96 Extension Note

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An Analysis of the SIBEC Site Index Estimates for Douglas-fir in the CWHxm2/01 Site Series

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Introduction

This extension note summarizes a project that examined which ecological variables can be used to modify the Site Index – Biogeoclimatic Ecosystem Classification (SIBEC) model (BCMFR 2008) to provide more accurate estimates of site index. The data also provide the opportunity to compare SIBEC site index estimates based on two different methods of obtaining site index: through stem analysis and by estimating site index from a height-age model. More information about this project can be found in Nigh (2010).

The SIBEC model is an important tool for estimating site index in British Columbia. The model is a correlation of BEC site series and tree species site index estimates, and is presented as entries in a table format. A SIBEC site index estimate is the mean site index for the target species and BEC site series. The strength of the SIBEC model is that site index can be obtained from site series and species regardless of whether site trees are present on the site.

This project focusses on coastal Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco var. *menziesii*) in the Western Very Dry Maritime Coastal Western Hemlock subzone variant (CWHxm2), site series 01. Although the results are valid only for Douglas-fir in the CWHxm2/01, the project also serves as a pilot for the rest of the SIBEC model.

Thirty-five stem analysis plots were established following the SIBEC Sampling and Data Standards (BCMFR 2008). These plots were supplemented with five plots from a Douglas-fir growth intercept project (Nigh 1996). The two projects had similar data collection protocols. The height data are presented graphically in Figure 1. Figure 2 shows a histogram of the distribution of the observed site indexes. Note the consistency in the height trajectories, the age range of the sample trees, and the relatively small range of site indexes.

Two analyses were performed. The first analysis examined the relationship between site index and ecological factors that influence site productivity using linear regression for continuous variables or analysis of variance (ANOVA) for class variables. The purpose of this analysis was to improve the SIBEC site index estimates. The second analysis compared the mean and variance of the site index data collected using two methods: by measuring site index directly using stem analysis and by estimating site index with Bruce's (1981) height-age model.

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The purpose of this analysis was to determine the amount of error introduced by using a model to estimate site index (Monserud 1984).

The linear regression and ANOVA analyses did not show any statistically significant relationships between site index and the ecological variables under study (Table 1, *p*-values from the F-test for the significance of the analysis ranged from 0.1115 to 0.8975). The mean and variance of the stem analysis-based site indexes and the estimated site indexes were 34.68 m and 10.02, and 34.80 m and 9.28, respectively. The average difference between the two site indexes was 0.12 m (not statistically significantly different from 0, $p = 0.38$). The ratio of the two variances was 1.08 (not significantly different from 1, $p = 0.81$). Therefore, the accuracy (bias and precision) of the two methods of obtaining a SIBEC site index estimate was similar.

To conclude, the BEC system adequately aggregates sites into units that are homogeneous with respect to site productivity for Douglas-fir in the CWHxm2/01 site series. The inclusion of pertinent site factors into the SIBEC model did not improve the site index estimate for Douglas-fir over the estimate based on site series alone. The site index estimates from the Bruce (1981) height-age model are as accurate as the site index estimates obtained from stem analysis for trees between 50 and 80 years.

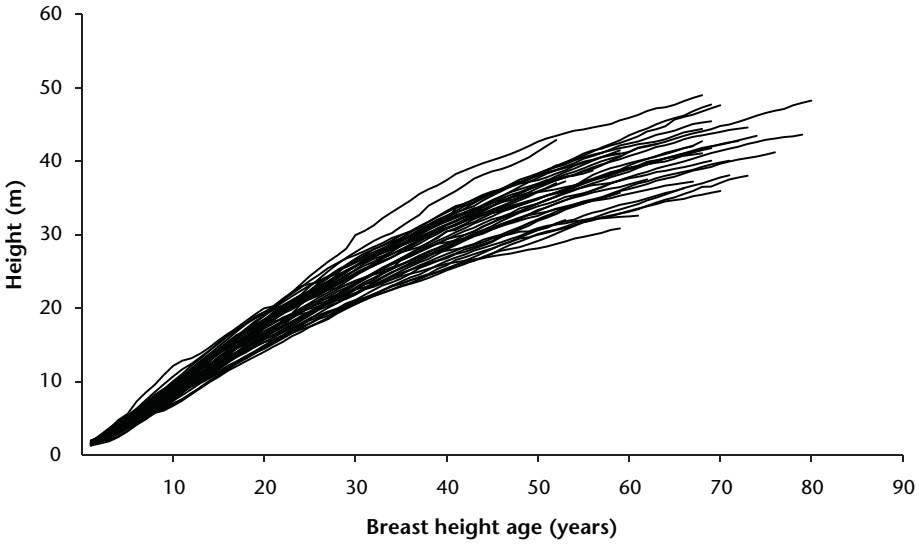

FIGURE 1 *Height trajectories for the 40 Douglas-fir site index plots.*

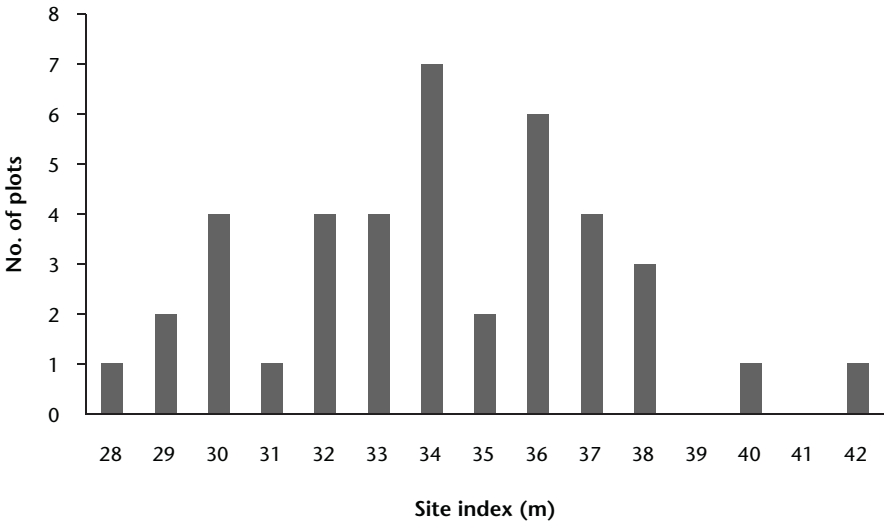

FIGURE 2 *Histogram of the site indexes of the 40 Douglas-fir site index plots.*

TABLE 1 *Explanatory variables used in the analysis to improve the error in the SIBEC model. The p-value is the significance of the F-test for the model.*

Variable name	Variable description[a]	Continuous (C)/ discrete (D)	*p*-value
UTMN	UTM northing (m)	C	0.8975
UTME	UTM easting (m)	C	0.6908
SMR	Soil moisture regime	D	0.1369
SNR	Soil nutrient regime	D	0.1115
Elev	Elevation (m)	C	0.3073
Slope	Slope (%)	C	0.8279
Aspect	Transformed aspect	C	0.4537
SlopePos	Slope position	D	0.3951
HumusForm	Humus form	D	0.5791
RootZonePartSize	Rooting zone particle size	D	0.1606
Drainage	Drainage	D	0.8666

a Values for the discrete variables are: SMR – 3 (slightly dry), 4 (fresh); SNR – B (poor), C (medium); SlopePos – LV (level), LW (lower slope), MD (middle slope), TO (toe), UP (upper slope); HumusForm – HR (hemimor), L (mull), LR (lignomor), R (mor), RD (mormoder), RR (resimor), UR (humimor); RootZonePartSize – CL (coarse-loamy), CLS (coarse-loamy-skeletal), FL (fine-loamy), FLS (fine-loamy-skeletal), S (sandy), SS (sandy-skeletal); Drainage – M (moderately well), W (well).

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