
Data Models

Chapter 8 - Vegetation Inventory Standards and Data Model Documents

**Resource Information Management Branch
Alberta Sustainable Resource Development**

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1. AVI Data Model

Version 2.1
March 2006

UPDATES

AVI Data Model, Version 2.1., March 2006 was incorporated into the Alberta Vegetation Inventory Standards and Data Model Documents (as part of Chapter 8) in June 2006. Subsequent revisions to the document are summarized below:

Date	Type of Revision	Version No.	Sections Revised
	None to date		

1.1 Introduction to Chapter 8 Section 1

The following document “AVI Data Model” forms a component of “Chapter 8 – Vegetation Inventory Standards and Data Model Documents”. The document details the Alberta Vegetation Inventory (AVI) digital format currently used within ASRD. “AVI Data Model” is designed for use with AVI Version 2.1.1 and should be used in conjunction with “Alberta Vegetation Inventory Interpretation Standards, Version 2.1.1 (Chapter 3 – Vegetation Inventory Standards and Data Model Documents).

1.2 AVI Logical Data Model

The AVI Logical Data Model (Figure 1-1) is intended to provide an overview of AVI entities/pseudo-entities and the relationships that exist between them in context of the business rules outlined in the first section of this document. The entity definition and relationships with other entities are governed by the business rules established for them. For example when an Anthropogenic Vegetated Layer contains CPR then business rules dictate that a Naturally Non-Vegetated Code of SO or SC must also exist. This results in a relationship connection between these two entities as indicated in the physical implementation of the AVI SDB specification. Because of certain exceptions dictated by business rules, some leeway for the purpose of simplification was taken when defining some entities. For example Layer Site has been related to the supertype Layer since it exists either optionally or by requirement in the majority of subtype Layers. This relationship, however, violates the rule that MOISTURE_REGIME and TPR cannot be found in association with the Anthropogenic Non-Vegetated Layer subtype. Where these types of exceptions exist, notes have been added to describe the situation.

1.2.1 Interpreter

Description:

Information about the name of the person that interpreted and assigned the polygon attributes.

Attributes:

INTERPRETER_INITIALS

Description: Initials of person that interpreted the polygon

Type: Character 2

Domain Values: Any alphanumeric characters.

AVI SDB 2.1 Physical Attributes: INITIALS and UINITIALS

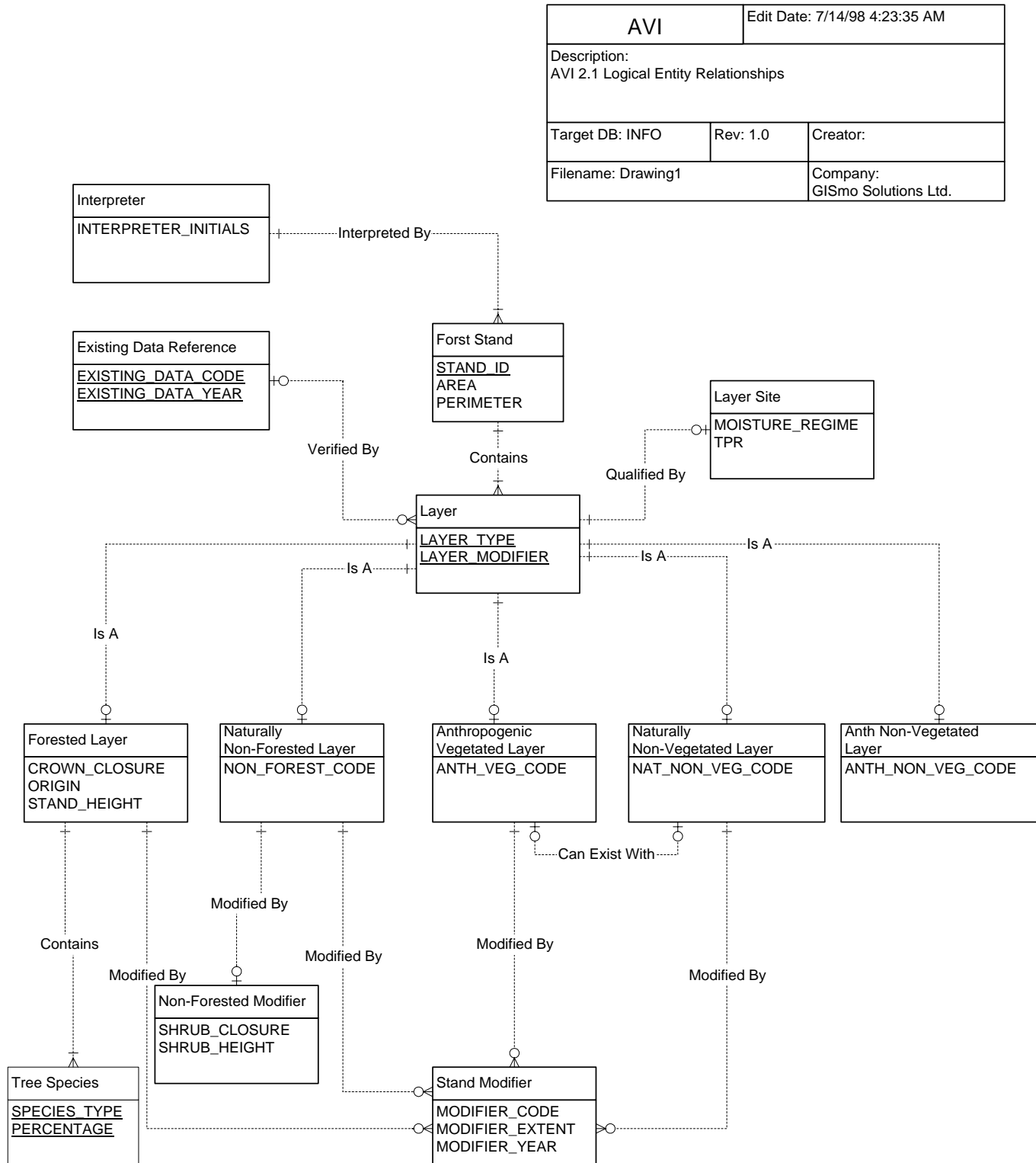


Figure 1-1 AVI Logical Model .

1.2.2 Existing Data Reference

Description:

Data gathered from other existing sources to verify or aid in the interpretation of the polygon label.

If more than one set of attributes (EXISTING-DATA-CODE and EXISTING-DATA-YEAR) exists for a polygon, the following hierarchy applies: 1 Interpreter field plot (F), 2 Air call (A), 3 Interpreted TPR (I), 4 Supplementary photography (S), 5 PSP (P), 6 Cruise data (C), 7 Volume plot (V), 8 Large- scale photography (L).

Attributes:

EXISTING_DATA_CODE

Description: Code indicating external source used.

Type: Character 1

Domain Values: F, A, I, S, P, C, V, L

AVI SDB 2.1 Physical Attributes: DATA and UDATA

EXISTING_DATA_YEAR

Description: Year associated with external data source.

Type: Integer 4

Domain Values: 1940 – current year of inventory

AVI SDB 2.1 Physical Attributes: DATA_YR and UDATA_YR

1.2.3 Forest Stand

Description:

An area containing a distinct combination of tree species, possessing uniformity in composition, age, arrangement or condition that can be uniquely delineated on aerial photography.

Attributes:

STAND_ID

Description: Uniquely generated ID.

Type: Integer 10

Domain Values: 1 – 2147483646

AVI SDB 2.1 Physical Attributes: COV-ID and POLY_NUM

AREA

Description: Area of polygon in square metres.

Type: Real

Domain Values: \geq Min Stand Size

AVI SDB 2.1 Physical Attributes:

PERIMETER

Description: Perimeter of polygon in metres.

Type: Real

Domain Values: > 0

AVI SDB 2.1 Physical Attributes:

1.2.4 Layer

Description:

A classification of the stand according to a distinct vertical or horizontal stratification that divides the stands into unique components.

Attributes:

LAYER_TYPE

Description: Class of stand layer.

Type: Character 1

Domain Values: Blank, C, H, M

AVI SDB 2.1 Physical Attributes: STRUC and USTRUC

LAYER_MODIFIER

Description: Percentage area of stand covered by Horizontal layer, or difference between the midpoint of upper layer to midpoint of lower layer for complex stands.

Type: Integer 1

Domain Values: 1 to 9

AVI SDB 2.1 Physical Attributes: STRUC_VAL and USTRUC_VAL

1.2.5 Layer Site

Description:

Distinct attribute information that is gathered for the majority of layer types.

Attributes:

MOISTURE_REGIME

Description: A general description of the moisture quality of layer.

Type: Character 1

Domain Values: d, m, w, or a

AVI SDB 2.1 Physical Attributes: MOIST_REG and UMOIST_REG

TPR

Description: Potential timber productivity of a stand based on height and age of dominant and co-dominant trees of the leading species.

Type: Character 1

Domain Values: G, M, F, or U

AVI SDB 2.1 Physical Attributes: TPR and UTPR

1.2.6 Forested Layer

Description:

A layer is considered forested if it supports tree growth (including seedlings and saplings) with a crown closure of $\geq 6\%$.

Attributes:

CROWN_CLOSURE

Description: Percentage of ground area covered by a vertical projection of the tree crowns to the ground.

Type: Character 1

Domain Values: A, B, C, or D

AVI SDB 2.1 Physical Attributes: DENSITY and UDENSITY

ORIGIN

Description: Year of stand origin.

Type: Integer 4

Domain Values: 1400 – current year

AVI SDB 2.1 Physical Attributes: ORIGIN and UORIGIN

STAND_HEIGHT

Description: Average height of the dominant and co-dominant trees of the leading species in meters.

Type: Integer 2

Domain Values: 1 – 40

AVI SDB 2.1 Physical Attributes: HEIGHT and UHEIGHT

1.2.7 Tree Species

Description:

A tree species approved in AVI 2.1.1 specification.

Attributes:

SPECIES_TYPE

Description: Code indicating type of tree species.

Type: Character 2

Domain Values: Sw, Se, Sb, P, Pl, Pj, Pa, Pf, Fb, Fa, Fd, Lt, La, Lw, A, Aw, Pb, Bw

AVI SDB 2.1 Physical Attributes: SP1 -> SP5 and USP1 -> USP5

PERCENTAGE

Description: Percentage of species within stand based on crown closure to closest 10%.

Type: Integer 2

Domain Values: 1-10

AVI SDB 2.1 Physical Attributes: SP1_PER -> SP5_PER and USP1_PER -> USP5_PER

1.2.8 Naturally Non-Forested Layer

Description:

A layer where the major component is naturally non-forested.

Attributes:

NON_FOREST_CODE

Description: A layer containing $\geq 6\%$ plant cover but $< 6\%$ tree cover.

Type: Character 2

Domain Values: SC, SO, HG, HF, or BR.

AVI SDB 2.1 Physical Attributes: NFL and UNFL

1.2.9 Non-Forested Modifier

Description:

Attributes required for specific non-forest types such as SO and SC.

Attributes:

SHRUB_CLOSURE

Description: Indicator to nearest 10% shrub crown closure within the stand.

Type: Integer 2

Domain Values: 1-10

AVI SDB 2.1 Physical Attributes: NFL_PER and UNFL_PER

SHRUB_HEIGHT

Description: Average height of shrubs in meters.

Type: Integer 2

Domain Values: 1-6

AVI SDB 2.1 Physical Attributes: HEIGHT and UHEIGHT

1.2.10 Anthropogenic Vegetated Layer

Description:

Vegetated land where the vegetation has been influenced by man, usually in areas that have been planted with cultivated species.

Attributes:

ANTH_VEG_CODE

Description: Code indicating type of anthropogenic activity.

Type: Character 3

Domain Values: CA, CP, CPR, CIP, or CIW.

AVI SDB 2.1 Physical Attributes: ANTH_VEG and UANTH_VEG

1.2.11 Naturally Non-Vegetated Layer

Description:

Natural cover types that have < 6% plant cover.

Attributes:

NAT_NON_VEG_CODE

Description: Code indicating non-vegetated type.

Type: Character 3

Domain Values: NWI, NWL, NWR, NWF, NMB, NMC, NMR, or NMS.

AVI SDB 2.1 Physical Attributes: NAT_NON and UNAT_NON

1.2.12 Anthropogenic Non-Vegetated Layer

Description:

A layer where the major component is influenced by man and plant cover is < 6%

Attributes:

ANTH_NON_VEG_CODE

Description: Code indicating anthropogenic non-vegetated type.

Type: Character 3

Domain Values: ASC, ASR, AIH, AIE, AIG, AIF, AIM, or AII.

AVI SDB 2.1 Physical Attributes: ANTH_NON and UANTH_NON

1.2.13 Stand Modifier

Description:

A condition or treatment providing additional information about the origin or condition of the cover type.

Attributes:

MODIFER_CODE

Description: Code related to condition or treatment

Type: Character 2

Domain Values: CC, BU, WF, CL, DI, IK, UK, WE, DT, BT, SN, ST, SI, SC, PL, TH, GR, IR.

AVI SDB 2.1 Physical Attributes: MOD1, MOD2, UMOD1, UMOD2

MODIFIER_EXTENT

Description: Percentage based indication of what portion of stand (by crown closure or land area affected) is affected by the condition or treatment.

Type: Integer 1

Domain Values: 1 to 5

AVI SDB 2.1 Physical Attributes: MOD1_EXT, MOD2_EXT, UMOD1_EXT, and UMOD2_EXT

MODIFIER_YEAR

Description: Year that condition or treatment took place where known.

Type: Integer 4

Domain Values: 1900 - current year

AVI SDB 2.1 Physical Attributes: MOD1_YR, MOD2_YR, UMOD1_YR, and UMOD2_YR

1.3 AVI SDB 2.1 Physical Model

The Entity Relationship Diagram in Figure 1-2 represents the current physical implementation of the AVI SDB 2.1 specification. The physical model differs significantly from the logical model with the incorporation of almost the entire logical model into a single physical attribute table.

Many of the relationships indicated in the logical model are implied in the physical model through the existence or absence of particular key fields. For example if the Species 1 field contains data then we can imply that the layer is forested and only those fields associated with a forested layer can be populated. For the most part this key definition schema works, but breaks down when you run into situations where more than one key field contains data. Without some form of discriminator field that distinctly indicates the intended layer type there is no way of clearly determining the intended layer when multiple key fields are populated. This complicates the validation process somewhat where multiple fields must be queried in order to get some idea of what the intended layer type is so that appropriate validation rules can be applied. It can also complicate some types of user queries, rather than query a single discriminatory field the user must query multiple key fields to refine their query according to layer type.

The other problem with using a single table is the amount of wasted space when only a single layer exists or there are no modifiers associated with a layer. In the majority of cases only a single layer is associated with an AVI stand. This means you are carrying an entire blank record in these situations. On a township basis this is not significant, but it is when you build a data repository for the entire province. In some situations where applications must process both layers of data the empty understorey records may have significant impact on the performance of the process.

While incorporating the entire model into a single table complicates some situations, and results in wasted space it makes the distribution and maintenance of data easier. Processes that extract subsets of data are more efficient since they only have work with a single physical table. In many cases it is also easier for end users to utilize the data since they do not have to be concerned with any complicated relate and join operations when using the data.

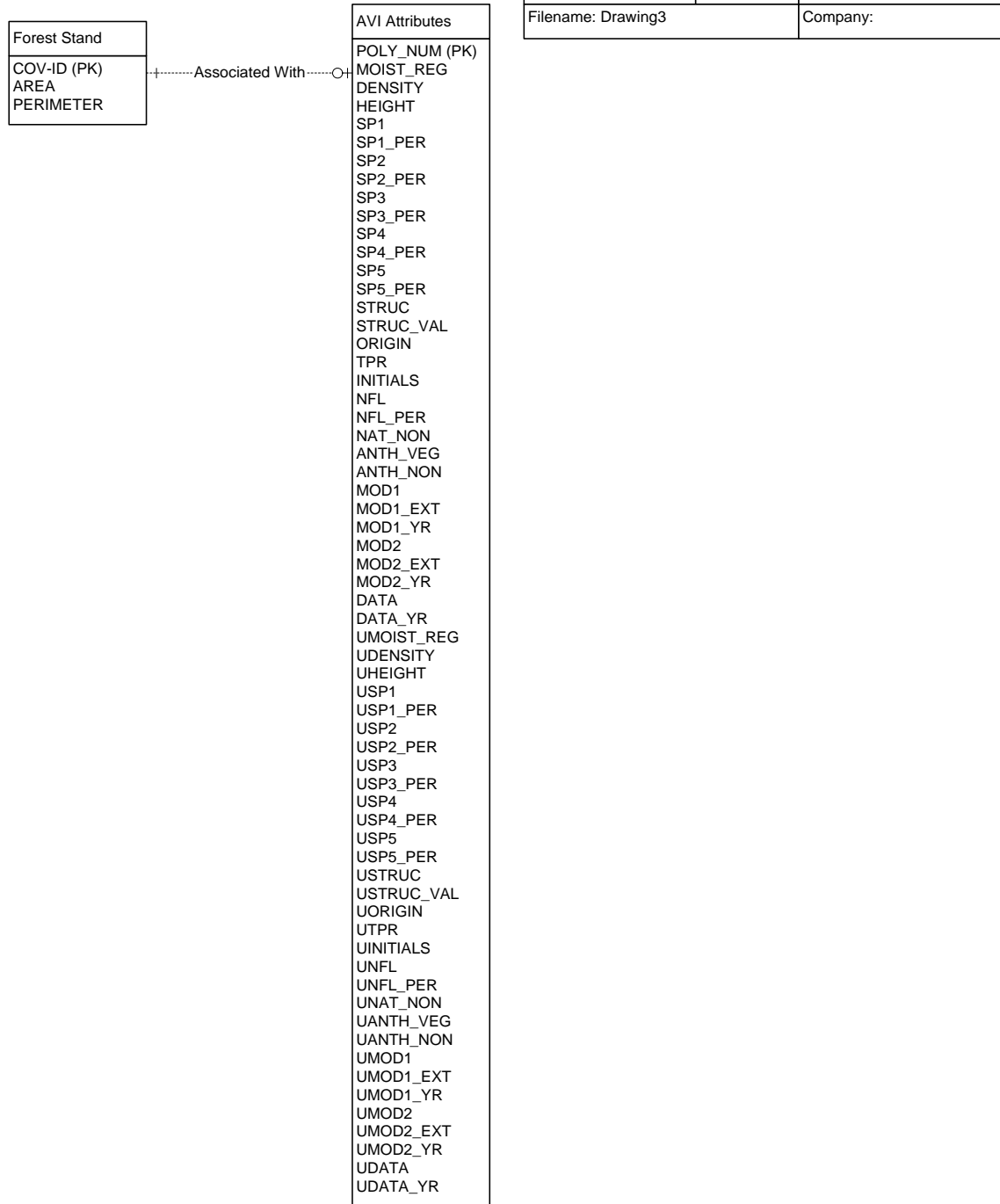


Figure 1-2 AVI Physical Model.

1.4 Physical to Logical Cross Reference

Rather than repeating the entire attribute definitions and domain values the following table (Table 1-1) is used to cross-reference physical fields to their logical equivalents.

Table 1-1: AVI Physical to Logical cross reference.

Physical Attribute	Entity	Logical Attribute
POLY_NUM	Forest Stand	STAND_ID
MOIST_REG	Layer Site	MOISTURE_REGIME
DENSITY	Forested Layer	CROWN_CLOSURE
HEIGHT	Forested Layer	STAND_HEIGHT
SP1	Tree Species	SPECIES_TYPE
SP1_PER	Tree Species	PERCENTAGE
SP2	Tree Species	SPECIES_TYPE
SP2_PER	Tree Species	PERCENTAGE
SP3	Tree Species	SPECIES_TYPE
SP3_PER	Tree Species	PERCENTAGE
SP4	Tree Species	SPECIES_TYPE
SP4_PER	Tree Species	PERCENTAGE
SP5	Tree Species	SPECIES_TYPE
SP5_PER	Tree Species	PERCENTAGE
STRUC	Layer	LAYER_TYPE
STRUC_VAL	Layer	LAYER_MODIFIER
ORIGIN	Forested Layer	ORIGIN
TPR	Layer Site	TPR
INITIALS	Interpreter	INTERPRETER_INITIALS
NFL	Naturally Non-Forest Layer	NON_FOREST_CODE
NFL_PER	Non-Forested Modifier	SHRUB_CLOSURE
NAT_NON	Naturally Non-Vegetated Layer	NAT_NON_VEG_CODE
ANTH_VEG	Anthropogenic Vegetated Layer	ANTH_VEG_CODE
ANTH_NON	Anthropogenic Non-Vegetated Layer	ANTH_NON_VEG_CODE
MOD1	Stand Modifier	MODIFIER_CODE
MOD1_EXT	Stand Modifier	MODIFIER_EXTENT

Table 1-1. continued.

Physical Attribute	Entity	Logical Attribute
MOD1_YR	Stand Modifier	MODIFIER_YEAR
MOD2	Stand Modifier	MODIFIER_CODE
MOD2_EXT	Stand Modifier	MODIFIER_EXTENT
MOD2_YR	Stand Modifier	MODIFIER_YEAR
DATA	Existing Data Reference	EXISTING_DATA_CODE
DATA_YR	Existing Data Reference	EXISTING_DATE_YEAR
UMOIST_REG	Layer Site	MOISTURE_REGIME
UDENSITY	Forested Layer	CROWN_CLOSURE
UHEIGHT	Forested Layer	STAND_HEIGHT
USP1	Tree Species	SPECIES_TYPE
USP1_PER	Tree Species	PERCENTAGE
USP2	Tree Species	SPECIES_TYPE
USP2_PER	Tree Species	PERCENTAGE
USP3	Tree Species	SPECIES_TYPE
USP3_PER	Tree Species	PERCENTAGE
USP4	Tree Species	SPECIES_TYPE
USP4_PER	Tree Species	PERCENTAGE
USP5	Tree Species	SPECIES_TYPE
USP5_PER	Tree Species	PERCENTAGE
USTRUC	Layer	LAYER_TYPE
USTRUC_VAL	Layer	LAYER_MODIFIER
UORIGIN	Forested Layer	ORIGIN
UTPR	Layer Site	TPR
UINITIALS	Interpreter	INTERPRETER_INITIALS
UNFL	Naturally Non-Forest Layer	NON_FOREST_CODE
UNFL_PER	Non-Forested Modifier	SHRUB_CLOSURE
UNAT_NON	Naturally Non-Vegetated Layer	NAT_NON_VEG_CODE
UANTH_VEG	Anthropogenic Vegetated Layer	ANTH_VEG_CODE
UANTH_NON	Anthropogenic Non-Vegetated Layer	ANTH_NON_VEG_CODE
UMOD1	Stand Modifier	MODIFIER_CODE
UMOD1_EXT	Stand Modifier	MODIFIER_EXTENT

Table 1-1. continued.

Physical Attribute	Entity	Logical Attribute
UMOD1_YR	Stand Modifier	MODIFIER_YEAR
UMOD2	Stand Modifier	MODIFIER_CODE
UMOD2_EXT	Stand Modifier	MODIFIER_EXTENT
UMOD2_YR	Stand Modifier	MODIFIER_YEAR
UDATA	Existing Data Reference	EXISTING_DATA_CODE
UDATA_YR	Existing Data Reference	EXISTING_DATE_YEAR

1.5 Valid Field Domain Values

The following is a summary of physical AVI fields and valid domain values associated with them:

Polygon Number: 1 – 9999 (2147483646 in Spatial Database)

Species 1 – 5: Sw, Se, Sb, P, Pl, Pj, Pa, Pf, Fb, Fa, Fd, Lt, La, Lw, A, Aw, Pb, Bw

Species 1 Percentage: 2 – 10

Species 2 Percentage: 1 – 5

Species 3 Percentage: 1 – 3

Species 4 Percentage: 1 – 2

Species 5 Percentage: 1 – 2

Moisture Regime: d, m, w, a

Crown Closure: A, B, C, D

Height: 0 – 40

Stand Structure: M, C, H

Stand Structure Modifier: 0 – 9

Origin: 1400 – current year

Timber Productivity Rating: G, M, F, U

Interpreter Initials: AA- ZZ

Non-Forest Vegetated: SC, SO, HG, HF, BR

Non-Forest Vegetated Shrub Closure: 0 – 10

Naturally Non-Vegetated: NWI, NWL, NWR, NWF, NMB, NMC, NWR, NMS

Anthropogenic Vegetated: CA, CP, CPR, CIP, CIW

Anthropogenic Non-Vegetated: ASC, ASR, AIH, AIE, AIG, AIF, AIM, AII

Stand Modifier 1 –2: CC, BU, WF, CL, DI, IK, UK, WE, DT, BT, SN, ST, SI, SC, PL, TH, GR, IR

Stand Modifier Extent 1 – 2: 0 – 5

Stand Modifier Year 1 – 2: 1900 – current year

Existing Data: F, P, V, C, S, A, L, I

Existing Data Year: 1940 – current year

1.6 AVI File Format Description

AVI file format descriptions for .PAT and .ATT files are provided in Table 1-2 and Table 1-3, respectively.

Table 1-2. AVI File Format Description – PAT File.

.PAT File				
Field Name	Data Type	Width	No. Decimals	Description
Area	Floating point	18	5	Area in m ²
Perimeter	Floating point	18	5	Perimeter in m ²
	Binary	5	0	Internal ArcInfo identifier
- id	Binary	5	0	ArcInfo id number
ID	Numeric	10	0	Polygon number (key field to link to spatial (.att) file)
Forestkey	Numeric	10	0	Polygon number (key field to link to spatial (.att) file)
Poly_num	Numeric	10	0	Polygon number (key field to link to spatial (.att) file)

Table 1-3. AVI Attribute Table – ATT File.

.ATT File				
Field Name	Data Type	Width	No. Decimals	Description
Poly_num	Numeric	10	0	Polygon number (key field to link to spatial (.pat) file). May also appear as FORESTKEY or ID.
Moist_reg	Character	1		Moisture regime: d = dry m = mesic w = wet a = aquatic
Density	Character	1		Crown closure (%): A = 6 to 30 % B = 31 to 50 % C = 51 to 70 % D = 70 % +
Height	Numeric	2	0	Average stand height (dominant & codominant trees) in meters.
Sp1, Sp2, Sp3, Sp4, Sp5	Character	2		Declining order of species based on crown closure Sw, Se, Sb, P, Pl, Pj, Pa, Pf, Fb, Fa, Fd, Lt, La, Lw, A, Aw, Pb, Bw
Sp1_per to Sp5_per	Numeric	2	0	Actual % (to nearest 10) of species listed above.

Table 1-3. continued.

.ATT File				
Field Name	Data Type	Width	No. Decimals	Description
Struc	Character			Stand structure: Blank = inferred single storey M = multi-layer canopy (2 storey) C = complex (multiple or uneven stories) H = Horizontal (homogeneous stand with scattered pockets)
Struc_val	Numeric	2	0	Used only with 'H' above (e.g., 80% Pl, 20% Aw pockets would be Pl8 / Aw2 (based on crown closure composition)
Origin	Numeric	4	0	Actual year of origin
Tpr	Character	1		Tree productivity rating (site index grouping) U = Unproductive F = Fair M = Medium G = Good
Initials	Character	2		AVI interpreters initials
Nfl	Character	2		Non-forest vegetated land (>6% plant cover and <6% tree cover): SC = closed shrub SO = open shrub HG = herbaceous grassland HF = herbaceous forbs BR = bryophyte (moss)
Nfl_per	Numeric	2	0	Nfl % closure, SC or SO only
Nat_non	Character	3		Naturally non-vegetated (<6% plant cover): NWI = Permanent ice/snow NWL = Seasonal thaws, lakes, ponds NWR = River NWF = Flooded NMB = Recent burn NMC = Cutbank NMR = Rock/barren NMS = Sand

Table 1-3 continued

.ATT File				
Field Name	Data Type	Width	No. Decimals	Description
Anth_veg	Character	3		Human-induced vegetation: A = Annual crops (farmland) CP = Perennial forage crops CPR = Rough pasture (>10% woody cover) CIP = Pipelines, powerlines etc. seeded to grass CIW = Geophysical and wellsites seeded to grass
Anth_non	Character	3		Anthropogenic non-vegetated land: ASC = Cities, towns, villages, hamlets ASR = Ribbon development, subdivisions, acreages AIH = Permanent right-of-way AIE = Peat extractions AIG = Gravel/borrow pits AIF = Farmyards AIM = Surface mines AII = Industrial sites, sewage lagoons
Mod1, Mod2	Character	2		Stand modifier 1 (or 2) condition/treatment: CC = Clearcut, partial cut BU = Burn WF = Windfall CL = Clearing DI = Disease IK = Insect kill UK = Unknown kill WE = Weather (eg., redbelt) DT = Discolored/dead tops BT = Broken tops SN = snags ST = Scattered timber SI = Site improvement (fertilization, draining) SC = Seedbed prepared PL = Planted/seeded TH = Thinned GR = Grazing development (domestic) IR = Irrigated

Table 1-3 continued

.ATT File				
Field Name	Data Type	Width	No. Decimals	Description
Mod1_ext, Mod2_ext	Numeric	2	0	Modifier extent: Blank = nil 1 = 1 to 25% loss of crown closure or area affected 2 = 26 to 50% 3 = 51 to 75% 4 = 76 to 94% 5 = Entire
Mod1_yr, Mod2_yr	Numeric	4	0	Year of the stand modifying occurrence
Data	Character	1		Data Source F = Interpreter plot P = PSP V = Volume plot C = cruise data S = supplementary photography A = air call L = large-scale photography I = interpreted TPR
Data_yr	Numeric	4	0	Year of the data source
Umoist_r	Character	1		Understorey moisture regime
Udensity	Character	1		Understorey density
Uheight	Numeric	2	0	Understorey height
Usp1, Usp2, Usp3, Usp4, Usp5	Character	2		Understorey species composition
Usp1_per to Usp5_per	Numeric	2	0	Understorey species percent
Ustruc	Character	1		Understorey stand structure
Ustruc_v	Numeric	2	0	Understorey stand structure value
Uorigin	Numeric	4	0	Understorey origin
Utp	Character	1		Understorey TPR
Uinitial	Character	2		Understorey interpreter's initials
Unfl	Character	2		Understorey non-forest vegetated land

Table 1-3 continued

.ATT File				
Field Name	Data Type	Width	No. Decimals	Description
Unfl_per	Numeric	2	0	Understorey non-forest vegetated land percent
Unat_non	Character	3		Understorey naturally non-vegetated land
Uanth_ve	Character	3		Understorey human induced vegetation
Utp	Character	1		Understorey TPR
Uinitial	Character	2		Understorey interpreter's initials
Unfl	Character	2		Understorey non-forest vegetated land
Unfl_per	Numeric	2	0	Understorey non-forest vegetated land percent
Unat_non	Character	3		Understorey naturally non-vegetated land
Uanth_ve	Character	3		Understorey human induced vegetation
Uanth_no	Character	3		Understorey anthropogenic non-vegetated
Umod1, Umod2	Character	2		Understorey stand modifier
Umod1_ex, Umod2_ex	Numeric	2	0	Understorey stand modifier extent
Umod1_yr, Umod2_yr	Numeric	4	0	Understorey stand modification year
Udata	Character	1		Understorey data source
Udata_yr	Numeric	4	0	Understorey data source year of collection

*NOTE: All leading "U" refers to understorey, the same codes apply as were used for the overstorey.

2. Depletion Update Data Model

Not available

3. Conifer Understorey Detection Data Model

**Version 1.0
December 2004**

UPDATES

“Conifer Understorey Detection Data Model” December 2004 was incorporated into the Alberta Vegetation Inventory Standards and Data Model Documents (as part of Chapter 8) in June 2006. Subsequent revisions to the document are summarized below:

Date	Type of Revision	Version No.	Sections Revised
	None to date		

3.1 Introduction to Chapter 8 Section 3

The following document forms part of Chapter 8 of Alberta's Vegetation Inventory Standards and Data Model Documents.

"Conifer Understorey Detection Data Model" describes the data model accepted by Alberta Sustainable Resource Development for use in conjunction with the understorey enhancement standard.

The interpretation standards for the conifer understorey inventory are described in "Detection of Coniferous Understorey Under Deciduous Dominant Stands" (part of Chapter 6 – Vegetation Inventory Standards and Data Model Documents). Understorey inventory is conducted in conjunction with, or as an addition to, Alberta Vegetation Inventory (see "Alberta Vegetation Inventory Standards" (Chapter 3 – Vegetation Inventory Standards and Data Model Documents)).

3.2 Logical Data Model

The logical data model for conifer understorey enhancement (see Figure 3-1) provides an overview of entities and pseudo-entities, and the relationships that exist between them. The entity definitions and the relationships between the various entities are governed by business and validation rules. For example, the existence of some entities may require further conformance to a set of rules that govern associations with other entities in the model. The validation criteria and business rules that govern these relationships have not been described in this data model. Currently this model does not retain linkages to source AVI data.

3.2.1 Interpreter

Description:

Information about the person who did the interpretation and assigned the polygon attributes.

Attributes:

INTERPRETER_INITIALS

Description: Initials of person that interpreted the polygon

Type: Character 2

Domain Values: Any alphanumeric characters.

Physical Attributes: CU_INITIALS

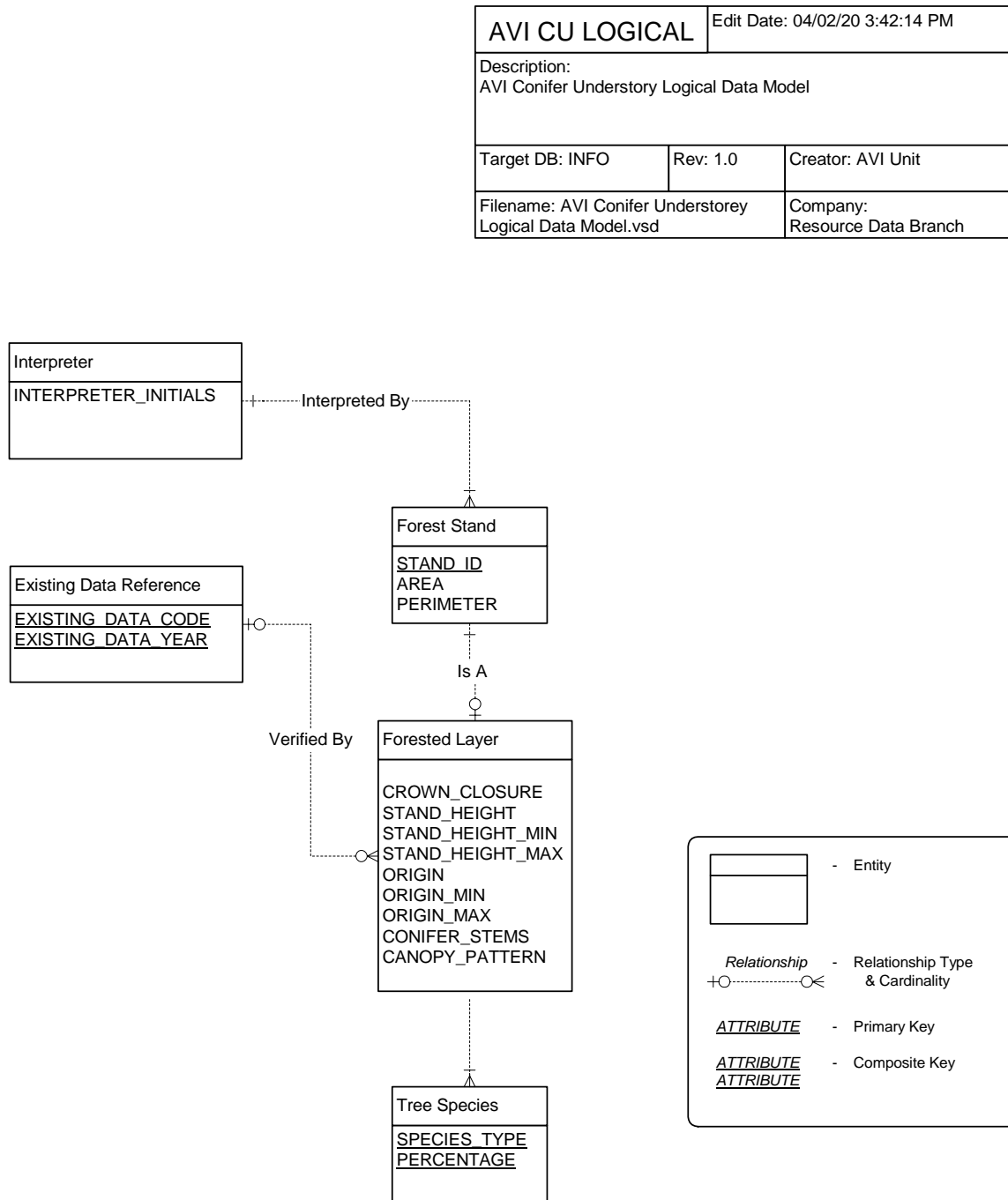


Figure 3-1. Conifer understorey detection Logical Data Model with key attribute relationships.

3.2.2 Existing Data Reference

Description:

Data gathered from other existing sources that aid in the interpretation of the coniferous understorey. If more than one set of attributes (EXISTING-DATA-CODE and EXISTING-DATA-YEAR) exists for a polygon, the following hierarchy applies: 1. Interpreter field plot (F), 2. Air call (A), 3. Interpreted TPR (I), 4. Supplementary photography (S), 5. PSP (P), 6. Cruise data (C), 7. Volume plot (V), 8. Large-scale photography (L).

Attributes:

EXISTING_DATA_CODE

Description: Code indicating external source used.

Type: Character 1

Domain Values: F, A, I, S, P, C, V, L

Physical Attributes: CU_DATA

EXISTING_DATA_YEAR

Description: Year associated with external data source.

Type: Integer 4

Domain Values: 1940 – current year (suggested years 1940 and current year of inventory)

Physical Attributes: CU_DATA_YR

3.2.3 Forest Stand

Description:

A community of trees possessing sufficient uniformity in composition, age, arrangement or condition to be distinguishable from the forest or other growth on adjoining areas, thus forming a silvicultural or management entity.

Attributes:

STAND_ID

Description: Uniquely generated ID.

Type: Integer 10

Domain Values: 1 – 2147483646

Physical Attributes: COV-ID and CU_POLY_NUM

AREA

Description: Area of polygon in square metres.

Type: Real

Domain Values: > Min Stand Size

Physical Attributes: AREA

PERIMETER

Description: Perimeter of polygon in metres.

Type: Real

Domain Values: > 0

Physical Attributes: PERIMETER

3.2.4 Forested Layer

Description:

Coniferous understoreys may be single storied or complex. Single-storey understoreys have $\geq 80\%$ of the understorey trees within a 3 m range along their modal tree height. Complex structures occur when no clearly defined understorey layer is present and heights of $> 20\%$ of the understorey trees exceed a 3 m range in height. Trees to be considered in the coniferous understorey have a height range of greater than or equal to 2 m and 3 m less than the AVI overstorey height.

Attributes:

CROWN_CLOSURE

Description: The ground area within a treed polygon, expressed as the percentage of the total polygon area, covered by a vertical projection of the tree crowns onto the ground.

Type: Character 1

Domain Values: A, B, C, or D

Physical Attributes: CU_DENSITY

STAND_HEIGHT

Description: Modal height of the coniferous trees in the layer.

Type: Integer 2

Domain Values: 1 – 37

Physical Attributes: CU_HEIGHT

STAND_HEIGHT_MIN

Description: Minimum height of the coniferous trees in the layer.

Type: Integer 2

Domain Values: 1 – 37

Physical Attributes: CU_HEIGHT_MN

STAND_HEIGHT_MAX

Description: Maximum height of the coniferous trees in the layer.

Type: Integer 2

Domain Values: 1 – 37

Physical Attributes: CU_HEIGHT_MX

ORIGIN

Description: Year of stand origin.

Type: Integer 4

Domain Values: 1400 – current year

Physical Attributes: CU_ORIGIN

ORIGIN_MIN

Description: Lower limit of origin variation.

Type: Integer 4

Domain Values: 1400 – current year

Physical Attributes: CU_ORIGIN_MN

ORIGIN_MAX

Description: Upper limit of origin variation.

Type: Integer 4

Domain Values: 1400 – current year

Physical Attributes: CU_ORIGIN_MX

CONIFER_STEMS

Description: Visual estimation of the number of coniferous stems per hectare expressed in density classes.

Type: Integer 1

Domain Values: 1 - 7

Physical Attributes: CU_STEMS

CANOPY_PATTERN

Description: Canopy pattern.

Type: Integer 1

Domain Values: 1 – 6

Physical Attributes: CU_PATTERNC

3.2.5 Tree Species

Description:

A tree species approved in AVI 2.1.1 specification.

Attributes:

SPECIES_TYPE

Description: Code indicating type of tree species.

Type: Character 2

Domain Values: Fb, Fa, Fd, F, Pl, Pj, P, Sb, Se, Sw, S, U

Physical Attributes: CU_SP1 -> CU_SP5

SPECIES COMPOSITION in PERCENT

Description: Percentage each tree species (5 maximum) occupies within an understorey layer based on crown closure recorded to the closest 10%.

Type: Integer 2

Domain Values: 1-10

Physical Attributes: CU_SP1_PER -> CU_SP5_PER

3.3 Physical Data Model

The Entity Relationship Diagram in Figure 3-2 represents the physical implementation of the “Inventory Enhancement of Conifer Species Under Deciduous Dominant Stand – Interpretation Standard”. The physical model differs significantly from the logical model in that almost the entire logical model is incorporated into a single physical attribute table. The physical model facilitates use in conjunction with the AVI 2.1 physical data model (Section 1.3).

Note that many of the relationships indicated in the logical model are implied in the physical model through the existence or absence of particular key fields. For example, if the Minimum Stand Height field contains data then we can imply that the understorey layer is complex.

Tables describing the ESRI ArcInfo coverage format structure for implementing the physical data model are provided in Appendix I.

AVI CU Physical		Edit Date: 04/02/20 4:16:57 PM
Description: AVI Conifer Understorey Physical Data Model		
Target DB: INFO	Rev: 1.0	Creator: AVI Unit
Filename: AVI Conifer Understorey Physical Data Model.vsd		Company: Resource Data Branch

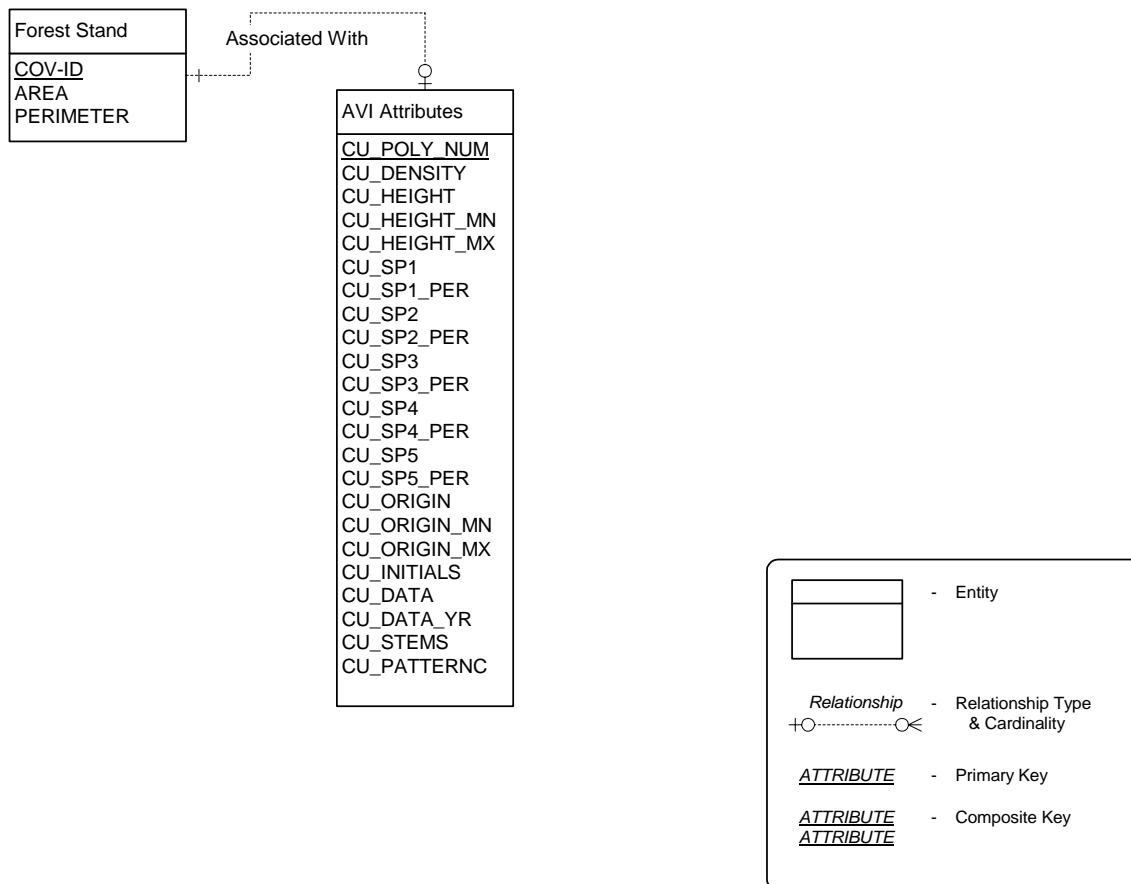


Figure 3-2. Conifer understorey detection Physical Data Model with key attribute relationships.

3.4 Physical to Logical Cross Reference

Rather than repeating the entire attribute definitions and domain values, Table 3-1 is used to cross-reference primary physical fields to their logical equivalents.

Table 3-1. Cross-reference of conifer understorey detection physical fields to their logical equivalents.

Physical Attribute	Entity	Logical Attribute
CU_POLY_NUM	Forest stand	STAND_ID
CU_DENSITY	Forested layer	CROWN_CLOSURE
CU_HEIGHT	Forested layer	STAND_HEIGHT
CU_HEIGHT_MN	Forested layer	STAND_HEIGHT_MIN
CU_HEIGHT_MX	Forested layer	STAND_HEIGHT_MAX
CU_SP1	Tree species	SPECIES_TYPE
CU_SP1_PER	Tree species	PERCENTAGE
CU_SP2	Tree species	SPECIES_TYPE
CU_SP2_PER	Tree species	PERCENTAGE
CU_SP3	Tree species	SPECIES_TYPE
CU_SP3_PER	Tree species	PERCENTAGE
CU_SP4	Tree species	SPECIES_TYPE
CU_SP4_PER	Tree species	PERCENTAGE
CU_SP5	Tree species	SPECIES_TYPE
CU_SP5_PER	Tree species	PERCENTAGE
CU_ORIGIN	Forested layer	ORIGIN
CU_ORIGIN_MN	Forested layer	ORIGIN_MIN
CU_ORIGIN_MX	Forested layer	ORIGIN_MAX
CU_INITIALS	Interpreter	INTERPRETER_INITIALS
CU_DATA	Existing data reference	EXISTING_DATA_CODE
CU_DATA_YR	Existing data reference	EXISTING_DATE_YEAR
CU_STEMS	Forested layer	CONIFER_STEMS
CU_PATTERNC	Forested layer	CANOPY_PATTERN

3.5 Valid Field Domain Values

Table 3-2 provides a summary of physical conifer understory inventory fields and valid domain values associated with them.

Table 3-2. Conifer understory detection inventory fields and valid domain values.

Physical Model Fields	Valid Domain Values
Polygon number	1 – 9999 (2147483646 in Spatial Repository)
Crown closure	A, B, C, D
Stand height	2 – 37
Stand height min	2 – 37
Stand height max	2 – 37
Species 1 – 5	Sw, Se, Sb, Pl, Pj, Fb, Fa, Fd, S, P, F, U
Species 1 percentage	2 – 10
Species 2 percentage	1 – 5
Species 3 percentage	1 – 3
Species 4 percentage	1 – 2
Species 5 percentage	1 – 2
Origin	1400 – current year
Origin min	1400 – current year
Origin max	1400 – current year
Interpreter initials	AA- ZZ
Existing data	F, P, V, C, S, A, L, I
Existing data year	1940 – current year
Conifer stems	1 – 7
Canopy pattern	1 – 6

3.6 AVI File Format Description

AVI file format descriptions for .PAT and .ATT files are provided in Table 3-3 and Table 3-4, respectively.

Table 3-3. Conifer understorey detection polygon attribute table (.PAT).

Field Name	Data Type	Width	Dec.	Description
Area	Floating Point	18	5	Area in squared metres
Perimeter	Floating Point	18	5	Perimeter in metres
#	Binary	5		ArcInfo internal record number
-id	Binary	5		ArcInfo internal id number
Cu_Poly_num	Integer	10		Polygon number (Primary Key)

Table 3-4. Conifer understorey detection attribute table (.ATT).

Field Name	Data Type	Width	Dec.	Description
CU_Poly_num	Integer	10		Polygon number (Primary Key)
CU_Density	Character	1		Crown Closure (%) A = 6 to 30% B = 31 to 50% C = 51 to 70% D = 70 % +
CU_Height	Integer	2		Modal understorey stand height (metres)
CU_Height_mn	Integer	2		Min understorey stand height (metres)
CU_Height_mx	Integer	2		Max understorey stand height (metres)
CU_Sp1 – CU_Sp5	Character	2		Declining order of species based on abundance in forest canopy - Sw, Se, Sb, Pl, Pj, Fb, Fa, Fd, S, P, F, U
CU_Sp1_per – CU_Sp5_per	Integer	2		Actual % (to nearest 10) of species
CU_Origin	Integer	4		Actual year of stand origin
CU_Origin_mn	Integer	4		Lower limit of origin variation
CU_Origin_mx	Integer	4		Upper limit of origin variation
CU_Initials	Character	2		AVI interpreters initials
CU_Data	Character	1		Data source F = Interpreter plot P = PSP V = Volume plot C = Cruise data S = Supplementary photography A = Air call L = Large-scale photography I = Interpreted TPR
CU_Data_yr	Integer	4		Year of the data source
CU_Stems	Integer	1		Density of coniferous stems per hectare
CU_Patternc	Integer	1		Canopy pattern class

For additional information, please contact:
Resource Information Management Branch,
Alberta Sustainable Resource Development
Edmonton, AB

<http://www.srd.gov.ab.ca/index.html>