

Lillooet Forest District

**Predictive Ecosystem Modelling
GIS Project Methodology and
Input Data Quality**

Prepared for:

**AINSWORTH LUMBER
LILLOOET**

Ainsworth

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March 2004

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1.0 Objectives:

The objectives of this project were to provide accurate Predictive Ecosystem Modelling (PEM) in the Lillooet Forest District District . This analysis would use many existing inventory GIS data sets, as well as creation of new data to support PEM analysis. The methodology used is the Ecoprep/Ecogen methodology originally developed by the British Columbia MOF research branch. This methodology has been further revised to the Silvatech/Shamaya version of Ecoprep/GIS Predictive Ecosystem Modelling analysis.

2.0 Area of Interest:

2.1 Mapsheets:

The following 96 mapsheets were completed for PEM analysis. The area of interest is located in the Southern coastal interior of British Columbia in the Lillooet region.

092O.030, 092O.029, 092O.028, 092O.020, 092O.019, 092O.018, 092O.017, 092O.016, 092O.015, 092P.001, 092O.010, 092O.009, 092O.008, 092O.007, 092O.006, 092O.005, 092O.004, 092I.092, 092I.091, 092J.100, 092J.099, 092J.098, 092J.097, 092J.096, 092J.095, 092J.094, 092J.093, 092I.082, 092I.081, 092J.090, 092J.089, 092J.088, 092J.087, 092J.086, 092J.085, 092J.084, 092J.083, 092J.082, 092I.072, 092I.071, 092J.080, 092J.079, 092J.078, 092J.077, 092J.076, 092J.075, 092J.074, 092J.073, 092J.072, 092I.062, 092I.061, 092J.070, 092J.069, 092J.068, 092J.067, 092J.066, 092J.065, 092I.054, 092I.053, 092I.052, 092I.051, 092J.060, 092J.059, 092J.058, 092J.056, 092J.055, 092I.044, 092I.043, 092I.042, 092I.041, 092J.050, 092J.049, 092J.048, 092I.034, 092I.033, 092I.032, 092I.031, 092J.040, 092J.039, 092J.038, 092I.024, 092I.023, 092I.022, 092I.021, 092J.030, 092J.029, 092I.014, 092I.013, 092I.012, 092I.011, 092J.020, 092J.019, 092I.003, 092I.002, 092I.001, 092J.010,

2.2 Analysis Units

For the purpose of GIS analysis the area of interest was split into 22 analysis units based on landscape units in the Lillooet district. This was done to keep the size of areas limited, so analysis could be completed in reasonable time limits and software limitations were not exceeded.

The following landscape units were completed. Abbreviations were given to each landscape unit, when conducting analysis.

<i>Landscape Unit</i>		<i>Abbreviation</i>
Spruce Lake	=	SL
Gun	=	GU
French Bar	=	FB
Carpenter North	=	CN
Carpenter South	=	CS
Watson Bar	=	WB
Pavillion	=	PV
Duffy South	=	DS
Duffy North	=	DN
Hurley East	=	HE
Hurley West	=	HW
Yalakom	=	YK
Stein West	=	SW
Stein East	=	SE
Kwoiek	=	KW
Murray	=	MU

Connell Creek	=	CC
Siska	=	SK
Bridge East	=	BE
Bridge West	=	BW
Lost Creek	=	LC
Texas Creek	=	TC

3.0 Input Data Assessment and Compilation

Before analysis could begin Silvatech needed to assess and compile all necessary digital data for the PEM. This was completed in 2001 for the initial analysis. Silvatech completed portions of the data compilation, while MSRM (MOE) completed preparation of other data sources for the Lillooet PEM.

The following GIS data was available for PEM analysis.

3.1 Existing Inventories for use in PEM

TRIM 2:	RIC standard Terrain resource inventory mapping. Appended coverage's for the district were created by MOE Kamloops in 2001. TRIM 2 was captured for the complete district in 2000.
Forest Cover:	Forest cover was appended together for Lillooet district in 2001 by MOE Kamloops. Forest cover dates are current to about the 1990's but mainly the late 90's.
Biogeoclimatic:	1: 20000 Biogeoclimatic regions for the district. Received May 2003 from MOF Kamloops regional office.
Geology:	Geology information appended and prepared by Silvatech from various digital data sources created by the British Columbia Ministry of Energy and Mines.

3.2 New created inventories to support PEM

Satellite:	Classification analysis of 2001 Landsat Imagery into landscape vegetation classes by Silvatech.
Terrain:	Terrain mapping studies created in the 90's were gathered and merged into a single coverage for the Lillooet District. Remaining areas missing for the Lillooet District were compiled from new studies in 2000 to complete terrain information for the study area.. Silvatech created final coverage in 2001.

Each data set was appended together for the area of interest and quality checked for spatial accuracy.

3.3 Data accuracy Checks and input quality

All GIS data was checked according to PEM standards. Positional accuracy was assessed for each PEM input in relation to TRIM data and TRIM orthophotos. Data assessment accuracy's can also be found in appropriate Metadata included with project deliverables.

Terrain Assessment

COMPILATION PERIOD

Compilation Scale: Varied among study areas (see initial fields of attribute database for metadata)

Period of Content: Varied among study areas: 1978 - 2001 (see initial fields of attribute database for metadata)

Period of Compilation: Varied among study areas: 1978 - 2001 (see initial fields of attribute database for metadata). Mapping products for individual study areas were compiled to create a seamless polygonal coverage during May 2001.

Comments:

Forest Renewal BC-funded district-wide terrain mapping for the Lillooet Timber Supply Area (1997-2001) was digitized using mono-restitution techniques and adhered to Resources Inventory Committee standards. Atticus Resource Consulting Ltd. completed most digital mapping products for these projects.

No metadata was provided by Hugh Hamilton Ltd. and Forsite Consultants Ltd. for terrain mapping completed outside of the Forest Renewal BC-funded district-wide terrain mapping initiative. It is believed that this digital data was compiled using mono-restitution techniques. However, given the lack of associated metadata, map coverages were imported into ARC/INFO GIS and checked for planimetric and topographic accuracy relative to TRIM streams and contours.

Digital map coverages produced by Silvatech Consulting Ltd. during this project were compiled using mono-restitution techniques where typelines were present on aerial photographs or digitised directly from paper maps where these existed. Compilation techniques for individual study areas mapped during this project were as follows:

Burkholder Lake	Mono-Restitution
Carpenter Lake (South)	Digitised from paper maps
Downton Creek (upper elevations)	Mono-Restitution
Duffey Lake	Mono-Restitution
Junction Creek (upper elevations)	Mono-Restitution
Lost Valley	Mono-Restitution
Pasulko Lake	Mono-Restitution
Pavilion Creek	Digitised from paper maps
Shulaps Creek (upper elevations)	Mono-Restitution
Stein Valley	Digitised from 1: 50000 NTS paper maps (data was hand transferred from aerial photographs)
Study Areas 56-61	Mono-Restitution

INPUT MAP COMPILATION QUALITY CONTROL

Edge Matching:

Terrain mapping was completed for sixty-plus study areas in the Lillooet Forest District during the period of 1978 to 2001. Completed mapping varied in Terrain Survey Intensity Level and map scale. Digital terrain mapping products were imported into ARC/INFO GIS and checked for positional accuracy. FRBC-funded terrain mapping deliverables were brought in first and updated to form a single polygonal coverage. Most coverages matched well; however, study area borders did not always match exactly. As no typed terrain polygon was < 0.05 ha in area, slivers < 0.05 ha along study area boundaries were merged into the longest bordered neighbour polygon. This rule was developed in consultation with the PGeo who had completed the original mapping products and was intended to eliminate sliver polygons in a manner consistent with the scale of the original mapping. Remaining digital terrain mapping products were then imported into the FRBC-funded terrain mapping coverage without shifting or edge

matching of data. This was done because differences in map scale differed greatly among studies. However, polygons < 0.05 ha were again merged into the longest bordered neighbour. Polygon slivers > 0.05 ha but <2 ha were merged manually into neighbouring polygons. This process was also developed in consultation with the PGeo who had completed the original mapping and was considered an acceptable means by which to eliminate sliver polygons in a fashion consistent with the scale at which the terrain attribute data was captured. Larger boundary slivers were addressed by the same PGeo or her designate and manually merged to appropriate neighbours or typed as individual polygons.

Edge Matching Error: 0 (no shifting of coverages took place)

Attribute/Label Matching: SURF_M1 was the data field that was checked for attribute data matching across study areas. 52% of edge boundaries did not match when comparing the SURF_M1 data field. This can be attributed to a number of factors. Scales of studies differed throughout the project area, which would affect the boundaries across study areas. Terrain analysts also could type differently across study areas. Study boundaries also exist at height of land and it is possible to have different surficial materials across boundaries.

Raster Size: Not applicable

Spatial Reconciliation:

i) Spatial Check Table:

Feature type	Count and/or Average Length (m)	Minimum Shift (m)	Average Shift (m)	Maximum Shift (m)
Point/Intersection				
Linear	3,800	0	0	0
Polygon				
Overall				

Mapped terrain polygons were compared to TRIM lakes and double lined rivers following the standards documents cited above. Terrain polygon boundaries and TRIM hydrography matched well with no major shifts being apparent. Mapped terrain polygons were also compared to TRIM contours. This was accomplished by assessing terrain polygon boundaries relative to major topographic features (e.g. ridges, gullies, and major slope changes). Terrain linework generally matched well with topographic contours, but in some instances terrain typelines deviated by as much as 40 m from identifiable topographic features. These discrepancies were attributed to terrain polygons having been delineated by hand on 1:20,000 aerial photographs and subsequently digitized using monorestitution techniques. Monorestitution techniques themselves have a capture error of ± 20 m. An additional human error of only 1 mm during hand-drafting of terrain polygon boundaries on 1:20,000 aerial photographs would be required to produce a positional error of 40 m as was detected during spatial accuracy checks

FC Data Assessment

COMPILATION PERIOD

Forest cover data was created using RIC MOF standards for Forest Cover. Coverage initially created by MOE in 2000. Silvatech corrected errors of slivers to create a new clean coverage. Only Rank 1 Layer 1 was attached to each polygon as a flat data structure.

Compilation Scale: 1:20000

Period of Content: Airphotos taken July, 1987

Period of Compilation: Reinventoried in 1990 with minor polygon updates dating to January 25, 2000

INVENTORY PROCEDURES

Data Capture

Delineation Method and Criteria: RIC FC standards

Sampling Design: RIC FC standards

Sampling Methods: RIC FC standards

Sampling Frequency: RIC FC standards

Attribution: RIC FC standards

Quality Assurance

Validation Method: Not Applicable FC RIC data capture standards

Validation Criteria: Not Applicable FC RIC data capture standards

Validation Design: Not Applicable FC RIC data capture standards

Validation Results: Not Applicable FC RIC data capture standards

Quality Control

Correlation Procedures: Not Applicable

Map Production: Not Applicable

Edge Matching: Not Applicable (information was matched as is)

Line Edit: Not Applicable

Symbol Edit: Not Applicable

Attribute Edit: Not Applicable

Legend Edit: Not Applicable

INPUT MAP COMPILATION QUALITY CONTROL

Edge Matching: Coverage's were joined together and matched as best as possible. Coverage was later fixed by Silvatech to correct many edgematching slivers from original data created by MOE.

Edge Matching Error: information was matched as is

Attribute/Label Matching: Looking at certain non-productive features and species assessed general attribute checking. Other FC content is impossible to check in the digital environment and was generally assessed for content when the ecologist was assessing ground sample sites in relation to forest cover.

Spatial Reconciliation:

i) Spatial Check Table:

ii)

Feature Type	Count or Average Length (m)	Min Shift (m)	Average Shift (m)	Maximum Shift (m)
Polygon	8	0	12	35

TRIM coverages Assessment

TWTR (TRIM water features)
TDEM (TRIM DEM features)
TTRN (TRIM Road features)
TSRF (TRIM Surficial Features)
TCTR (TRIM Contour Features)

COMPILATION PERIOD

TRIM 2 files. Data was appended together for the area of interest, plus surrounding sheets. This was done for subsequent buffer analysis that might affect the classification of features in the AOI. All features contain FCODES pertaining to GDBC standards with the DEM also containing elevation. Information was appended together and generated by MOE. 2001

Compilation Scale: 1:20000
Period of Content: TRIM 2 Unknown
Period of Compilation: Year 2000.

INVENTORY PROCEDURES

Data Capture

Delineation Method and Criteria: GDBC TRIM RIC standards
Sampling Design: GDBC TRIM RIC standards
Sampling Methods: GDBC TRIM RIC standards
Sampling Frequency: GDBC TRIM RIC standards
Attribution: GDBC TRIM RIC standards

Quality Assurance

Validation Method: Not Applicable
Validation Criteria: Not Applicable
Validation Design: Not Applicable
Validation Results: Not Applicable

Quality Control

Correlation Procedures: Not Applicable
Map Production: Not Applicable
Edge Matching: Not Applicable (information was matched as is)
Line Edit: Not Applicable
Symbol Edit: Not Applicable
Attribute Edit: Not Applicable
Legend Edit: Not Applicable

INPUT MAP COMPILATION QUALITY CONTROL

Edge Matching: TRIM matched accurately
Edge Matching Error: information was matched as is
Attribute/Label Matching:

Raster Size:
Spatial Reconciliation: No spatial reconciliation is necessary

Biogeoclimatic Assessment

COMPILATION PERIOD

Comments: MOF Kamloops regional ecologist sanctioned Biogeoclimatic coverage. Coverage was received in shapefile format from regional office and cleaned up for minor topology and attribute errors by Silvatech.

Compilation Scale: 1: 20000
Period of Content: 2001-2003
Period of Compilation: 2002

INVENTORY PROCEDURES

Quality Assurance

Validation Method: Coverage sanctioned by MOF
Validation Criteria: Coverage sanctioned by MOF
Validation Design: Coverage sanctioned by MOF
Validation Results: Coverage sanctioned by MOF

Quality Control

Correlation Procedures:

i) Taxonomy: Not Applicable (Coverage sanctioned by MOF)
ii) Attributes: Not Applicable (Coverage sanctioned by MOF)
Map Production: It is believed MOF personnel transferred BEC linework to 1:20000 maps that were then digitized directly from paper maps.
Edge Matching: Not Applicable (Coverage sanctioned by MOF)
Line Edit: Not Applicable (Coverage sanctioned by MOF)
Symbol Edit: Not Applicable (Coverage sanctioned by MOF)
Attribute Edit: Not Applicable (Coverage sanctioned by MOF)
Legend Edit: Not Applicable (Coverage sanctioned by MOF)

INPUT MAP COMPILATION QUALITY CONTROL

Edge Matching: Not Applicable (Coverage sanctioned by MOF)
Edge Matching Error: Not Applicable (Coverage sanctioned by MOF)
Attribute/Label Matching: Not Applicable (Coverage sanctioned by MOF)

Raster Size:

Spatial Reconciliation:

Spatial Check Table: No Check coverage. When coverage was received from regional office general positional accuracy was assessed in BEC in relation to water or ice features. Positional accuracy was difficult to assess although BEC lines fit topographic features and gains in elevation.

Satellite Classification Assessment

COMPILATION PERIOD

Training areas for classification of LANDSAT 7 imagery consisted of characteristic or typical non-forested ecosystems delineated by the project ecologist through visual interpretation of 1:15,000 scale colour aerial photographs for the Lillooet Forest District. Supervised and unsupervised classifications were performed using the ERDAS IMAGINE 8.4 product suite to identify non-forested ecosystems. The raster-based classification of non-forested ecosystems was subsequently compiled to form a seamless, vector-clean polygonal coverage in ARCINFO GIS format.

Compilation Scale: 30-meter resolution determined by Landsat 7 pixel size

Data Type:	LANDSAT 7 Imagery	LANDSAT 7 Imagery
Data Content:	Track 47 (Scenes 24 and 25)	Track 48 (Scenes 24 and 25)
Content Date:	July 12, 1999	September 21, 1999

Period of Compilation: March 2000

INVENTORY PROCEDURES

Data Capture

Delineation Method and Criteria:

Training areas for classification of LANDSAT 7 imagery consisted of characteristic or typical non-forested ecosystems delineated by the project ecologist through visual interpretation of 1:15,000 scale colour aerial photographs for the Lillooet Forest District. Ecosystems were delineated as they were encountered on available photographs, though an effort was made to review photographs representing the range of biogeoclimatic conditions within the project area and to limit ecosystem delineation to the largest of units that were observed. Boundaries for classified ecosystems were first established through supervised and unsupervised classifications of LANDSAT 7 imagery that were performed using the ERDAS IMAGINE 8.4 product suite. The resultant raster-based classification was subsequently compiled to form a seamless, vector-clean polygonal coverage using ARCINFO GIS. Further information is presented in the project citation provided above.

Sampling Design:

The selective sampling design used to develop remote sensing training areas was as described above. The location and number of non-forested ecosystems delineated by the project ecologist is presented in the project citation provided above.

Sampling Methods:

Sampling methods used to develop remote sensing training areas and classify LANDSAT 7 satellite imagery were as described above.

Sampling Frequency:

Training areas were delineated through visual interpretation of 1:15,000 scale colour aerial photographs. The number of units delineated for each non-forested ecosystem type is detailed in the project citation provided above.

Attribution:

Non-forested ecosystems were identified through a combination of supervised and unsupervised classification, as described in the ERDAS Field Guide and ERDAS IMAGINE 8.4 online documentation.

Quality Assurance

Validation Method:

Validation of inferred entities consisted of a comparison of ecosystem classifications arrived at through aerial photograph interpretation and LANDSAT 7 image classification. Comparisons were completed for up to 50 random points within each of six 10 by 10 km sections of the project area. Validation areas were selected based on availability of aerial photographs to the project team.

Validation Criteria:

The sole criterion used to verify inferred entities was whether ecosystem classifications arrived at through aerial photograph interpretation and LANDSAT 7 image classification were identical. However, ecosystem definitions employed during entity validation were those arrived at through image classification rather than training area definitions developed by the project ecologist because some training area ecosystem types could not be resolved.

Validation Design:

Validation of inferred entities was completed using a stratified random sampling design that was applied independently to each of the 10 by 10 km sections of the project area selected for quality assurance. Ecosystem definitions arrived at through image classification served as the basis of stratification. Random sample points were allocated to each ecosystem using ERDAS IMAGINE 8.4 classification accuracy assessment routines.

Validation Results:

Overall classification accuracy ratings for assessed sections of the project area were as follows:

Area 1	54.00%
Area 2	63.27%
Area 3	62.50%
Area 4	66.00%
Area 5	54.17%
Area 6	52.00%

Quality Control

Correlation Procedures:

- i) Taxonomy: Not Applicable (project specific taxonomy and classification)
- ii) Attributes: Not Applicable (project specific attribute definition)
- Map Production: Not Applicable (classified imagery was compiled in digital form only)
- Edge Matching: Not Applicable (full scene remote sensed imagery)
- Line Edit: Not Applicable (full scene remote sensed imagery)
- Symbol Edit: Not Applicable (full scene remote sensed imagery)
- Attribute Edit: Not Applicable (full scene remote sensed imagery)
- Legend Edit: Not Applicable (classified imagery was compiled in digital form only)

INPUT MAP COMPILATION QUALITY CONTROL

- Edge Matching: Not Applicable (full scene remote sensed imagery)
- Edge Matching Error: Not Applicable (full scene remote sensed image)
- Attribute/Label Matching: Not Applicable (full scene remote sensed image)
- Raster Size: 30 meters
- Spatial Reconciliation:

i) Spatial Check Table:

	Linear Features
--	-----------------

	Track 51,Scene 18
Count or Average Length (m)	3454.67
Minimum Shift (m)	0
Average Shift (m)	8.89
Maximum Shift (m)	23.11

Spatial check statistics relative to TRIM 2 topographic data are based on three measurements taken along eight linear features within the coverage area of each of Tracks 47 and Track 48. Collected measurements always included the maximum shift value along assessed features. Spatial check plots are provided within the project reference cited above.

Bedrock Geology Data Assessment

COMPILATION PERIOD

The geology was compiled as a series of ten projects. Each project had slightly different legends and mapcodes. For this reason we have prefixed the mapcode for each region with a region designator. Over time, with revisions these regional differences will be removed. Some 1:250 000 mapsheets contain portions of 2 or more regions and digital information will reside in several files for these sheets. So if you are missing information for a portion of a sheet check other regions for that sheet as well. (From energy and mines web site)

According to MOEM (Ministry of Energy and Mines) data was digitized from various studies across the province. Supplied database information from MOEM links attributes to GIS coverage and through MOEM legend key, bedrock geology was determined. GIS Information is quite broad when only bedrock geology is extracted from data and boundaries are dissolved.

More information on Mineral studies can be found at MOEM web site.
<http://www.em.gov.bc.ca/mining/Geolsurv/General/ArcviewIndexs/arcviewindex.htm>

Compilation Scale: 1: 250000

Period of Content: Content ranges from various geology studies in the 90's. Mineral survey was last updated in 1997

Period of Compilation: July 1999 was the period of compilation for the data sets.

Information was captured to various standards of geological mapping and then standardized to linking 9digit code tables. These tables have been provided to undersatand geological data set.

9 digit code with pem groupings.xls: This used the 6th digit to group rock types for use in PEM.

BC_codes.xls: Shows relationship of geology code in ARC/INFO coverage to 9 digit code.

INVENTORY PROCEDURES

Quality Assurance

Validation Method: Not Applicable (Coverage sanctioned by MOEM)

Validation Criteria: Not Applicable (Coverage sanctioned by MOEM)

Validation Design: Not Applicable (Coverage sanctioned by MOEM)

Validation Results: Not Applicable (Coverage sanctioned by MOEM)

Quality Control

Correlation Procedures:	
i) Taxonomy:	Not Applicable (project specific taxonomy to geology studies)
ii) Attributes:	Not Applicable (project specific to geology studies)
Map Production:	Not Applicable
Edge Matching:	Not Applicable (information was matched as is. entities and edges between study boundaries did differ slightly)
Line Edit:	Not Applicable
Symbol Edit:	Not Applicable
Attribute Edit:	Not Applicable Not Applicable All information in GIS coverage linked to provided MOEM tables to extract geology information. The Lillooet PEM will use only a small portion of the geology attributes and bedrock type is grouped to further simplify the information.
Legend Edit:	Not Applicable

INPUT MAP COMPILATION QUALITY CONTROL

Edge Matching:	Coverage's were joined together and matched as best as possible. Different studies could have edges not match.
Edge Matching Error:	Information was matched as is. Entities between study boundaries did differ slightly
Attribute/Label Matching:	Not Applicable
Raster Size:	
Spatial Reconciliation:	
i) Spatial Check Table:	

No Spatial check was concluded for this coverage. General checking was done over the coverage to see if water features in Geology generally fit well to TRIM. The Lake features between the data sets matched quite well even though geology was produced at 1:250000. Shifts cannot be quantified on this coverage, but general positioning can be assessed.

4.0 GIS processing and Attribute creation

4.1 Overview

Once all coverage's are completed, GIS analysis is started. The Process proceeds as follows.

1. AML's are executed on source data to generate overlay coverage's and features for the creation of predictive ecosystem modelling (PEM). PEM polygons are created from this analysis.
2. A resultant PEM polygon database (.dbf) is generated by the final AML, which is then brought into a Microsoft Access summary program and summarized by specific criteria (Matrix summary).
3. The Ecologist creates knowledge bases for ecosystem typing to be run EcoNGen.
4. The (SSORT) Microsoft Access program then takes summarized database from matrix summary, as well as knowledge table and formats data for entry into EcoNGen.
5. Data is the processed in EcoNGen and resultant ecosystem type is output from EcoNGen, which is then linked back to GIS PEM polygons.
6. Final GIS PEM coverage is created and mapped.

The following explains the AML's in a stepwise procedure used in PEM analysis and any relevant methodology or attributes. A Lillooet PEM legend has been supplied in word format to explain attribute data values in the PEM database and the resultant summary of these values in Matrixsummary.

4.2 Area of Interest (AML)

All AML's were initially developed to do analysis on a Landscape basis. This AML generated the area of interest from a list of BEC zones and the Landscape/Analysis unit being analyzed (see 2.2 for areas and abbreviation).

This program created a bounds coverage that all Full district source GIS data would be clipped to and a buffered boundary that would also be used in clipping of source GIS data. A buffered and non-buffered clip was needed for some coverage's because during analysis, features outside the area of interest could affect results in the AOI.

4.3 Pre-processing (AML)

-Used to pre-process full district Lillooet data sets to a specific analysis unit (2.2)

Clips study area coverage's to the area of interest and also buffer clip coverage's that were necessary for features outside the analysis unit. Features outside the AOI could affect features inside the AOI, when buffered.

The TRIM water feature additions of lake, marsh, swamp, sand and islands are merged into a single coverage adding the following attributes to the FC coverage.

1 = presence of specified TRIM feature

River_id = 1
Lake_id = 1
Swamp_id = 1
Island_id = 1
Marsh_id = 1

AML also combines water polygonal features from TRIM, to create a refined FC coverage with TRIM water appended to FC. Elimination of polygons < 1000 meters squared was conducted on the merging of FC and TRIM water features to create a final FC used in the PEMPOLY.AML.

-Elimination was restricted to not eliminate FC boundaries and small water features like lakes or marshes < 1000 m squared. Many TRIM features are < 1000m2 and needed to be retained so information was not lost in elimination.

4.4 Grid to TIN (AML)

Generates a TIN from TRIM2 DEM points and Breaklines. The TIN is generated from a buffer clip of the DEM coverage in pre-processing.

The following methodology was used to create the area of interest TIN.

```
CREATETIN tin_%aoi% 1 1  
COVER %DEM% POINT elevation # 1 #  
COVER %DEM% Line -9999 softline # fcode = 'HA90200110' /* uses soft type breaklines  
COVER %DEM% Line -9999 hardline # fcode = 'HA90200000' /* uses hard breakline  
COVER %DEM% Line -9999 hardline # fcode = 'HA90200130' /* uses hard hydro breaklines  
COVER %DEM% Line -9999 hardline # fcode = 'HA90200140' /* uses hard man made breaklines  
COVER %DEM% Line -9999 hardline # fcode = 'HA90200120' /* uses hard non hydro breaklines
```

4.5 Slope (AML)

Purpose is to generate slope coverage's for the Area of Interest (AOI)

Slope/Aspect polygons are created from TIN using the TINARC command.
(TINARC <Tin coverage> <output> POLY percent)

Forest cover and TRIM water are then added to the slope aspect coverage and polygons with water attributes have the percent slope set to zero. (lakes_id = 1 or marsh_id = 1 or river_id = 1 or swamp_id = 1)

The S field was then calculated within the TINARC output according to the following percents.

Slope Grouping calculation

S = 1 0-8%
S = 2 8-25%
S = 3 25-45%
S = 4 45-65%
S = 5 65-85%
S = 6 85-130%
S = 7 130+%

- The slope aspect coverage was then dissolved by S field to create slope cover for the analysis unit.
- Slope areas < 1000m2 were eliminated into the longest border area to decrease artefacts. Slope areas of 0 were not allowed to eliminate to a higher class. This was so flat areas of TRIM water features were prevented from receiving a slope class.
- Resultant slope coverage would be an input to create PEM polygon coverage.

This AML also created slope category coverage's for analysis in subsequent AML's. Each coverage was generated from TINARC output based on reselection criteria.

slope5_aoi% = slopes less than, or equal to, 5%
slopegt5_aoi% = slopes greater than, 5%
slope510_aoi% = slopes between 5 and 10%
slope10_aoi% = slopes less than, or equal to, 10%
slope20_aoi% = slopes greater than, or equal to, 20%
slope30_aoi% = slopes greater than, or equal to, 30%
slope40_aoi% = slopes greater than, or equal to, 40%
slope310_aoi% = slopes greater than 10 % or equal to, 30%
slope520_aoi% = slopes greater than 5 % or equal to, 20%

4.6 Aspect (AML)

Slope categories >= 2 were only calculated for AS (aspect) field. Aspect information was contained in the slope aspect coverage created in the slopes AML. The AS field was calculated as follows.

AS = 0= No aspect
AS = 1= Hot 91 to 235 degrees
AS = 2= Warm 236 to 290 degrees
AS = 3= Cool 291 to 90 degrees

Categorised coverage was dissolved by AS field and aspect areas < 1000m2 were eliminated into the longest border area. Slope classes of 0 and 1 were unioned into the Aspect coverage and given no Aspect to resolve issues that may have occurred due to eliminate. Resultant aspect coverage would be an input to create PEM polygon coverage.

4.7 Alpinepoly (AML)

Alpinepoly AML takes alpine classification that is not stratified in forest cover and clips out satellite image classification to create satellite classification coverage within forest cover alpine areas. The satellite

classification of Alpine areas is then used as an input to the PEM polygon creation in the pempoly AML. The satellite classification provides stratification where forest cover is lacking in Alpine areas, to better determine ecosystem above tree line.

4.8 PEM poly (AML)

Created the PEM polygon coverage to be used in analysis by using an overlay of five main coverage's.

The Five coverages that form the PEM polygon coverage are:

Forest Cover: Generated in Preprocessing AML

Aspect: Generated in aspect AML

Slope: Generated in slopes AML

BEC: Generated in areaofinterest AML

Alpinepoly: Generated in Alpinepoly.aml

- Once all were unioned areas of < 899m2 were eliminated to the longest border area. Elimination is restricted and the following source polygons are locked down so elimination did not occur (Forest cover, Water, BEC, however water was allowed to eliminate into water). The reason 899m2 was used is that 30Meter pixels were being used as input from satellite data for alpine. If greater than 900m2 was used then a large amount of satellite data could be lost in alpine regions.

-A second elimination of < 899m2 was conducted by locking down all polygons created by the previous elimination, then unlocking small polygons < 25m2 that may have been unable to eliminate due to previous locking.

- Resultant polygons formed final PEM polygons. A unique number in the PEM_TAG field was created for each polygon remaining in the coverage. This PEM_TAG number forms the base of what most summary analysis is conducted. The final coverage formed the base of which other data layers would be overlaid and summarized for each PEM polygon

4.9 Solar (AML)

Purpose of AML is to create solar radiation values for a four-day period in August and quantify which regions of the landscape receive the most solar radiation.

The AML initially creates a 25Meter lattice from the TIN generated in Gridtotin.aml and then runs solar radiation AML on the lattice GRID. Solar radiation values were calculated for a 4 day period in August, using a solar radiation algorithm used by MSRM.

Julian dates 227 to 230 over 4-hour period intervals calculated kilojoules of energy per day. These values were then grouped in GRID into 3 classes based on our knowledge of the area and where solar radiation breaks should occur.

Kilojoules of energy per day data groupings

<i>kj/per day</i>	<i>SR grouping</i>
0 to 77000	= 3
77000 to 85500	= 2
85500 to 150000	= 1

SR = 1 Full South-facing, no obstructions – Intensive solar radiation

SR = 2 Warm aspects – east or west – moderate solar radiation

SR = 3 Full North-facing, no variations – Cool solar radiation

The solar values were then converted to a polygon coverage and overlaid with the PEM polygon coverage. Each PEM polygon was then calculated to the highest solar radiation category that **intersected** the PEM polygon. (1 being highest intensity and 3 being lowest solar intensity.) Calculated in the SR field in PEM polygon coverage.

4.10 Satellite (AML)

Purpose is to apply a satellite classified image category to a PEM polygon created in the PEMPOLY.AML.

Classified Landsat satellite imagery was converted to polygons, classified into types and overlaid with the PEM polygon coverage. If the PEM polygon was greater than 50% of one satellite image class then it was given that class.

This was entered into the SA field of the PEM polygon coverage. Categories can be found in the Lillooet PEM Legend.

4.11 Terrain (AML)

Terrain categories were grouped according to the Lillooet PEM legend.

The terrain coverage was dissolved six times into its appropriate terrain attribute groupings, and then the PEM associated attribute was added to each dissolved coverage.

<u>Terrain Coverage Attribute</u>		<u>PEM attribute</u>	<u>Definition</u>
surfm_1	=	TS	Surface Materials
surf_e1	=	TE	Surface Expression
ssurfm_1	=	TU	Subsurface Materials
geop_1	=	TG	Geological Expression
drain_1	=	TD	Drainage
ttex_1	=	TX	Texture

Each terrain category was then overlaid with the PEM polygon coverage. PEM polygons were then assigned the terrain type that encompassed the maximum terrain area above 50 % of the PEM polygon. If the terrain type did not overlay with 50% or greater of the PEM polygon, then the PEM polygon was not given a terrain attribute. Terrain Types and classification can be found in the PEM legend.

4.12 Geology (AML)

Purpose is to apply grouped bedrock type geology category to a PEM polygon.

Classified Rock type coverage was overlaid with the PEM polygon coverage. If the PEM polygon was greater than 50% of one rocktype class then it was given that class.

This was entered into the BR field. Categories can be found PEM Legend

4.13 Landforms (AML)

Purpose is to calculate the presence of line landform features in a PEM polygon and create Polygon landform coverage to be used in matrix.aml

Previous Landform AML calculated many landform features into one data field. So if multiple landform features occurred in a PEM polygon the data would not reflect this. For the Lillooet PEM we broke the Landforms into multiple fields.

Eg. L1 = Rock Polygon (Polygon)
L2 = Esker (Line)

..And so on (See PEM legend)

For line Landform features, these fields were calculated directly into the PEM polygon coverage in this AML. The density of the line feature in each PEM polygon would influence the density ranking of each feature in the PEM polygon. This solved the issue of very small landform segments falling into PEM polygons and not being significant to contribute to the ecosystem. Each line type was overlaid with the PEM polygon coverage and the following was calculated.

Landform density per PEM polygon = (Landform Feature) / (PEM polygon area / 10000)

represents landform feature code number

L# = 0 No influence in PEM polygon

L# = 1 0+ m/ha to 20 m/ha Low influence in PEM polygon

L# = 2 20 m/ha to 40 m/ha (Moderate influence in PEM polygon)

L# = 3 40 m/ha or greater (High influence in PEM polygon)

The second portion of this AML produces a single landform polygon coverage. Each type of landform is unioned to a single coverage, with column fields for each type representing 1 = presence and 0 = no presence. The L# methodology is also used in this coverage. This polygon coverage is used as an overlay in matrix.aml and summarized in matrixsummary.

See PEM legend for a full listing of Landform features.

4.14 Stream density (AML)

PEM polygons are overlaid with TRIM 2 streams. The sum length of streams in each polygon per hectare is then calculated. The result is calculated and grouped in the W field of the PEM polygon coverage.

Stream density per PEM polygon = (Stream length) / (PEM polygon area / 10000)

These results are then grouped into the following categories for each PEM polygon.

W = 0 No streams found in polygon

W = 1 10 m/ha to 30 m/ha (low soil moisture influence)

W = 2 30 m/ha to 60 m/ha (moderate soil moisture influence)

W = 3 60 m/ha or greater (high soil moisture influence)

4.15 Adjacency (AML)

Purpose is to produce non-productive forest cover polygon coverage and their adjacency to the following items

First portion of AML generates a coverage of all non-productive Forest cover polygons and their adjacency up to 50 meters to the following items.

Adj1 = 1, if adjacent to streams

Adj2 = 1, if adjacent to a wetland

Adj3 = 1, if adjacent to a rock outcrop

Adj4 = 1, if adjacent to an alpine polygon

Adj5 = 1, if adjacent to open range polygon

The Non-productive coverage is then used in the Matrix.AML in creation of the final overlay coverage.

The second portion of this AML checks the 50 M adjacency of **PEM POLYGONS** to the following.

Adjp3 = 1, if adjacent to a rock outcrop

Adjp4 = 1, if adjacent to an alpine polygon

Adjp5 = 1, if adjacent to open range polygon

If the PEM polygon was 50m Adjacent to a feature, then the ADJp# field was calculated to 1 in the PEM polygon coverage.

4.16 Lake Wetland Benches (AML)

Produces polygon coverage of lake and wetland benches for the area of interest (AOI). A lake/wetland bench (LB = 1) is an area of 0-5% slope that is adjacent to a lake or wetland, extending to a maximum distance of 100m.

The procedure Buffers lake, marsh, swamp features 100 M and finds slopes 0-5% that share a common boundary with marsh , swamp or lake features. The slopes 0-5% coverage was created in Slopes.AML.

4.17 River Benches (AML)

To generate polygon river benches around river polygons in area of interest (AOI). Only double lined rivers in TRIM are used to calculate feature. River polygons are buffered appropriately for each type of bench and programming then finds adjacency of slope percentages to bench types or rivers.

A low bench (SLB = 1) is 0-5% slopes adjacent to a double-line stream to a maximum distance of 100m

A high bench (SHB = 1) is 0-5% slopes adjacent to SLB or adjacent to a 5%-20% slope up to 50 meters from a double line stream

A stream terrace (ST = 1) is a 0-10% slopes adjacent to a SLB or a SHB or adjacent to 5+ - 20% slope 50 to 200 meters out from a double line stream

A single coverage is produced containing (SLB, SHB, ST) values that are used in matrix.aml. Slope coverage's used in this AML were created in slopes.aml.

4.18 Gullies (AML)

Purpose is to produce polygon coverage of gullies and their appropriate slope Gully buffers.

- Gully (G = 1) is a 20m buffer around all single-line streams that has a slope of 30% or greater.

-Gully Buffer (GB = 1) is a 40m buffer around all gullies (G=1), that has a slope of 30% or greater and is adjacent to a gully.

Single polygon coverage is produced containing (G, GB) values that are used in matrix.aml. Slope coverage's of slope% were created in slopes.aml

4.19 Hills (AML)

Purpose is to generate hilltop and hill buffer polygons.

- Hilltops (HT = 1) are the lowest contour lines, which would form a polygon (no dangles), with perimeter of 1200m or less

- Hillbuffers (HB = 1) are areas of 20% slope or greater that are within a 40m buffer of a hilltop and adjacent to hill tops

AML uses contour coverage clipped to a buffered AOI to generate hills. Extended contours are needed for outside the AOI because hills can exist along AOI boundary. Closed contours of < 1200m and selected and hill top polygons are generated. Hill tops are then buffered and slopes > 20% and adjacent to the hill top are then reselected.

A single polygon coverage is produced containing (H, HB) values that are used in matrix.aml. Slope coverage's were created in slopes.aml

4.20 Ridges (AML)

Purpose of AML is to generate a polygon ridgeline, ridge-top, and a ridge-buffer coverage.

Ridge Lines are generated from hypsographic breaklines in the TRIM2 DEM. FCODES = HA90200000 or HA90200110' or HA90200120.

-Interior Ridge Tops (RT = 1) are 20m buffered ridgelines that are greater than, or equal to, 30% slope.

-Interior Ridge Buffers (RB = 1) are 40m buffers adjacent to a ridge top that have slopes greater than, or equal to, 30% slope.

-Ridge top Low (RTL = 1) are 20m buffered ridgelines, that are greater than or equal to 10% slope, and less than or equal to 30% slope.

A single coverage is produced containing (RT, RB, RTL) values that are used in matrix.aml. Slope coverage's were created in slopes.aml

4.21 Toe Slopes1 (AML)

Purpose is to generate ascii-grid files of the DEM and slope grids to run in 'ScenarioSlopePosition' of SELES (Spatially Explicit Landscape Event Simulator)

slopeg_%aoi% = SLOPE(%dem%,percentrise)

GRIDASCII %dem% tdem_%aoi%.asc

GRIDASCII slopeg_%aoi% slopeg_%aoi%.asc

- Outputs should be tdem_%aoi%.asc and slopeg_%aoi%.asc. These are two ascii files that the SELES program uses to calculate toe slope position.

4.22 SELES slope program (Generation of toe slopes)

The next step in the PEM analysis is to generate toe slopes for the area of interest. MOF research branch researched this for some time and concluded that the best way to classify toe slopes is a method using a program called SELES. To calculate toe slopes you need to the latest version of SELES (Spatially Explicit Landscape Event Simulator) created by Dr. Andrew Fall of Simon Fraser University.

The SELES program has variables to select the correct .asc files for processing. SELES then uses .asc files exported by toes1.aml. Once processed a slope position .asc file is output.

Toe slope position is calculated as an area with > 40% slopes above and < 25% slopes below that are within 100 meters.

MOF research branch found that this program was the most effective procedure to find toe slopes, based on various approaches investigated.

4.23 Toe Slopes2 (AML)

Purpose is to generate toe of slope polygons for area of interest from grid-ascii files. Creates polygon coverage of 1 = toe slope for input to final PEM overlay

-output.asc (from SELES) = toes_%aoi%

Tos = 1 - toe polygons where grid cell/polygon within 100m of greater than 40% slopes above, and less than 25% slopes below

4.24 Elevation (AML)

To generate a polygon coverage, which divides BEC units, based on new elevation guidelines.

-To generate elevation differences the GIS converts a GRID elevation model to a polygon coverage, overlays BEC classification with the elevation polygon coverage, then groups areas into (E) classifications.

E = 1 - MHmm1&2 subzone lower band of higher productivity below 920 m

E = 2 - MHmm1&2 subzone upper band of lower productivity above 921 m

E = 20 - ESSFxv2 below 1900 m

E = 21 - ESSFxv2 above 1901m

E = 22 - ESSFdv2 and ESSFxc4 below 1840 m

E = 23 - ESSFdv2 and ESSFxc4 above 1841 m

E = 24 - ESSFdv1 below 1600 m

E = 25 - ESSFdv1 above 1600 m

E = 26 - ESSFxc3 below 1840 m

E = 27 - ESSFxc3 above 1840 m

A single coverage is created of BEC areas being analysed and appropriate elevation break dividing BEC zone. This coverage is used in the Matrix.aml as an input overlay.

4.25 Matrix (AML)

Purpose is to overlay all the component coverages that are required in the EcoPrep database.

The following coverages form the component database for entry into matrix summary.

Overlay coverage's

PEM Polygon coverage

Adjacency Polygon coverage created in adjacency.aml

Lake benches coverage created in lbenches.aml

River benches coverage created in rbenches.aml

Gullies coverage created in gullies.aml

Hills coverage created in hills.aml

Ridges coverage created in ridges.aml

Toe slope coverage created in toes1&2.aml

Elevation coverage created in elevation.aml

Landform features created in landformsnew.aml

Area of interest coverage to clip final resultant

Each resultant coverage from previous AML's are overlaid in a sequence of 8 unions. The final overlay is an identity with the PEM polygon coverage to create a large overlay of all information clipped to the area of interest. Due to the large coverage created and number of polygons, an eliminate of polygons < 100 meters squared is performed to create the final matrix overlay coverage. Specific data fields are then output in dbase format from this GIS coverage to be used in matrix summary.

4.26 GIS data output to be used in matrix summary.

GIS data output to be used in matrix summary.

mtx_%aoi%#	- Internal GIS coverage number
gistag,	- Internal GIS coverage number
AREA	- Area of matrix polygon overlay
pem_tag	- PEM polygon number
pem_area	- PEM polygon area
fc_%aoi%#	- internal forest cover coverage number
mapstand	- Forest cover mapstand number
POLYGON	- Forest cover polygon number
Polyarea	- Forest cover polygon area
Npforestcode	- Non-productive forest code from
species1	- species 1 of forest cover
species2	- species 2 of forest cover
species3	- species 3 of forest cover
calcrowncloscls	- crown closure 3 of forest cover
prjhcls	- projected heightclass of forest cover
prjagecls	- projected age class of forest cover
attrbt1	- attribute1 of forest cover
actvty1	- actvty1 of forest cover
lake_id	- Lake presence 1 = yes
river_id	- River Presence 1 = yes
swamp_id	- Swamp Presence 1 = yes
marsh_id	- Marsh Presence 1 = yes
urban_id	- Urban Presence 1 = yes
s	- Slope class
as	- Aspect class
beclabel	- Biogeoclimatic label
mhresult	- Stream length / PEM polygon area / 10000
W	- Stream density classification
adj1	-Streams NPR adjacency
adj2	-Wetland NPR adjacency
adj3	-rock NPR adjacency and PEM polygon adjacency
adj4	-alpine NPR adjacency and PEM polygon adjacency
adj5	-open range NPR adjacency and PEM polygon adjacency
lb	- Lake bench 1 = yes , 0 = no
slb	- River Low bench 1 = yes , 0 = no
shb	- River High bench 1 = yes , 0 = no
st	- Stream Terrace 1 = yes , 0 = no
g	- Gully 1 = yes , 0 = no
gb	- Gully Buffer 1 = yes , 0 = no
ht	- Hill top 1 = yes , 0 = no
hb	- Hill Buffer 1 = yes , 0 = no
rt	- Ridge Top 1 = yes , 0 = no
rb	- Ridge Buffer 1 = yes , 0 = no
rtl	- Ridge Top Low 1 = yes , 0 = no
tos	- Toe slope 1 = yes , 0 = no
e	- Elevation category
sa	- Satellite Classification Category
sr	- Solar Radiation category
l1	- Rock landform 1 = yes , 0 = no
l4	- Slide landform 1 = yes , 0 = no
l6	- Flooded area landform 1 = yes , 0 = no
l8	- Moraine landform 1 = yes , 0 = no

19	- Skree landform 1 = yes , 0 = no
111	- Glacier landform 1 = yes , 0 = no
114	- Islands landform 1 = yes , 0 = no
115	- Sand Bar landform 1 = yes , 0 = no
116	- Pit landform 1 = yes , 0 = no
12	- Esker landform 1 = yes , 0 = no
13	- Cliff/Scarp landform 1 = yes , 0 = no
15	- Beaver Dam landform 1 = yes , 0 = no
113	- Ridge landform 1 = yes , 0 = no
117	- Rock bluffs landform 1 = yes , 0 = no
119	- Cliff drop off landform 1 = yes , 0 = no
120	- Cliff drop indefinite landform 1 = yes , 0 = no
ts	-Terrain Surface materials category
te	-Terrain Surface expression category
tu	-Terrain subSurface materials category
tg	-Terrain Geological processes category
td	-Terrain Drainage category
tx	-Terrain Texture category
br	-Bedrock Type (as grouped in PEM Legend)

5.0 Matrix Summary

A final GIS output database is summarized in matrix summary to give polygon area summaries and group overlay data into categories of percentage of PEM polygon data. This program has been provided with deliverables and is based on Microsoft Access 97. Each area of interest must be processed individually.

Summary percentage fields in the matrix summary output will have the (_P) designation. For Example: Landform L2 in the GIS data will output a summary field of L2_P. Polygon features will be summed as follows.

- _P = 1 greater than or equal to 5% and less than 20% of the PEM polygon area
- _P= 2 greater than 20% and less than 50% of the PEM polygon area
- _P= 3 greater than 50% of the PEM polygon area

Other features calculated in Matrixsummary to be used in creation of knowledge tables are as follows.

SF	Slope grouping of PEM polygon
SFC	Slope grouping of PEM polygon (different from SF)
H	Forest Height grouping of PEM polygon
CC	Crown closure grouping
A	Age Grouping

All definitions can be found in the PEM legend document.

5.1 Output table from Matrix Summary

PEM_TAG	- PEM_TAG polygon link
AREA_SUM	- sum area of PEM polygon from matrix output
PEM_AREA	- PEM polygon area
FC_NC_	- Internal FC number
FC_TAG	- FC polygon link
POLYGON	- Forest cover polygon number
POLYAREA	- Forest cover polygon area

Carry over attributes from PEM polygons in Matrix summary. (No summary calculation) See 4.26 for definitions below

NP_CD	- Non Productive forest code
SPC1	- FC species1
SPC2	- FC species2
SPC3	- FC species3
CRNCL_CL	-Crown Closure class
HTCL_PR	-Height Class projected
AGECL_PR	-Age Class projected
ATTRBT1	
ACTVTY1	
LAKES_ID	-Lake ID from TRIM
RIVER_ID	-River ID from TRIM
SWAMP_ID	-Swamp ID from TRIM
MARSH_ID	-Marsh ID from TRIM
URBAN_ID	-Urban ID from TRIM
S	
AS	
BECLABEL	
MHRESULT	
W	
ADJ1	
ADJ2	
ADJ3	
ADJ4	
ADJ5	
LB	
SLB	
SHB	
ST	
G	
GB	
HT	
HB	
RT	
RB	
RTL	
TOS	
E	
SA	
SR	
L1	
L4	
L6	
L8	
L9	
L11	
L14	
L15	
L16	
L2	
L3	
L5	
L13	
L17	
L19	
L20	

TS
TE
TU
TG
TD
TX
SH
BR

** Calculated definitions in Matrix summary ** See PEM Legend definitions. See 4.25 for type definition and 5.0 for (_ P) calculation.

LB_P
SLB_P
SHB_P
ST_P
G_P
GB_P
HT_P
HB_P
RT_P
RB_P
RTL_P
TOS_P
SH_P
SF
SFC
HST
CCOC
A
D

Percentage calculation of polygon landform features in matrixsummary. See 4.25 for type definition and 5.0 for (_ P) calculation

L1_P
L4_P
L6_P
L8_P
L9_P
L11_P
L14_P
L15_P
L16_P

Species Name modification in Matrix summary.

SP1
SP2
SP3

6.0 SSORT

Once data has been summarized in Matrix summary a second Access program is used to prepare the data for EcoNGen. Knowledge Bases and summarized. SSORT Program has been provided with deliverables. The SSORT program is based on Microsoft Access 97.

7.0 EcoNgen

Information is then processed by the ecologist through EcoNgen using data tables created by SSORT. When processed based on knowledge tables and GIS overlay data the resultant site series answers are then output to an access database. Information is then returned to GIS analyst and linked back to PEM TAG. Final output information is then processed to final PEM standards.

8.0 GIS Data checking and QA

All GIS data was assessed according to PEM standards and quality control procedures can be found in 3.0 of this document and in NON or INP.RTF metadata files.

An initial step of PEM processing for the Lillooet TSA was to review programming and go through each AML in relation to the PEM legend to assess if attributes in the legend were reflected in AML programming. If Legend tables or analysis intention seemed unclear or possibly incorrect then they were confirmed and double-checked with the ecologist. After processing the first landscape unit, resultant answers were checked to see if the PEM GIS coverage answer was being derived correctly. Eg. Load all lakes, the 0-5% slope coverage and lake bench coverage from Lakebench.AML into Arcview and visually check correct answer is being derived.

As another QA procedure, analysis attribute data as well as derivation, was checked for sample PEM polygons before full analysis proceeded. Analysis sample data was checked by the GIS Analyst for PEM polygon creation and final Matrix overlay procedures to assess if desired PEM procedure was occurring. This QA procedure was to check elimination and overlay processes were producing a desired result to improve the PEM analysis. Resultant data sets were then given to the ecologist and could be further checked as a secondary QA procedure while the ecologist worked with the data.

Sample PEM polygons were selected for assessment in Matrix summary and checked to see if summaries were coming out correct. Summaries were also visually checked in Arcview by visually loading matrixsummary answers linked to PEM polygons, while also viewing GIS source data to see if discrepancies in overlay procedure or access database processing existed. An example of this would be to load RT_P colour values linked to PEM polygons in Arcview along with the Ridgetop coverage and assess if PEM polygons are receiving ridgetop percentage values correctly. Matrix summary answers were also checked for 1 to 1 linking to PEM polygons and data was not being lost during GIS analysis or Access database processing.

9.0 Delivered GIS data

-MTX(aoi).dbf

Output data from GIS analysis that is the raw input for Matrixsummary. There is one .dbf file for each landscape unit.

-Matrixsummary.MDB

Access 97 program for summarizing data exported by the GIS. Each Landscapeunit .dbf was processed through matrix summary to create a summarised database for each landscape unit..

-MTX(aoi).MDB

Matrix summary data output after .dbf has been summarised. There is one summarised MDB for each landscape unit to give one record for each PEM polygon. A second table

was added to each access file that includes ECP_TAG which links to each PEM polygon in the ECP coverage.

-SSORT.MDB

Access 97 program which formats matrix summary output and knowledge tables to a format that can be used by EcoNGen.

-PEM_4021_ECP.E00

Predicted site series, North and South polygon coverage's were created for the area of interest

PEM_4021_STS.E00

Predicted structural stage, North and South polygon coverage's were created for the area of interest

-Source E00 coverages were provided except for DEM, TRIM water and contours which were very large and were provided in previous years of Lillooet PEM analysis.

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