

FLNRO Provincial Site Productivity Layer

PEM/TEM-SIBEC and Biophysical Analysis

Version 6.1, December 5, 2017

Updates Prepared by Madrone Environmental Services Ltd.

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Document History

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Document Revision History

Revision Number	Revision Date	Summary of Changes	Author
1	March 31, 2012	Created Document	Jeff Kruys
2	April 4, 2012	Revised distribution list Revised section 1.1 Added section 1.2 Revised section 3.0	Jeff Kruys
3	May 8, 2012	Minor text corrections Explanatory footnotes added to Appendix B maps	Jeff Kruys
3.1	July 11, 2012	Revised section 1.1 (updated description of intended uses)	Gordon Nigh
3.2	July 27, 2012	Added "Accuracy Assessment" column to Appendix A table; updated maps of BAPIDs 4024 and 5511 in Appendix B	Jeff Kruys
3.3	July 30, 2012	Created Table 3 in section 1.5 for data revision history; Renumbered subsequent tables; Added "BGC Units Requiring Crosswalking (by)" column and removed "Non-SIBEC BGC Units" column in Table 9 (formerly Table 8) in Appendix A	Jeff Kruys
4.0	March 31, 2013	Removed section 1.2 Review and Feedback; updated Table 1 in section 1.3; restructured the entire document from section 2.0 onwards.	Jeff Kruys
4.1	June 30, 2013	Updated the PEM/TEM dataset list in Appendix B and PEM/TEM maps in Appendix C; moved table of Site Prod Working attribute fields from section 6.2 to section 3.1, as these fields are now all defined at stage 1 of the workflow; updated section 6.2 with description of Script 10 which now also produces FGDB datasets for FTP distribution	Jeff Kruys
4.2	October 28, 2013	Site Prod v3.1 dataset released; updated references to current data version number	Jeff Kruys

Revision Number	Revision Date	Summary of Changes	Author
4.3	March 31, 2014	Added descriptions of Scripts 11 and 12 to section 6.2; added quality assurance methods for Scripts 11 and 12 to section 7.1; updated workflow diagram in Appendix A	Jeff Kruys
4.4	March 31, 2015	Inserted a new sections 4.2 to 4.4 and renumbered subsequent 4.x sections; revised section 6.2; updated workflow diagram in Appendix A; updated table of PEM/TEM datasets in Appendix B; updated map figures in Appendix C; removed references to BCGW and iMap throughout document	Jeff Kruys, Erin Philip
5.0	March 31, 2016	Updated sections 4.4 and 4.5 with description and use of the newly restructured SIBEC table	Jeff Kruys
6.0	June 30, 2017	Updated contacts and distribution list; removed section 4.3 "Correcting PEM/TEM Attribute Errors" as correcting TEIS data is no longer in the scope of this project; renumbered subsequent sections accordingly; reduced technical details in sections 2.0 to 7.1 as the data processing procedures are now described in a new document, "Guide to Creation of the PSPL".	Jeff Kruys
6.1	December 5, 2017	Updated section 1.4, Data Revision History. Updated version number and dates throughout the document to reflect the new version of the data.	

Reference Documents

Please see the following documents for more information:

Document Name	Version	Author
A Biophysical Model for Estimating Site Index for the Major Commercial Species in British Columbia	1	Gordon Nigh
Guide to Creation of the PSPL	6.1	Jeff Kruys
PSPL Processing Checklist (Excel document)	6.1	Jeff Kruys

Distribution List

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Table of Contents

Document Revision History	iii
Reference Documents	v
Distribution List.....	v
1.0 Site Productivity Dataset	1
1.1 Description and intended uses.....	1
1.2 Spatial data structure.....	2
1.3 Non-spatial data structure	2
1.4 Data revision history	3
1.5 Update cycle for data and documentation	4
2.0 Site_Prod_Master Data Storage and Processing Environment	5
3.0 Creation of the Site Prod Point Feature Class	7
3.1 Initial derivation of point features and ID_TAG values	7
3.2 Creation of the Timber Supply Area boundaries feature class	9

3.3	Creation of input files for ClimateWNA application.....	10
3.4	Removal of Site Prod points in non-forested areas	11
4.0	PEM/TEM-SIBEC Model	11
4.1	Cleaning of PEM/TEM data from TEIS geodatabase	11
4.2	Compilation of SIBEC sources to SIBEC "Supertable" for 2015	12
4.3	Creating the PEM/TEM-SIBEC crosswalk table.....	12
4.4	Extraction of PEM/TEM data and site index calculation	13
4.5	Dissolving PEM/TEM feature class for depiction on map figures	15
4.6	Updating the Overlapping BAPIDs table	15
4.7	Writing PEM/TEM-SIBEC site index values to the Site Prod points.....	16
5.0	Biophysical Model	16
5.1	Addition of species ranges and biophysical model site index values to Site Prod points	16
6.0	Final Products	17
6.1	Creation of discrepancy tables and rasters	17
6.2	Creation of final datasets for loading to DMF, HectaresBC and FTP.....	17
7.0	Quality Assurance	19
7.1	Data correctness	19
7.2	Data accuracy	19
Appendix A – Workflow Diagram		20
Appendix B – List of PEM/TEM Datasets		22
Appendix C – Maps of PEM/TEM Datasets		30

1.0 Site Productivity Dataset

The Site Productivity Dataset provides site index estimates province-wide for commercial tree species. The estimates are based on available ecosystem data (spatial delineations and descriptions) from existing PEM (Predictive Ecosystem Mapping) and TEM (Terrestrial Ecosystem Mapping) datasets, coupled with SIBEC data (the Site Index Estimates by BEC Site Series: 2013 Approximation table, along with various 2014 and 2015 addenda). In areas where no PEM or TEM data are available, site index estimates are based on biophysical data and species ranges.

1.1 Description and intended uses

These data and accompanying documentation are the result of the initial two years of the Site Productivity Project (2012-2014), and can be considered the final release of the current version of the data. Updated versions are released when necessary to reflect updates to the data process... When updated, versions will be released annually on June 30 in coordination with the release of a new SIBEC Approximation.

The data is being distributed in ESRI File Geodatabase (FGDB) format, which can be viewed using the ESRI ArcGIS Desktop software suite (version 9.3.1 or newer) or other GIS or GID viewing software. The data structure is described in further detail in sections 1.3 and 1.4 of this document.

The province-wide vector (point) dataset comprises 6.0 GB of data (1.0 GB when archived in zip files). To facilitate data transfer via FTP, it has been divided by Timber Supply Area (TSA) management unit into 36 separate feature classes, each in its own FGDB. The raster version of the data comprises 22 province-wide rasters, one for each tree species included in the Site Productivity project. This data is distributed via FTP in a single FGDB which occupies 388 MB, or 311 MB when archived in a zip file.

The site index layer contains estimates of site index that are derived from a SIBEC/PEM/TEM or a biophysical site index model. The site index values are more appropriately used for strategic, as opposed to operational, purposes. It would be appropriate, for example, to group points from the site productivity layer into classes (e.g., analysis units), average the site indexes for those points, and then assign that average site index to the class. If used for operational purposes (e.g., site specific applications), the site index estimates should be verified through a ground-based survey. The site index estimates can have significant errors in some situations, and it is not possible to assess the accuracy of the estimates without doing a ground-based survey.

Starting at version 2 and continuing through to the current version 6, the Site Productivity Dataset is being produced in two editions: one named "Site Prod with All PEM/TEM" which incorporates all of the PEM and TEM data available regardless of accuracy assessment (AA) and/or ecosystem intensity survey level (ESIL), and another named "Site Prod with Approved PEM/TEM" that uses only the PEM and TEM projects that have undergone and

passed a third party accuracy assessment, or that utilized a suitable number of field sample sites during the mapping process, typically ESIL levels 1-5. See Appendices B and C for details and maps of the PEM and TEM datasets that were used in each of these two editions of the Site Productivity Dataset. Both editions contain biophysical site index data over all areas of the province.

1.2 Spatial data structure

The goal of the Site Productivity project is to produce a spatial dataset covering the entire province which provides a site index estimate in each hectare for every tree species (from a set of 22 species; see Table 1 below) that could potentially be growing on that hectare.

The spatial structure of the Site Productivity Dataset is derived from standards developed for the Hectares BC (HaBC) project, which defines a standard 100m raster grid covering the province. The Site Productivity Dataset will consist of points that lie at the center of each raster cell in a standard Hectares BC raster grid. Points that lie offshore, outside of BC's land borders, or in permanently non-forested areas will not be stored in the Site Productivity Dataset.

1.3 Non-spatial data structure

The non-spatial attributes of the Site Productivity Dataset are listed in the following table.

Table 1 - Non-spatial attributes of the Site Productivity Dataset

Field Name	Field Type, Length	Description
ID_TAG	Text, 20	Unique identifier for the point
AT_SI	Float	Site index estimate for At (trembling aspen)
BA_SI	Float	Site index estimate for Ba (amabilis fir)
BG_SI	Float	Site index estimate for Bg (grand fir)
BL_SI	Float	Site index estimate for Bl (subalpine fir)
CW_SI	Float	Site index estimate for Cw (western redcedar)
DR_SI	Float	Site index estimate for Dr (red alder)
EP_SI	Float	Site index estimate for Ep (paper birch)
FD_SI	Float	Site index estimate for Fd (Douglas-fir)
HM_SI	Float	Site index estimate for Hm (mountain hemlock)
HW_SI	Float	Site index estimate for Hw (western hemlock)
LT_SI	Float	Site index estimate for Lt (tamarack)
LW_SI	Float	Site index estimate for Lw (western larch)
PA_SI	Float	Site index estimate for Pa (whitebark pine)
PL_SI	Float	Site index estimate for Pl (lodgepole pine)
PW_SI	Float	Site index estimate for Pw (western white pine)
PY_SI	Float	Site index estimate for Py (ponderosa pine)
SB_SI	Float	Site index estimate for Sb (black spruce)
SE_SI	Float	Site index estimate for Se (Engelmann spruce)
SS_SI	Float	Site index estimate for Ss (Sitka spruce)

Field Name	Field Type, Length	Description
SW_SI	Float	Site index estimate for Sw (white spruce)
SX_SI	Float	Site index estimate for Sx (interior spruce)
YC_SI	Float	Site index estimate for Yc (yellow-cedar)
BAPID	Long Integer	Business Area Project ID of the PEM or TEM source dataset used for estimating site index value for the species listed in the PEM_SPP field. Value will be <Null> if all site index values for the point were calculated using the Biophysical Model.
PEM_SPP	Text, 30	Comma-delimited list of two-letter codes of tree species for which site index estimates are derived from the PEM/TEM-SIBEC model (as opposed to the Biophysical model)
BGC_LABEL	Text, 9	Biogeoclimatic unit (zone, subzone, variant and phase). The BEC unit codes written here belong to the BEC version 8 classification, unless the point lies within a PEM/TEM polygon, in which case the BEC unit code belongs to the BEC classification version used in that particular PEM/TEM project.
TSA_NUMBER	Text, 30	Numeric code (as defined in the BCGW feature class WHSE_ADMIN_BOUNDARIES.FADM_TSA) of the Timber Supply Area in which the point lies

1.4 Data revision history

Table 2 - Data Revision History

Revision Number	Revision Date	Summary of Changes	Author
1.0	March 31, 2012	Created data, using SIBEC: 2011 Approximation and 85 PEM/TEM datasets	Jeff Kruys
1.1	July 27, 2012	Removed PEM/TEM-SIBEC Site Index estimates derived from BAPIDs 4024 and 5512 from the Merritt TSA and Okanagan TSA Site Prod datasets, and replaced with original Biophysical Model Site Index estimates	Jeff Kruys
2.0	March 31, 2013	Incorporated 102 more PEM/TEM datasets (and removed 5 that were used in version 1), for a total of 182 PEM/TEM datasets; performed further QA and error correction on all PEM/TEM data; developed crosswalk table of all PEM/TEM ecosystem unit codes to SIBEC classification standard; calculated site index values using SIBEC: 2011 Approximation and the updated Biophysical Model; created two editions of Site Prod data for FTP distribution: "Site Prod with All PEM/TEM" and "Site Prod with Approved PEM/TEM".	Jeff Kruys
3.0	June 30, 2013	Recalculated using SIBEC 2013 table; added PEM/TEM datasets with BAPIDs 6065, 6066 and 6067; removed PEM/TEM datasets with BAPIDs 210 and 4485	Jeff Kruys

Revision Number	Revision Date	Summary of Changes	Author
3.1	October 28, 2013	Recalculated after fixing bug in scripted process which caused significant portion of SIBEC table to be ignored when calculating site index estimates for the PEM/TEM-SIBEC model	Jeff Kruids
4.0	March 31, 2015	Recalculated using SIBEC 2015 "supertable"; added PEM/TEM datasets with BAPIDs 5677, 6309, 6420, 6421; removed PEM/TEM datasets with BAPIDs 4023, 4024	Jeff Kruids
5.0	March 31, 2016	Recalculated using an updated crosswalk table for relating PEM/TEM ecosystem unit codes to equivalent SIBEC ecosystem unit codes	Jeff Kruids
6.0	June 30, 2017	Added TEM datasets with BAPIDs 1, 47, 6456, 6471, 6472; changed BAPIDs 4776, 5682 and 6067 to "approved PEM/TEM" status; recalculated using updated PEM/TEM to SIBEC ecosystem unit crosswalk table and the newest versions of VRI and provincial BGC linework	Jeff Kruids
6.1	December 5, 2017	Fixed an issue in the data processing scripts that resulted in some site index values of -999, and in some biophysical site index values being assigned to the final point feature attributes when they should not have been, due to the points in question lying outside of the UBC and VRI species range polygons.	Jeff Kruids

1.5 Update cycle for data and documentation

As mentioned in section 1.1, a new Site Productivity dataset is intended to be released on June 30 of each year, to coincide with the release of a new SIBEC Approximation, and with the incorporation of new PEM and TEM datasets that have been received since the most recent Site Productivity dataset version was created. The following is a minimal list of the documents and sections therein that require reviewing and updating with each new Site Productivity data release:

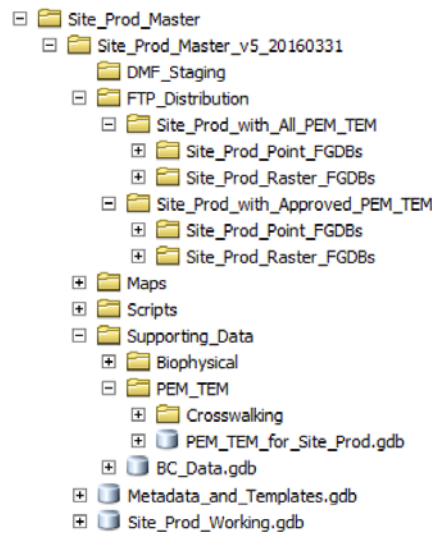
- FLNR Provincial Site Productivity Layer (this document)
 - Document Revision History
 - 1.4 Data Revision History
 - Appendix B – List of PEM/TEM Datasets
 - Appendix C – Maps of PEM/TEM Datasets
 - Other sections as needed
- FAIB Site Productivity Strategic Work Plan

- Description of work plan for the coming year
- Site Productivity website front page <http://www.for.gov.bc.ca/hts/siteprod>
 - Text in main body of web page
- Provincial Site Productivity Layer website <http://www.for.gov.bc.ca/hts/siteprod/provlayer.html>
 - Text in main body of web page, and PEM/TEM coverage map figures

2.0 Site_Prod_Master Data Storage and Processing Environment

Version 6.0 of the Site Prod feature class is built through a series of Python geoprocessing scripts running under an ArcGIS 10.3 license, using supporting datasets available through the BCGW and other sources. The entire workflow is illustrated in Appendix A.

Data has been organized into a folder structure to be stored on Ministry of Environment servers in parallel with similar data structures such as the TEIS Environment (Terrain and Ecosystem Inventory), as the Site Productivity data is derived in part from the PEM and TEM data stored there. The folder structure is shown below:



- The **DMF_Staging** folder contains the final Site Productivity point data in file geodatabase (FGDB) format to be delivered to a staging folder, from which it will be loaded to the Data Mashup Framework (DMF).
- The **Documentation** folder contains this document and other files containing descriptions of various aspects of the Site Productivity project.
- The **FTP_Distribution** folder contains the final Site Productivity data in file geodatabase (FGDB) format, which is ready for public distribution via FTP. These datasets are among the final outputs of the workflow described in this document, and specifically they are created by Script 10 (see section 6.2).

- The **Maps** folder contains ArcMap MXD files for generating map figures for documentation purposes.
- The **Scratch** folder contains a Scratch file geodatabase for holding temporary datasets produced by the geoprocessing scripts.
- The **Scripts** folder contains all Python geoprocessing scripts and supporting files.
 - The **Supporting_Data** folder contains local copies of datasets needed by the geoprocessing scripts. It contains the following subfolders. These are described in detail in the “Guide to Creation of the PSPL” document.
- The **Metadata_and_Templates** file geodatabase contains the following items:
 - **Site_Prod_BAPID_Overlaps**: This table lists all potential and existing pairs of BAPIDs (PEM or TEM project numbers) that partially overlap each other spatially. The attribute fields are BAPID1, BAPID2 and WINNER, which indicates which of the two overlapping BAPIDs takes precedence. The Python script **06_UpdateOverlappingBAPIDTable.py** will automatically detect these overlaps in the PEM/TEM feature class and add new rows to this table; the user must then manually enter the BAPID number of “winner” in each newly added row.
 - **Site_Prod_BAPIDs**: These tables are simple listings of BAPID numbers and various details about each PEM/TEM project. The attributes are copied from the tbl Projects table in the TEIS Project Tracker database. The table must be manually maintained to reflect the current list of all BAPIDs of PEM/TEM datasets being used for the Site Productivity project.
 - **Site_Prod_Metadata_Items**: This table lists details of the attribute fields that should belong to the template feature class attribute tables. The Python script **00_CreateSiteProdTemplates.py** creates new feature class templates based on the contents of this table.
- The **Site_Prod_Raster** file geodatabase contains the set of province wide rasters to be loaded to HectaresBC. This is created by running the script **10b_CreateFinalSiteProdRasters.py**.
- The **Site_Prod_Working** file geodatabase is where the Site Prod point feature classes are kept during development. There are 89 feature classes, one for each 1:250K mapsheet tile in BC, and they are all processed serially by each of the Python scripts that modifies them.

The entire data development workflow is illustrated in the diagram in Appendix A. It begins with two parallel processing streams, one that creates the point feature class and applies the Biophysical Model site index estimates to each point (in scripts 1 to 3), and another that processes the PEM/TEM polygon data and calculates weighted site index estimates for each polygon using the SIBEC table (in scripts 4 to 6). The points are then overlaid with the PEM/TEM polygons, resulting in points with site index estimates from both models. When a given point has been assigned site index estimates for a given species from both models, the PEM/TEM-SIBEC Model estimate takes

precedence over the Biophysical Model estimate. The final Site Prod point feature classes (for loading to the DMF and the FTP site) and a set of rasters (for loading to Hectares BC) are derived from this (in scripts 7 to 10).

The following sections outline the functions of the Python scripts that build the Site Prod feature class. For a more detailed technical look at the processes, see the “Guide to Creation of the PSPL” document.

3.0 Creation of the Site Prod Point Feature Class

The following sections outline the data processing steps that create the working Site Prod point feature classes and the addition of attributes which will later be used to calculate Biophysical Model site index estimates.

3.1 Initial derivation of point features and ID_TAG values

Script 1: Create Site Prod points from HaBC raster

As the point grid is based on the Hectares BC specification, the first step is to create a generic Hectares BC raster and convert it to a point feature class. We will be assigning an ID_TAG value to each point based on which TSA and which BCGS 1:250K mapsheet the point lies in.

The specifications of the standard Hectares BC raster grid are as follows:

- East-West (x) minimum: 159,587.5 BC Albers
- East-West (x) maximum: 1,881,187.5 BC Albers
- North-South (y) minimum: 173,787.5 BC Albers
- North-South (y) maximum: 1,748,187.5 BC Albers
- Cell Width: 100 metres
- Cell Height: 100 metres
- Cell Area: 1 hectare
- Grid Width (number of columns): 17,216 cells
- Grid Height (number of rows): 15,744 cells
- Total Grid Size: 271,048,704 cells

After creating the temporary generic raster, the script converts it to 89 point feature classes, one for each 1:250K mapsheet tile, in the **Site_Prod_Working** file geodatabase. It also assigns unique ID_TAG values to each point feature. The rest of the table consists of the following attribute fields, which are defined in the

Site_Prod_Metadata_Items table in the **Metadata_and_Templates** file geodatabase:

Table 3 - Attribute fields stored in the working Site Prod feature classes after running Script 1

Attribute Group	Attribute	Attribute Description
ID_TAGs and TSAs (populated by Script 1)	ID_TAG	Unique ID for each point (see section 3.1)
	TSA_NUMBER	Numeric code of the TSA in which the point lies
Provincial BGC unit for each point	BGC_LABEL	Biogeoclimatic unit in which the point lies, according to the latest BEC linework (currently version 8)

Attribute Group	Attribute	Attribute Description
(populated by Script 8a)	ZONE	Biogeoclimatic zone in which the point lies, according to the latest BEC linework (currently version 8)
Attributes required for ClimateWNA input (populated by Script 2a)	ELEVATION	Elevation in meters according to TRIM 100m DEM
	SLOPE	Slope in degrees according to TRIM 100m DEM
	ASPECT	Aspect in degrees azimuth according to TRIM 100m DEM
	LAT	Latitude in decimal degrees
	LONG	Longitude in decimal degrees
PEM/TEM attributes and site index values (populated by Script 7)	TEIS_ID	Unique ID of PEM/TEM polygon in which the point lies
	BAPID	Project ID for PEM/TEM polygon in which the point lies
	SDEC_# (3 fields)	Decile value of ecosystem component of PEM/TEM polygon in which the point lies
	SITE_S# (3 fields)	Site series code of ecosystem component of PEM/TEM polygon in which the point lies
	SITEMC_S# (3 fields)	Site series mapcode of ecosystem component of PEM/TEM polygon in which the point lies
	BGC_LBL	Biogeoclimatic unit of PEM/TEM polygon in which the point lies
	SIBEC_BGC# (3 fields)	Biogeoclimatic units of PEM/TEM ecosystem unit after cross-walking
	SIBEC_SS# (3 fields)	Site series codes of PEM/TEM ecosystem unit after cross-walking
	SIBEC_REG# (3 fields)	SIBEC Region of PEM/TEM ecosystem unit after cross-walking
	SIBEC_SRC# (3 fields)	SIBEC Source of PEM/TEM ecosystem unit after cross-walking
	USE	A code indicating whether the polygon's three ecosystem components can all be used for calculating site index values
	PEM_SI_xx (22 fields)	Weighted PEM/TEM-SIBEC site index estimate for species xx
	PEM_SPP	List of species for which the site index estimate was derived from PEM/TEM-SIBEC
UBC species ranges (populated by Script 8b)	UBC_SPP	List of codes of species whose ranges the point lies within according to UBC species ranges
VRI species ranges (populated by Script 8c)	VRI_SPP	List of codes of species whose ranges the point lies within according to observed species in VRI data
Biophysical site index estimates (populated by Script 8d)	BPSI_OBL_xx (15 fields)	Biophysical site index estimate for species xx according to provincial (version 8) biogeoclimatic linework
	BPSI_PBL_xx (15 fields)	Biophysical site index estimate for species xx according to localized PEM/TEM biogeoclimatic linework
ClimateWNA attributes (populated by Script 2b)	MWMT	Mean warmest month temperature (°C)
	MCMT	Mean coldest month temperature (°C)
	TD	Temperature difference between MWMT and MCMT, or Continentality (°C)
	MAP	Mean annual precipitation (mm)
	MSP	Mean summer (May to Sept.) precipitation (mm)
	AHM	Annual heat:moisture index $(MAT+10)/(MAP/1000)$
SHM	Summer heat:moisture index $((MWMT)/(MSP/1000))$	

Attribute Group	Attribute	Attribute Description
	DDLTO	Degree-days below 0°C, chilling degree-days
	DDGT5	Degree-days above 5°C, growing degree-days
	DDGT18	Degree-days above 18°C, cooling degree-days
	NFFD	Number of frost-free days
	PAS	Precipitation as snow (mm)
	EMT	Extreme minimum temperature over 30 years
	EREF	Hargreaves reference evaporation
	CMD	Hargreaves climatic moisture deficit
Discrepancy values (populated by optional script)	DISCREP_xx (15 fields)	Numeric difference between biophysical site index and PEM/TEM-SIBEC site index for species xx

3.2 Creation of the Timber Supply Area boundaries feature class

The BC Geographic Warehouse (BCGW) geodatabase contains a vector dataset depicting TSA boundaries (**WHSE_ADMIN_BOUNDARIES.FADM_TSA**), but it is not topologically clean, in that it contains overlapping polygons and gaps between adjacent polygons. We needed to subdivide the entire HaBC raster, created in the previous step, into “tiles” conforming to the TSA polygons. So it was necessary to create a topologically clean TSA boundaries feature class.

Note that many TSAs occupy entire forest districts. However, in some cases, a group of multiple adjacent forest districts forms a single TSA. So the forest district feature class (named **WHSE_ADMIN_BOUNDARIES.FADM_DISTRICT** in the BCGW geodatabase) was used as a basis for constructing the TSA polygon feature class.

In some instances, a forest district is split into multiple TSAs. It can be seen that in each such case, the line or lines upon which the forest district is split follow the boundaries of forest region compartment polygons, found in the BCGW feature class **WHSE_ADMIN_BOUNDARIES.FADM_REGION_COMPARTMENT**. See the figure below; note that the blue line that splits the forest district (with orange boundaries) into two TSAs is made up of regional compartment boundaries (in black).

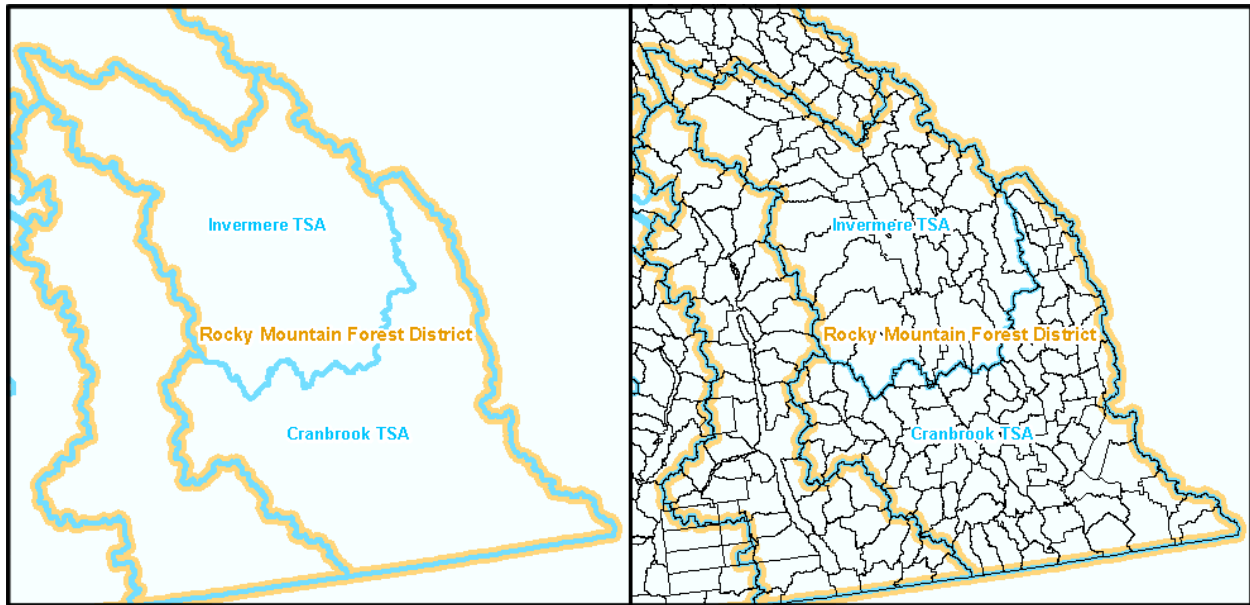


Figure 1 - Derivation of Timber Supply Area boundaries using Forest Region Compartment boundaries

The resulting TSA polygon feature class was included in the 2011-12 fiscal year deliverables for this project.

3.3 Creation of input files for ClimateWNA application

Script 2a: Add elevation, slope, aspect and BGC attributes to Site Prod points, and create ClimateWNA input files

Historical climate information is required by the Biophysical Model, and the ClimateWNA standalone application is required to assign this information to each Site Prod point. ClimateWNA is available as a free download from <http://www.genetics.forestry.ubc.ca/cfcg/ClimateWNA/ClimateWNA.html>. For the Site Productivity project, the use of version 4.62 (no later) of ClimateWNA is required.

This Python script creates CSV files conforming to ClimateWNA's requirements for bulk data input, consisting of ID_TAG, slope, aspect, biogeoclimatic zone, latitude, longitude and elevation of each point. (Not all of these parameters are required for ClimateWNA, but they are required for the Biophysical Model site index calculations later.)

Each of the four output CSV files will contain approximately 24 million lines and will take from 12 to 24 hours for ClimateWNA to process, depending on the computer's processing speed. Multiple instances of ClimateWNA can be run in parallel on multiple PCs, or on a single PC with multiple CPU cores, with little or no speed penalty. The ClimateWNA application will create four new CSV files as output.

Script 2b: Write the ClimateWNA attribute values to the Site Prod point features

This script reads in the ClimateWNA output files and copies the climate data into the Site Prod point attribute fields (see Table 2), specified by the unique ID_TAG values.

3.4 Removal of Site Prod points in non-forested areas

Script 3: Remove Site Prod points in non-forested areas

Points that lie in non-forested areas are not stored in the final Site Prod feature class. This script will remove from the working Site Prod feature classes any points that lie within any of the polygon features in the BCGW feature classes listed below in Table 4.

Table 4 - BCGW feature classes depicting permanently non-forested areas

Feature Class Name	Description
WHSE_BASEMAPPING.TRIM_EBM_AIRFIELDS	Airfields
WHSE_BASEMAPPING.TRIM_EBM_BUILDINGS	Buildings
WHSE_BASEMAPPING.TRIM_EBM_BUILTUPAREAS	Built up areas
WHSE_BASEMAPPING.TRIM_EBM_DESIGNATEDAREAS	Designated areas
WHSE_BASEMAPPING.TRIM_EBM_EXTRACTIONSITES	Developed areas, eg. sports fields, military establishments, campgrounds, landfills, quarries
WHSE_BASEMAPPING.TRIM_EBM_HYDRONAVBARRIERS	Hydrological navigation barriers, eg. gravel bars, dams
WHSE_BASEMAPPING.TRIM_EBM_HYDRORELATEDFEATURES	Hydrological related features, eg. wharves, docks, beacons
WHSE_BASEMAPPING.TRIM_EBM_ICEMASSES	Ice masses
WHSE_BASEMAPPING.TRIM_EBM_LANDCOVER	Agricultural features, eg. vineyards, orchards
WHSE_BASEMAPPING.TRIM_EBM_LANDFORMS	Non-forested landforms, eg. slides, moraine, lava beds
WHSE_BASEMAPPING.TRIM_EBM_OCEAN	Ocean
WHSE_BASEMAPPING.TRIM_EBM_WATERBODIES	Water bodies
WHSE_BASEMAPPING.TRIM_EBM_WATERCOURSES	Water courses
WHSE_BASEMAPPING.TRIM_EBM_WETLANDS	Wetlands

4.0 PEM/TEM-SIBEC Model

The PEM/TEM-SIBEC model, incorporates Predictive Ecosystem Mapping (PEM) and Terrestrial Ecosystem Mapping (TEM) data that has been gathered in many areas of the province over recent decades. These datasets delineate distinct ecosystem units down to the level of biogeoclimatic unit and site series. This information is then used in combination with the Ministry of Forests' SIBEC table, which lists site index estimates developed through field sampling for each BGC unit, site series, and observed tree species.

4.1 Cleaning of PEM/TEM data from TEIS geodatabase

In the first years of the Site Productivity project, much manual work went into standardizing the ecosystem attribute data of the PEM and TEM datasets chosen for use in the project, and edge matching between pairs of spatially adjacent PEM/TEM projects. This was a prerequisite to the work of crosswalking all ecosystem unit codes to the SIBEC classification standard. The "cleaned" data is stored in the TEIS geodatabase and is made available via

the BCGW data distribution services. The following automated processes require this “cleaned” PEM/TEM data to function correctly.

4.2 Compilation of SIBEC sources to SIBEC "Supertable" for 2015

The most recent official release of a full SIBEC table was in 2013. There was an addendum released in 2014. These are published on the SIBEC website,

<http://www2.gov.bc.ca/gov/topic.page?id=6221CAFD41244A8987DA4D7C7F414FB0>.

In March 2015, additional site index approximations were provided for use in the Site Prod project, which corresponded to the ecosystem unit codes used in the newly released PEM datasets for Kootenay Lake, Cranbrook, Arrow and Merritt Timber Supply Areas (BAPIDs 5677, 6309, 6420 and 6421 respectively). Included were rules for handling "lumped" or aggregate ecosystem units. All of these sources for site index approximations were compiled together into a SIBEC "Supertable" which we refer to as the SIBEC 2015 release, although it will not be published in the same form as previous SIBEC tables. An Excel document containing the "supertable" and all of its sources in separate worksheets was included in the release of Site Prod version 4.0, in a file named SIBEC_Supertable_20150331.xls. As of June 2017, no more new SIBEC approximations have yet been released, so this same table is used for version 6.0 of the Site Prod layer. It is also stored within the Site Prod processing environment, in the file geodatabase table `\Supporting_Data\BC_Data.gdb\SIBEC2017`, and it is read from that location by various Site Prod data processing scripts.

4.3 Creating the PEM/TEM-SIBEC crosswalk table

Ecosystem classification standards have evolved through several versions, and the various PEM and TEM project datasets stored in the TEIS Environment, gathered over many years, may adhere to any of these versions. Not all productive forested ecosystem units in the PEM and TEM data have an exact matching ecosystem unit in the SIBEC table.

In consultation with ecosystem classification specialists (most notably Ted Lea and Del Meidinger), a “crosswalk table” system has been developed which specifies the equivalent SIBEC-standard ecosystem classification for every ecosystem code found in the PEM and TEM project datasets used for Site Productivity. The crosswalk table takes the form of an Excel spreadsheet. This crosswalk table must be continually updated to reflect the complete list of ecosystems found in all of the PEM and TEM datasets and the current contents of the SIBEC table.

Script 4a: Create an updated crosswalk table

This script will read the current PEM/TEM data and the crosswalk table from the previous version of Site Prod (supplied by the user as an argument). The information from the previous crosswalk table will be repeated in a new crosswalk table output, and new rows are added for ecosystem units that are in the current PEM/TEM data but weren't listed in the previous crosswalk table. This output table must be sent to Ted Lea and/or Barb von

Sacken, and they will populate with SIBEC ecosystem units equivalent to the newly added PEM/TEM ecosystem units where possible.

4.4 Extraction of PEM/TEM data and site index calculation

Script 4b: Extract, crosswalk, and write site index values to PEM/TEM data

This script will copy the PEM and TEM project datasets from the TEIS and PEM Master Long Table feature classes (the locations of which must be specified as the first arguments to this script) and stores them all together in a feature class named **PEM_TEM_SiteProd**. The script will only copy the few required attribute fields out of the approximately 275 fields that the original PEM and TEM feature classes contain.

The script populates new attribute fields with equivalent ecosystem unit codes found in the SIBEC table, according to the crosswalk table created in the previous step, as well as a field containing codes relating to the “usability” of the polygon for the purposes of calculating weighted site index values. The script then creates two new feature classes, **PEM_TEM_SiteProd_USE** (containing “usable” polygons) and **PEM_TEM_SiteProd_DO_NOT_USE** (containing “unusable” polygons, only for depiction on map figures).

The final step in this script is to calculate and write site index estimates to the **PEM_TEM_SiteProd_USE** feature class. It steps through each polygon in the feature class and, referring to the SIBEC table’s site index values, calculates site index estimates for each polygon and stores them in 22 attribute fields, one for each tree species. Additionally, a field named **PEM_SPP** is populated with a comma-delimited list of tree species for which site index values were calculated by the PEM/TEM-SIBEC model for each polygon.

For each polygon in the PEM/TEM dataset, one weighted site index value is calculated **for each tree species** that is ecologically suitable for the site series. Each weighted site index for a species incorporates all of the SIBEC site index estimates for that species in the (up to) three PEM/TEM site series components, excluding any site series for which the SIBEC table gives no site index estimate. This equation is:

$$si_T si_T = \sum_S c_{S,P} si_{T,S} \sum_S c_{S,P} si_{T,S}$$

where:

Table 5 - Elements of the Site Index equation

Element	Description	Determination
si_T	The weighted Site Index for a given Tree Species	Computed
S	The set of Site Series components within the PEM/TEM Polygon (determined by the BGC Unit and Region) for which the SIBEC table gives a Site Index Estimate for the Tree Species	Observed
$c_{S,P}$	The Site Series component fraction (decile) within a PEM/TEM Polygon	Observed

Element	Description	Determination
$Si_{T,S}$	The Site Index Estimate in the SIBEC table for the Tree Species for a given Site Series within a BGC Unit and Region	Estimated

Site index calculation example

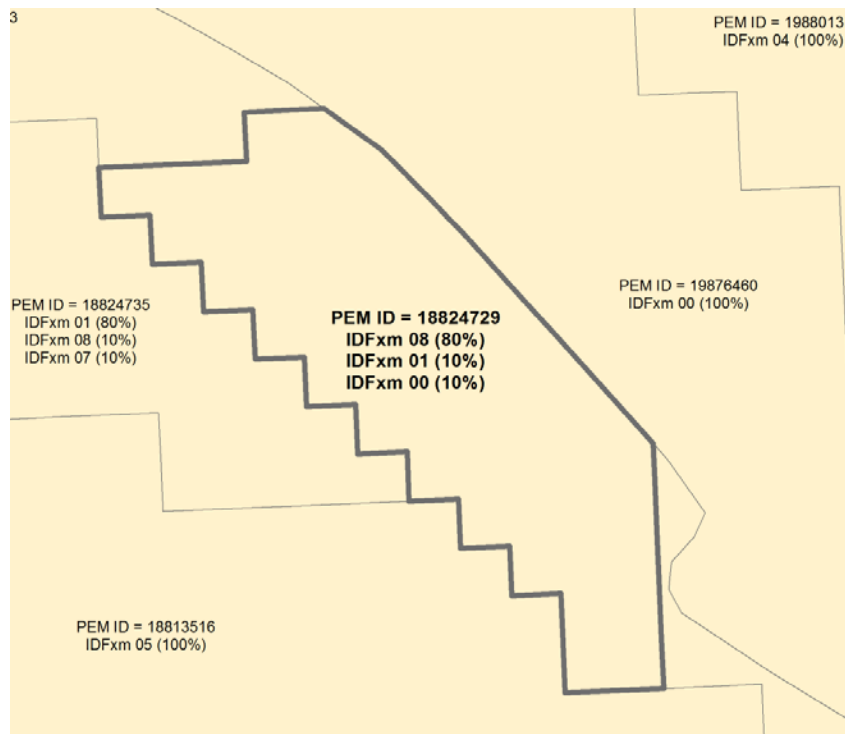


Figure 2 – Example of a PEM polygon

For the example polygon above, the relevant SIBEC table entries are as follows:

Table 6 - Excerpt from the SIBEC table

BGC Unit	Site Series	Tree Spp	Region	Site Association	Mean Plot Site Index
IDFxm	01	Fd	Cariboo	Fd - Pinegrass - Feathermoss	16.40222221
IDFxm	08	Fd	Cariboo	Sxw - Snowberry - Prickly rose	18
IDFxm	08	Sx	Cariboo	Sxw - Snowberry - Prickly rose	18

We determine from the SIBEC table that Fd is an ecologically suitable species in IDFXm 01 and IDFXm 08, two site series which collectively occupy 9/10ths of the polygon. For the remaining 1/10th of the polygon (IDFXm 00 site series), there is no SIBEC site series estimate for Fd, so this 1/10th of the polygon should not be included in the weighted averaging of the available site index estimates. It can be stated that 90% of the polygon supports any growth of Fd.

Similarly, Sx is potentially present in IDFXm 08 which occupies 8/10ths of the polygon.

So we calculate:

$$si_{Fd} = (18 \times (8 \div 9)) + (16.40222221 \times (1 \div 9))$$

$$= 17.8224691344$$

$$si_{Sx} = (18 \times (8 \div 8))$$

$$= 18$$

The attributes stored for this PEM/TEM polygon are shown in the following table:

Table 7 - Attribute values stored as a result of the sample calculation

Attribute	Attribute Description	Value
PEM_SI_FD	Calculated site index for the Fd species	17.8
PEM_SI_SX	Calculated site index for the Sx species	18

4.5 Dissolving PEM/TEM feature class for depiction on map figures

Script 5: Create dissolved PEM/TEM dataset for map figures

This is not a necessary step for data development. It creates simplified feature classes for depiction of PEM/TEM spatial distribution on map figures (such as in Appendix C of this document). It is recommended to run this script under ArcGIS 10.1 or later with 64-bit geoprocessing installed. The output feature classes are named **TEI_Long_Tbl_SiteProd_USE_Dissolved** and **TEI_Long_Tbl_SiteProd_DO_NOT_USE_Dissolved**. The ArcMap MXD files are found in the **Maps** folder.

4.6 Updating the Overlapping BAPIDs table

Script 6: Update table of overlapping BAPIDs

There will always be overlapping areas between PEM and TEM projects, so for every pair of overlapping projects, it must be decided which one of the pair takes precedence. These decisions result from a manual process of comparing the details of the two PEM/TEM projects in question for vintage of data (ie. the most recent data is usually better quality), the known quality of the data (the relative experience of the PEM/TEM mappers for example), the survey intensity level (projects that included a high level of field sampling are considered better quality), and known accuracy of data (eg. results of a third party accuracy assessment).

The **Site_Prod_BAPID_Overlaps** table (found in the **Metadata_and_Templates** file geodatabase) contains one row for each pair of BAPID numbers of PEM/TEM projects that spatially overlap. This script searches the current PEM/TEM feature class for pairs of overlapping BAPIDs that aren't already listed in the table, and adds them to the table. The script does not automatically select which of the pair has the better quality data; after the script has completed, the user must manually edit the table and fill in the **WINNER** field with the BAPID number that takes precedence in each new record that the script added to the table.

4.7 Writing PEM/TEM-SIBEC site index values to the Site Prod points

Script 7: Write PEM/TEM-SIBEC site index values to Site Prod points

This script overlays the working Site Prod point feature classes with the PEM/TEM feature class and copies the PEM/TEM attributes and site index values to the working Site Prod point feature class attributes. It refers to the **Site_Prod_BAPID_Overlaps** table (see section 4.4) when any point lies within multiple overlapping PEM/TEM polygons to decide which polygon's attributes to assign to the point.

5.0 Biophysical Model

The following section describes the Biophysical Model for calculating site index estimates for all Site Prod points, regardless of whether the point lies within a PEM/TEM polygon.

5.1 Addition of species ranges and biophysical model site index values to Site Prod points

Script 8a: Write Provincial BGC units to Site Prod points

This script performs an overlay of each of the Site Prod point feature classes with the provincial BGC unit layer. The values in the working Site Prod point attributes BGC_LABEL and BCGW_ZONE are overwritten by this process.

Script 8b: Write UBC species ranges to Site Prod points

This script performs an overlay of each of the Site Prod point feature classes with the species distribution range data developed by UBC researchers and stored in \Supporting_Data\BC_Data.gdb\UBC_species_ranges (raw data available for download from <https://sites.ualberta.ca/~ahamann/data/rangemaps.html>). The values in the Site Prod point attribute UBC_SPP is overwritten by this process, populated with a comma-delimited list of species codes, for example "At,Pl,Sb,Sw,Sx". Note that not all of the species in that list will actually have site index values calculated for that point, only the species that are also predicted for that point's location according to the Biophysical or PEM/TEM-SIBEC models.

Script 8c: Write VRI species ranges to Site Prod points

This script performs an overlay of each of the Site Prod point feature classes with the latest VRI polygon feature class. The species listed in the VRI attributes SPECIES_CD_1 through SPECIES_CD_6 are used to populate the Site

Prod point attribute VRI_SPP with a comma-delimited list of species codes, for example, “At,Pl,Sb,Sw,Sx”, i.e. the list of tree species observed at a Site Prod point location according to VRI. Note that not all of the species in that list will actually have site index values calculated for that point, only the species that are also predicted for that point’s location according to the Biophysical or PEM/TEM-SIBEC models.

Script 8d: Write species ranges and biophysical site index values to Site Prod points

The biophysical model was initially created as a statistical model in SAS by Gord Nigh, and its logic has since been translated to Python and embedded directly into this script. Biophysical model site index estimates are written into the attribute fields of the 89 feature classes in the **Site_Prod_Working** file geodatabase.

The biophysical site index calculations for a given point depend on the BGC zone that the point lies in. The BGC linework developed for a PEM or TEM project usually differs from the provincial BGC linework; therefore, a point may lie in one BGC zone according to the provincial linework, but a different zone according to PEM or TEM data. Therefore, the script performs calculations for the provincial BGC zone and stores them in the **BPSI_OBL_xx** (BioPhysical Site Index - Original BGC Linework) fields, and separate calculations using the PEM/TEM BGC zone, storing these results in the **BPSI_PBL_xx** (BioPhysical Site Index - PEM/TEM BGC Linework) fields. Site index values calculated using BGC zone linework in PEM/TEM datasets takes precedence over those calculated using provincial BGC zone linework.

6.0 Final Products

6.1 Creation of discrepancy tables and rasters

Optional Script: Create discrepancy tables and rasters

This script is only run on Gord Nigh’s request. It updates the working Site Prod feature classes’ attributes named **DISCREP_xx** (where **xx** is the two-letter species code) with the numeric difference between the biophysical site index value and the PEM/TEM site index value for the species, when site index estimates from both models have been calculated. It then creates one CSV file and one raster for each of the 15 tree species, listing the discrepancies for all points for which there are two differing site index estimates for the species. These CSV files and rasters can be viewed and analyzed in order to identify problem areas where change or improvement is needed in some aspect of the calculations.

6.2 Creation of final datasets for loading to DMF, HectaresBC and FTP

Script 9a: Create final Site Prod feature classes

This Python script will create the FGDBs containing point feature classes for distribution via the Site Prod FTP site, the DMF, and Hectares BC. Two sets of 36 FGDBs (corresponding to the 36 TSAs) are written: one set for the “Site

Prod with Approved PEM/TEM” edition of the data, which is identical to the Site Prod data to be loaded into the DMF, and another set for “Site Prod with All PEM/TEM” edition.

The final Site Prod feature classes have attribute tables conforming to the BCGW-modeled non-spatial data structure as outlined in Table 1 (see section 1.3), although the data will not be loaded to the BCGW geodatabase. The Working Site Prod feature classes with all of their intermediate attributes can be preserved in the Site_Prod_Master data processing environment for the purposes of investigating the calculations that led to the final results, and to provide a base for processing the next version of the PSPL.

Script 9b: Create final Site Prod rasters

This script creates two FGDBs (one for each of the two Site Prod editions) each containing 22 rasters, one per tree species, depicting the site index values province-wide. Starting at Site Prod version 3.1, the rasters for Site Productivity with Approved PEM/TEM will be loaded to Hectares BC. As well, the rasters for both Site Productivity editions (with Approved PEM/TEM and with All PEM/TEM) will be made available in file geodatabase format via FTP, and the Approved PEM/TEM edition of the point feature classes will be made available for download via the DMF.

Script 10: Create final Site Prod feature classes and layer files for PDF maps

This scripted process converts the rasters for Site Productivity with Approved PEM/TEM, created by Script 9b, into polygon feature classes which are then formatted for use in the production of PDF map products.

When the script has completed, a file geodatabase named Site_Prod_Polygons_for_PDFs.gdb will have been created in the Maps folder of the Site Prod data processing environment. The feature classes in this FGDB will be used by Script 11 and its associated MXD file.

Script 11: Create PDF maps

This script creates a series of map documents in georeferenced PDF format. On these map figures, the site index values are depicted at 3m intervals. With 36 TSAs in the province, and 22 species, this script could potentially produce 792 PDF files, each displaying the site index values for one species in one TSA. The script filters out non-existent combinations of TSA and species; for example, since there are no values for Cw found in the Fort Nelson TSA, there will be no PDF map produced for that combination. With the Site Prod 6.0 data, this script resulted in 436 of the possible 792 PDF maps being produced.

These PDFs are distributed via the Site Prod FTP site and the DMF. Once the PDF files have been created by this script, they are transferred to Graham Hawkins who ensures that they are copied to the appropriate servers and properly linked from the website.

7.0 Quality Assurance

Data quality is expressed in two ways: data correctness and data accuracy. The former involves checking the data development process to ensure that the expected numbers are produced. The latter requires checking the results against other similar datasets and/or against data observed in the field.

7.1 Data correctness

After each step of the data development process, the results are reviewed manually. Since there are 85 million points available to be checked, a random sample must suffice. Samples should be selected to span all timber supply areas, PEM/TEM project areas, and biogeoclimatic zones or units. Detailed quality assurance methods that should follow each stage of data development process are detailed in the “Guide to Creation of the PSPL” document. Any issues discovered generally indicate faulty coding in the data processing scripts.

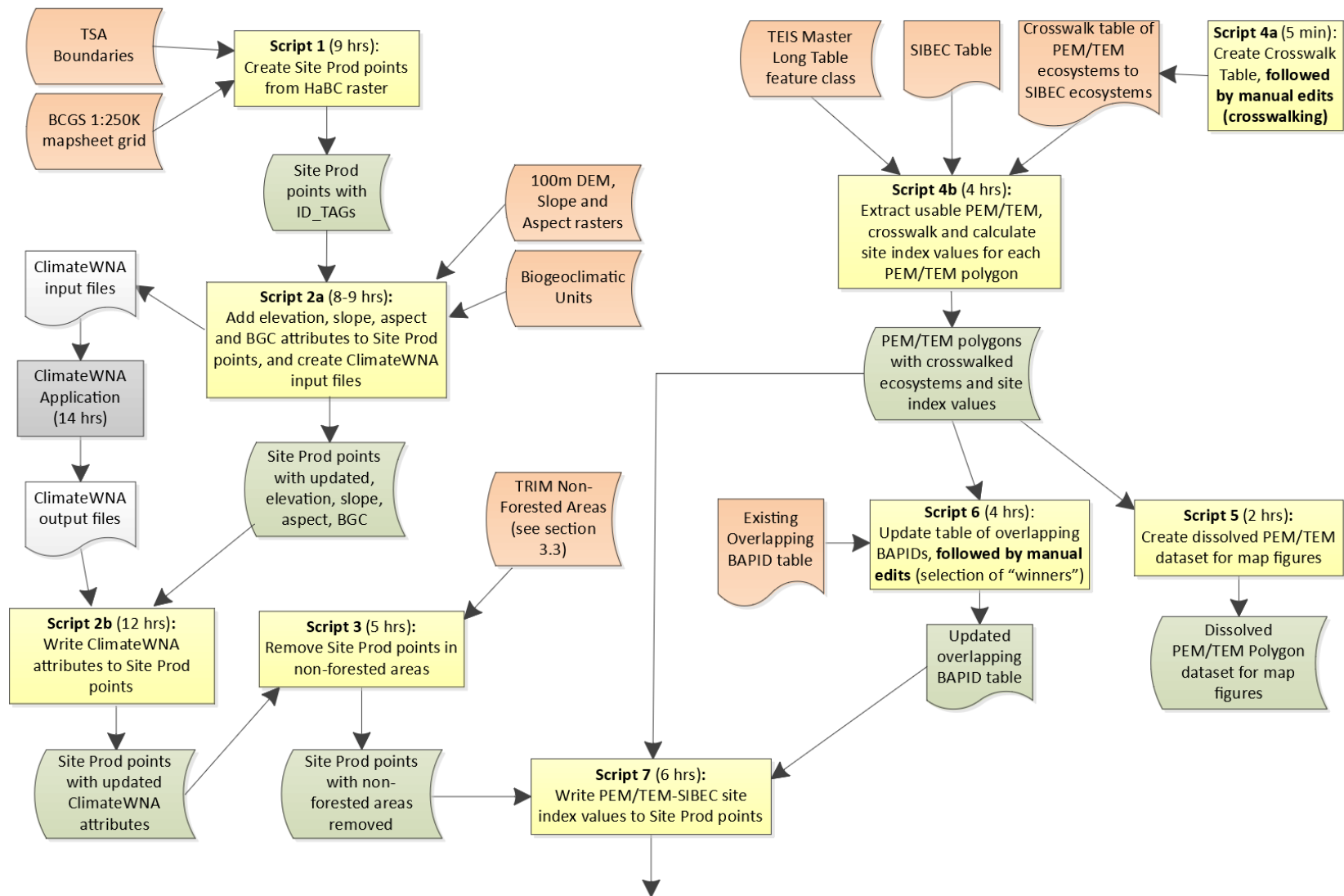
7.2 Data accuracy

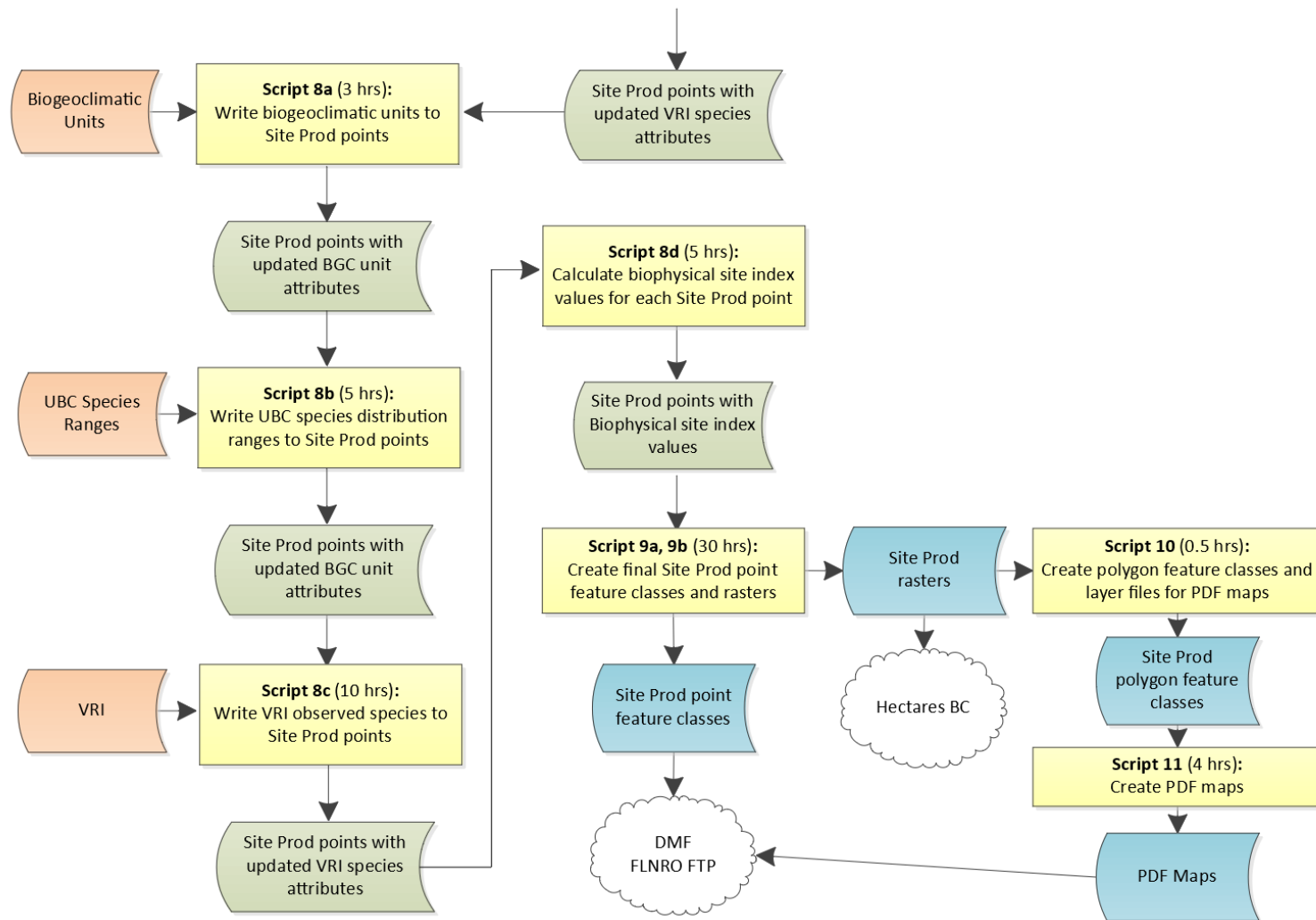
The discrepancy values (see section 6.1) may provide an indication of areas where Site Prod data is less accurate or less reliable. Individual points where the biophysical model site index and the PEM/TEM-SIBEC model site index differ widely lead one to question which model is more accurate. Investigating the origins of each of the two differing values may lead to recognition that one model or the other needs refinement in a certain region.

The accuracy of some source data can come into question. PEM and TEM datasets sometimes go through accuracy assessments which estimate their reliability, and the Site Prod accuracy suffers when PEM/TEM accuracy is low. In other cases, a deficiency of field sampling can lead to equations used in the biophysical model that may not give accurate results in all parts of a biogeoclimatic zone and improvements cannot be made to the model until further sampling is carried out.

In the future, a comparison will be made of Site Prod data and the RESULTS data to assess Site Prod accuracy. Findings resulting from this process will appear in this section in future versions of this document.

Appendix A – Workflow Diagram





Appendix B – List of PEM/TEM Datasets

Table 7 is a list of PEM/TEM datasets used in the Site Productivity project.

More information and metadata regarding these PEM/TEM datasets can be found in the feature class WHSE_TERRESTRIAL_ECOLOGY.STE_TEI_PROJECT_BOUNDARIES_SP, found in the BCGW geodatabase.

The **Earliest Site Prod Version** column indicates the version number of the Site Productivity dataset in which this PEM/TEM dataset was first used.

The **Accuracy Assessment** (AA) and Ecosystem Survey Intensity Level (**ESIL**) columns give an indication of the reliability of the PEM/TEM dataset. Note that accuracy assessments were not generally performed on PEM/TEM data until recent years; for earlier projects, the Ecosystem Survey Intensity Level (ESIL) value is a reliability indicator. ESIL is defined as the sampling intensity characterized according to percentage of polygons that have been field inspected or density of inspections by area. Coding must follow Table 6-3 in the Standard for Terrestrial Ecosystem Mapping in British Columbia (see <http://archive.ilmb.gov.bc.ca/risc/pubs/teecolo/tem/tem6/tem63.htm>).

The **Site Prod Editions** column indicates which editions of the Site Productivity dataset the PEM/TEM dataset has been incorporated into. The Site Productivity dataset editions are named “Site Prod with All PEM/TEM” and “Site Prod with Approved PEM/TEM”. Every PEM/TEM dataset is included in the “All” edition, but for a PEM/TEM dataset to be included in the “Approved” edition, completion and approval of a third party accuracy assessment and/or an ESIL value of 1-5 are necessary.

The **Superseded Overlapping Projects** column lists BAPID numbers of PEM/TEM datasets that are superseded by the PEM/TEM dataset in question.

Overlapping areas are still present in the PEM/TEM data, but in these areas, the polygons belonging to the superseded PEM/TEM project are disregarded (see section 4.8).

Table 7: Summary of PEM/TEM datasets used in the PEM/TEM-SIBEC Model

BAPID	Project Name	Earliest Site Prod Version	Accuracy Assessment	ESIL	Site Prod Editions	Superseded Overlapping BAPIDs
1	Klawli TEM	6.0	Completed; not approved	4	All and Approved	4052
29	TFL 41 - Dala Creek TEM	1.0	Not completed	4	All and Approved	
31	Mamin Blackwater TEM	2.0	Not completed	4	All and Approved	
36	TFL39 - Walbran Caycuse TEM	2.0	Not completed		All	

BAPID	Project Name	Earliest Site Prod Version	Accuracy Assessment	ESIL	Site Prod Editions	Superseded Overlapping BAPIDs
46	TFL 45 - Knight Inlet TEM	1.0	Not completed	3	All and Approved	4776, 5682, 6067
47	TFL 37 TEM	6.0	Not completed	3	All and Approved	50, 92, 170, 177
50	Adam and Eve TEM	2.0	Not completed		All	
52	Dinan McClinton TEM	2.0	Not completed	4	All and Approved	4056
53	Henderson Lake TEM	2.0	Completed; approved	3	All and Approved	3058
54	Chemainus River TEM	2.0	Not completed		All	
57	Klanawa River TEM	2.0	Completed; approved		All and Approved	
58	Salmon River TEM	2.0	Completed; approved	4	All and Approved	
64	Catface LU TEM	2.0	Not completed		All	
65	Sydney River TEM	2.0	Not completed		All	
68	Hesquiat LU TEM	2.0	Not completed	4	All and Approved	
69	Muriel Ridge TEM	2.0	Not completed	4	All and Approved	171
70	Fortune LU TEM	2.0	Not completed		All	
71	Marble LU TEM	2.0	Not completed	4	All and Approved	
73	Tranquil Creek TEM	2.0	Not completed		All	
74	Bedwell TEM	2.0	Not completed		All	
75	Ursus TEM	2.0	Not completed	4	All and Approved	175
77	Atleo TEM	2.0	Not completed	4	All and Approved	
78	Pretty Girl TEM	2.0	Not completed	4	All and Approved	
81	Iron River TEM	2.0	Not completed		All	
91	Adams Lake TEM	2.0	Not completed	R	All	3006
92	TFL19 Gold River TEM	2.0	Not completed	4	All and Approved	
108	BC Gas Pipeline TEM	1.0	Not completed	R	All	
121	Cathedral Park TEM	1.0	Not completed	4	All and Approved	4778
131	Forbidden Plateau TEM	2.0	Not completed	4	All and Approved	
133	TFL 35 TEM	1.0	Not completed	4	All and Approved	
142	Indian Arm - Mt Seymour Park TEM	2.0	Not completed	5	All and Approved	
149	Sutherland River Babine TEM	2.0	Not completed		All	
153	Chilliwack Lake TEM	2.0	Not completed	5	All and Approved	1073
157	Nahatlach Lake TEM	2.0	Not completed		All	

BAPID	Project Name	Earliest Site Prod Version	Accuracy Assessment	ESIL	Site Prod Editions	Superseded Overlapping BAPIDs
166	Phillips River TEM	1.0	Completed; approved	1	All and Approved	
167	QCI Upper Yakoun TEM	2.0	Not completed	4	All and Approved	52
168	QCI Louise Island TEM	2.0	Not completed		All	
169	Haans TEM	2.0	Not completed	4	All and Approved	
170	Schoen Strathcona Park TEM	2.0	Not completed		All	
171	Upper Kennedy TEM	2.0	Not completed	R	All	
172	Bulson River TEM	2.0	Not completed		All	70
174	Lower Nahmint TEM	2.0	Not completed		All	
175	Taylor River Maber Creek TEM	2.0	Not completed		All	
176	Namu Koeye TEM	1.0	Not completed	4	All and Approved	5681, 6067
177	Tsitika River TEM	2.0	Not completed		All	
178	Upper Nahmint TEM	2.0	Completed; approved		All and Approved	
179	TFL 47 TEM	1.0	Completed; approved		All and Approved	47, 177, 4776
180	TFL 46 - S. Vancouver Island TEM	2.0	Not completed	4	All and Approved	54, 5627
182	Akie Pesika TEM	2.0	Not completed	4	All and Approved	
184	Valemount Kinbasket Lake TEM	2.0	Not completed	4	All and Approved	
185	Ingenika TEM	2.0	Completed; not approved	4	All	
198	Fort Sheppard TEM	1.0	Not completed	4	All and Approved	
203	Tsulquate TEM	2.0	Not completed	4	All and Approved	
204	Great Central Lk TEM	2.0	Completed; approved		All and Approved	
205	TFL 41 - Kitimat TEM	1.0	Not completed		All	
206	Clayoquot Sound REVISIT	2.0	Not completed	4	All and Approved	69, 71, 171
207	QCI TFL39 Peel Security TEM	2.0	Not completed	4	All and Approved	
208	TFL18 - Slocan Vavenby TEM	2.0	Not completed	4	All and Approved	
214	Dunkley TFL53 TEM	1.0	Not completed	4	All and Approved	
222	Cummins River TEM	2.0	Not completed	4	All and Approved	
225	Bonanza TEM	2.0	Not completed	4	All and Approved	177
226	Wood River TEM	2.0	Not completed	4	All and Approved	
228	Shushartie TEM	2.0	Not completed	4	All and Approved	
230	Mahatta TEM	2.0	Not completed	4	All and Approved	

BAPID	Project Name	Earliest Site Prod Version	Accuracy Assessment	ESIL	Site Prod Editions	Superseded Overlapping BAPIDs
231	Sukunka TEM	1.0	Not completed	4	All and Approved	
234	Sooke Hills TEM	2.0	Not completed	4	All and Approved	
235	TFL 8 - Pope and Talbot TEM	1.0	Completed; approved		All and Approved	1055
236	TFL 44 - Sproat Lake TEM	2.0	Completed; approved		All and Approved	
238	TFL 14 - Spillimacheen TEM	1.0	Completed; approved	4	All and Approved	
239	TFL 15 OK Falls TEM	1.0	Not completed	4	All and Approved	108
240	Gosnell Creek TEM	1.0	Not completed	5	All and Approved	
242	Mt Cornation TEM	2.0	Not completed		All	
243	Upper Qualicum TEM	2.0	Not completed		All	
1029	Ellerslie Lk TEM	1.0	Not completed		All	
1039	Princess Royal Island TEM	2.0	Not completed	4	All and Approved	5438
1055	Granby Kettle TEM	1.0	Not completed			
1056	Tulsequah Chief TEM	1.0	Not completed	4	All and Approved	
1073	Hope IFPA TEM	2.0	Not completed	4	All and Approved	108
3006	Clearwater PEM	1.0	Not completed		All	
3037	Sarita TEM	2.0	Completed; approved	4	All and Approved	
3057	Escalante TEM	2.0	Not completed	4	All and Approved	
3058	Toquart Effingham TEM	2.0	Not completed	5	All and Approved	
3072	Block 4/Port McNeill TEM	2.0	Completed; approved	4	All and Approved	47, 203
4000	Johnston TEM	1.0	Not completed		All	
4001	Bella Vista TEM	1.0	Not completed	4	All and Approved	4778
4006	Mission TEM	2.0	Not completed	4	All and Approved	
4018	Bell Pole PEM	1.0	Not completed	P	All	
4019	Boundary TSA PEM	1.0	Completed; approved		All and Approved	1055, 4029
4029	Osoyoos Okanagan Area A Mapping TEM	1.0	Not completed	4	All and Approved	4778
4033	TFL 23 PEM	1.0	Completed; not approved		All	1055, 4018
4034	Upper Wood River PEM	1.0	Not completed	P	All	
4039	Abitibi PEM 2001/2002	1.0	Not completed	R	All	185
4041	INVERMERE TSA PEM	1.0	Completed; conditionally approved	P	All and Approved	6135

BAPID	Project Name	Earliest Site Prod Version	Accuracy Assessment	ESIL	Site Prod Editions	Superseded Overlapping BAPIDs
4044	TFL48 PEM	1.0	Completed; conditionally approved		All and Approved	
4045	TFL 49 PEM	1.0	Completed; approved		All and Approved	
4051	TFL 30 PEM	1.0	Not completed	P	All	
4052	Prince George TSA PEM	1.0	Completed; conditionally approved		All and Approved	
4053	Blackwater Retrofit PEM	1.0	Completed; conditionally approved	P	All	
4056	QCI Husby TEM	2.0	Completed; not approved	5	All	
4078	Deer Vernon TEM	2.0	Not completed	R	All	
4119	Flores Island TEM	2.0	Not completed		All	
4201	Klaskish TEM	2.0	Not completed	4	All and Approved	
4202	Lull Sallie TEM	1.0	Not completed	4	All and Approved	46, 4776, 5682, 6067
4212	Chadsey TEM	2.0	Not completed		All	
4296	Fort Nelson TSA PEM	1.0	Not completed		All	
4299	Cortez LU TEM	1.0	Not completed	4	All and Approved	
4301	Fullmore LU TEM	1.0	Not completed	4	All and Approved	179, 5437, 5682
4303	Dewdney Cedarflat TEM	2.0	Not completed	4	All and Approved	
4316	Revelstoke PEM	1.0	Completed; conditionally approved (ICH units only)		All and Approved	4018
4322	TFL 55 PEM	1.0	Completed; approved	P	All and Approved	
4475	Fort St. John PEM	1.0	Not completed	R	All	4296
4477	Commonage TEM	1.0	Not completed	4	All and Approved	
4482	Bulkley Woodlots TEM	1.0	Completed; approved	4	All and Approved	6471
4489	Indian LU TEM	2.0	Not completed	4	All and Approved	
4490	Bute East LU	1.0	Not completed	4	All and Approved	
4492	King Island TEM	1.0	Not completed	R	All	
4493	Ingram Lake TEM	1.0	Not completed	R	All	1029
4498	Lake Country TEM	1.0	Not completed	4	All and Approved	5433, 5511

BAPID	Project Name	Earliest Site Prod Version	Accuracy Assessment	ESIL	Site Prod Editions	Superseded Overlapping BAPIDs
4508	McBride Community Forest TEM	2.0	Not completed	4	All and Approved	
4510	Burns Lake Community Forest Integrated VRI/PEM	1.0	Not completed	4	All and Approved	4482
4511	Morice & Lakes TSA PEM	1.0	Completed; conditionally approved		All and Approved	149, 240, 4482, 4510
4516	Soo LU TEM	2.0	Not completed	4	All and Approved	
4517	Callaghan LU TEM	2.0	Not completed	4	All and Approved	
4518	Mamquam LU TEM	2.0	Not completed	4	All and Approved	
4519	Lower Squamish LU TEM	2.0	Not completed	4	All and Approved	4518
4520	East Howe TEM	2.0	Not completed	4	All and Approved	
4521	Siska Watershed TEM	2.0	Not completed		All	
4522	CDFmm TEM	1.0	Not completed	5	All and Approved	234, 4904
4677	Chapman LU TEM	1.0	Not completed	4	All and Approved	
4678	Sechelt LU TEM	1.0	Not completed	4	All and Approved	4522
4679	Sloquet LU TEM	2.0	Not completed	4	All and Approved	
4680	Sloquet High LU TEM	2.0	Not completed	4	All and Approved	
4681	Tuwasus LU TEM	2.0	Not completed	4	All and Approved	
4682	Meager LU TEM	2.0	Not completed	4	All and Approved	
4683	Birkenhead LU TEM	2.0	Not completed	4	All and Approved	
4684	Howe LU TEM	1.0	Not completed	4	All and Approved	
4685	Ryan LU TEM	2.0	Not completed	4	All and Approved	
4776	TFL45 TEM Augmentation	1.0	Not completed	R	All and Approved	166
4777	Kingcom TSA TEM	1.0	Not completed	4	All and Approved	179
4778	Okanagan - very dry belt PEM	1.0	Not completed		All	91, 108
4834	Joe Rich SEI	1.0	Not completed	4	All and Approved	
4883	QCI Husby - Kootenay Inlet TEM	2.0	Not completed		All	
4884	QCI Husby - Skidegate Inlet TEM	2.0	Not completed		All	
4890	QCI Husby - Hibben Island TEM	2.0	Not completed		All	
4902	Henderson Lake TEM	2.0	Completed; approved		All and Approved	

BAPID	Project Name	Earliest Site Prod Version	Accuracy Assessment	ESIL	Site Prod Editions	Superseded Overlapping BAPIDs
4903	Alberni West TEM	2.0	Not completed	4	All and Approved	171, 175, 178, 180, 204, 206, 3058
4904	Powell River Block 1 TEM	1.0	Not completed	4	All and Approved	
4906	Skidegate TEM	2.0	Not completed	4	All and Approved	4884
4907	North Island Block3 TEM	1.0	Not completed	4	All and Approved	47, 4777, 5682
4908	Railroad LU TEM	2.0	Not completed	4	All and Approved	
4909	Gates LU TEM	2.0	Not completed	4	All and Approved	
4910	Rogers LU TEM	2.0	Not completed	4	All and Approved	
4911	Lizzie LU TEM	2.0	Not completed	4	All and Approved	
4912	Billygoat LU TEM	2.0	Not completed	4	All and Approved	
4913	Jervis LU TEM	1.0	Not completed	4	All and Approved	
4914	Salmon LU TEM	1.0	Not completed	4	All and Approved	
4915	Brittain LU TEM	1.0	Not completed	4	All and Approved	
4916	Bulkley TSA PEM	1.0	Completed; conditionally approved		All and Approved	4482
4917	Westbank First Nation Community Forest TEM	1.0	Completed; approved	4	All and Approved	4778, 5433, 5511
5433	Updated Central OK Valley Central OK South Slopes Kelowna Ellison Joe Rich	1.0	Not completed	5	All and Approved	4045, 4778, 4834, 5511
5435	Vanderhoof Forest District PEM	1.0	Not completed		All	
5437	Strathcona TSA TEM	1.0	Not completed	4	All and Approved	47, 92, 166, 179, 4776
5438	Kitasoo TEM	1.0	Not completed	R	All	1029, 4493
5492	Okanagan TEM	1.0	Not completed		All	108
5511	OK TSA PEM	1.0	Completed; conditionally approved		All and Approved	91, 108, 121, 235, 1055, 3006, 4018, 4029, 4316, 4778, 4834
5512	Cariboo PEM	1.0	Completed; approved		All and Approved	4052
5627	Teal Jones TEM	2.0	Not completed		All	
5638	Sunshine Coast TSA Haslam LU TEM	2.0	Not completed	4	All and Approved	4522, 4904, 6122

BAPID	Project Name	Earliest Site Prod Version	Accuracy Assessment	ESIL	Site Prod Editions	Superseded Overlapping BAPIDs
5639	Sunshine Coast TSA Skwawka LU TEM	2.0	Not completed	4	All and Approved	
5640	Sunshine Coast TSA Bunster LU TEM	2.0	Not completed	4	All and Approved	4522, 4904
5641	Soo TSA Upper Lillooet LU	2.0	Not completed	4	All and Approved	
5666	Soo TSA Whistler LU	2.0	Not completed	4	All and Approved	
5672	Kingcome TSA Ahta-Charles-Miriam LU TEM	2.0	Not completed	4	All and Approved	
5676	Belize LU TEM	1.0	Not completed		All	
5677	Kootenay Lake PEM	4.0	Incomplete for some non-forested site series		All	
5681	EBM TEM Midcoast TSA	2.0	Not completed	R	All	
5682	EBM TEM Kingcome TSA	2.0	Not completed	R	All	
6065	North Coast TSA North TEM	3.0	Not completed	R		
6066	North Coast TSA South TEM	3.0	Not completed	R		
6067	Mid-Coast Kingcome TSA TEM	3.0	Not completed	R		4000, 5681
6118	Narrows LU TEM	1.0	Not completed	4	All and Approved	
6122	Lois Lake West TEM	1.0	Completed; approved	4	All and Approved	
6123	Lois Lake East TEM	1.0	Completed; approved	4	All and Approved	
6135	Stoddart Creek TEM	1.0	Not completed		All	
6309	Cranbrook PEM	4.0	Completed; approved		All and Approved	4041, 5677
6420	Arrow PEM	4.0	Completed; approved		All and Approved	1055, 4018, 4019, 4033, 4316, 5511, 5677
6421	Merritt PEM	4.0	Completed; approved		All and Approved	108, 121, 4045, 4778, 4917, 5511
6456	Coast EBM TEM Phase 4	6.0	Not completed		All and Approved	
6471	North Kalum Ecosystem Mapping and Wildlife Interpretations TEM	6.0	Not completed		All and Approved	
6472	Coast EBM TEM Phase 5	6.0	Not completed	R	All and Approved	1029, 5438

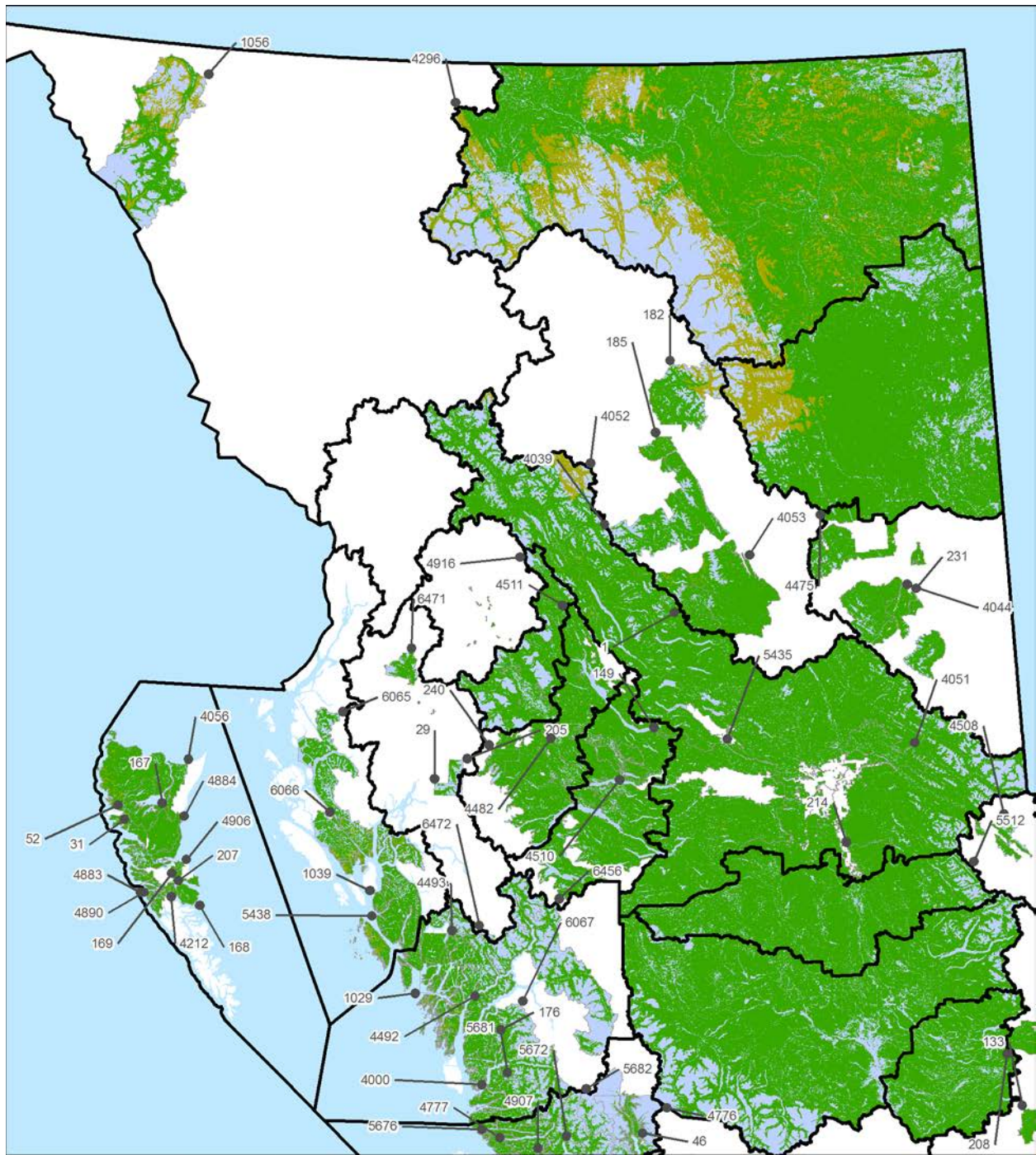
Appendix C – Maps of PEM/TEM Datasets

The figures on the following pages illustrate the relative locations of the PEM and TEM datasets used in this project. Each figure illustrates the full coverage areas of the datasets.

The first three maps show the PEM/TEM datasets that were incorporated into the “Site Prod with All PEM/TEM” dataset. The last three maps depict only the PEM/TEM datasets that were incorporated into the “Site Prod with Approved PEM/TEM” dataset.

The area covered by PEM/TEM polygons whose ecosystem units were used for site index calculations is shown in **dark green**. The areas where ecosystem codes indicate the presence of forest, but the codes could not be crosswalked to any ecosystem listed in the SIBEC table, are shown in **olive green**. Non-productive and non-forested ecosystems are shown in **blue**. Areas that have not been mapped by any PEM/TEM project are shown in **white**.

Note again that Biophysical Model site index values have been calculated in **all** forested areas of the province. Site index estimates derived from PEM and TEM data, where available, take precedence over site index estimates derived from the Biophysical model.



All PEM and TEM Projects for Site Productivity - North Coast & Interior

Legend

- TSA Boundary
- PEM/TEM Boundary
- SIBEC Ecosystems
- Non-Productive Ecosystems
- Forested but Non-SIBEC

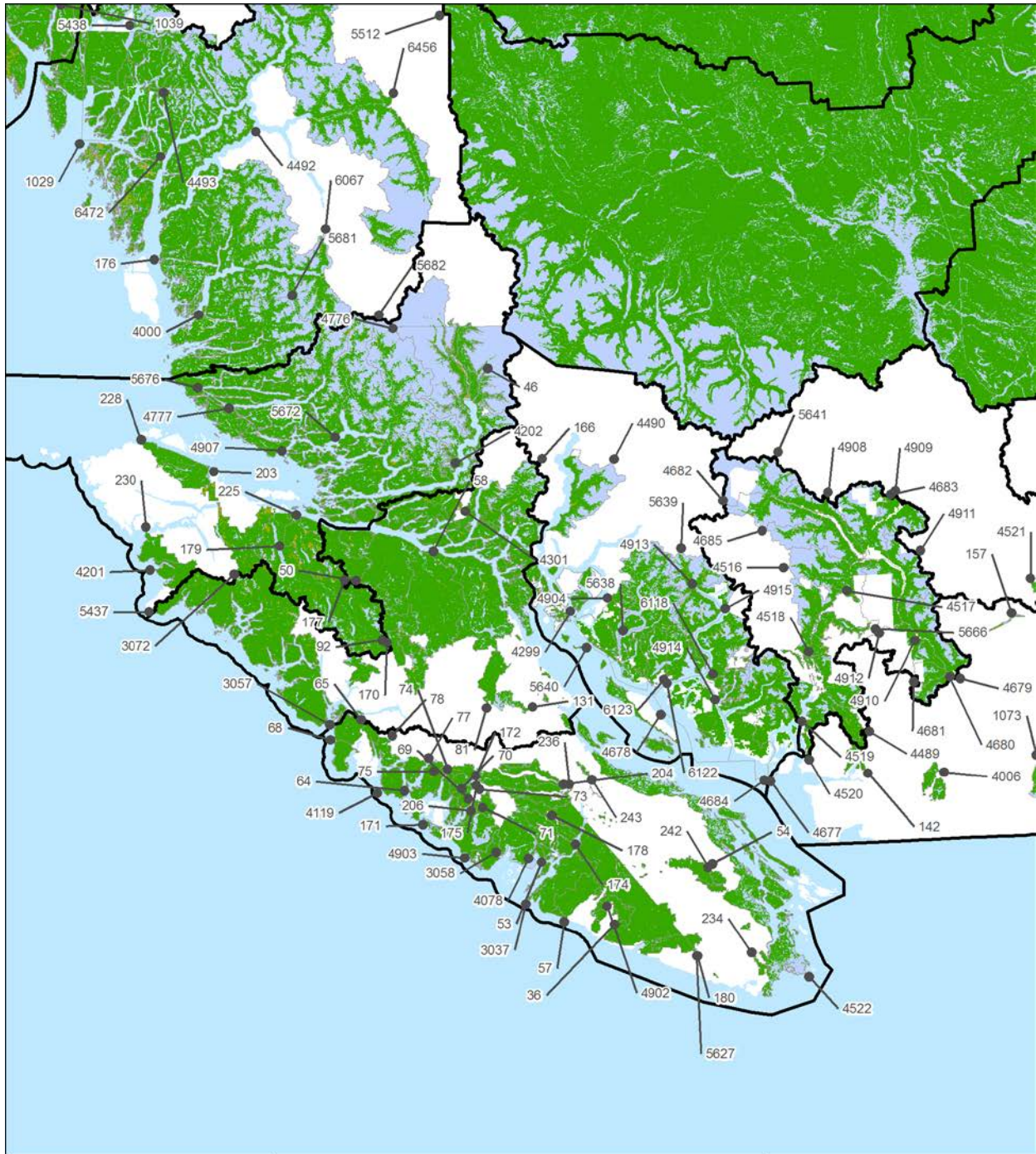
N

0 50 100 150 200

 Kilometres

1:5,800,000

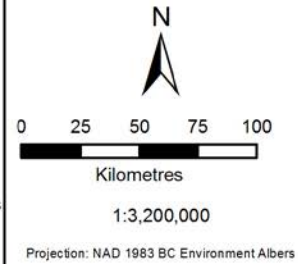
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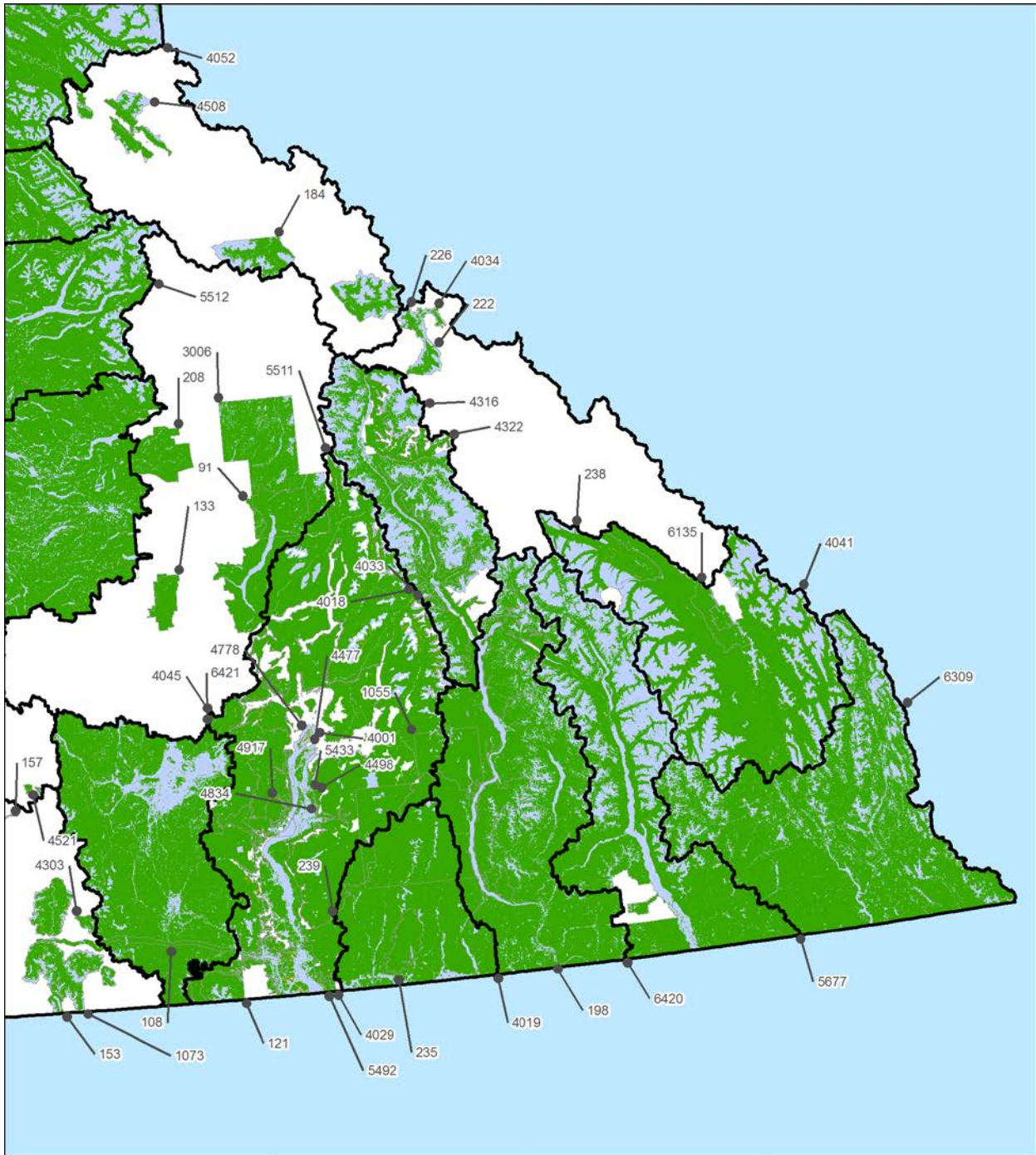


All PEM and TEM Projects for Site Productivity - South Coast

Legend

-  TSA Boundary
-  PEM/TEM Boundary
-  SIBEC Ecosystems
-  Non-Productive Ecosystems
-  Forested but Non-SIBEC

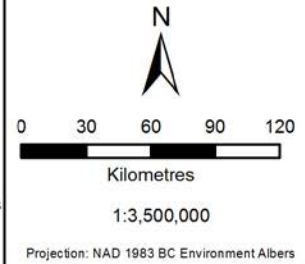


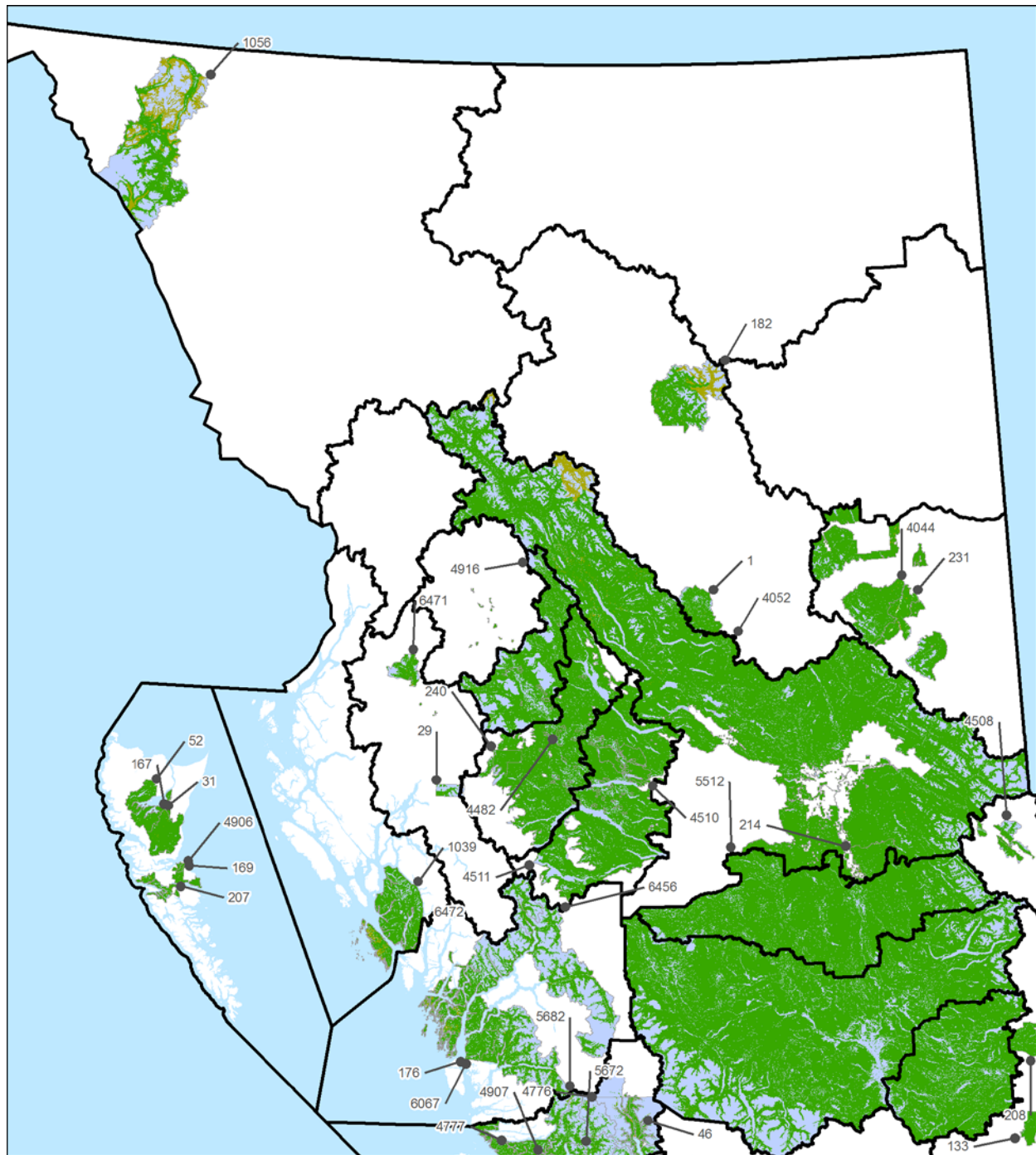


All PEM and TEM Projects for Site Productivity - South Interior

Legend

-  TSA Boundary
-  PEM/TEM Boundary
-  SIBEC Ecosystems
-  Non-Productive Ecosystems
-  Forested but Non-SIBEC

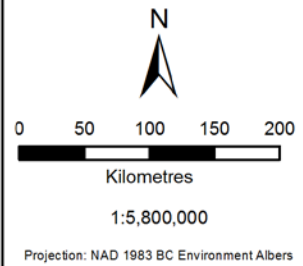


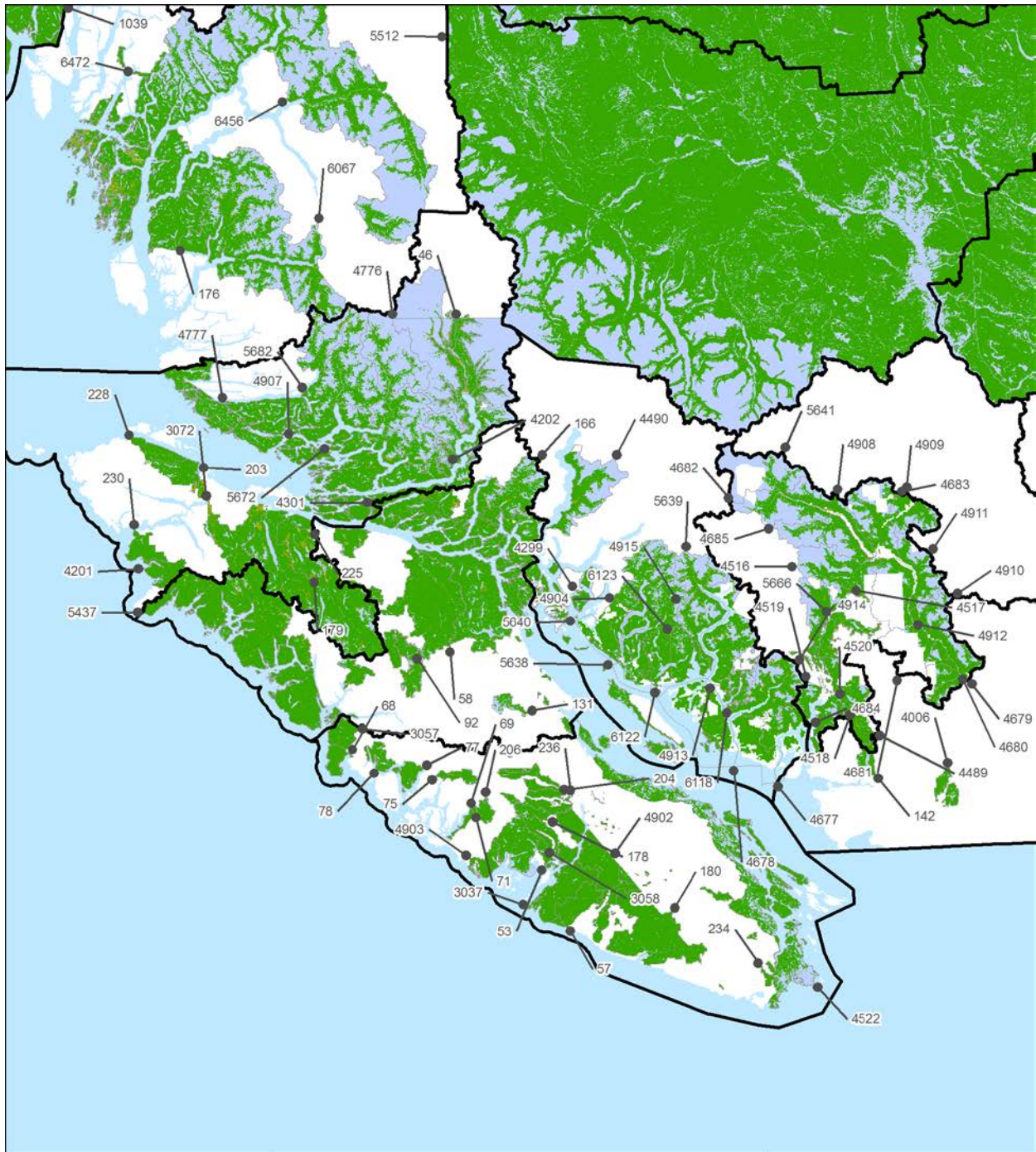


Approved PEM and TEM Projects for Site Productivity - North Coast & Interior

Legend

- TSA Boundary
- PEM/TEM Boundary
- SIBEC Ecosystems
- Non-Productive Ecosystems
- Forested but Non-SIBEC

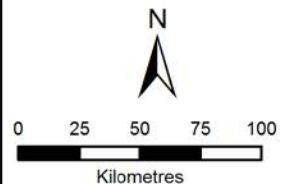




Approved PEM and TEM Projects for Site Productivity - South Coast

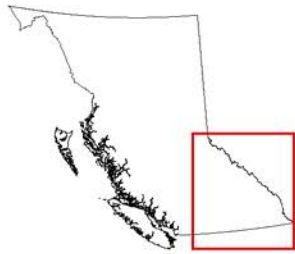
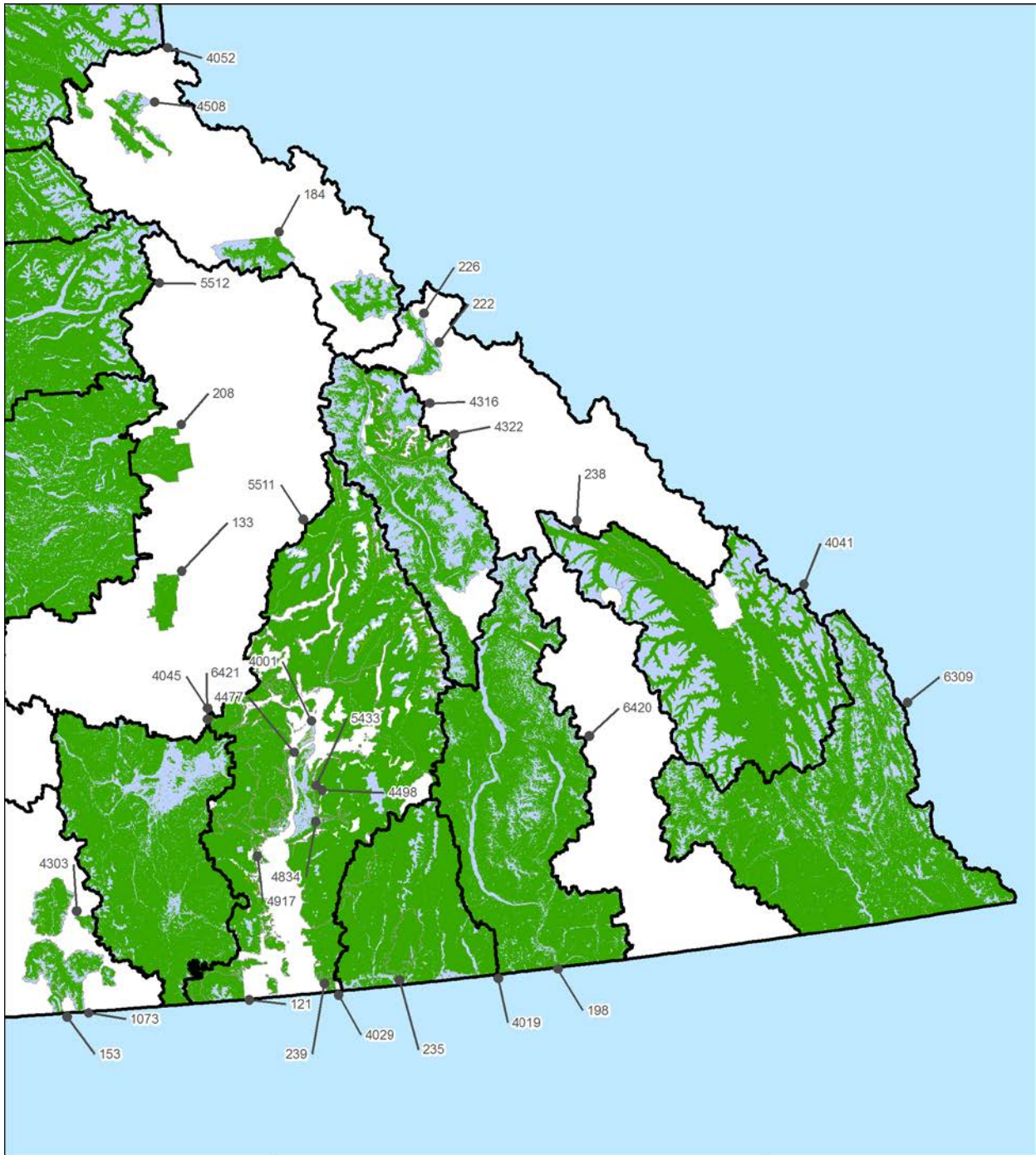
Legend

- TSA Boundary
- PEM/TEM Boundary
- SIBEC Ecosystems
- Non-Productive Ecosystems
- Forested but Non-SIBEC



1:3,100,000

Projection: NAD 1983 BC Environment Albers



Approved PEM and TEM Projects for Site Productivity - South Interior

Legend

- TSA Boundary
- PEM/TEM Boundary
- SIBEC Ecosystems
- Non-Productive Ecosystems
- Forested but Non-SIBEC



1:3,500,000

Projection: NAD 1983 BC Environment Albers