

# Lake Carroll Lake Vegetation Index Survey Summary 2010-2012

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## Background

**The Lake Vegetation Index (LVI)** is a rapid assessment protocol in which selected sections of a lake are assessed for the presence or absence of vegetation through visual observation and through the use of a submerged vegetation sampling tool called a Frodus. The assessment results provide a list of species present and the dominant (and where appropriate, co-dominant) species that are found in each segment. These results are then entered into a scoring table and a final LVI score is computed, using a multi-step algorithm which incorporates four scoring metrics: % native taxa, % invasive species, % sensitive species and Coefficient of Conservatism of the dominant species. The Coefficient of Conservatism is a number from 0 to 10 that indicates how broad or narrow a taxon's ecological niche is, as determined by expert botanists. The LVI score provides an estimate of the vegetative health of a lake at a particular point in time. The threshold score for impairment is 37.

Our assessment team was trained and qualified by FDEP to conduct these assessments as an independent team and must prequalify each year, prior to conducting additional assessments. The LVI field data collection method consists of dividing the lake into twelve pie-shaped segments (see diagram below) and selecting a set of four segments from the twelve to include in the LVI. The assessment team then travels across the segment and identifies all unique species of aquatic plants present in the segment. Additionally, a Frodus is thrown at several points on a single five-meter belt transect that is established in the center of the segment, from a point along the shore to a point beyond the submerged vegetation zone.

Although a healthy, well-balanced lake community may be maintained with some level of human disturbance, human activities may result in lake degradation. Human stressors include increased inputs of nutrients, sediments and/or pesticides from watershed runoff, undesirable removal of native shoreline and/or upland buffer vegetation, and introduction of nuisance (generally exotic) plants and animals. DEP has methods to evaluate if human activities have resulted in the condition where a particular waterbody has exceeded water quality criteria (Chapter 62-02, Florida Administrative Code), including whether adverse impacts to biological communities have occurred. DEP water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life support), and an exceedance of these standards is associated with interference with the designated use.

Chlorophyll a is a measure of algal biomass in the water column. In clear, low alkalinity lakes (lakes where color is < 40 PCU and alkalinity is < 20 mg/L CaCO<sub>2</sub>), a healthy system is expected to have ≤6 µg/L of chlorophyll a. In colored (≥40 PCU) lakes or clear, high alkalinity (≥ 20 mg/L CaCO<sub>2</sub>) lakes, healthy

systems are expected to have  $\leq 20$   $\mu\text{g/L}$  of chlorophyll a. Higher Chlorophyll a values may result in unwanted shading of aquatic plants and/or greater potential for harmful algal blooms. The Lake Vegetation Index (LVI) assesses how closely the plant community of a lake resembles a native undisturbed community. It is used in combination with chlorophyll a measurement to allow detection of an imbalance in the plant community, even when the algal community appears healthy (and vice versa).

## Methods

Lake Carroll was sampled on July 20, 2010 and July 26, 2012, by the Florida Center for Community Design and Research at the University of South Florida. Surface water samples were obtained in each of the 4 sections of the LVI assessment for analysis of nutrients, chlorophyll a, bacteria and color.

For the LVI, species lists were developed for four of twelve sections of the lake (Figure 1), and the following information was derived from those lists: percent native species, percent invasive exotic species, percent sensitive species, and the Coefficient of Conservatism (C of C; a measure of how tolerant a species is to disturbance) of the dominant species. According to DEP SOP LT 7000, the LVI score ranges and categories are: (78-100) Exceptional; (38-77) Healthy; and (0-37) Impaired. DEP's new draft F.A.C. Chapter 62.302 requires at least two temporally independent LVIs with an average score of 43 or above in order to meet the expectation of a healthy, well balanced community. The LVI was sampled per DEP SOP FS7310 and calculated per DEP SOP LT7000.

## Site Information

Lake Carroll is located in the Sweetwater Creek Watershed in west central Florida in Hillsborough County near Tampa. The lake has a surface area of 210 acres with a mean depth of 10 feet and a maximum depth of 25 feet. The dominant land use in the surrounding area is single family residential.

## Results

### *Water Quality*

Table 1 details sampling results from the 2010 and 2012 water quality assessment that coincide with the LVI assessments.

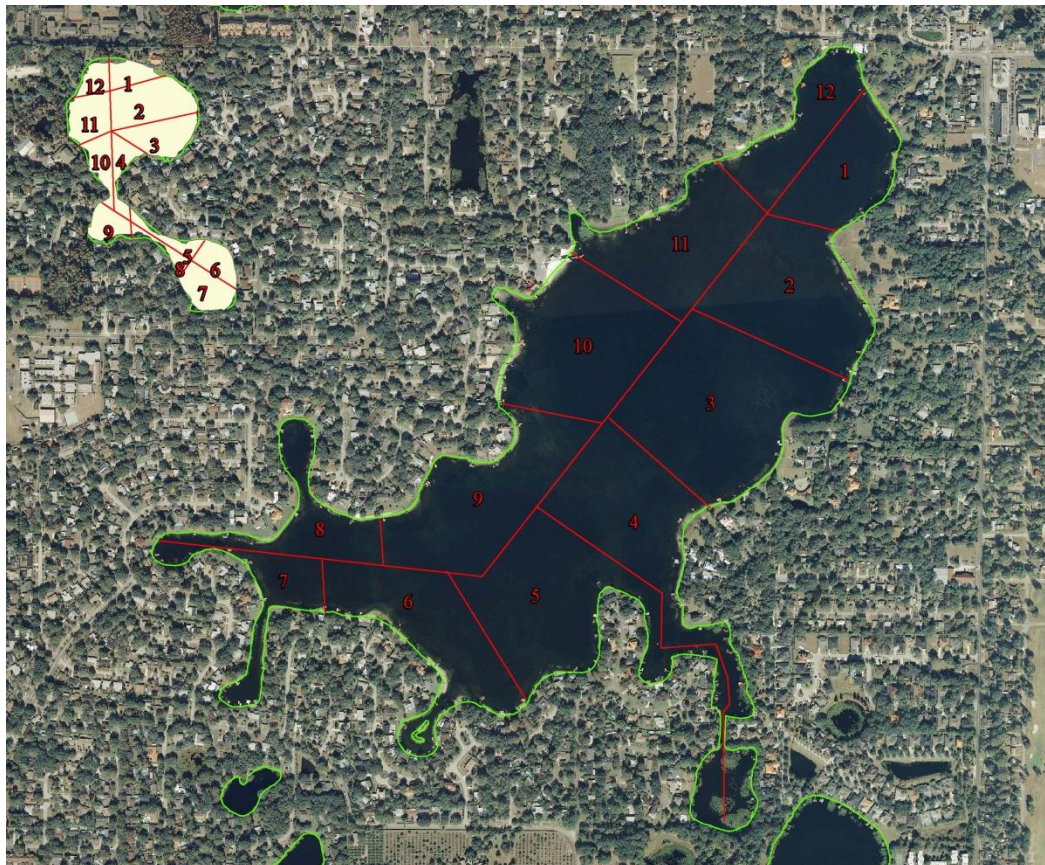
**Table 1. Water Quality Summary for Lake Carroll LVI Efforts**

Analysis	Results 7/20/2010	Results 7/26/2012
Field Water Temperature ( $^{\circ}\text{C}$ )	31.72	30.35
Field pH (SU)	7.61	7.14
Secchi Depth (ft)	10.80	10.05
Field Dissolved Oxygen (mg/L)	7.6	6.85

Field Specific Conductance (µmhos/cm)	0.226	0.209
Color (pcu)		7.6
Chlorophyll a (µg/L)	2.90	4.2
Total Phosphorous (mg/L)	.041	0.019
Ammonia (mg/L)	0.043	0.047
Nitrate+Nitrite (mg/L)		0.016
Total Kjeldahl Nitrogen (mg/L)	0.510	0.371
Total Nitrogen (mg/L)	0.510	0.375
Fecal Coliform (#/100ml)	<20	35
Enterococci (#/100ml)	273	160

### *Lake Vegetation Index Summary*

The LVI survey was conducted by the Florida Center for Community Design and Research following the FDEP SOP (<http://www.dep.state.fl.us/water/bioassess/docs/lvi-1000.pdf>) on 7/20/2010 using regions 1, 4, 7 and 10 and scored a 57. This survey identified 9 non-native invasive species out of 58 total species (15.58%). A second LVI survey of Lake Carroll was conducted by the Florida Center for Community Design and Research on 7/26/2012 using regions 2, 5, 8 and 11 and scored a 50. This survey identified 12 non-native invasive species present out of 50 species found (24%).



**Figure 1. LVI region map for Lake Carroll**

Florida Department of Environmental Protection has proposed changes to the scoring metrics that comprise the Lake Vegetation Index ( <http://www.dep.state.fl.us/water/bioassess/docs/lvi-1000.pdf> ). These changes are an update to existing Coefficient of Conservatism scores and an alteration of the % invasive metric to include only Florida Exotic Pest Plant Council (FLEPPC) Type I plants. When these changes are applied to the data collected in 2012, the score is raised from a 50 to a 57. Both scores are in the Healthy category. Tables 2 and 3 contain the species list and occurrence information relating to these two LVI events.

Lake Carroll 7/20/2010		Section			
SPECIES (FLEPPC Type)	CofC	1	4	7	10
Acer rubrum	4.65			1	
<b>Alternanthera philoxeroides(II)</b>	0	1	1		
Andropogon glomeratus	3.9			1	1
Baccharis glomeruliflora	6.12	1			1
Bacopa caroliniana	5.31	1	1	1	1
Bidens alba	1				1
Boehmeria cylindrica	5.91	1	1	1	
Carya aquatica	6.64	1			
<b>Casuarina equisetifolia(I)</b>	0				1
Coreopsis leavenworthii	3.43	1			1
<b>Cyperus alternifolius(II)</b>	0		1		
Cyperus polystachyos	1.56	1			1
Cyperus odoratus	4.25	1	1	1	1
Cyperus surinamensis	2.03	1			
Eclipta alba (E. prostrata)	3.22		1	1	
Eleocharis baldwinii	2.82	1	1		
Eleocharis interstincta	7.8	1			1
Fuirena scirpoidea	6.5	1	1	1	1
<b>Hydrilla verticillata(I)</b>	0	1	1	1	1
Hydrocotyle	2	1	1	1	1
Juncus marginatus	3.65			1	1
Liquidamber styraciflua	5.56			1	
Ludwigia arcuata	5.32	1	1	1	1
Ludwigia octovalvis	4.09		1		1
<b>Ludwigia peruviana(I)</b>	0	1		1	1
Magnolia virginiana	9.44				1
<b>Melaleuca quinquenervia(I)</b>	0			1	1
Micranthemum glomeratum	5.85	1		1	1
Mikania scandens	1.95		1		
Myrica cerifera	3.82			1	
Najas guadalupensis	5.07	1	1	1	1
Nuphar sp.	4.64		1		1
Nymphaea odorata	6.99	1	1	1	1

**Table 2.** LVI summary from 7/20/2010 Survey “1” indicates presence of plant species in LVI section. “D” indicates that the species is present and the dominant species in the LVI section

Nymphoides aquatica	6.09	1	1	1	1
Osmunda cinnamomea	6.44		1		
Osmunda regalis	8.04			1	
<b>Panicum repens(I)</b>	0	1	1	1	1
Pinus elliotii	4.21	1	1		1
Pluchea rosea	5.45		1	1	
Polygonum hydropiperoides	4.02	1		1	
Potamogeton illinoensis	6.64	D	D	D	D
Quercus laurifolia	5.14	1		1	
Rhexia mariana	5.5				1
Sabal palmetto	4.85	1		1	1
Sagittaria lancifolia	4.96			1	1
Salix caroliniana	2.95			1	
Sambucus canadensis	1.48	1		1	
<b>Schinus terebinthifolius(I)</b>	0	1		1	1
Scirpus californicus	6.01			1	1
Sesbania herbacea	1.5				1
Taxodium ascendens	7.21	1	1		1
Typha sp.	1.6			1	1
Ulmus americana	7.68	1			1
Utricularia biflora (U. gibba)	6.37		1		1
Utricularia inflata	5.85		1		
Vallisneria americana	6.99	1	1	1	1
<b>Wedelia trilobata(II)</b>	0	1	1	1	1
Xyris platylepis	5.32			1	1

Lake Carroll 7/26/2012		Section			
SPECIES	CofC	2	5	8	11
Acer rubrum	4.65	1	1		1
<b>Alternanthera philoxeroides(II)</b>	0.00	1	1	1	1
Andropogon glomeratus	3.90		1		
Baccharis glomeruliflora	6.12		1		
Bacopa caroliniana	5.31	1	1	1	1
Bacopa monnieri	4.49			1	
Blechnum serrulatum	7.15	1	1		
Boehmeria cylindrica	5.91		1		1
Canna flaccida	6.75			1	
<b>Casuarina equisetifolia(I)</b>	0.00	1	1		1
<b>Colocasia esculenta(I)</b>	0.00	1			
<b>Cyperus alternifolius(II)</b>	0.00	1	1		
Cyperus polystachyos	1.56	1			
Cyperus odoratus	4.25		1		
<b>Dioscorea bulbifera(I)</b>	0.00		1		1
Eleocharis equisetoides	9.10				1
Eupatorium capillifolium	0.83	1			1
Fuirena scirpoidea	6.50	1	1	1	1
<b>Hydrilla verticillata(I)</b>	0.00	1	1		
Hydrocotyle spp.	2.00	1	1	1	1
Iris virginica				1	
Ludwigia arcuata	5.32			1	
Ludwigia octovalvis	4.09			1	
<b>Ludwigia peruviana(I)</b>	0.00		1		1
Ludwigia repens	5.20	1			
<b>Melaleuca quinquenervia(I)</b>	0.00	1	1	1	1
Micranthemum glomeratum	5.85	1	1	1	
Najas guadalupensis	5.07	1		1	
Nitella spp.	7.28	1	1		
Nuphar sp.	4.64			1	
Nymphaea odorata	6.99	1	1	1	1
Nymphoides aquatica	6.09	1	1	1	1
Osmunda cinnamomea	6.44		1		
<b>Panicum repens(1)</b>	0.00	1	1	1	1
Pinus elliotii	4.21	1	1		
Pluchea rosea	5.45			1	1
Pontederia cordata	5.38				1
Potamogeton illinoensis	6.64	1	1	1	1
Quercus laurifolia	5.14	1		1	
Quercus nigra	4.14		1		
Rhexia cubensis	7.22	1			
Sagittaria lancifolia	4.96				1
Salix carolina	2.95	1			1
<b>Salvinia minima(I)</b>	0.00			1	
<b>Schinus terebinthifolius(I)</b>	0.00		1		1
Taxodium distichum	7.21	1	1	1	1
Typha sp.	1.60		1	1	1
Utricularia biflora (U. gibba)	6.37		1		
Vallisneria americana	6.99	D	D	D	D
<b>Wedelia trilobata(II)</b>	0.00	1		1	1

**Table 3. LVI summary from 7/26/2012 Survey**  
 “1” indicates presence of plant species in LVI section. “D” indicates that the species is present and the dominant species in the LVI section.

This report is a supplement to the Lake Carroll Assessment Report from the Florida Center for Community Design and Research at the University of South Florida (USF-FCCDR). The most recent full assessment of Lake Carroll was conducted in 2010 by USF-FCCDR. The assessment report can be found at: [http://www.hillsborough.wateratlas.usf.edu/upload/documents/432\\_Lake%20Carroll%202010.pdf](http://www.hillsborough.wateratlas.usf.edu/upload/documents/432_Lake%20Carroll%202010.pdf) .

The USF-FCCDR Lake and Stream Assessment Program is funded by Hillsborough County and the Southwest Florida Water Management District with the goal to assess 24 lake and stream segments each summer.