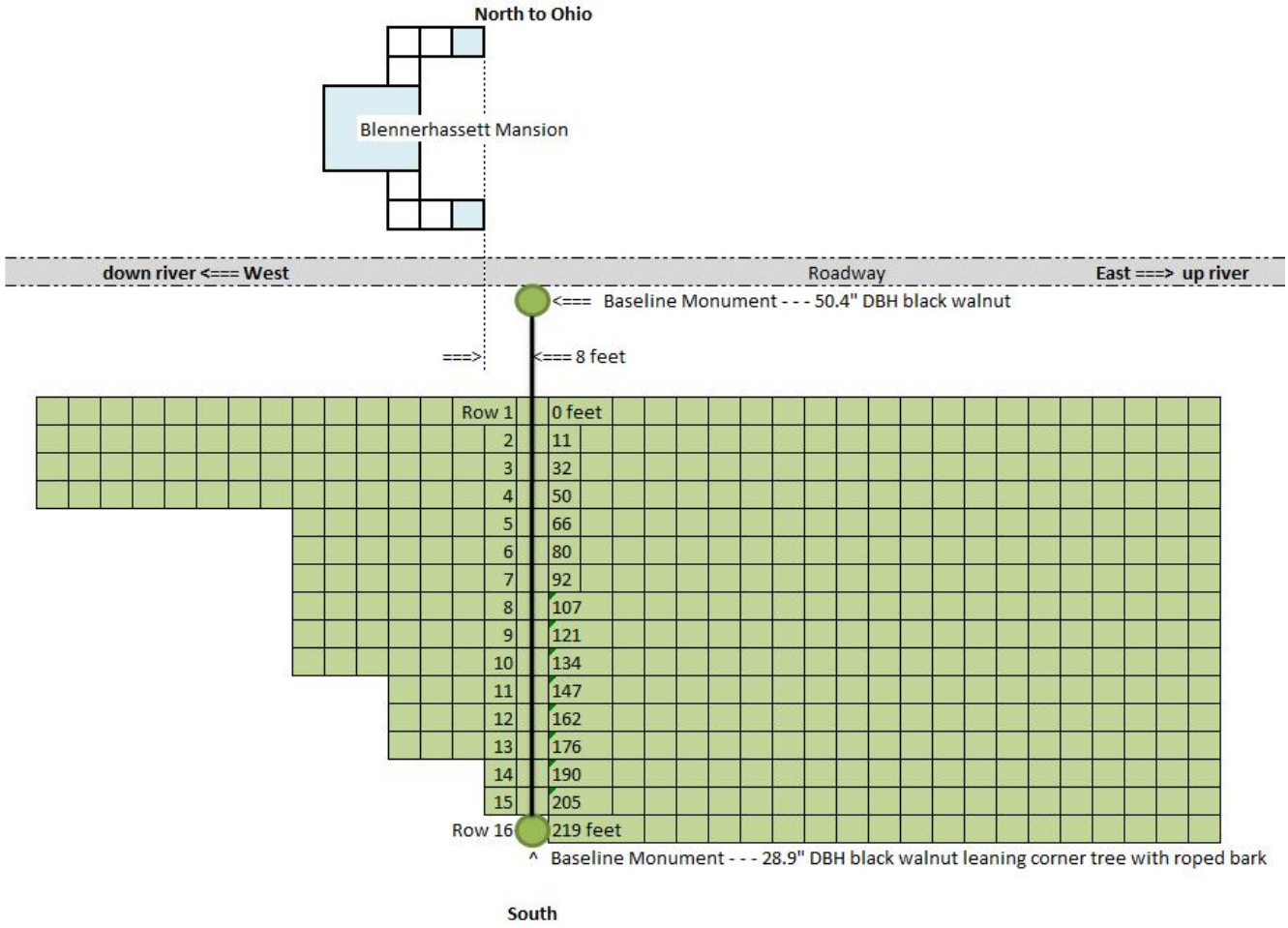
Blennerhassett Black Walnut Survey after 2018

by John Kelsey and James McKenna

In West Virginia's Blennerhassett State Park there is a plantation of black walnuts planted in 1935. Most of the hundreds of earlier black walnut plantations in the United States were cut for gunstocks during the two great wars. The Blennerhassett planting was spared, being too young in the 1940s. The park is on an island in the West Virginia River (some people call it the Ohio River). The Blennerhassett property belongs to the DuPont company and is leased to the West Virginia Park Service. In any case, these trees are off limits for multiple reasons. One of us has a special bond with these trees, being about the same age. The fate of these trees will be to mature, grow old, and stay upright as long as they can.

Information sign by the lower Blennerhassett plot

Many black walnut growers and forest scientists are interested in how tree growth behaves at all stages, throughout a tree's life cycle. There is data for young plantings, but mature plantations are rare. We have had to project growth model curves into the void graph areas – always dangerous. Of course, any measure of growth requires two measurements separated by a few years (decades). May 2nd, 2019, Russ Hern and the authors conducted a survey to establish a benchmark for future growth measurements of this unique 83 year old pure walnut planting in the heart of the Central Hardwood Forest Region of North America. There are two plots presumably all the same age. The rows of the lower plot average 14.6 feet apart and run East-West. The upper plot rows run North-South. Our three-man-team only measured the lower plot. We started by establishing a coordinate system from a baseline (string) struck perpendicular to the rows. The baseline goes from a permanent object to a permanent object so it can be reestablished for later measurements. In-row tree locations were measured from the baseline string with a footage wheel. The map below shows the coordinate system layout.



Lower Plot Map

Data Collected

Three of us boated to the island on May 2nd and two of us returned on May 24th to measure crown and systematically record defects. That adds up to 5 man-days to measure 200 trees (not all alive). The following data items were recorded:

1. **Row** (1 to 16)
2. Tree **Position** measured by wheel from base line string (feet)
3. Diameter Breast High **(DBH)** measured with pi tape (inches)
4. McKenna's **Quality** Score (0 to 5) - - - 5 is the elusive perfect tree.
5. Merchantable **Length** estimate includes a veneer log length plus a sawlog length (feet)
6. **Canopy Code**: 2 for co-dominant; 3 for intermediate; 4 for suppressed.
7. **Crown x** is the crown width in some possible viewing direction (feet)
8. **Crown y** is the crown width perpendicular to the Crown x direction (feet)
9. 14 different **Defects** were recorded and explained below (Boolean)

Baseline Monument Tree (North end) - notice the orange 5 gallon bucket for scale

Defects

1. Epicormic sprouts - a sign of trouble above
2. Dead Top – a sign of shade intolerant suppression and poor tree health
3. Mechanical damage – bad luck – tree's defensive bark is breached
4. Decay, ants – defensive bark is breached – first fungi - then ants
5. Cavity – then wood peckers – then squirrels
6. Lean – reaction to a dominant neighbor
7. Roped bark – don't know? - curious
8. Persimmon bark – associated with internal defects, poor health, and slow growth
9. Frost crack – ruins butt log
10. Wind damage – bad luck – different and less serious than #2. dead top
11. Unstable – major buttress damage – a candidate to fall
12. Bird peck – a serious veneer defect from sapsuckers – hard to spot in old trees
13. Widow maker – large dead side branch
14. Lightning – bad luck – bleak future – normally soon salvaged – but not here

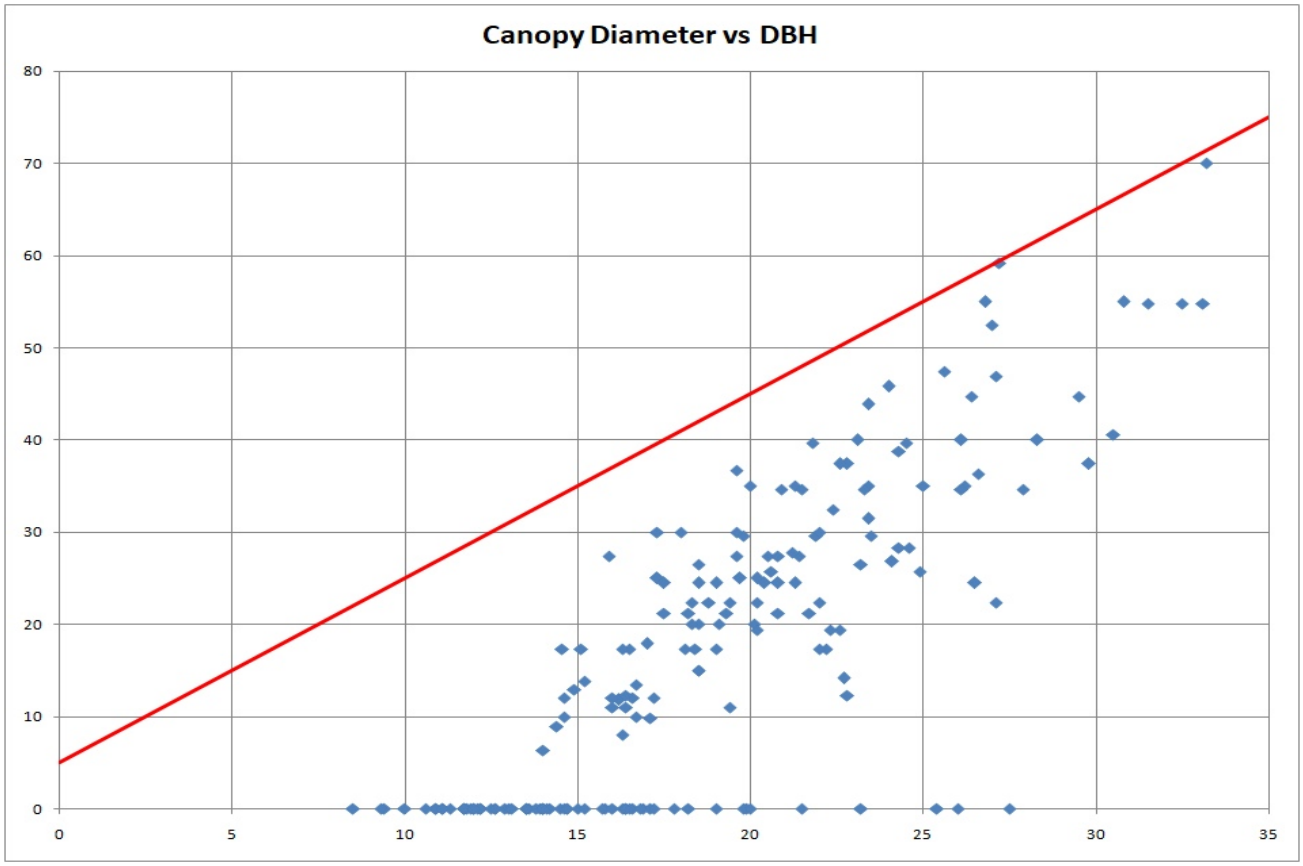
Results

The lower plot consists of 185 live trees on 2.4 acres. There are 16 rows. Trees average 34.5 feet apart within the rows. Their diameter breast high (DBH) is 18.9 (sDev = 5.3) inches and the merchantable log length is 27.2 (sDev = 11.4) feet. The canopy height was checked in two places and measured 108 and 146 feet high.

The plot is kept as a beautiful park setting, which mostly involves cutting the grass. Dead and fallen trees are promptly removed. It appears that there has been no recent forestry management. For those of us studying the economics of forest management, these plots are a sparkling demonstration of no management. With only natural thinning, the trees have become very crowded, and are up against a condition known as the "density ceiling." While many of the trees are healthy, others are failing to compete. The suppressed trees are in a fatal decline and are accruing multiple defects in the process. Intermediate trees are losing their canopy position and going dark – moving toward suppression, but the dominant trees are healthy and reaching from *Almost Heaven* toward heaven.

The plot's Crown Competition Factor (CCF) is 221%. (CCF = the max crown space they *should have* divided by the space they *do have*). A CCF around 220% is considered the density ceiling for black walnut (Van Sambeek, personal communication). Another density metric is Basal Area which is 163 square feet/acre for this plot. Timber Stand improvement (TSI) thinning targets are about 75 sqft/a

Crown size was measured to see if it correlates to tree growth when we finally get growth measurements. This is a low quality measurement, but much better than just saying "co-dominant". Trees below the canopy were given zero for crown size and huddle along the bottom of the chart below.



The red line is the Max Crown Diameter, MCD, determined years ago from open grown black walnut trees. The MCD is the biggest crown a tree can support for a given diameter, hence the fastest growing rate. There should be no tree crowns above the MCD red line. There are 118 trees in the canopy and 67 below the canopy. Notice that the largest trees are close to the MCD red line. These large crowned trees, around 60 foot crowns and 30 inches DBH, have averaged 0.36 inches per year growth over their 83 year life. They obviously have not been suppressed. They are truly "boss" trees. They must have grown up close to the red line the whole time. They have aggressively stomped lesser neighbors in the canopy battle at every argument.

In this kill-or-be-killed setting, it is amazing to see the lengths some trees reach out to get canopy space. The "boss" trees are typically straight, but the lesser trees are often leaning toward their lopsided crowns away from their bossy neighbor. Many years of highly competitive living has amplified small differences in genetics, micro-site, or luck. The number of healthy dominant trees is about the same as would be selected as crop trees in a TSI program. The number of failing trees also matches about the number a TSI program would cull, but the natural Blennerhassett culls are still here trying to stay upright. The CCF and basal area numbers tell us there are twice too many stems here. The CCF and basal area metrics are about averages and can be deceiving. We don't have 185 trees all growing at half speed. As the graph above shows, many are growing close to full speed; losers are struggling to stay alive; and there is a continuum of results between.

Defect	Trees	% of Trees
epicormic	67	36
dead top	46	25
mechanical	44	24
decay - ants	40	22
cavity	34	18
lean	27	15
roped bark	22	12
persimmon bark	21	11
frost crack	15	8
wind damage	14	8
unstable	7	4
bird peck	4	2
widow maker	2	1
lightning	2	1

Trees per defect (36% have of the trees have epicormic sprouts)

# of defects	# of trees	avg(Score)	% of Value
0	38	53,771	31.8
1	48	36,639	27.4
2	42	31,449	20.5
3	34	23,318	12.3
4	15	22,370	5.2
5	2	28,398	0.9
6	4	28,162	1.8
7	1	6,856	0.1
8	1	800	0.0

Defects per tree (38 trees have no defects and represent 32% of the total plot commercial value)

Holes in the Canopy

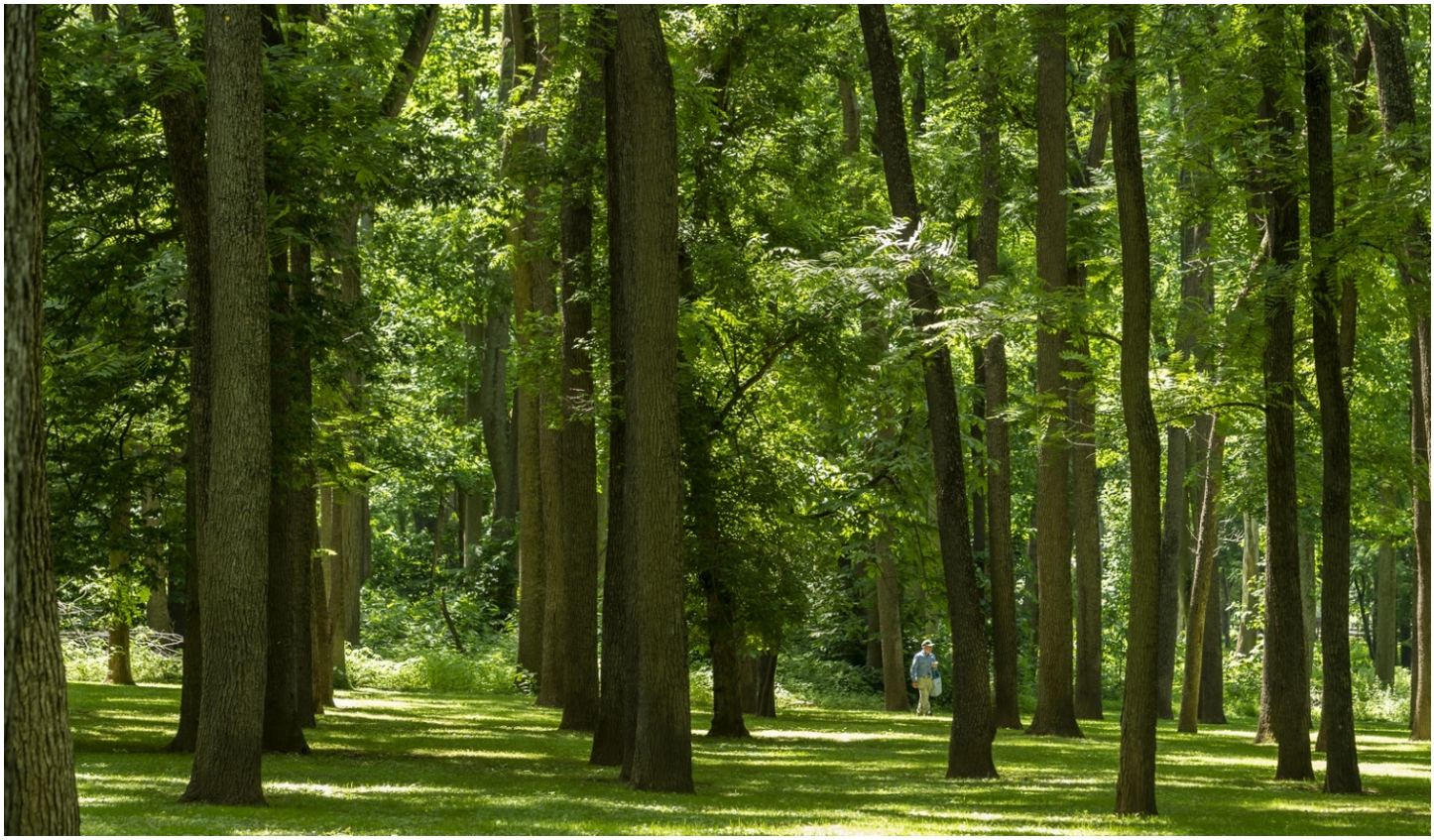
There has been a comment that trees over 60 years old will not respond to thinning. To test the idea, we recorded the sizes of a canopy holes above stumps. Some stumps had no hole above them, so they must have been overtopped when the tree died. Some canopy holes had no stumps beneath them, but did have a depression showing where a tree had been. We judged the age of each stump based on the stage of decay. During the next measurement campaign we can see if the canopy holes are closing. From our brief observation, it appears that the holes are not closing for two reasons: 1. We did not see new young growth extending into the holes. The exception is wind damaged trees whose epicormic sprouts are headed off with vigor in all directions. 2. Canopy holes persist above depressions after the stump has completely rotted away – maybe after 25 years.

Canopy Estimating Position

Left-to-right: 50.4" DBH north baseline monument tree; Russ Hern - - - two grey beards

Plant Material

In 1935, there would have been very few retail or wholesale nursery outlets for purchasing seedlings to plant as folks commonly do today. From several places where the trees were close together in their row, it appears that they must have started this planting by directly seeding nuts down each row as close as 1-foot apart. Given that several 4-foot + DBH walnuts occur in the yard of the mansion, we assume that the planters likely used those nuts to establish this planting. The plantation trees perhaps could be half siblings - an easy question to answer for molecular biologists. In any case, even small differences in genetics and environment are amplified in the distribution of growing success within this highly competitive setting. It seems that, even among close relatives, winners are growing close to full speed and losers are becoming den trees in this "reality show".



Summertime at Blennerhassett Park *photo courtesy of Todd Griffith*

Commercial timber has not been on any priority list here. Our timber brains are judging results for an operation whose goals have been completely elsewhere. They have succeeded. This is an idyllic place if you are not focused on 14 types of defects. It is easy to get dreamy here. This is how we see our own young plantings when we close our eyes. It is also fun to hypothesize on the economics of a partial harvest, or the positive effect that a timely thinning might have had, but that's all a blue sky fantasy. These trees are not to be disturbed. They will continue their duty to cast shade on picnickers, feed squirrels willing to swim the mighty West Virginia, and demonstrate nature's processes to the sharp observer.

For a copy of the measurement data contact jfknutz@gmail.com or jrmckenn@purdue.edu

Follow-up emails

Friends,

Before growth started this spring, Jim McKenna, Russ Hern, and I measured an 83 year old plot of black walnuts at West Virginia's Blennerhassett Island State Park. Report attached.

Blennerhassett is a nice place, but hard to rhyme. https://www.youtube.com/watch?v=MilfP2fVLhU

Regards, jfk

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West Virginia Black Walnut News #13b

Aaaargh! - - - some confusion. The park is certainly not "off limits" (unless you are carrying a chainsaw). You ride a paddle-wheeler from the dock in Parkersburg. As I remember, the tickets are $10, purchased at the museum two blocks from the dock, The boat leaves on the hour from 11:00 until 4:00. For better quality info check the link below and scroll down the webpage.

https://wvstateparks.com/park/blennerhassett-island-historical-state-park/

Before starting out, call 304-420-4800 to assure that everything is in order.

Regards, jfk

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West Virginia Black Walnut News #13c

Friends,

A brief and mangled Blennerhassett history:

Aaron Burr ran for president against Thomas Jefferson in 1800, which came out a draw in the electrical cottage, sic. Jefferson finally won the tie-breaker, and in those days the runner up, Burr, became vice president and was promptly expelled.

Burr, having nothing to do, was often a guest at the Blennerhassetts' mansion on the Ohio River. Burr and Blennerhassett hatched up an idea to take Texas away from Mexico and make a new country. Making a new country was great fun. They had just done the same thing to England.

With Burr's military and political experience and Blennerhassett's money, they headed down river collecting frontier participants. This territory was US, Spanish, French, Mexican, Louisiana Purchase, and well before Trump's Wall, so the boundaries were fuzzy. They had made it to Mississippi when arch-enemy (Jefferson), considering the plan a threat, had Burr arrested for treason. The rest is history.

Burr's problem was timing. Sam Houston had the same idea later, and it worked. If Burr had had a little better timing, we would be cheering for the Burr Astros, the Burr Rockets, and hearing "Burr, we have a problem".

I asked the nice lady at the ticket counter about the black walnut trees on the island. She said “Yes, the trees were planted by Thomas Jefferson.” In history there are sometimes bits and pieces of truth. The trees were planted. They didn't just come up in rows.

Regards, jfk

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West Virginia Black walnut News 13d

Friends,

While we were measuring the Blennerhassett tree crowns, Russ noticed that it was a lot easier with a little wind and swaying. I came across this drone video that proves Russ' point.

https://twitter.com/i/status/1117505430895439872

With a video like this overlaid on a stem map and some smart software, we should be able to figure out all the crown areas.

Regards, jfk

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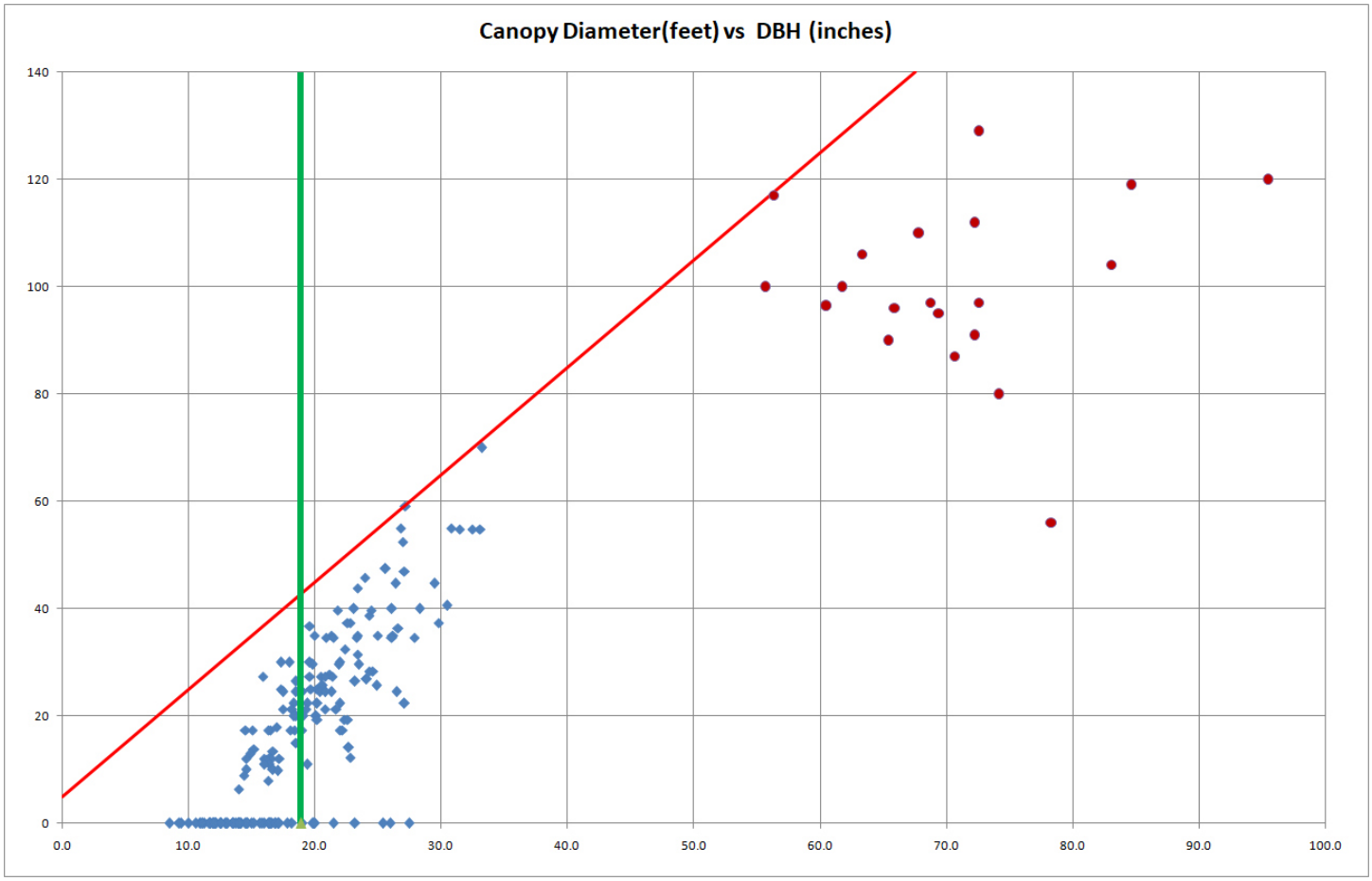
West Virginia Black walnut News 13e

Comments about Blennerhassett Data

An exchange of emails with Bob Chenoweth has been an eye opener regarding thinning and lessons from the Blennerhassett data. Most of the forest science and the thinning work I had done were about averages. In young plots, which are all the plots we visit, the trees are generally all about the same size - the average size for the plot. When full competition kicks in, things get nasty. Then it's kind of like free enterprise. You can talk about average sized retailers, but there aren't any out there. Small advantages and disadvantages get amplified by canopy competition. The big guys get bigger and the small guys fall further behind. Competition expands the standard deviation. When I first saw the Blennerhassett black walnuts, I knew it had been unmanaged because ugly trees were still there.



The Blennerhassett plot we measured has 185 live black walnut trees, all 83 years old. They are shown as blue diamonds above. Just for laughs, I added the red circles - some state black walnut big tree champions from the native range. The red line is the Max Crown Diameter, (MCD). The green line is the average DBH of all 185 live trees, 18.9 inches (sDev = 5.3). There are not 185 average trees. Live tree diameters range from 8 to 33 inches. The 67 trees below the canopy have no canopy diameters and are huddled on the zero line along the bottom of the chart. The 118 trees above the zero line are in the canopy and average 21.3 DBH. The sub-canopy trees average 14.7 inches. The sub-canopy losers are on the way to compost and will never reenter the canopy. They were not removed by a management plan. They are nature's culls – still alive, but relatively harmless. The big question is: "Did their presence hurt the crop tree growth?" A little extra growth on the high value crop trees is probably worth more than all the culls combined.

The canopy battle continues. A tree's distance well below the red MCD line is an indicator of pending crown-squeeze trouble. Trees close to the red MCD line should be healthy and growing at close to the max rate. They have nearly all the crown they can support.

The few 30 inch plus trees here are impressive. A good management plan needs to understand how the 30 inchers managed to average 0.36 inches per year for 83 years, and then duplicate the process over the whole plot. Obviously the 30-inchers were never long suppressed. They must have grown up close to the red line their whole life. How does that work? Each year the DBH gets bigger so a growing tree continuously can use more canopy space, but we can't stretch our fields like a rubber sheet. They must have been wiping out their neighbors on a routine basis. And they did it without any help. That's cool, but there are only eight 30-inchers, and the plot could support 40 such giants on the 2.4 acres. The 40 most valuable trees average 25.5 inches DBH, but would have been bigger had they been pampered.

Photo courtesy of Todd Griffith

I thought I had invented a novel thinning plan I called “Pampering Crop Trees” (attached chapter 12) then I saw the same idea written up by Dick Schlesinger in the Black Walnuts Notes from years ago. The basic idea is to first identify and mark crop trees plus a few spares. Crop trees need crown diameter to be close to their MCD = 2 * DBH + 5 (red line) over their entire life. So we go to a crop tree and look up. Trees like the “Blennerhassett Eight” will need no help – walk on. Crop trees whose crowns are being squeezed could use a little assist. We girdle the one neighbor that is the most bother in the canopy and walk on to the next crop tree. When the holes we have made in the canopy are closing, it is time to reexamine the crop trees – maybe 4 years. Some reasons to go slow are: 1. to maintain shade on the lower part of the crop tree, 2. to maintain support against wind and bow-over, and 3. to keep pushing crop trees upward.

I started using the "Pampering" method last winter. It was amazingly simple and quick, once I got going. When I finished, it was hardly noticeable that I had done anything. One big difference is that I felt good about it, vs. usually feeling crappy during thinning. That tells me something. Maybe I’m just being politically correct, but pampering crop trees sounds better than culling my babies. I like Hugh Pence’s comment about plantation thinning, “Sometimes it makes you choke.”

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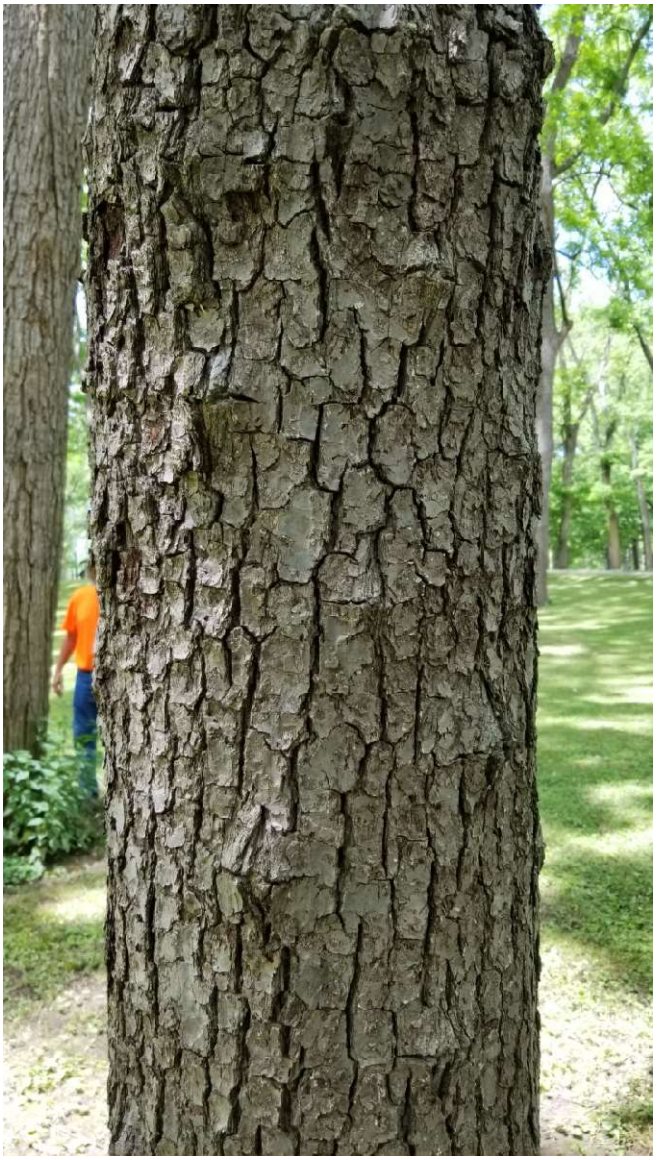
West Virginia Black Walnut News #13f

Blennerhassett Bark

We observed a couple of black walnut bark features which were rather new to me. Knot knowing the proper names, we called them “Roped Bark” and “Persimmon Bark”. We included them in the list of “Defects”, but I’m not sure they are defects. I wood like to know Dan Harris’ opinion of what lies beneath.



Persimmon Bark was usually on smaller trees that had other defects. We recorded 21 trees with persimmon bark. They averaged 15.5 inches DBH vs.18.9 inches for the plot average. Also they averaged 3.4 defects per tree including the persimmon bark. There were 14 of the 21 persimmon barked trees that were “overtopped” beneath the canopy, and 5 more had very small canopy crowns. Generally bark holds a history of a tree’s growth, including tiny annual rings. Bark patterns cannot be easily changed, so whatever the condition that causes persimmon bark, it must have been present for many years.

Roped Bark tended to be on larger trees. There were 22 trees with roped bark. They averaged 23.6 inches DBH vs. an 18.9 inch average for the plot. They were typical of the plot regarding other defects.

I have in mind one more addendum to West Virginia Newsletter #13. The subject will be “Mechanical Damage”. Then I’ll quit – I swan.

Jfk

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