

4. DOCUMENTATION OF SIBEC APPLICATION IN THE CURRENT TIMBER SUPPLY ANALYSIS

This documentation summarizes the application of SIBEC estimates in conjunction with PEM for the dry-belt region of the Okanagan TSA.

Data sources and methods to compute site index

The PEM coverage for the Okanagan drybelt was provided by JMJ on September 18, 2002.² Since then, revisions were made by JMJ to PEM map entity definitions to reflect changes in site series groupings. Revised lookup tables³ were provided by JMJ on November 18, 2002 that defined specific PEM map entity definition changes, which enabled the September 18, 2002 version of the PEM map to be updated accordingly.

The latest SIBEC data were provided by JMJ on November 18, 2002. This comprised a combination of local data (which included new SIBEC plots sampled during the fall 2002) plus MOF SIBEC data, for a total of 939 SIBEC plots. This data set also included the revised PEM map entity definitions as of November 18, 2002. From this data set, average site index, sampling error and sample size were computed for each BGC subzone / PEM map entity / species combination, which provided the basis for assigning SIBEC estimates in the dry-belt.

Approximately 40% of the SIBEC data originated from locally sampled data, with the remaining 60% provided by MOF sources. The SIBEC data collection design in the Okanagan IFPA was random only in the selection of grid points (which geographically distributed plots across the target population), but biased in terms of subjectively searching within a 200m radius around each grid point for a suitable SIBEC tree occurring in an homogenous site. The MOF data represents a variety of unknown sources, which may or may not have been established in the Okanagan TSA. For the purposes of the current timber supply analysis, all data sources were pooled.⁴

Site index scenarios presented

At the time of the analyses, MOF standards were not yet in place to define appropriate application of SIBEC data for timber supply analysis. Preliminary feedback from the MOF indicated that SIBEC suitability criteria for a given species / map entity combination could comprise a sample size ≥ 4 with a maximum sampling error of 3.5m at the 95% level of confidence, however, this was not considered a standard for timber supply analysis⁵. To help assess different assumptions and data reliability, three separate site index scenarios were compared. For SIBEC estimates, these scenarios helped explore the impact of changing the sampling error for a given species / site index estimate, as well as the impact of

² The coverage "okan_pem.zip" was downloaded from JMJ's posted FTP site September 19, 2002

³ The files "crosswalksite series to map entity 2002nov18.xls", and "pem_ties_nov17.xls" were provided by JMJ on November 18, 2002

⁴ The decision to pool all SIBEC data sources were agreed to by the MOF and OIFS (per. comm. With G. Dick).

⁵ Telephone conversation with Shirley Mah, Research Branch, Ministry of Forests.

using site index species conversion equations. The three scenarios and their priority for site index selection sources, are described as

SI Source Selection Priority	Scenario 1	Scenario 2	Scenario 3
Average SI from SIBEC plots where $n \geq 4$ and sampling error $\leq 2.0m$	1	1	
Average SI from SIBEC plots where $n \geq 4$ and sampling error $\leq 3.5m$			1
Computed SI from species conversion equation with lowest sampling error, based on average SI from SIBEC plots where $n \geq 4$ and sampling error $\leq 2.0m$		2	
Computed SI from species conversion equation with lowest sampling error, based on average SI from SIBEC plots where $n \geq 4$ and sampling error $\leq 3.5m$			2
SI from SIBEC 1997 1 st approximation by 3m classes, whose reliability score = high	2	3	3
Forest cover site index of leading managed stand species	3	4	4
Computed SI from species conversion equation of leading managed stand species, based on existing species forest cover site index	4	5	5

Procedure used to compute site index for all scenarios

Input requirements for TFIC's timber supply analysis were that all site index estimates be provided for each forest cover polygon. To achieve this, the following steps were made:

- a. A site index lookup table was generated, to provide the 'best' site index estimate for a given BGC subzone / PEM map entity / species / scenario combination.
- b. Forest cover coverage was merged with the PEM coverage.
- c. For each resultant polygon, inventory site index estimates were converted to managed stand species site index using species conversion equations, where species conversion occurred in the analysis unit definition for managed stands.
- d. Assigned best estimate of site index to each PEM map entity by decile class. With up to 10 decile classes for a given PEM map entity, a weighted average site index was computed for each PEM resultant polygon.
- e. Depending on scenario, different sampling error thresholds were established to quantify the risks from changes in the reliability of estimates used. This included a range from 2.0m to 3.5m sampling errors. For scenarios where site index conversion equations were included (scenarios 2

and 3), the same sampling error limits were used to choose the most appropriate reference species.

- f. An elevation constraint on the use of SIBEC estimates included a maximum elevation limit⁶ in the ESSFdc1 (1850m), ESSFdc2 (1750m), and ESSFxc (1950m). For polygons greater than these limits, inventory site index estimates were used.
- g. For portions of the dry-belt that were not PEM mapped, inventory site index estimates were used.
- h. As multiple PEM polygons were present for a given forest cover polygon, an average site index was computed, weighted by the area proportion of each resultant PEM polygon.

Site Index scenario combination used in the Composite Analysis

For the dry-belt, scenario #2 was included as part of the composite analysis. The basis for this decision was that

- a. Site index conversion equations are an accepted component of timber supply analysis, as they are used whenever species conversion is defined as part of the silviculture regimes, and are applied to TIPSYS managed stand yield tables for all species other than the leading species
- b. A sampling error around a maximum sampling error of 2.0m within a given PEM map entity, was felt to be comparable to the sampling error achieved with estimates derived for the adjacent wetbelt region, where the overall SIA sampling error was less than 1.5m.

Comparing the proportion of Site Index Sources used

To evaluate the relative importance of site index data sources used in each of the three scenarios, the proportion of the THLB assigned to a given leading species (in the managed stands) was computed.

The total THLB area of all PEM map entities was computed by the sum of their individual areas across all decile classes, and linking this with the site index source that was used for a given scenario. The THLB proportion was identified from data provided by TFIC.⁷

Figures 1,2, and 3 illustrate the proportional area of each site index source by species and scenario. The total THLB area that each species is leading is 295,121ha, 63,218ha, and 106,148ha, for PI, Fd, and Sx, respectively. These graphs illustrate the relatively large proportion of the landbase that does not have suitable SIBEC estimates which meets the criteria established in each scenario. It also illustrates the high dependency on inventory site index across all scenarios.

For the composite analysis (scenario #2), 44% of the THLB were assigned site index estimates from new SIBEC data, while 16% were based on species conversion equations, 9% from 1st approximation SIBEC data, and the remaining 31% were assigned inventory site index (where no other preferred site index information was available).

⁶ This followed recommendations from Shirley Mah, MOF to apply the same elevation limits as defined in the 1997 SIBEC report (1st approximation SIBEC).

⁷ The file 'JST_PROPORTION_THLB.TXT' was provided by TFIC November 25, 2002, to approximate the THLB by multiplying each resultant polygon area by a proportional amount equivalent to the THLB area.

Effect of changing sample size selection criteria

At the time of defining site index scenarios, four SIBEC plots was defined as the minimum for each species / PEM map entity cell to be assigned a SIBEC site index in the current timber supply analysis. Subsequently, we were informed that sample size threshold would likely increase to seven SIBEC plots per cell.⁸

To quantify the impact that this further constraint may have on our resulting harvest forecasts, the site index lookup tables were re-run with a minimum of seven SIBEC plots per cell. For all estimates of site index, no significant changes to site index estimates resulted between the two lookup tables. Therefore, we can conclude that the change from a minimum of four to seven SIBEC plots per cell had no resulting impact on the harvest forecasts modeled.

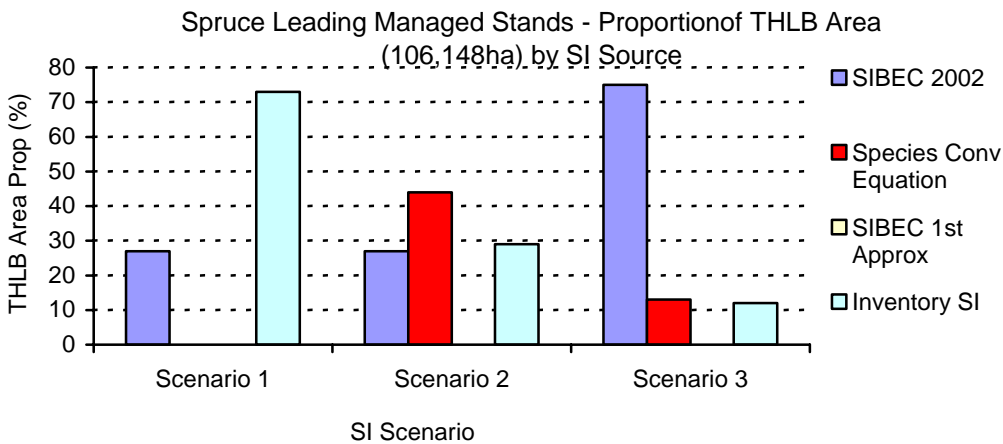
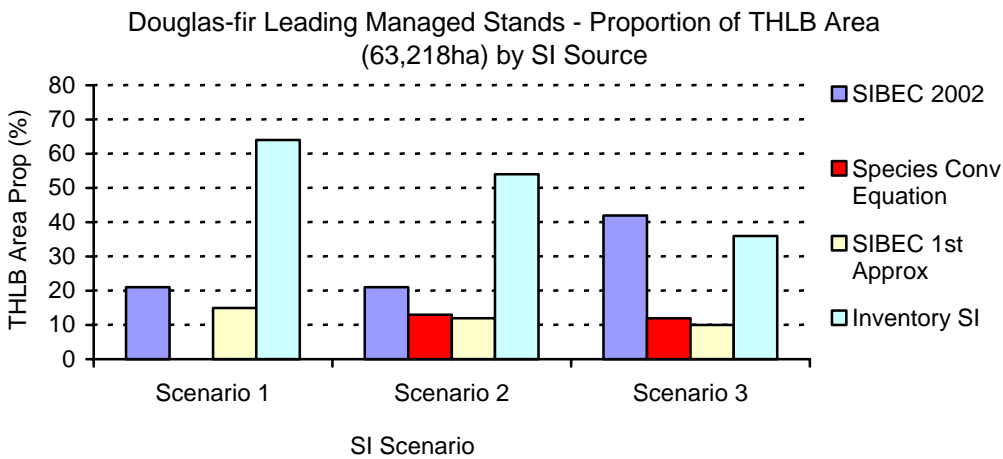
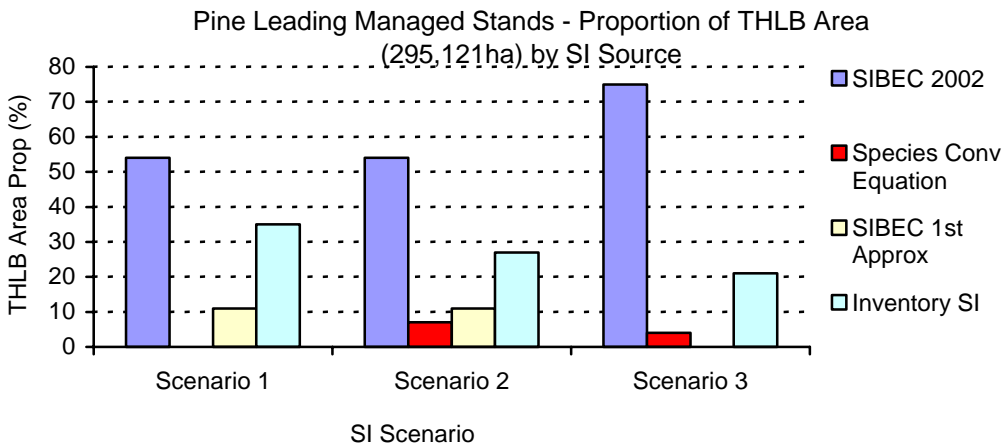
Comparing site index estimates across age classes

For illustrative purposes, site index estimates were averaged for each scenario across all age classes, weighted by the proportional THLB area. Results are illustrated in figures 4, 5 and 6, along with the THLB area by age class.

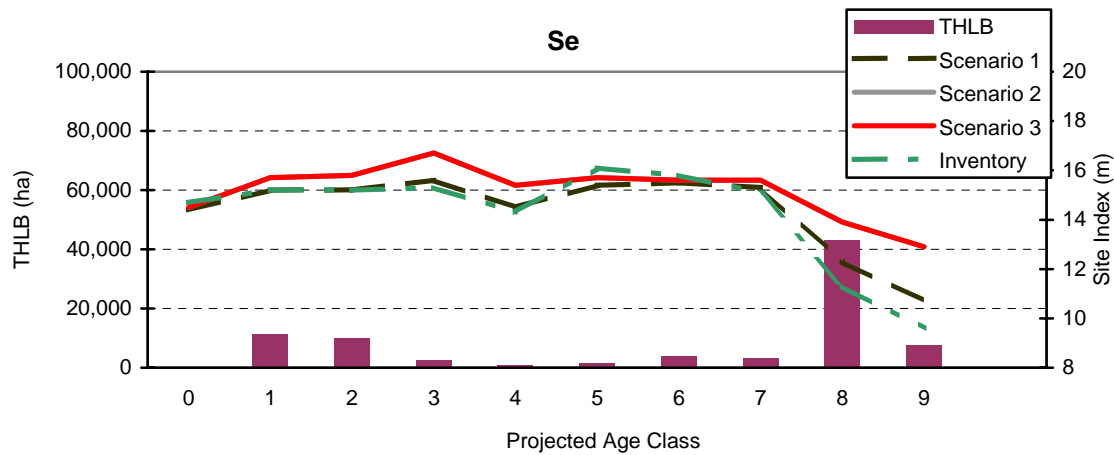
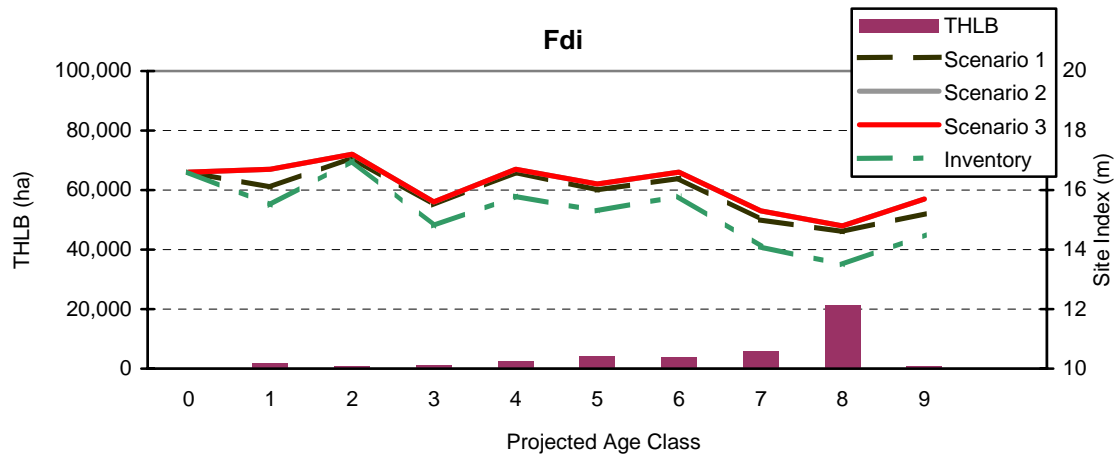
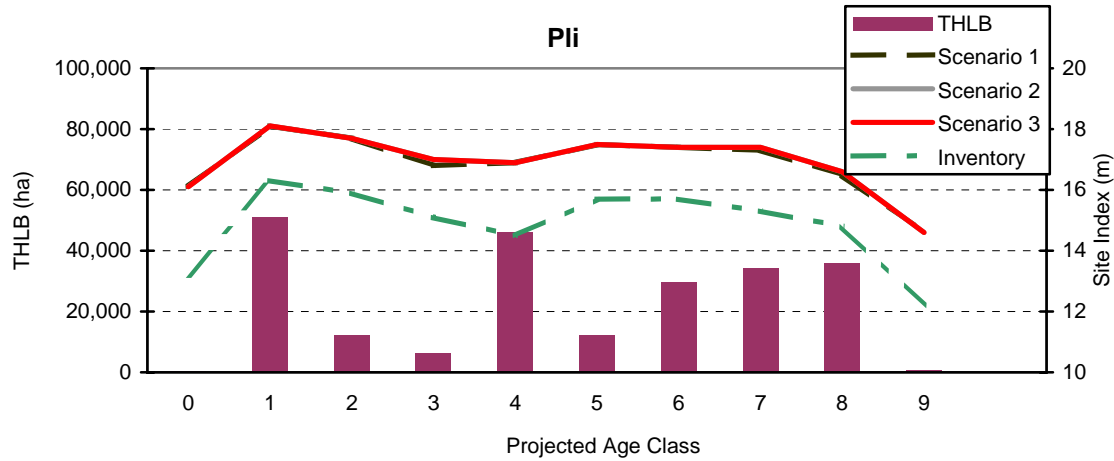
Standard MOF practice has been to apply SIBEC estimates only to very young and very old stands, and to depend on inventory site index for the remaining land base. By comparing SIBEC and inventory site index estimates across all age classes, inventory site index estimates continue to under-estimate productivity across all age classes (relative to SIBEC estimates). For the current timber supply analysis, SIBEC estimates were used in favor of inventory site index across all age classes, wherever possible.

The parallel shape of site index estimates from each scenario relative to the inventory site index indicates the dependency on inventory site index within all three site index scenarios.

⁸ Per comm. with Shirley Mah, October 23, 2002



Figures 1, 2, 3. Comparing the proportion of site index data sources, by scenario



Figures 4, 5, 6. Comparing site index estimates by site index scenario, across age classes for the drybelt. THLB by age class also plotted.

Comparing SIBEC estimates by Scenario across BEC subzones

Site index estimates were also computed separately for each BGC zone, by managed stand leading species and scenario, for a subset of the THLB.⁹ This comparison helps identify the range of computed site index estimates across the different BGC zones, relative to inventory site index.

Species	BGC Zone	Scenario 1	Scenario 2	Scenario 3	Inventory SI
Fd	ESSF	16.8	16.9	16.9	16.8
Fd	IDF	15.1	15.2	15.2	14.1
Fd	MS	15.5	16.4	16.4	14.9
PI	ESSF	15.5	15.6	15.6	14.9
PI	IDF	16.1	16.2	16.2	15.1
PI	MS	18.2	18.2	18.2	15.6
Sx	ESSF	12.8	13.8	13.8	12.3
Sx	IDF	15.9	16.7	16.7	15.5
Sx	MS	14.7	16.8	16.8	13.8
<i>Weighted Average</i>		<i>16.1</i>	<i>16.5</i>	<i>16.5</i>	<i>14.6</i>

Comparing SIBEC data against SIA data

We compared the SIBEC estimates against data collected by J.S. Thrower & Associates Ltd. in site index adjustment (SIA) projects in nearby ecologically similar areas. For the purposes of this comparison, only lodgepole pine plots that were classified in the field as 01 or 04 site series were included.

The result is that SIBEC estimates for the Okanagan IFPA consistently under-estimated site index in the SIA estimates by about 1–3 m for lodgepole pine. The SIA data were taken from randomly located sample plots, thus do not include the many sources of bias from subjectively located sample plots. However, the SIA data were taken in areas outside the Okanagan TSA and thus may contain a location bias.

BGC subzone / variant	Site Index (m)		Difference of (SIA–SIBEC) (m)	Sample Size	
	SIA	SIBEC		SIA	SIBEC
ESSFdc1	18.1	14.6	3.5	10	15
ESSFdc2	17.9	17.0	0.9	28	23
IDFdk1	20.6	18.3	2.3	18	24
IDFdm1	20.6	19.0	1.6	34	8
MSdm1	19.6	18.2	1.4	46	56
MSdm2	20.3	18.6	1.7	50	80
MSxk	19	15.6	3.4	16	49

⁹ Young stands without an associated managed stand species were excluded.