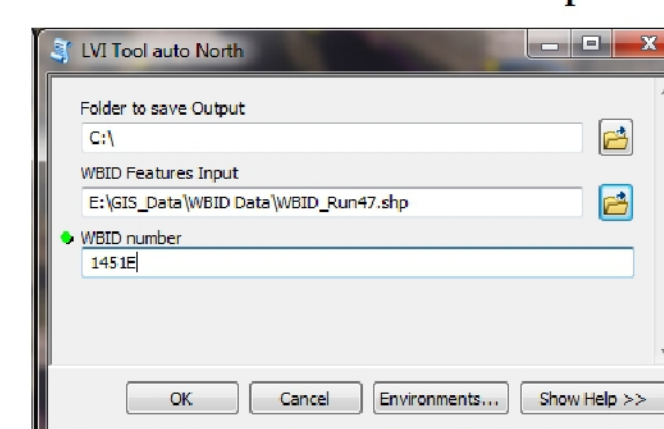
The default map TOC contains the following layer files to use for default symbology

- LVIwbid_12pts_wRandNum
 - Default symbology for the points whose coordinates define the perimeter points
 - Data source example: Pts1451E_84_rand_3
- LVIwbid_12segments
 - Default symbology for the line segments which are to be sampled
 - Data source example: 1451ESegs_183
- LVIwbid_crosslines (to be used if desired, not helpful with complex lake shapes)
 - Default symbology for the lines from the center to the individual points
 - Data source example: 1451Ecrosslines
- WBID_Run47
 - This is the basis for all WBID information and data validation
- Aerial Imagery 2011 is included for background reference

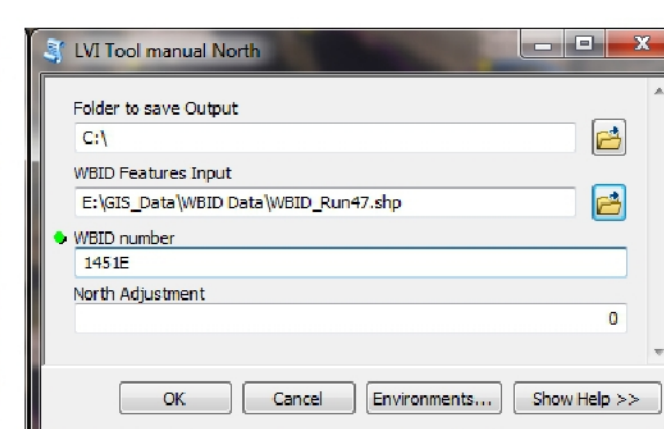
LVI Tools, located in the Tech Svcs Tools custom toolbox



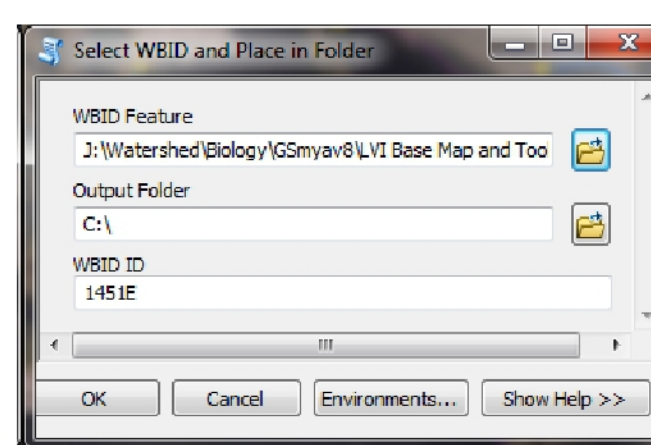
The LVI Tool auto North inputs



LVI Tool manual North inputs provide for a northly point orientation



The Select WBID and Place in Folder tool is used when a WBID has small narrow sections which will not be sampled and whose additional perimeter length will skew the perimeter length of the WBID needing to be sampled. In such a case, this tool will select and export a WBID to a shapefile file where it can be manually edited, avoiding change of the original WBID shape. The exported shape can then be used as input for the LVI Mapping tool, after editing.



Process

Prerequisites:

- ArcGIS 10.1 or later
- ArcInfo license

LVI auto North tool: on entering the required inputs.

The tool will do the necessary processing to:

- Find the centroid of the lake
- Draw a line to the perimeter which is north, 0°, from the centroid
- Plot 12 evenly spaced points along the perimeter with coordinates, in Decimal Degrees, populated in the table
 - *This is the key to the entire process. The arcpy geometry object is used to retrieve the coordinates of the points along the perimeter, using the *positionAlongLine()* method, creating the 12 evenly spaced points. This capability for Python scripting, via ArcPy, was first made available in ArcGIS 10.1.
- The tool then uses the 12 points to:
 - Divide the lake perimeter into 12 equal line segments
 - Calculate and append the perimeter segment length, in meters, to the end of the name of the ...Segs... shapefile, for quick reference
- Generate a Random Number which is appended to the name of the shapefile which contains the 12 points
- Create 12 lines to connect the centroid of the wbid to the each of the 12 perimeter points for visualization, if wanted
- Add the necessary shapefiles to the map TOC

LVI Tool auto North results

The outputs of the tool are dynamically added to the map TOC.

The outputs are:

- centroid<wbid>
- Pts<wbid>_84_rand_<random number 1-3>, is data source for Layer file "LVIwbid_12pts_wRandNum"
- <wbid>Segs_<integer for segment length in meters>, data source for the Layer file "<wbid>Segs_<###>"
 - Determine the FID of the lines corresponding the segments to be sampled and use a definition query, on the corresponding Layer, to isolate those lines for symbolization
- <wbid>crosslines

The crosslines are provided as a visualization tool for the lake segments.

The "Pts..." shapefile contains the Decimal Degree coordinates of the points, which define the segments, and the final integer, in the shapefile name, is a random number generated by the LVI Tool providing the random number reference needed to define the segments to be sampled, as noted previously in this poster.

The "...Segs..." shapefile contains the 12 equal segments, one may exist as 2 pieces of a line, and the number at the end of the name indicates the length of each segment, in meters. (Use a Definition Query after the data is connected to the layer file to display only the study segments.)

LVI Tool manual North results

When using this tool, the outputs are the same as the "LVI Tool auto North". The difference is:

- This is the tool to use when a line from the centroid of the WBID intersects the perimeter line more than once
 - This tool may need to be run twice to provide the desired results
 - First, run the tool using the default value for the "North Adjustment", which is Zero (0)
 - If the results are as needed, finalize the map ... otherwise, locate the "Pts<wbid>_84_rand_<random number 1-3>" point which is east of north and closest to north, 0 degrees.
 - Use the measure tool, in meters, to measure along the perimeter line to the approximate north point
 - Use this value as the "North Adjustment" input and run the tool again
 - First, remove from the map all shapefiles produced by the previous run of the tool.
 - Run the tool again and finalize the map as described in "LVI Tool auto North results" heading above.
 - Remember the definition query for the "...Segs..." shapefile to display the shore segments to be studied.

Finalized LVI Map

