Live Oak Crown Volumes
Edward Frank, February 27, 2009

A recent problem example, Problem #11, presented by Bob Leverett, at Ed Frank's behest, discussed the idea of calculating the volume of the top portion of a sphere. In the example cited initially it modeled the canopy of some of the low and broad spreading live oaks that Larry Tucei had measured Ed Frank's description that motivates the above drawing follows. "Think of the hemisphere partially buried in the ground. The shape of the tree canopy is the part that is sticking out. There is a height h1 which is the height of the part sticking out of the ground. In a tree this is the height of the tree. h1 = R- h2 There is also r1 which is the pseudo- radius of the hemisphere at the point it intersects the ground surface as measured from the center of the circle at ground level to the edge of the circle. This is the crown spread divided by two." The portion above the brown line is the area of interest, i.e the part of the hemisphere above ground. The volume of the area above the brown line is what we want to determine. Bob Leverett produced a spreadsheet that automatically calculated the volume of this are based upon height of the tree and crown radius. A tree crown fits this shape model if: a) it has a domed shaped top surface, b) the base of the crown is flat or at ground level on a flat surface, and 3) the width of the crown spread is greater than or equal to twice the vertical thickness of the crown.

A number of trees measured by Larry Tucei as part of the Live Oak Project generally fit these shape parameters. Nine examples were selected based upon photographs that showed the entire canopy form for testing this methodology. The results are presented below. The calculated crown volumes are presented in cubic feet. These were calculated based upo maximum crown spread. Average maximum crown spread would result is smaller volumes.

Name	Height (ft)	Crown Spread (feet)	Crown Volume (ft3)
Walkaih Bluff Oak	73	165	984149
Josephine Stewart Oak	74.6	156	930309
Tree of Life	58.6	165	731870
Celina P. Roman Oak	69	135	665836
E. O. Hunt Live Oak	45	170	658418
Ruskin Live Oak	57	153	620950
Seven Sisters (multi)	57	153	620950
East Biloxi Live Oak	57	144	561118
Shrine of the Holy Cross Oak #1	75 (65a)	124.5	(a 539444)
McDonogh Oak	48.9	154.5	519605
Sarah Hunt Oak	51	136.5	442616
Middleton Oak	67.5 (59a)	118	(a 430135)
Edgewater Park Oak	47	120	320140

Looking at the results you can see that by far the largest volume crown measured was for a live oak the Walkaih Bluff Oak at almost 900,000 cubic feet. The Middleton Oak, one of the largest volume trunk live oaks known, and certainly the largest ever accurately modeled, finished eighth out of nine trees calculated. Other live oaks have either a more typical upright trunk form, or for this initial calculation set did not have photographs of the full crown showing it form. More will be added as the canopy forms of trees on the list are reviewed. many of the other live oaks measured will also fit into this form category. All photos are by Larry Tucei, except for the Middleton Live Oak photo by Will Blozan.

Ruskin Live Oak in Ocean Springs, Ms. 27'2" cbh, 57′ height and 153' Spread
http://www.nativetreesociety.org/fieldtrips/mississippi/liveoakjan2007/ms_live_oaks.htm

r_1	h_1	R				V_q
76.5	57	79.83553				620950

East Biloxi Live Oak 35' CBH 57' Height 144' Spread
http://www.nativetreesociety.org/fieldtrips/mississippi/liveoakjan2007/ms_live_oaks.htm

r₁	h₁	R				V_q
72	57	73.97368				561118

*** E.O. Hunt Oak, located at the South Ms. Regional Center in Long Beach, CBH- 37', Spread- 170' and Height ~45'

http://www.nativetreesociety.org/fieldtrips/mississippi/liveoak/live_oak_galleries.htm

r_1	h_1	R				V_q
85	45	102.7778				558418

*** The Sara Hunt Oak, also located at the South Ms. Regional Center- CBH-26'7", Spread-136.5, Height ~51'
http://www.nativetreesociety.org/fieldtrips/mississippi/liveoak/live_oak_galleries.htm

r_1	h_1	R	h_2	V	V_p	V_q
68.25	51	71.16728				442616

*** Edgewater Park Oak. CBH-22'11", Spread-120' and Height 47'
http://www.nativetreesociety.org/fieldtrips/mississippi/edgewater/edgewater_mall_live_oak.htm

r_1	h_1	R	h_2	V	V_p	V_q
60	47	61.79787				320140

*** Tree of Life, Audubon Park, New Orleans.- CBH-35′ 2″, Spread-165′
http://www.nativetreesociety.org/fieldtrips/louisiana/audubon/audubon_park_live_oaks.htm

There has been a limb breakage and the maximum spread now is 150 feet. A remeasure may yeild a higher value.

r_1	h_1	R	h_2	V	V_p	V_q

82.5	58.6	87.37381				731870

Dedeaux Oak located at 5607 Vidilia Rd., Delisle, MS- CBH-30'1", Spread-148' and Height-69'.
http://www.nativetreesociety.org/fieldtrips/mississippi/delisle/delisle_and_pass_christian.htm

r_1	h_1	R				V_q
74	69	74.18116				765523

*** Celina P. Roman Oak, CBH-25', Height-69' and Spread-135
http://www.nativetreesociety.org/fieldtrips/louisiana/oak_alley/oak_alley_plantation.htm

Limb breakage has reduced the spread to 112.5

r₁	h₁	R				V_q
67.5	69	67.5163				665836

McDonogh Oak, CBH-27'7", Height-48.9' and Max. Spread- 154.5'
http://www.nativetreesociety.org/fieldtrips/louisiana/citypark/city_park_new_orleans_louisiana.htm

r₁	h₁	R				V_q
77.25	48.9	85.46802				519605

Seven Sisters Live Oak – Multitrunk CBH- 47' 9", Height-57' and Spread-153'.
http://www.nativetreesociety.org/fieldtrips/louisiana/sevensisters/seven_sisters_live_oak.htm
Multitrunk tree with seven trunks - volume is of composite crown.

r$_1$	h$_1$	R				V$_q$
76.5	57	79.83553				620950

Shrine of the Holy Cross Oak #1, CBH- 22'7", Height-75', Spread-124.5'.
http://www.nativetreesociety.org/fieldtrips/alabama/knollpark/andrew_jackson_oak_and_knoll_park.htm (base of canopy at about 10 feet)

r₁	h₁	R				V_q
62.25	75	63.33375				677413
62.25	65	62.30817				539444

Middleton Oak, SC CBH 32.8 feet, height 67.5, spread 118
http://www.nativetreesociety.org/fieldtrips/south_carolina/middeltonoak/middelton.htm
Does BVP have any crown volume calculations? I used the measured height of 69 feet and also used 59 feet for height to offset the small point sticking out of the main mass of the canopy. The latter results in a full hemisphere. Number calculated for comparison purposes.

r₁	h₁	R				V_q
59	67.5	59.53519				530117
59	59	59				430145

Walkaih Bluff Oak H-73' Sp-165'.

r_1	h_1	R	h_2	V	V_p	V_q
82.5	73	83.11815				984149

Josephine Stewart Oak H-74.6' Sp-156'.
http://www.nativetreesociety.org/fieldtrips/louisiana/oak_alley/oak_alley_plantation.htm

r_1	h_1	R	h_2	V	V_p	V_q
78	74.6	78.07748				930309