Dendrometer Cost Estimate, 2019 & 2020

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/today

Plot Selection

Assumptions for tree selection for dendrometer band installation:

- all stemDiameters converted to aboveground biomass based on specific allometric equations from Chojnacky et al., 2014
- within subset of 5 target Tower plots all trees > 1 cm & < 75th percentile aboveground biomass located in subset of plots measured with diameter tapes or calipers on an annual basis (Table 2)
- all trees > 75th percentile aboveground biomass located in subset of plots recieve dendrometer bands
- all trees ≥ 95th percentile aboveground biomass in all Tower plots recieve dendrometer bands

The diameter thresholds at each site, based on aboveground biomass are summarized in Table 1

Table 1: stemDiameter thresholds for the 75th and 95th percentiles based on aboveground biomass

siteid	75th	95th
BONA	15.1	23.6
DEJU	12.2	16.2
HEAL	12.8	14
NIWO	14.1	25.1
RMNP	26.1	38.9
SJER	29.3	47.7
SOAP	25	50.7
TEAK	26.3	57.5
WREF	23.1	54.6

Table 2: Target plots by site

x	BONA	DEJU	HEAL	NIWO	RMNP	SJER	SOAP	TEAK	WREF
1	BONA_071	DEJU_045	HEAL_047	NIWO_040	RMNP_041	SJER_045	SOAP_031	TEAK_043	WREF_073
2	BONA_072	DEJU_046	HEAL_051	NIWO_041	RMNP_042	SJER_046	SOAP_043	TEAK_044	WREF_074
3	BONA_075	DEJU_047	HEAL_066	NIWO_045	RMNP_043	SJER_047	SOAP_044	TEAK_045	WREF_075
4	BONA_076	DEJU_048	HEAL_073	NIWO_046	RMNP_044	SJER_049	SOAP_046	TEAK_046	WREF_076
5	BONA_077	DEJU_049		NIWO_051	RMNP_045	SJER_050	SOAP_047	TEAK_047	WREF_077

Equipment

Assumptions for equipment lists:

- totalBandLenth = (dbh + extra, based on size) * 3.14

- label tape = sum tapeCount (totalBandLenght/640)*1.2
- springs 1.5 in = only used for stems < 10 cm dbh, no qualifying stems (may be used during remeasurement to extend already installed bands)
- springs 3 in 0.26 guage = count of stems 10-40 cm dbh *1.25
- springs 3 in 0.31 guage = count of stems >50 cm dbh *1.25
- hole punch, tin snips, hatchet = 1 per DSF
- mora knife = 2 per DSF (may need additional knives if multiple sites within a domain are installing concurrently - D18/19)
- metal digital calipers - model listed here suggested in Smithsonian protocols, comparable product is acceptable. May need to use dial calipers intead of digital in wet environments (mcmaster.com item # 2325A55)
- TOTAL_known = sum of listed equipment costs + 2.5% fully burdened cost
- TOTAL_est = incresed equipment cost by 40% to account for sites with no initial data

Additional Consideration: *per unit cost of springs varies from $1.50- $7, depending on volume, if ordered directly by domains. This estimate assumes ordering by HQ then distributing to DSFs. It may still be preferable, logistically, to order direct from supplier, despite increased cost.*

Table 3: Banding summary by site

domainid	siteid	springLength	n	maxDBH	totalBandLength	tapeCount	springs
D10/13	NIWO	long_0.26	70	45.3	5779	12	88
D10/13	NIWO	long_0.31	2	66.2	432	1	3
D10/13	RMNP	long_0.26	113	49.6	13599	26	142
D10/13	RMNP	long_0.31	2	52.2	371	1	3
D17	SJER	long_0.26	8	48.6	1220	2	10
D17	SJER	long_0.31	6	65.4	1272	2	8
D17	SOAP	long_0.26	26	48.4	3364	7	33
D17	SOAP	long_0.31	33	105.7	8076	16	42
D17	TEAK	long_0.26	56	49.2	7231	14	70
D17	TEAK	long_0.31	77	139.6	20315	38	97
D18/19	BONA	long_0.26	111	33.9	9407	18	139
D18/19	BONA	long_0.31	2	120	588	1	3
D18/19	DEJU	long_0.26	108	25.6	6780	13	135
D18/19	HEAL	long_0.26	8	14	444	1	10

Table 4: Equipment list for banding stems at sites with initial vst data available

Vendor	Item	count	price
www.mcmaster.com	item no. 1598T62 - stainless steel label tape 1/2 (1.3 cm) in 21ft (6.4 m) .007 thickness	152	$1,263.12
www.leespring.com	lee Spring - LE 026C 05 S - 1.5 in springs, stainless steel		
www.leespring.com	lee Spring - LE 026C 11 S - 3 in springs, stainless steel 0.26 gauge	627	$689.70

Vendor	Item	count	price
www.leespring.com	Lee Spring - LE 031C 11 S - 3 in springs, stainless steel 0.31 gauge	156	
www.roperwhitney.com	heavy duty hole punch	4	$392.00
www.amazon.com	tin snips	4	$80.00
www.knifecenter.com	mora knife	8	$120.00
www.forestry-suppliers.com	hatchet - use CDW equipment if available	4	$160.00
www.mcmaster.com	mcMaster item no. #2325A55		
TOTAL_known			$2,772.44
TOTAL_est.	TOTAL_known * 1.2, to account for YELL with no initial data		$3,326.93

Labor and Travel

Assumptions for labor cost estimates:

- hrs_per_plot = average time for 2 staff to complete full vst measurement of a Tower plot (provided by DM)
- n_targetPlot = count of plots in the lowest 5 mortorn order list
- n_nonTarget = count of plots that contain largest trees
- n_bands = count of trees >75th percentile of biomass in target plots + count of trees >95th percentile of biomass in non-target plots
- hrs_field_install = (n_targetPlot * hrs_per_plot * 2 staff) + (n_nonTarget plots * 30 min travel) + (n_bands * 25 mins(WREF, SJER, and SOAP), 12 mins (all other sites)
- hrs_field_remeasure = (n_targetPlot * hrs_per_plot * 2 staff) + (n_nonTarget plots * 30 min travel) + (n_bands * 3 mins (all sites)
- hrs_travel = (hrs_field / 8)*(hrs_to_site * 2) *assumed 0.5 hrs travel for all sites with field lodging (i.e. DEJU, HEAL, SOAP, TEAK)*
- labor_cost = (hrs_field + hrs_travel) * $51.66/hr (2019 sites) OR $53/hr (2020 sites: SOAP, TEAK, YELL)
- travel_cost = ((hrs_field / 8) * lodging) + ((hrs_field / 8) * perDiem) * 15% GRA

Table 5: Assumptions for cost development. * YELL, baseline data for are not yet available, labor estimates are based on data from similar sites.

siteid	hrs_plot	n_target	n_nonTarget	n_bands	hrs_band	hrs_to_site	lodging	perDiem
BONA	8	5	7	113	0.18	0.5		
DEJU	6	5	8	108	0.18	0.5	95	90
HEAL	3	4	0	8	0.18	0.5	95	90
NIWO	4	5	3	72	0.18	1		
RMNP	8	5	3	115	0.18	1		
SJER	5	5	2	14	0.37	0.75		
SOAP	8	5	7	59	0.18	0.5	45	66
TEAK	8	5	14	133	0.18	0.5	20	66
WREF	9	5	14	0	0.37	1.5		
YELL*	9	5	5	100	0.18	2		

Table 6: Labor and travel costs for dendrometer band installation and full vst meaurement of 5 target plots.

siteid	hrs_field	hrs_travel	labor_cost	travel_cost	total_cost_install	total_cost
BONA	106.1	14	6204	0	6204	$6,204.37
DEJU	85.6	11	4990	2340	7331	$7,330.61
HEAL	25.6	4	1529	851	2380	$2,380.14
NIWO	55.9	14	3611	0	3611	$3,611.03
RMNP	104.5	28	6845	0	6845	$6,844.95
SJER	56.74	12	3551	0	3551	$3,551.11
SOAP	107.7	14	6450	1787	8237	$8,236.67
TEAK	113.6	15	6816	1483	8299	$8,299.30
YELL*	112.5	60	8911	0	8911	$8,911.35
TOTAL					55370	$55,369.53

Table 7: Labor and travel costs for full vst measurement of 5 target plots and re-meaurement of all banded trees.

siteid	hrs_field	hrs_travel	labor_cost	travel_cost	total_cost_annual
BONA	89.15	12	5361	0	$5,360.95
DEJU	69.4	9	4155	1915	$6,069.95
HEAL	24.4	4	1505	851	$2,356.20
NIWO	45.1	12	3026	0	$3,026.30
RMNP	87.25	22	5790	0	$5,790.25
SJER	51.7	10.5	3297	0	$3,296.60
SOAP	86.45	11	5165	1404	$6,569.00
TEAK	93.65	12	5599	1187	$6,786.25
WREF	97	39	7208	0	$7,208.00
YELL*	97.5	52	7924	0	$7,923.50
TOTAL					$54,387.00

Materials and labor total cost, year 1 = **$58,696.46**

Annual re-measurement labor total cost for years not currently on vst schedule, this estimate includes Wind River and is based on 2020 labor rates = **$54,387.00**

Timeline

Table 8: Timeline for dendrometer band installation.

siteid	proposedYear	permittingStatus	Tower_vst_2019	extend_TFT
SJER	2019	site host approved		yes
WREF	2019	site host approved	scheduled: 8/26 - 9/12.	yes
WREF	2019	site host approved	scheduled: 8/26 - 9/12.	yes
NIWO	2019	site host approved	scheduled: 9/9 - 9/12	no
BONA	2019	site host approved		yes
HEAL	2019	site host approved		no
RMNP	2019	pending	scheduled: 8/5 - 8/8 (pending site host approval).	no

siteid	proposedYear	permittingStatus	Tower_vst_2019	extend_TFT
DEJU	2019	pending		no
SOAP	2019/2020	pending	characterization data used	
TEAK	2019/2020	pending	characterization data used	
YELL	2020	pending	inital bout	

Site Specific Modifications

RMNP

The site host at this site has requested a maximum of 80 bands be installed. A total of 86 trees qualify for bands according to this analysis. Trees at this site were ordered by biomass and every 14th tree removed to retain the final distribution of tree sizes banded at the site.

The trees selected for removal include:

- NEON.PLA.D10.RMNP.03039
- NEON.PLA.D10.RMNP.02184
- NEON.PLA.D10.RMNP.02418
- NEON.PLA.D10.RMNP.02311
- NEON.PLA.D10.RMNP.02309
- NEON.PLA.D10.RMNP.02900