



University of Idaho

College of Natural Resources

RECONSIDERING STOCKTYPE SIZES: LONG-TERM RESULTS FROM A STOCKTYPE COMPARISON STUDY IN NORTHERN IDAHO

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**CENTER FOR FOREST NURSERY &
SEEDLING RESEARCH**

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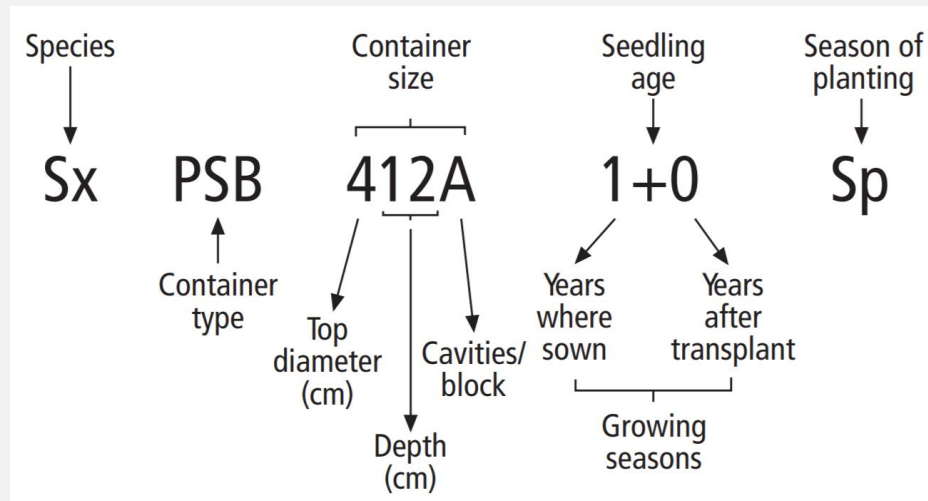
WHAT IS A STOCK TYPE?

I Defined by the seedling's age and the basic method by which it was produced (e.g., bareroot, container, etc.)

- Inexactly implies seedling size and provides no information about physiological condition

I Objective of selection is to decide, by species, site conditions, and experience, the seedling characteristics that best suite each site

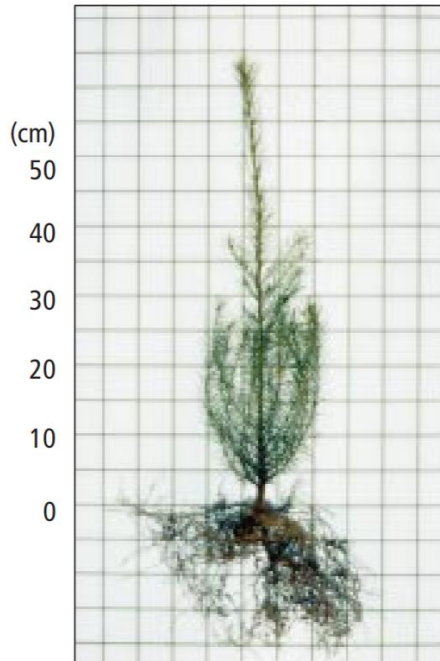
I STOCK TYPE IS ONE OF ONLY A FEW THINGS A CUSTOMER CAN REQUEST FROM THE NURSERY TO MEET THEIR REFORESTATION NEEDS



BAREROOT STOCK TYPES

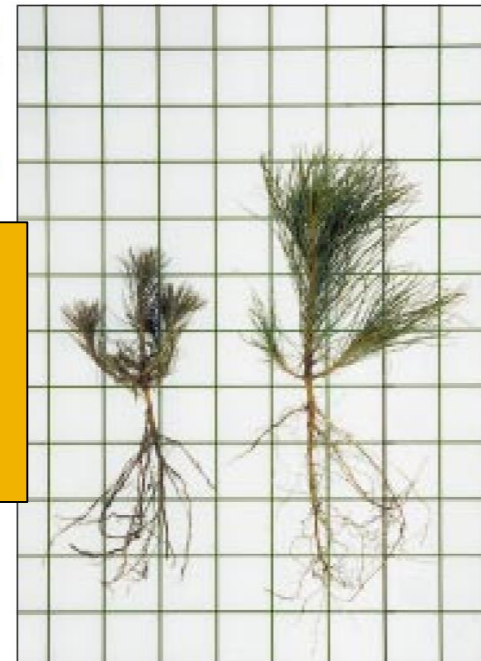
PLATE I. Examples of seedlings grown as bareroot stock types.

Plate 1a.
Fdc BBR 2+0



Coastal DF
Bed bareroot
2 years in
same bed

Plate 1b.
Pli BBR 1+0 (left) and
Pli BBR 2+0 (right)



Interior
Lodgepole
Bed bareroot
1 vs. 2 years



CONTAINER STOCK TYPES USUALLY DEFINED BY CONTAINER TYPE AND CELL SIZE (THERE ARE MANY)

Styroblock® container growing system														
Tray Dimensions: 23 5/8 x 13 7/8 inches / 600 x 352 mm					Cell Specifications									
Series	# of Cells	Planting Density		Volume Spec	Designation		Diameter				Actual Volume		Cell Depth	
		/sq.ft	/sq.m		Metric	US	Top		Drain Hole		cu.in	ml	in	mm
							in	mm	in	mm				
400	20 x 20 <small>12 5/8 x 12 5/8 in (322 x 322 mm)</small>	354.3	3814	5	105C		0.5	12	0.4	9	0.3	4.5	1.75	44
540	30 x 18	237.2	2557	8	105A		0.56	14	0.42	11	0.5	8	2.00	51
308	22 x 14	135.3	1458	8	105B		0.56	14	0.42	11	0.5	8	2.00	51
448	28 x 16	196.2	2121	17	207A	1	0.69	17	0.47	12	1.0	17	2.82	72
240	20 x 12	105.9	1135	18	206A		0.9	23	0.31	8	1.1	18	2.48	63
				40	211A	2A	0.95	24	0.36	9	2.4	39	4.47	113
				50	213A	3A	0.95	24	0.55	14	3.0	49	5.09	129
209	19 x 11	92.6	996	40	310A		1.00	25	0.55	14	2.4	40	4.10	104
198	18 x 11	87.3	936	40	310C		1.00	25	0.55	14	2.4	40	4.10	104
				45	311A		1.02	26	0.55	14	2.6	45	4.33	110
				50	312A		1.07	27	0.55	14	2.9	48	4.75	121
				60	313A	4A	1.10	28	0.45	11	3.7	60	5.21	132
180	18 x 10	79.1	852	60	309A		1.10	28	0.75	19	3.7	60	3.74	95
				70	313C		1.13	29	0.73	18	4.0	66	5.21	132
160	16 x 10	70.6	756	80	310B	4S	1.18	30	0.61	15	3.3	54	4.07	103
				65	313B	4	1.17	30	0.55	14	3.9	65	4.97	126
				90	315B	5.5	1.18	30	0.73	18	5.5	90	5.96	151
				120	323A	7	1.18	30	0.45	11	7.3	120	8.94	227
144	16 x 9	63.5	681	80	411B		1.24	31	0.55	14	4.9	80	4.33	110
				95	313D		1.28	32	0.73	18	5.8	95	5.21	132
128	16 x 8	56	609	80	410C		1.875 x 1.375	37 x 30	0.75	18	4.9	80	4.00	101
112	14 x 8	49.4	530	80	410A	6S	1.42	36	0.30	20	4.9	80	4.07	103
				95	412B		1.42	36	0.86	22	5.8	95	4.58	116
91	13 x 7	40.1	430	105	415B	6	1.40	36	0.86	22	6.6	108	5.83	148
				130	415C	8L	1.53	39	0.86	22	7.9	130	5.96	151
77	11 x 7	34.0	364	80	410B		1.43	36	0.55	14	4.9	80	4.07	103
				125	412A	10S	1.64	42	0.86	22	7.6	125	4.58	116
				170	415D	10	1.65	42	0.86	22	10.0	164	5.96	151
60	10 x 6	26.5	284	220	512A	15S	2.05	52	0.86	22	13.4	220	4.69	119
				250	515A	15	2.00	51	0.73	18	15.3	250	5.96	151
				340	615A	20	2.33	59	0.73	18	20.5	336	5.96	151
45	9 x 5	19.8	213	450	620A	28	2.33	59	0.73	18	26.9	440	7.95	202
35	7 x 5	15.4	166	440	815C		3.01	78	1.00	25	26.9	440	5.96	151
28	7 x 4	12.3	132	340	615B		2.33	59	0.73	18	20.5	336	5.96	151
				500	623A	30	2.33	59	0.95	25	31.7	520	8.94	227
24	6 x 4	10.5	113	700	815A		3.24	82	1.00	25	42.7	700	5.96	151
20	5 x 4	8.8	95	535	815B		3.00	76	1.25	32	32.6	535	5.96	151
				700	723A	45	2.73	69	0.98	25	43.3	710	8.94	227
15	5 x 3	6.6	71	1000	1015A	60	3.97	101	0.98	25	61.0	1000	5.91	150
8	4 x 2	3.5	38	3000	1318A	Gallon	6.19	157	0.98	25	195.2	3200	7.02	178

INTERIOR DOUGLAS-FIR CONTAINER STOCK TYPES



WESTERN LARCH CONTAINER STOCK TYPES



WESTERN WHITE PINE CONTAINER STOCK TYPES



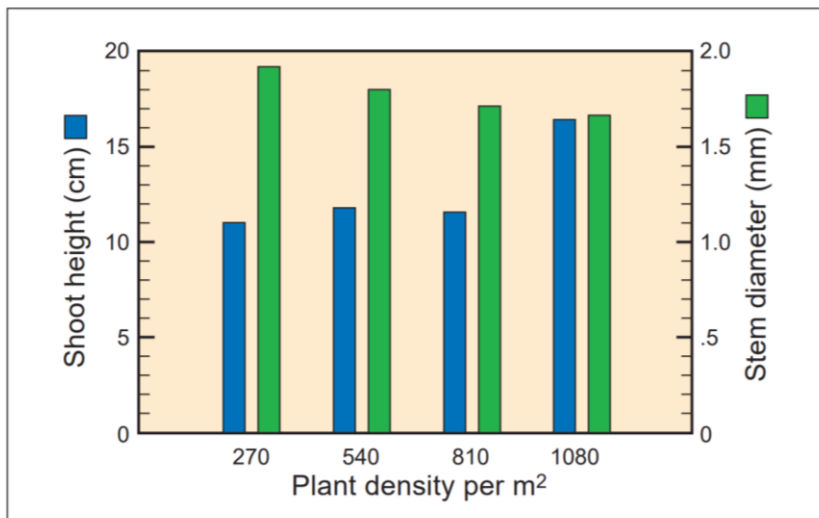


STOCK TYPE SELECTION CONSIDERATIONS

SEEDLING SIZE

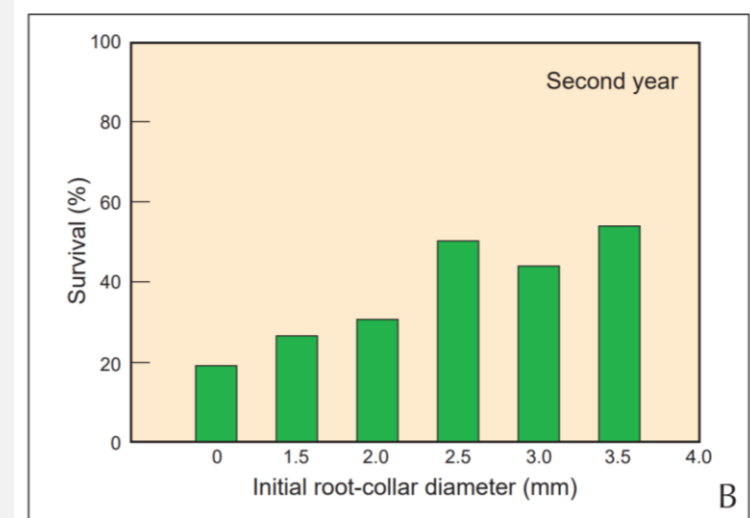
- I Select the seedling size that overcomes the site limiting factors
- I Principles of container size and age:
 - Longer time for growth = taller seedlings and larger stem diameters
 - Larger container sizes = more roots, larger diameter, and typically taller
 - Wider seedling spacing = more branching and larger diameter

Same cell size, different spacing



Ritchie et al. 2010. Chp 2, Vol 7. CTNM
Adapted from Timmins & Tanaka 1976

E. Spruce survival by stem diameter



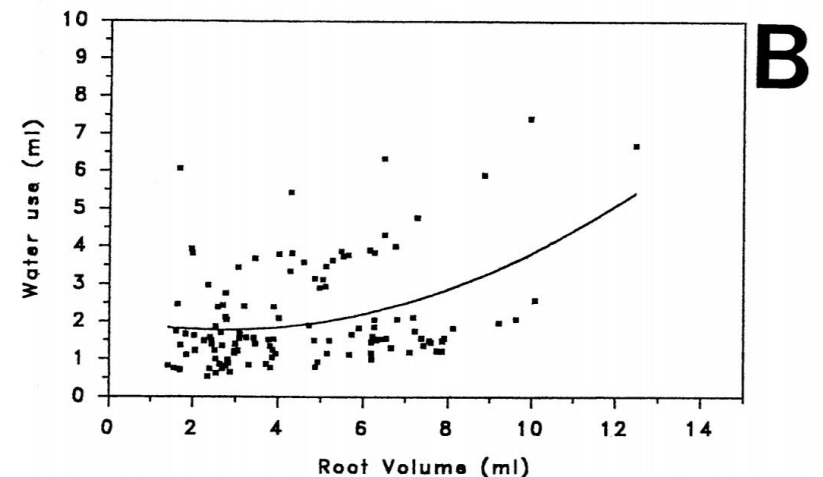
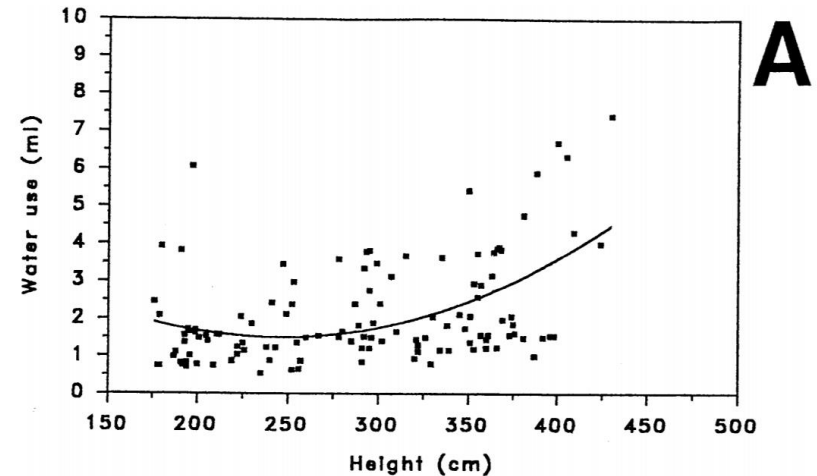
Ritchie et al. 2010. Chp 2, Vol 7. CTNM
Adapted from Hines & Long 1986

STOCK TYPE SELECTION CONSIDERATIONS

LIMITING FACTORS - DROUGHT

- I Select drought-tolerant species & time planting to avoid drought period (i.e. spring)
- I Well-branched, woodier stems, and hardened tissues (stress resistant) minimize water loss
- I Avoid stock with large shoots & poorly developed or small root systems. Need well balanced seedlings

Taller seedlings have more needles, increasing water loss. If new root growth does not increase too, seedlings can lose too much water



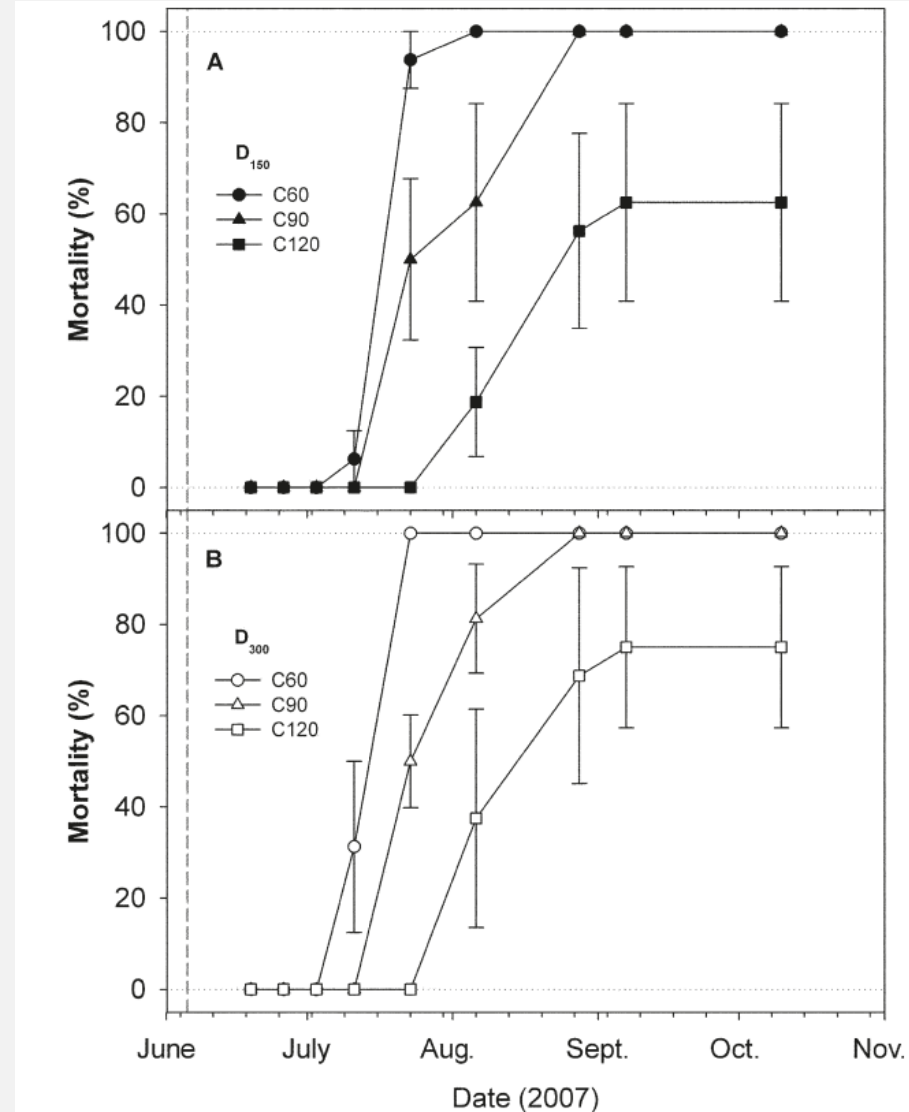


STOCK TYPE SELECTION CONSIDERATIONS

LIMITING FACTORS – VEGETATION COMPETITION


I Larger stocktypes may give seedlings better ability to withstand competition

Larger stocktypes (circles) had lower mortality with high grass competition (bottom graph) compared to smaller container sizes






STOCK TYPE RESOURCES



Provincial Seedling
Stock Type Selection
and
Ordering Guidelines



BRITISH COLUMBIA
Ministry of Forests

REFORESTATION, NURSERIES, & GENETICS RESOURCES

RNGR

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RNGR MISSION:
To supply people who grow forest and conservation seedlings with the very latest technical information.

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POPULAR RNGR.net RESOURCES

- [National Nursery and Seed Directory](#)
- [Intertribal Nursery Council](#)
- [FNN/TPN Subscription Form](#)
- [Native Plant Network](#)
- [Links](#)

UPCOMING EVENTS

Breed for Seed: Inland Empire Tree Improvement Cooperative
Coeur d'Alene, ID
March 04, 2020
[For more information, click here.](#)

SER's 2020 North American Conference: Reclaim Restore Rewild
Quebec, Canada
June 07, 2020 - June 11, 2020
[For more information, click here.](#)

National Conference on Ecosystem Restoration
Portland, OR
August 02, 2020 - August 06, 2020
[For more information, click here.](#)

[View More Events...](#)

PUBLICATIONS

- **Tree Planters' Notes**
This publication is dedicated to technology transfer and publication of research information relating to nursery production and outplanting of trees, shrubs, and native plants for reforestation, conservation, and restoration.
- **The Container Tree Nursery Manual**
This seven volume set provides a comprehensive overview of topics concerning the production of tree and woody shrub seedlings in containers.
- **Tropical Nursery Manual**
A Guide to Starting and Operating a Nursery for Native and Traditional Plants
This comprehensive manual serves people who are starting or operating a nursery for native and traditional species in the tropics. Key concepts, principles, and processes are presented, based on proven practices and the best science available.
- **The Woody Plant Seed Manual**
General principles such as seed biology, harvesting, storage, testing as well as nursery practices.

RNGR.net includes a repository of approximately 12,000 searchable and downloadable articles relevant to nursery production, seedling quality, reforestation, tree improvement, germplasm conservation, and native plant restoration. Click [here](#) for more publications.

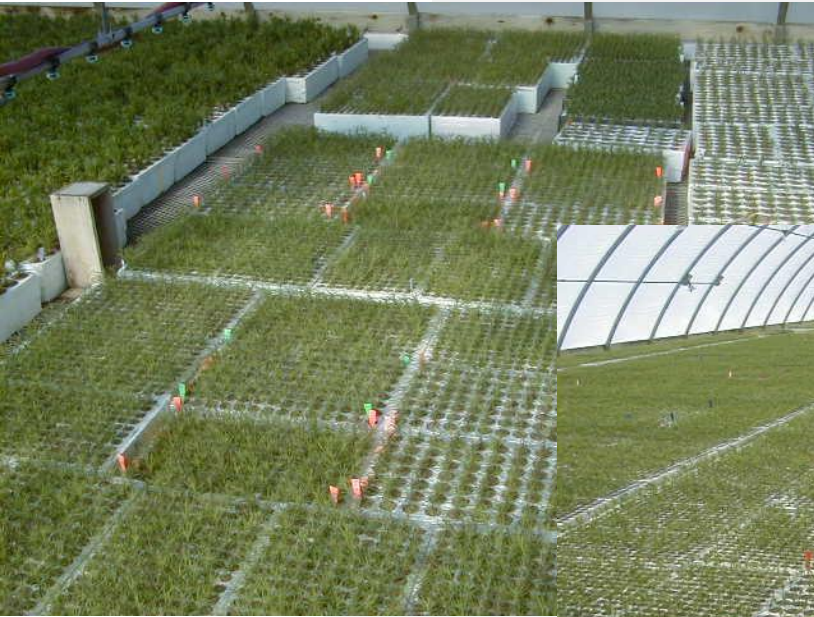


INLAND NORTHWEST STOCK TYPE STUDY

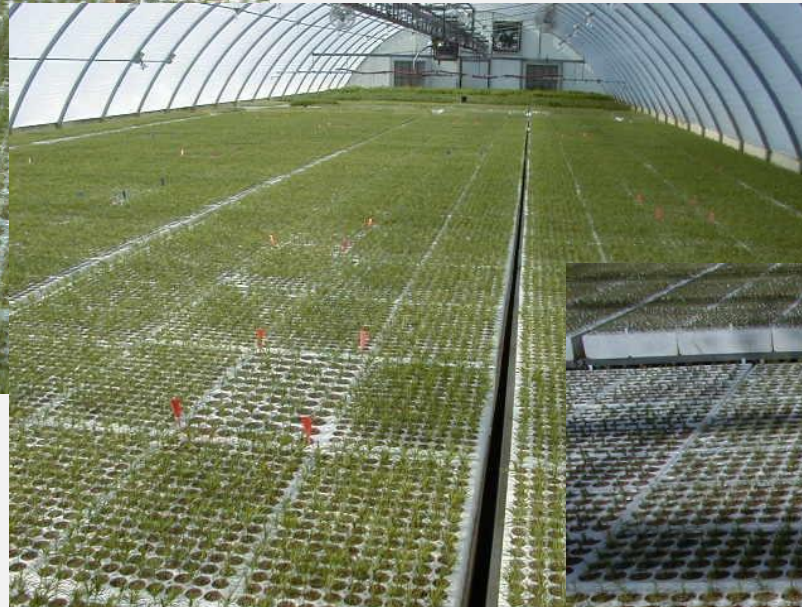
- I Each unique species and stocktype were randomly assigned a row within 3 or 4 blocks per site
- I 20 seedlings per row, spaced 8 ft within a row and 10 ft between rows
- I Running Iron planted late April 2007
- I Cameron Creek planted early June 2008
- I Initial, 1 year, 2/3 year, and 11/12 year (2019) measurements of height, diameter, and survival

Species	Styro 4	Styro 5	Styro 6	Styro 8	Styro 10	Styro 20
Interior Douglas-fir	X		X	X	X	X
Western larch	X		X	X	X	X
Western white pine		X	X	X	X	X

NURSERY PROPAGATION



Styro 6
112/105
415B



Styro 20
45/340
615A



Styro 10
77/170
415D

INITIAL SEEDLING SIZE

DOUGLAS-FIR

Stocktype	Height (cm)	Caliper (mm)
Styro 4	17.6 (12.6-23.5)	2.8 (1.9-3.9)
Styro 6	17.9 (12.6-27.6)	3.1 (2.3-4.4)
Styro 8	18.5 (12.4-22.9)	3.4 (2.3-4.1)
Styro 10	17.5 (8.9-26.2)	3.6 (2.4-4.7)
Styro 20	33.8 (21.9-46.3)	4.8 (1.7-7.6)

WESTERN LARCH

WESTERN WHITE PINE

Stocktype	Height (cm)	Caliper (mm)
Styro 4	15.5 (10.5-27.4)	2.8 (2.1-3.6)
Styro 6	15.2 (10.4-22.4)	3.2 (2.4-4.3)
Styro 8	15.7 (10.5-25.5)	3.4 (2.4-4.4)
Styro 10	15.0 (9.8-22.8)	3.6 (2.5-4.8)
Styro 20	27.7 (11.2-39.4)	5.4 (2.8-7.9)

Stocktype	Height (cm)	Caliper (mm)
Styro 5	13.1 (7.0-23.0)	3.3 (1.9-4.4)
Styro 6	14.5 (6.3-30.7)	3.6 (2.6-5.4)
Styro 8	13.1 (7.0-25.5)	3.7 (2.6-5.0)
Styro 10	13.7 (6.0-22.7)	4.0 (2.7-5.2)
Styro 20	15.4 (6.4-29.2)	4.8 (3.5-6.4)



TWO SITES IN NORTHERN IDAHO



RUNNING IRON



- I 117-acre stand
- I Planted spring 2007
- I Northwest aspect
- I 17% slope, 2900 ft elevation
- I Western redcedar/queencup beadlily habitat type
- I Site prep: broadcast burn



RUNNING IRON





RUNNING IRON - BEGINNING



RUNNING IRON - AGE 3

Styro 20 DF



Styro 20 WL



Styro 20 WWP





CAMERON CREEK



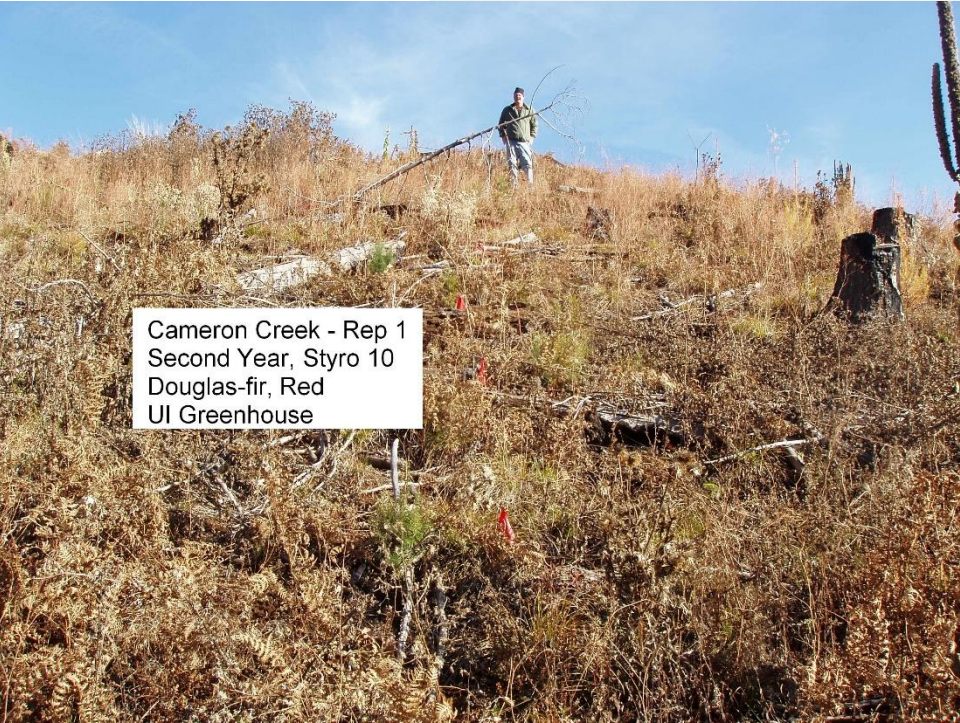
- I 64-acre stand
- I Planted spring 2008
- I Southwest aspect
- I 19% slope, 3100 ft elevation
- I Western redcedar/queencup
beadlily habitat type
- I Site prep: broadcast burn



CAMERON CREEK



CAMERON CREEK – YEAR 2



Cameron Creek - Rep 1
Second Year, Styro 10
Douglas-fir, Red
UI Greenhouse



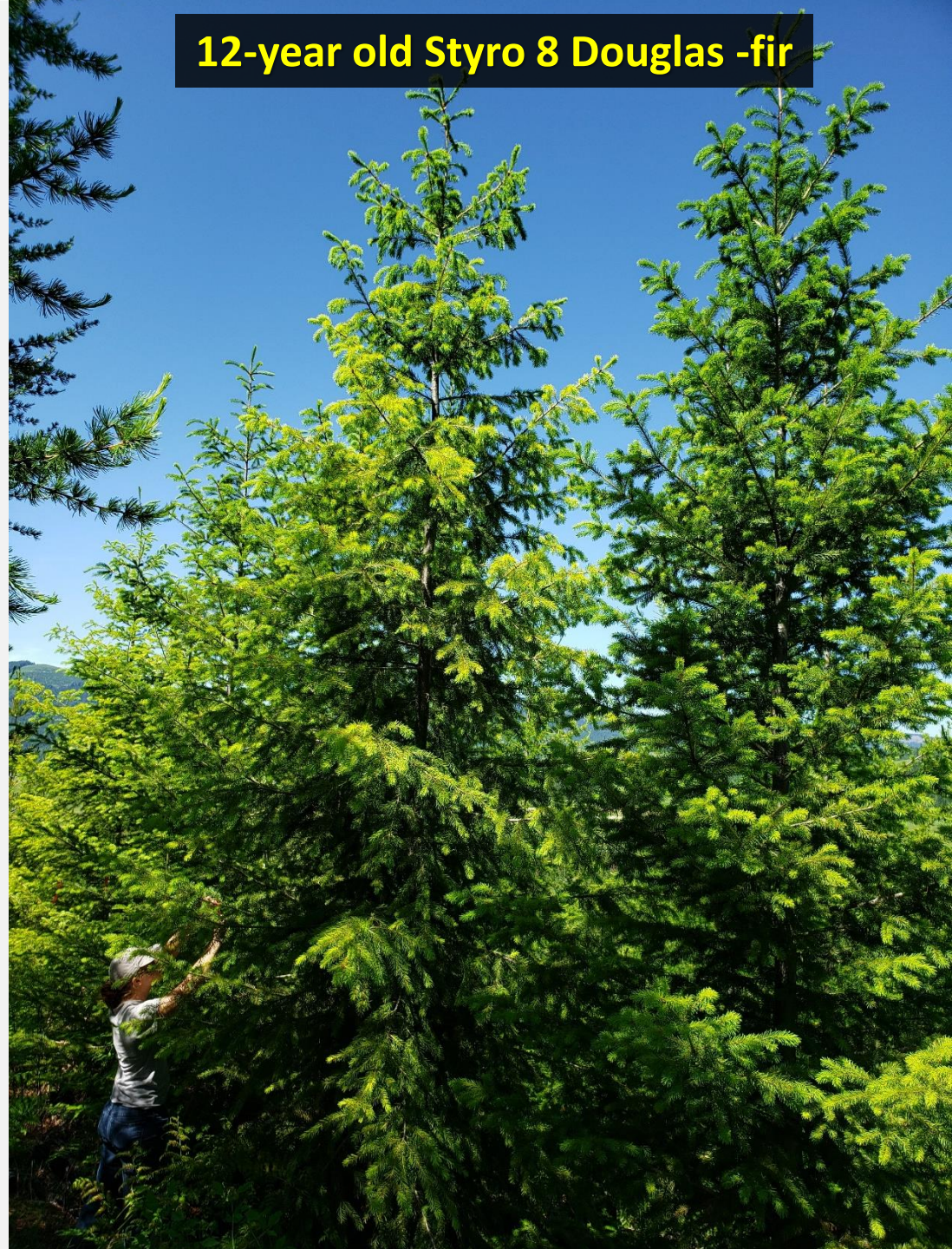
Cameron Creek - Rep 1
Second Year, Styro 10
Western Larch, Red
UI Greenhouse

2019 MEASUREMENTS

11TH GROWING SEASON AT
CAMERON CREEK

12TH GROWING SEASON AT
RUNNING IRON

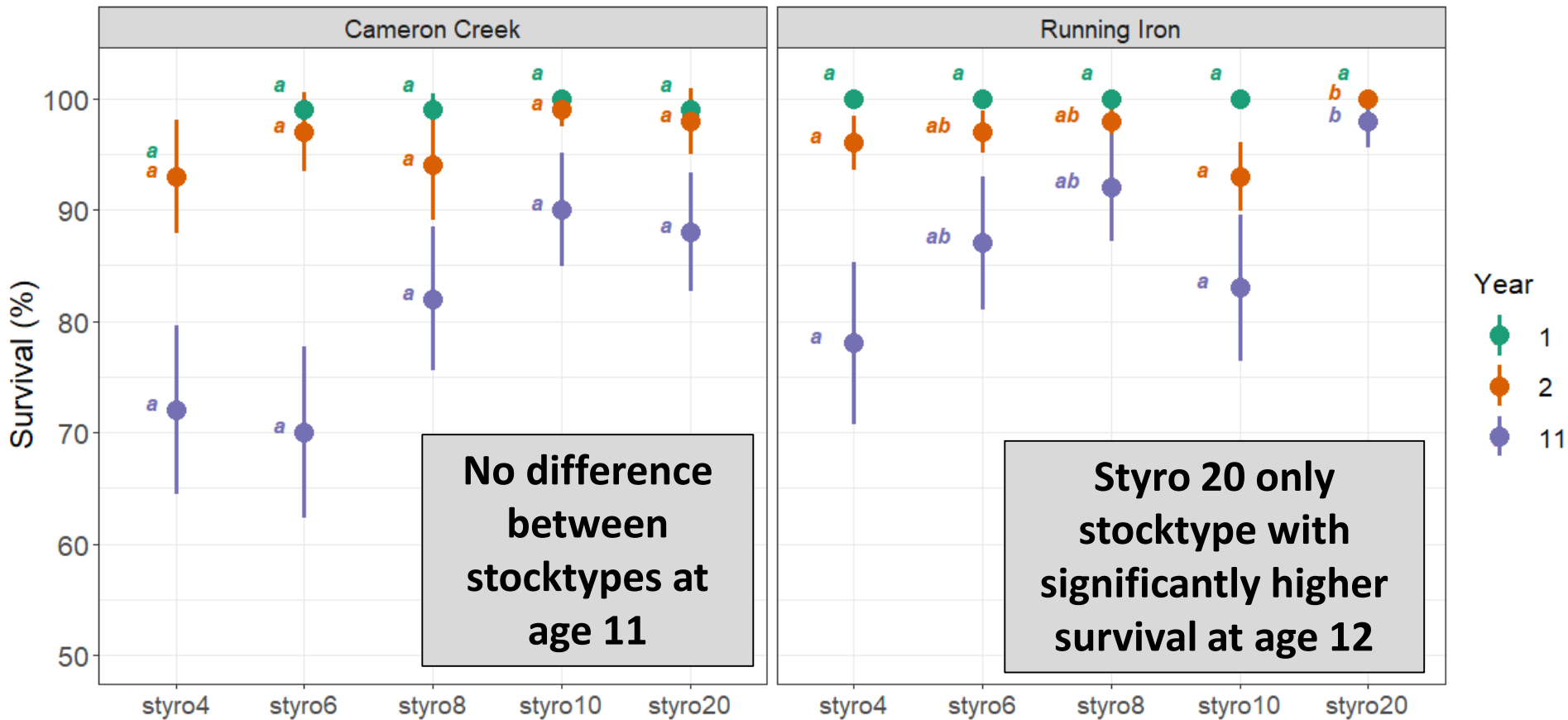
12-year old Styro 8 Douglas -fir





SURVIVAL BY STOCK TYPE

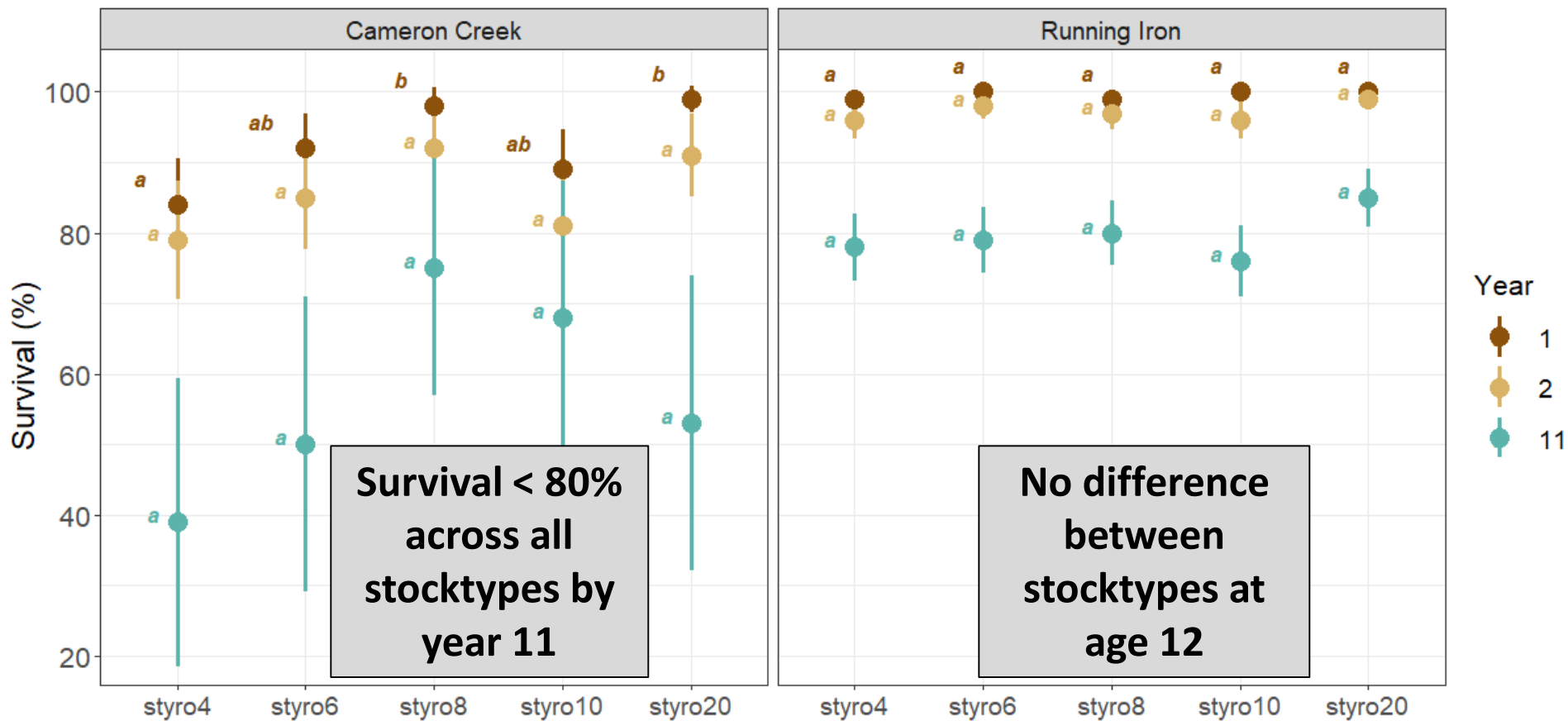
Interior Douglas-fir





SURVIVAL BY STOCK TYPE

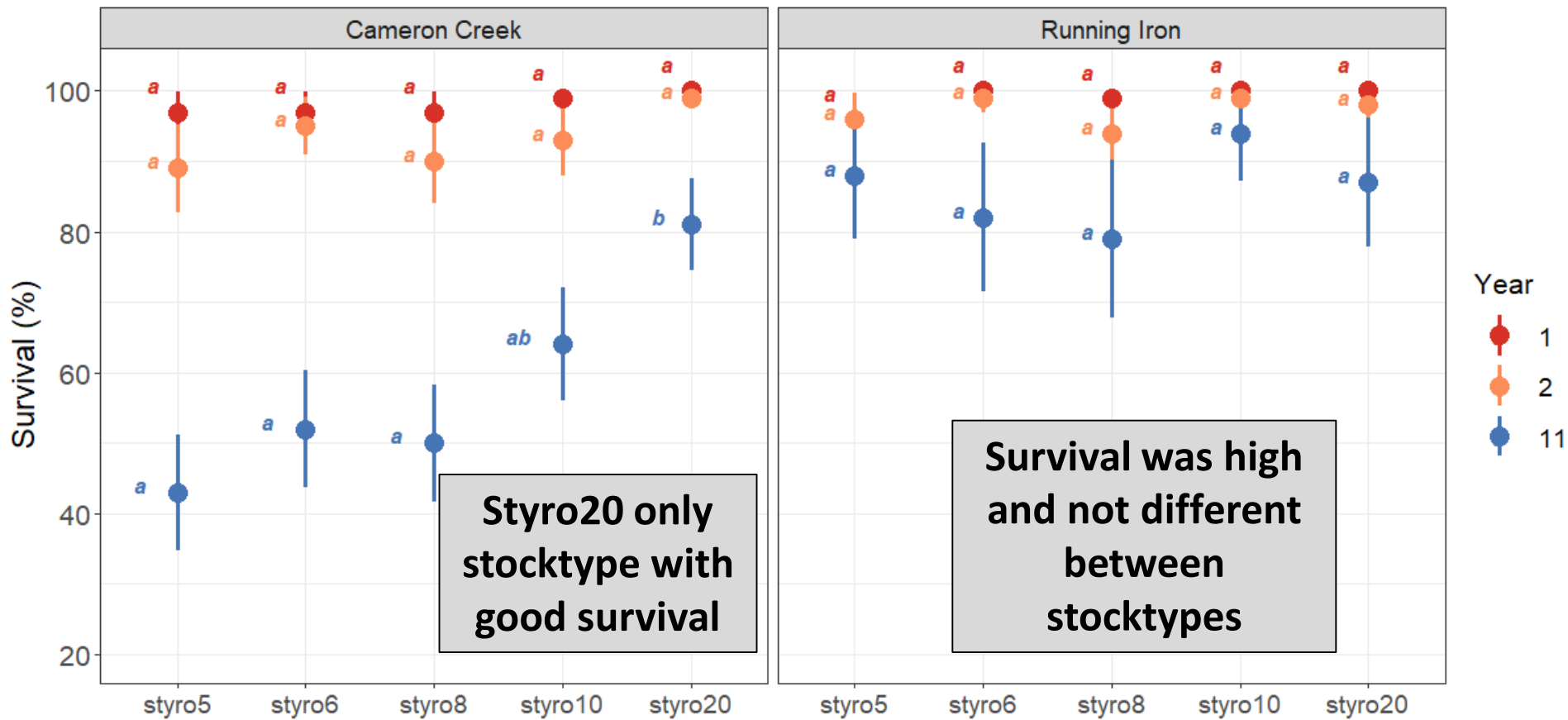
Western Larch



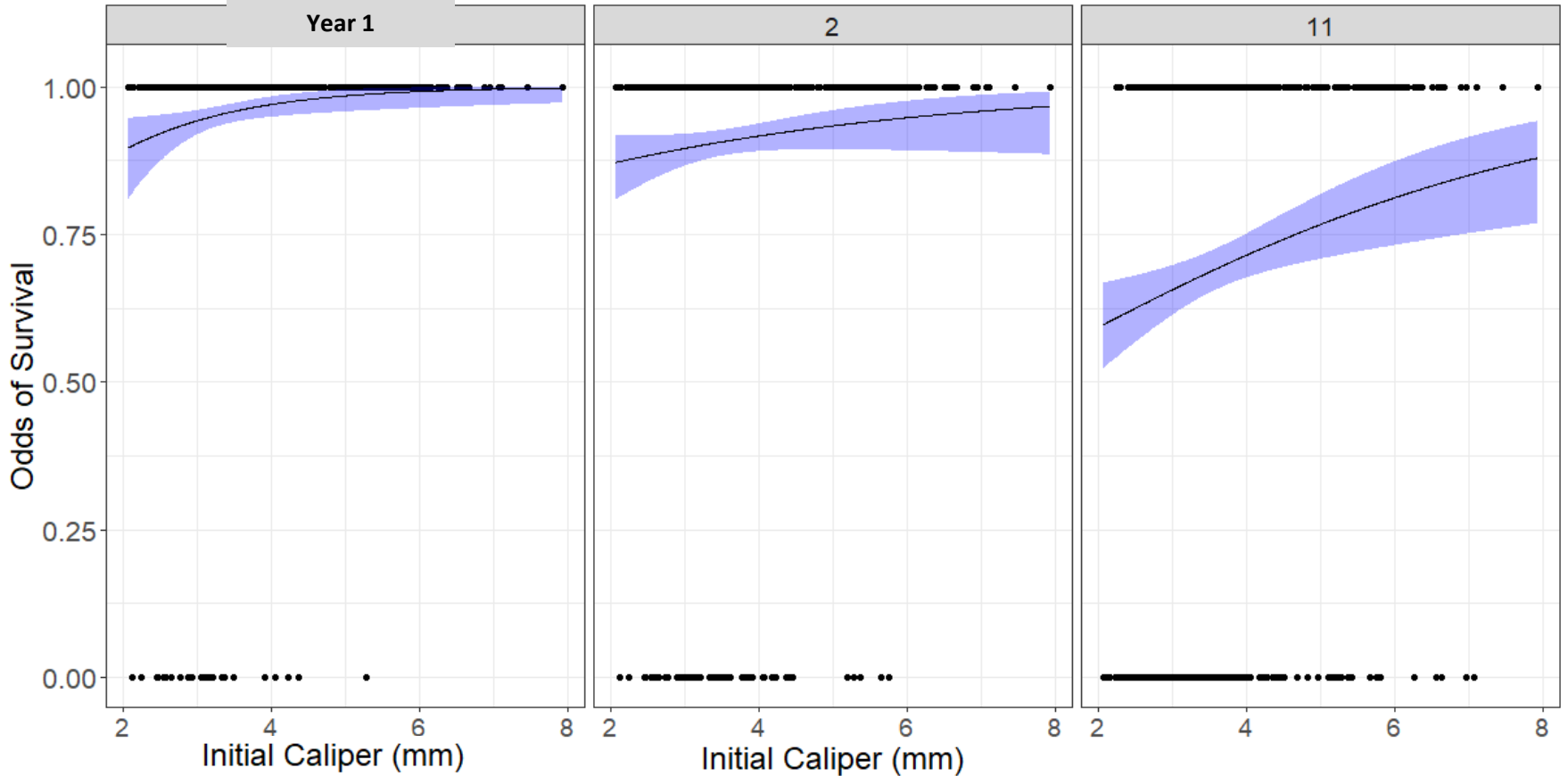


SURVIVAL BY STOCK TYPE

Western White Pine



INDIVIDUAL WESTERN LARCH SURVIVAL



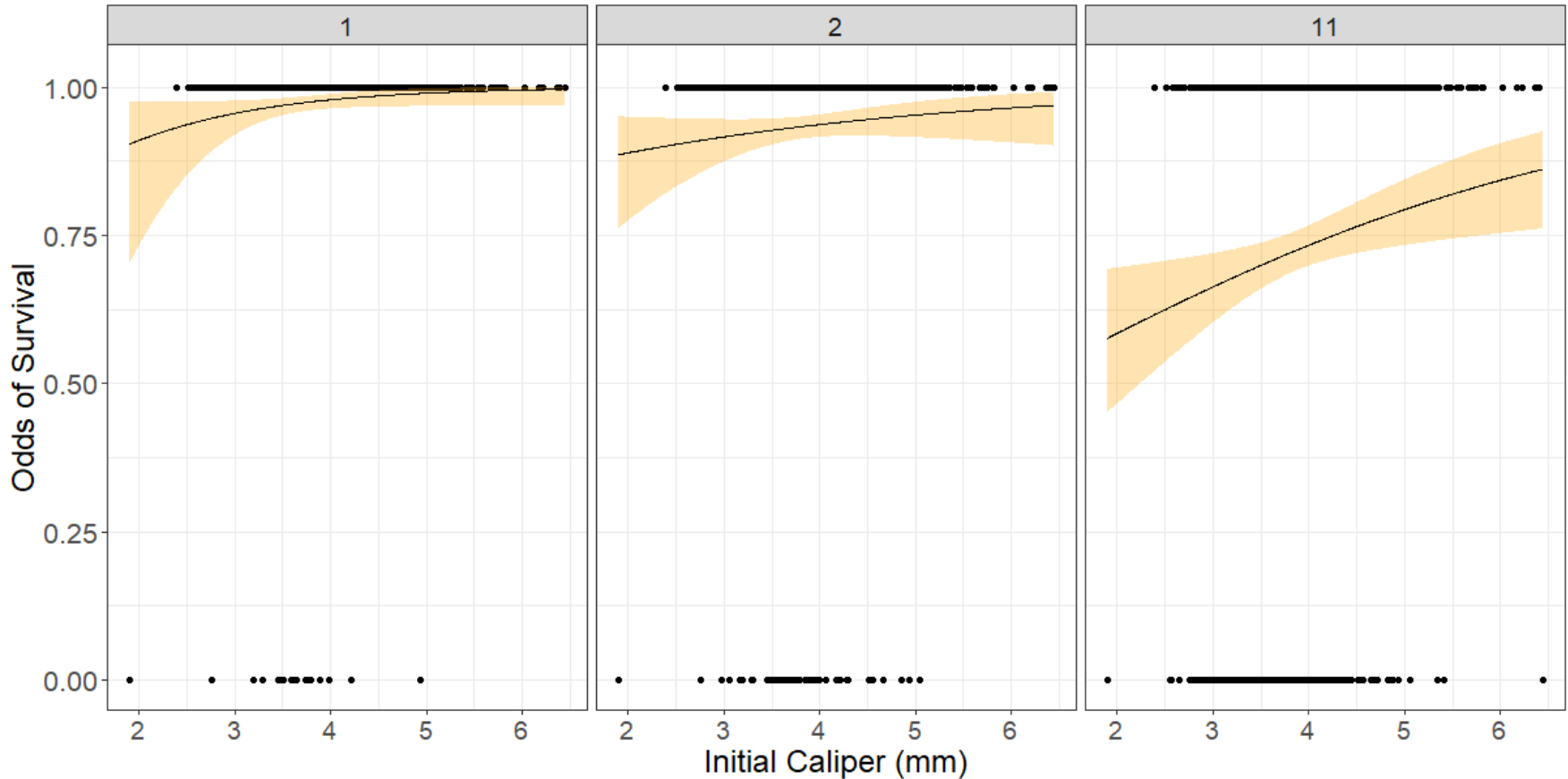
Year 1: Odds of a seedling surviving increased **2 x** for each 1 mm increase in caliper

Year 2: Odds of survival increased by **1.3x** for each 1 mm increase in caliper

Year 11/12: Odds of survival increased by **1.3x** for each 1 mm increase in caliper



INDIVIDUAL WHITE PINE SURVIVAL



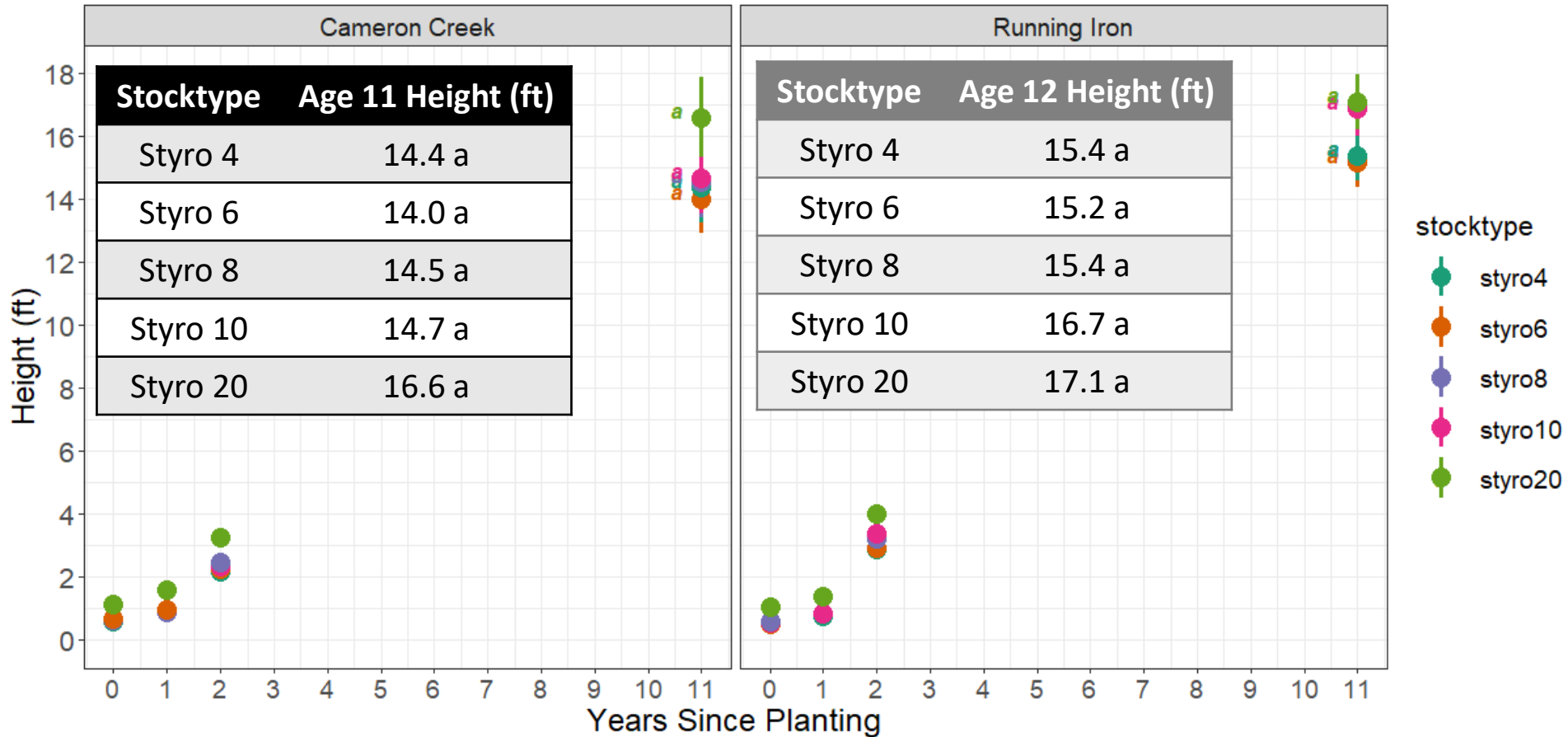
Year 1: Odds of survival increased by **2.2x** for each 1 mm increase in caliper

Year 2: Odds of survival increased by **4.3x** for each 1 mm increase in caliper

Year 11/12: Odds of survival increased by **0.7x** for each 1 mm increase in caliper

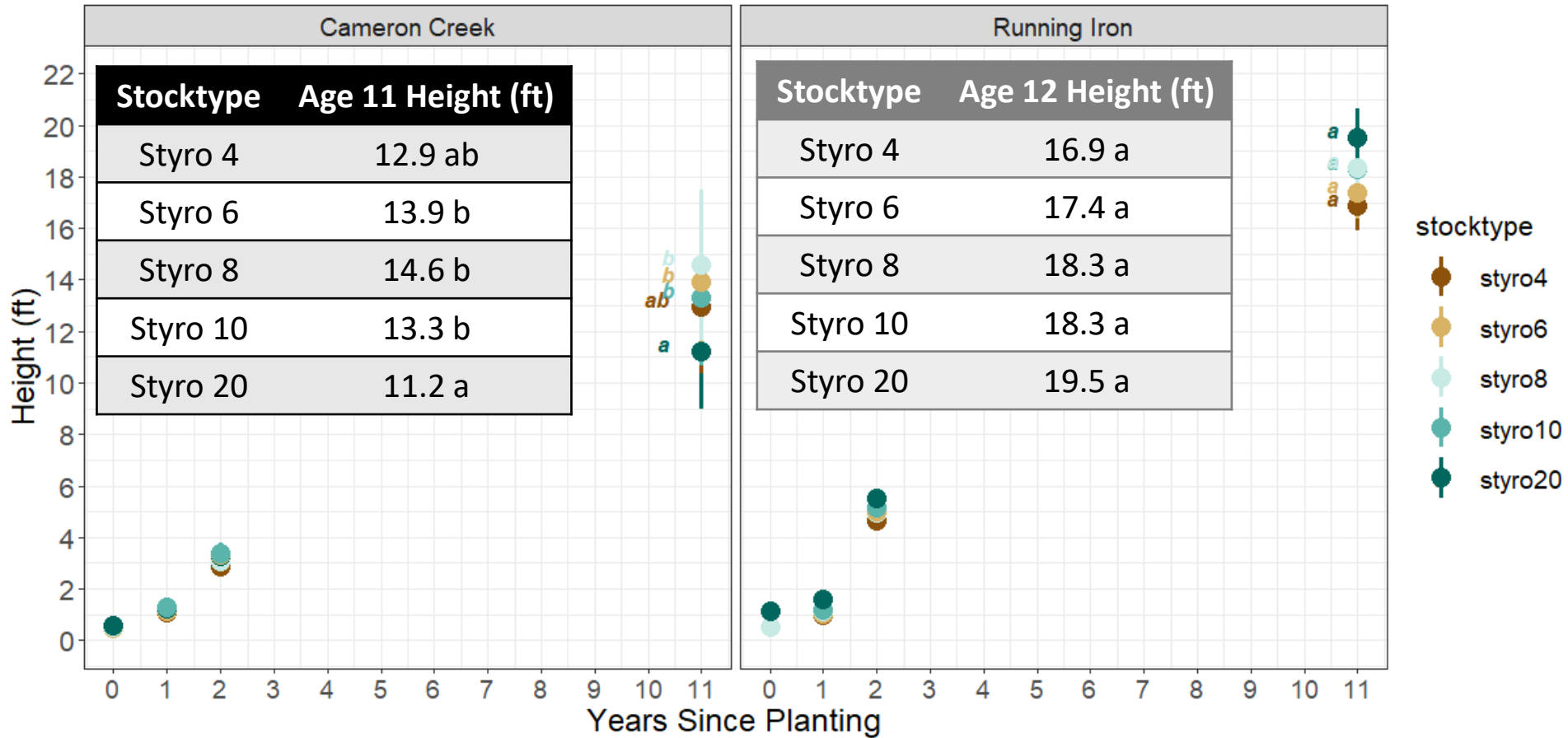


INTERIOR DOUGLAS-FIR HEIGHT



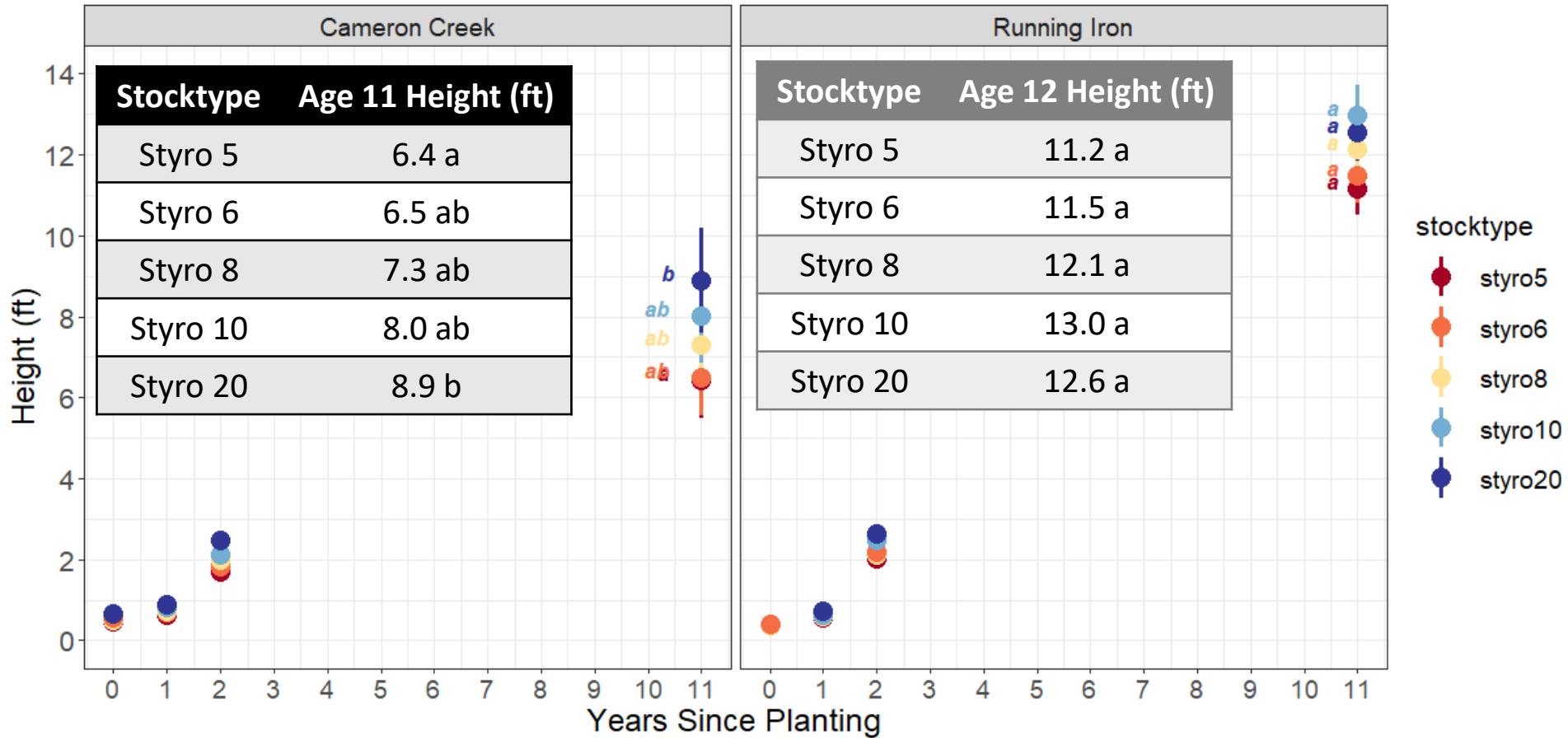


WESTERN LARCH HEIGHT



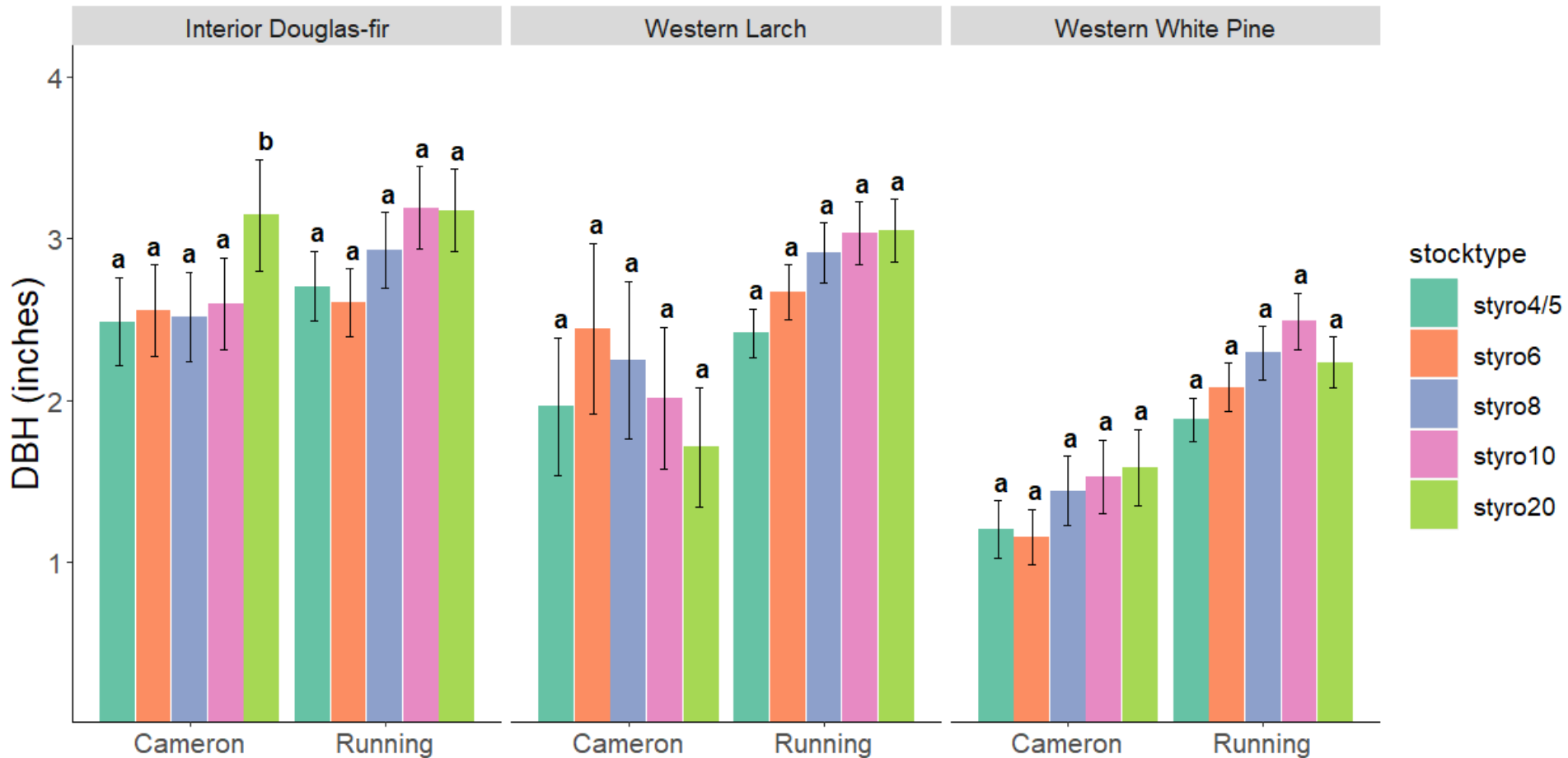


WESTERN WHITE PINE HEIGHT





DIAMETER AT BREAST HEIGHT (AGE 11/12)

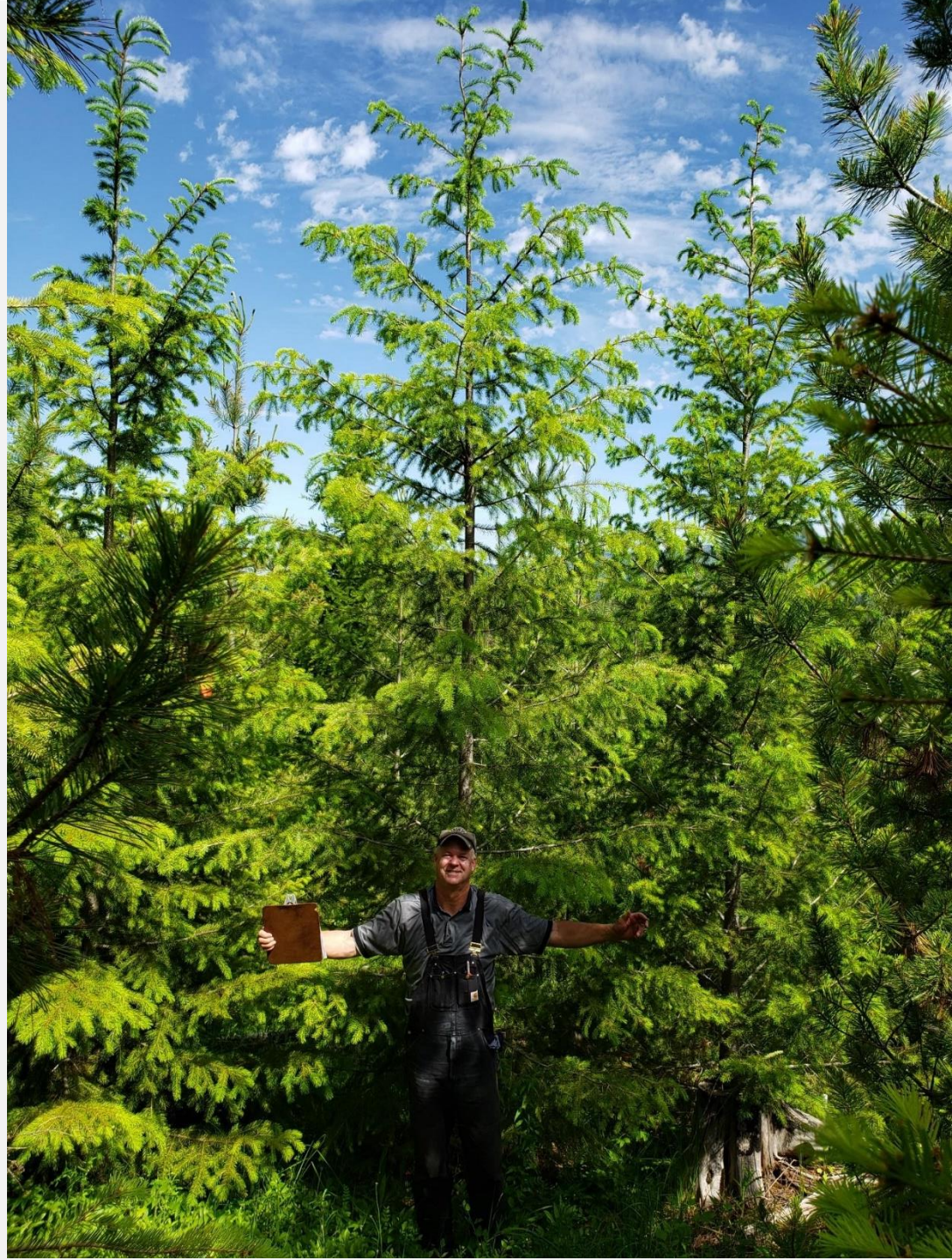


AGE 12
STYRO 4
DOUGLAS-FIR AT
RUNNING IRON



3/10/2020

AGE 12
STYRO 8
DOUGLAS-FIR AT
RUNNING IRON



SUMMARY

- I Survival was high for the first 2 or 3 years after establishment but decreased by 11/12 years. Survival only greater for styro 20
- I Seedlings consistently had lower survival at Cameron Creek (Harsher site?: steep slope and southwest aspect)
- I Larger initial caliper resulted in greater survival for WL and WWP at ages 11 and 12, but not DF
- I Lower nursery cost for smaller stock types may overcome lower survival and higher number of planted seedlings to achieve adequate stocking at age 12
- I Stock type had minimal effect on tree height or diameter at ages 11 and 12, suggesting similar trends in volume over time



ACKNOWLEDGEMENTS

- I PotlatchDeltic Corp. funded the initial study installation and measurements, and continued support over the years
 - John Mandzak was instrumental in project initiation
 - Chance Brumley and Abbie Acuff helped relocate study sites and provided stand history data
- I All the CFNSR staff and students, and PotlatchDeltic staff over the years that grew, planted, and measured the seedlings
- I Jordan Nate (PotlatchDeltic Corp. Intern), Sara Smith, and Aaron Daughtree (CFNSR Interns) helped with 2019 data collection

3/10/2020

QUESTIONS?

