Appendix S1

Table S1. LiDAR survey details. Data from the 2014 campaign were only used to compute topographical variables and not forest height (P95) since no clear-cuts were surveyed during this campaign.

Year of acquisition	2012	2014	2016
Period of the year	July to August	June to July	July to November
LiDAR technology	Optech ALTM 3100A	Riegl LMS-Q680i	Optech ALTM Galaxy
Impulse frequency	100 Hz	87-160 Hz	300-350 Hz
Scanning frequency	52 Hz	52-64 Hz	52 Hz
Flight altitude	950 m	800 m	1200 m
Flight speed	77 $m.s^{-1}$	51 $m.s^{-1}$	72 $m.s^{-1}$
Wipe angle	±19°	±30°	±24°
Mean point density	6.6 $points.m^{-2}$	3.2 $points.m^{-2}$	8.5 $points.m^{-2}$
% of the study area	18%	5 %	77%

Table S2. Generalized variance inflation factor (GVIF) analysis. GVIF analysis (Fox and Monette 1992) is analogous to classical variance inflation factor (VIF) analysis but allows calculation of GVIF for categorical variables, where values can be compared with values of continuous variables after correcting for differences in degrees-of-freedom (Df). The transformation that permits the comparison of categorical and continuous variables is $GVIF^{(1/(2\times Df))}$. To apply a classical threshold of VIF <10, $GVIF^{(1/(2\times Df))}$ should be less than $10^{(1/(2\times Df))}$. The selection column indicates variable rejection after applying a threshold equivalent to VIF > 10, while all displayed values for accepted variables are smaller than an equivalent VIF threshold of 5.

	GVIF	Df	$GVIF^{(1/(2\times Df))}$	Selection
Age	1.9615	1	1.4005	YES
Potential vegetation	1.5855	2	1.1221	YES
Surface deposits	1.6953	2	1.1411	YES
Sylvicultural scenarios	1.1617	1	1.0778	YES
Slope	1.3901	1	1.1790	YES
Degree-days	13.3901	1	3.6592	NO
TWI	1.3077	1	1.1435	YES
Elevation	11.6518	1	3.4135	NO
Aspect	1.0553	7	1.0039	YES

Table S3. Growth rates observed in 23 individual black spruces remeasured between 1974 and 2015 (t1 and t2) in 59 permanent plots located in a 20 km radius of our study area. We only retained dominant or co-dominant black spruces aged between 10 and 50 years (Age_{t1} and Age_{t2}; estimated with dendrochronology) to compare these growth rates with the results obtained in our model. Values in columns of height at t1, t2, and Δ are in meters.

t1	t2	Age_{t1}	Age_{t2}	$Height_{t1}$	$Height_{t2}$	Δ Years	Δ Height	Growth rate ($cm.year^{-1}$)
1974	1980	37	43	6,7	7,7	6	1	16,7
1999	2015	28	44	10,6	13,4	16	2,8	17,5
1999	2015	28	44	9,9	12,7	16	2,8	17,5
1999	2015	26	42	9,3	13,3	16	4	25,0
1999	2015	32	48	13,6	16	16	2,4	15,0
1999	2015	29	45	7,3	9,9	16	2,6	16,3
1999	2015	25	41	7,2	9,6	16	2,4	15,0
1999	2015	24	40	7	9,9	16	2,9	18,1
1999	2015	28	44	8	11,1	16	3,1	19,4
1999	2015	28	44	8,4	10,9	16	2,5	15,6
1999	2015	23	39	7,9	11	16	3,1	19,4
1999	2015	32	48	8,6	11,3	16	2,7	16,9
1974	1980	25	31	8,8	10,8	6	2	33,3
1974	1980	33	39	7,9	8,6	6	0,7	11,7
1974	1980	37	43	9,1	9,8	6	0,7	11,7
1974	1980	39	45	8,8	9,3	6	0,5	8,3
1974	1980	30	36	10,4	11,2	6	0,8	13,3
1974	1980	30	36	9,1	10,2	6	1,1	18,3
1974	1980	30	36	7,9	8,7	6	0,8	13,3
1974	1980	35	41	8,2	9,1	6	0,9	15,0
1974	1980	38	44	10,1	11	6	0,9	15,0
1975	1980	31	36	8,8	10,5	5	1,7	34,0
1990	2001	33	44	8,9	12,7	11	3,8	34,5

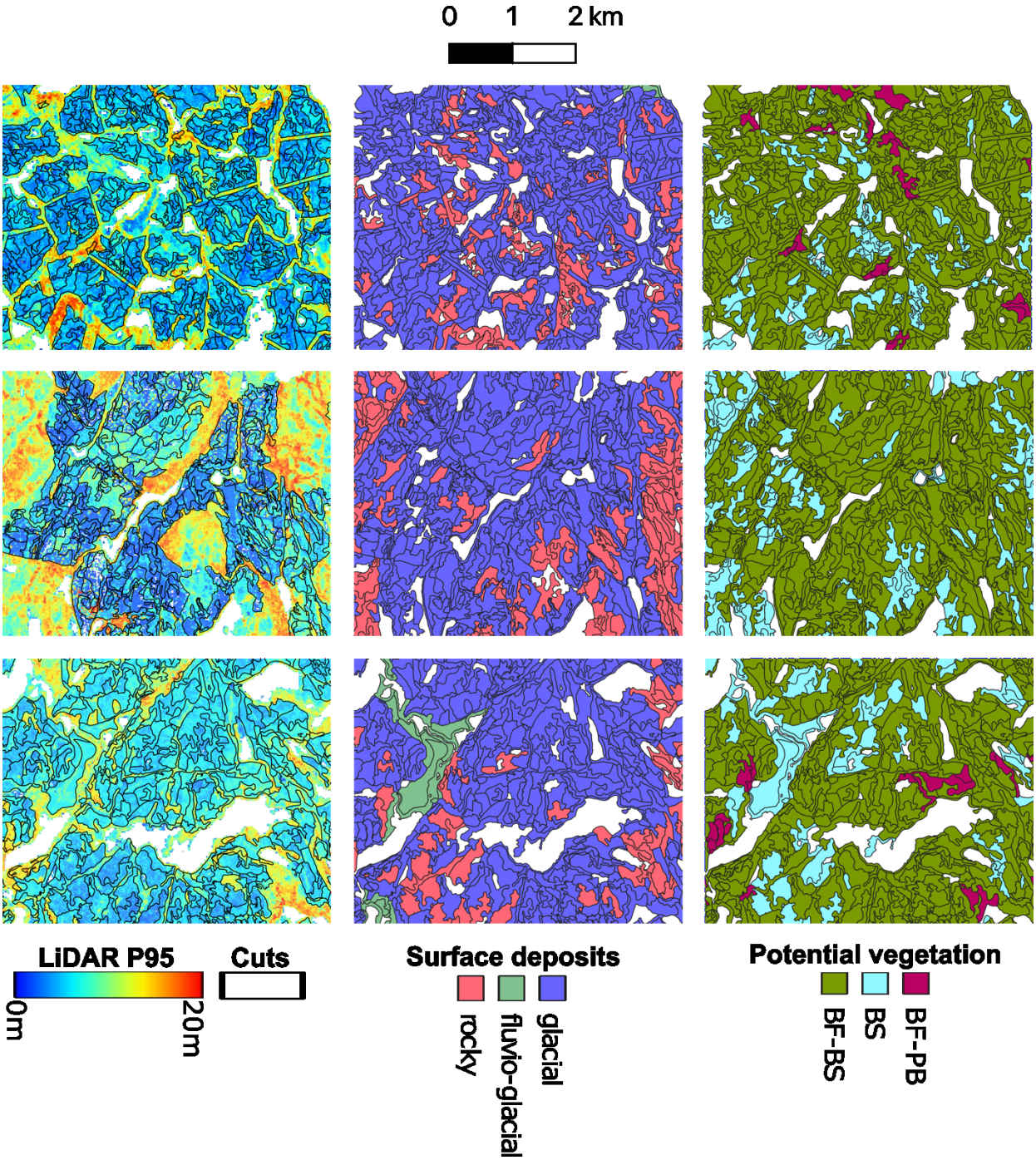

Figure S1. Illustration of data from forestry maps used in our model for three logged sectors (i.e., rows 1 to 3) in our study area. The first column shows the 1:20000 polygons (minimum size of 4 ha) identified as clearcuts, overlayed upon the 20 m × 20 m raster of canopy height model (LiDAR P95). The second and third columns illustrate the spatial distribution of categorical variables (i.e., surface deposits and potential vegetation) extracted from forestry maps.

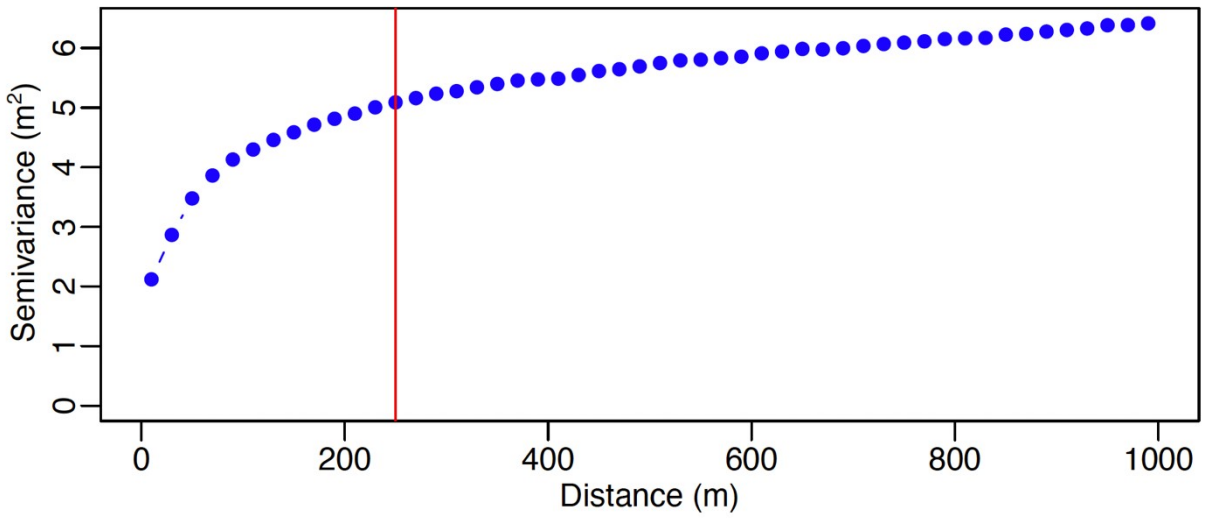

Figure S2. Semi-variogram obtained with 10.000 randomly selected pairs of 20 m × 20 m pixels (for each distance class) in the logged sectors of the canopy height models (P95 in meters). The red vertical bar shows the 250 m minimum distance retained to select pixels of the training and validation datasets.

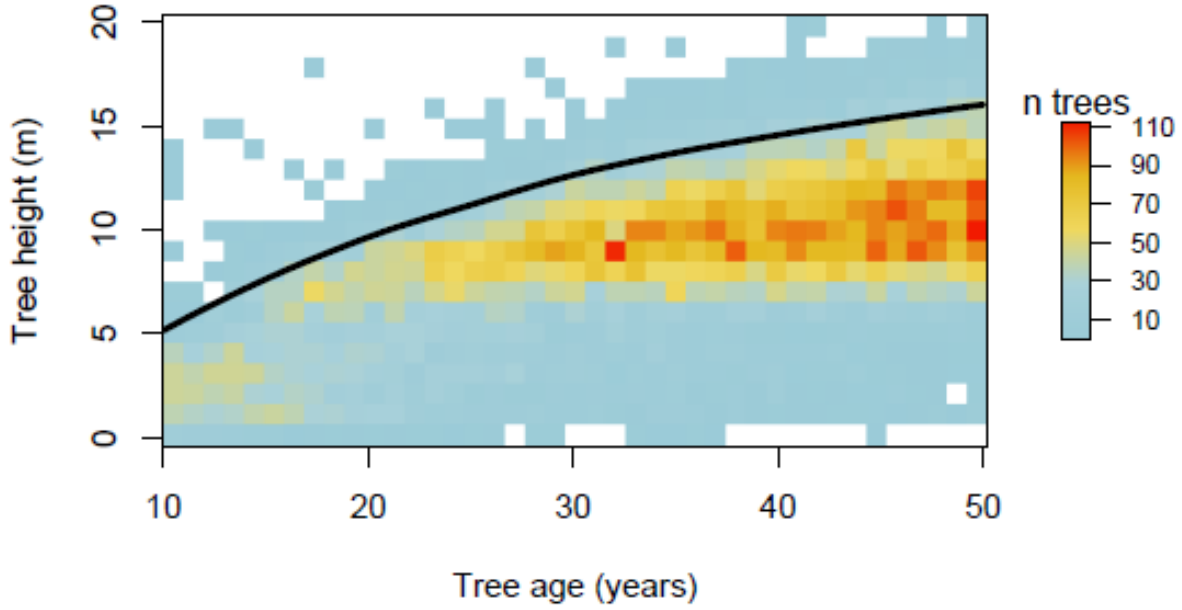

Figure S3. The age-height relationship established for 65000 black spruce trees that were measured as part of the permanent plot inventory network maintained by the provincial government of Quebec. The black line shows the 95th percentile that marked an aberrant height threshold for each age class.

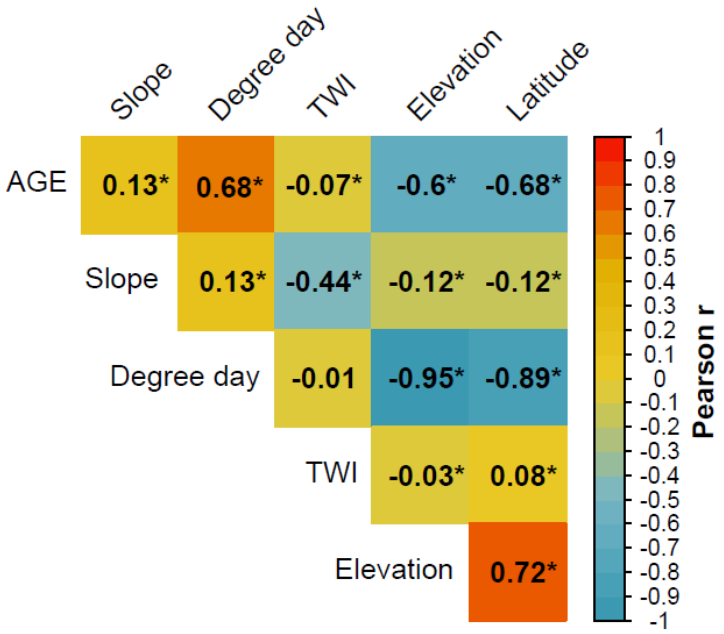

Figure S4. Correlation matrix between continuous and categorical variables; Pearson's r is specified for each pair of variables. Latitude has been added to the list of variables to obtain information on the effect of the south-north gradient of the study site. The cell color depicts the strength of correlation; (*) indicates relationships where $p < 0.\ 05$.

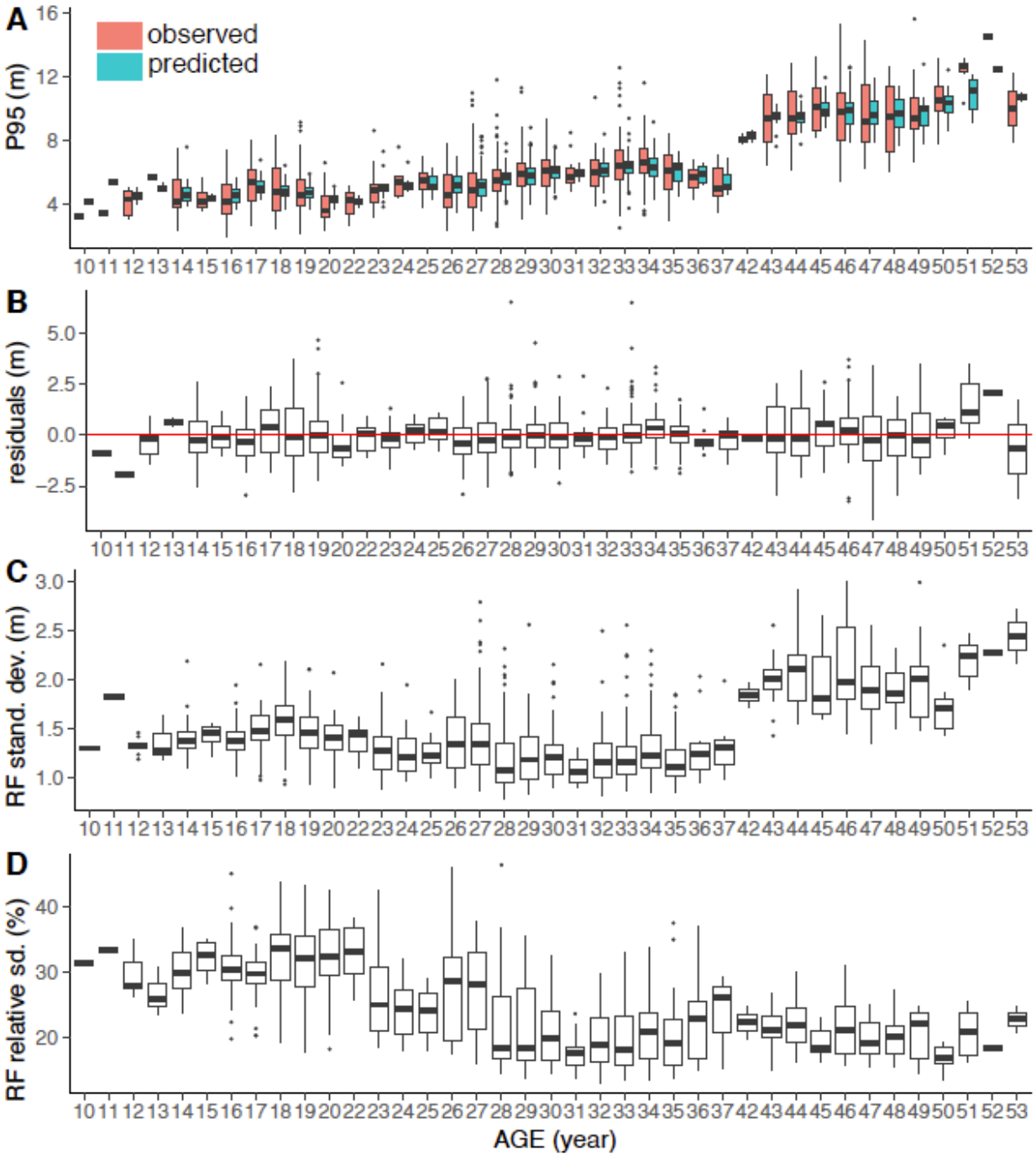

Figure S5. Model uncertainty across age classes in the validation dataset. Observed and predicted values for each age class (A) and residuals (observed – predicted values; B) in the validation dataset. Random forest absolute (C) and relative standard deviation (D) in the prediction of the validation dataset (see the *Methods* section for details).

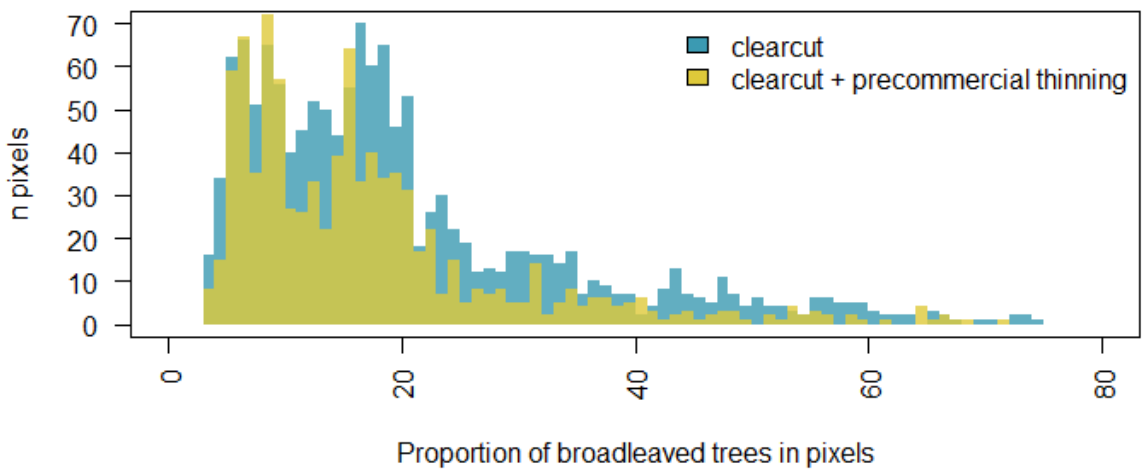

Figure S6. The proportion of deciduous trees in the pixels of the training dataset. The Laurentian Forestry Centre (Canadian Forest Service) established the proportion of deciduous trees with a Random Forest classification of the territory based on Landsat images between the provinces of Ontario and Newfoundland and Labrador (30 m × 30 m raster), and more than 10k inventory plots from the Ministère de la Forêt et des Farc of Québec.