

**ALBERTA VEGETATION INVENTORY
STANDARDS MANUAL**

Version 2.1
November, 1991

Alberta Environmental Protection
Resource Data Division
Data Acquisition Branch

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1.0 INTRODUCTION

Detailed vegetation information is necessary for Forest Management Agreement holders and the Department of Forestry, Lands and Wildlife to provide the best possible forest management plans, wildlife habitat classifications and integrated resource management plans.

Standards for a vegetation inventory are required so that the needs of the users are met and the level of information is consistent among the users. This manual provides the background, procedures and specifications associated with implementing an ongoing Alberta Vegetation Inventory. This inventory will be the first truly integrated approach to the mapping of Alberta's vegetation information.

1.1 Background

Since the completion of the Phase 3 Forest Inventory in 1984, there has been an unprecedented boom in forestry development. Along with government staff responsible for ongoing forest management plans, there are now several new Forest Management Agreement (FMA) holders, among others, who must participate in integrated resource plans. As a result of varied activities in and uses of forests, high quality data in a flexible format, with the capability of spatial presentation at various levels, has become essential to forest management.

In response to the needs for an integrative, comprehensive approach to vegetation information, a pilot vegetation inventory (Alberta Vegetation Inventory - AVI) was initiated in September 1987 for high priority lands in the White Area. However, longer term needs for Green Area inventory and a compatible inventory computer system were not addressed by AVI.

The necessity of a new inventory for the Green Area, particularly to cope with recent FMA developments (covering half of the Green Area), provided an opportunity to consider a common vegetation standard that would be supported by the Department and FMA holders. The benefits of a single standard were as follows:

- 1) standardized information for land management decisions;
- 2) information sharing (e.g., 1:20 000 base maps), and
- 3) the potential for joint information systems development.

A steering committee composed of Departmental and industry senior management guided development of vegetation inventory standards. The developmental tasks were delegated to a task group composed of staff from the Department and industry. User needs were reviewed with various client groups. AVI standards were evaluated. Following the review, four criteria were considered basic to the development of a new vegetation inventory standard for the Green Area:

- 1) 1:20 000 scale,
- 2) inventory integration,
- 3) AVI standard as a starting point, and
- 4) continuous inventory.

1.1.1 Working Scale 1:20 000

To fulfil daily activities, various levels of information detail (i.e., at a variety of scales) had to be available. Two scales common are 1:20 000 and 1:50 000. A majority of the activities require the large scale of 1:20 000, but smaller scales (1:50 000 and 1:100 000) and larger scales (1:10 000) were also necessary. The 1:20 000 scale was chosen for the standard working scale with the expectation that an inventory system so based would allow for generalization to smaller scales and also for incorporation of more detailed (1:10 000 and ground) information.

1.1.2 Inventory Integration

The ability to integrate information from other sources is desired. The other sources include base map and orthophoto information and more complex information like ecological land classification and silviculture activity. These items are not covered in detail by this document, but are listed as desirable components of any information system that might store and handle the inventory data.

1.1.3 AVI Standard as a Starting Point

The Alberta Vegetation Inventory (AVI) was earlier proposed as the inventory standard for the Department. During development of the new standard for the Green Area, it became apparent that AVI could fulfil the majority of the vegetation information requirements of FMA holders and the Department. As a result, the specifications for the Alberta Vegetation Inventory are similar to AVI standards with some minor additions.

1.1.4 Continuous Inventory

The Alberta Vegetation Inventory is intended to be a continuous inventory requiring an average of 1/20th of the land area to be re-inventoried annually. There is the opportunity to review and revise specifications to meet changing needs and technology because the inventory process will be ongoing.

2.0 COVER TYPE SPECIFICATIONS

Scale of the maps will be 1:20 000. The minimum requirement for photo emulsion type will be 1:20 000 black and white photography. Air photo acquisition specifications, air photo interpretation procedures, transfer of photo detail to base maps and quality control procedures are available upon request from Alberta Forestry, Lands and Wildlife.

2.1 Moisture Regime Modifiers

The moisture regime modifier applies to all vegetated land cover types. Moisture regime will be indicated by a lower case prefix and added to the polygon attribute.

	Interpretation and Database Code
Dry - rapidly drained substratum	d
Mesic - moderately well drained substratum	m
Wet - poorly drained to flooded where the water table is usually at or near the surface, or the land is covered by shallow water (e.g., sedge fens)	w
Aquatic - permanent deep water areas where the pre-dominant growth medium is water and the vegetation is characterized by hydrophytic vegetation (emergent) that grows in or at the surface of the water (e.g., pond weeds, water-lily, etc.	a

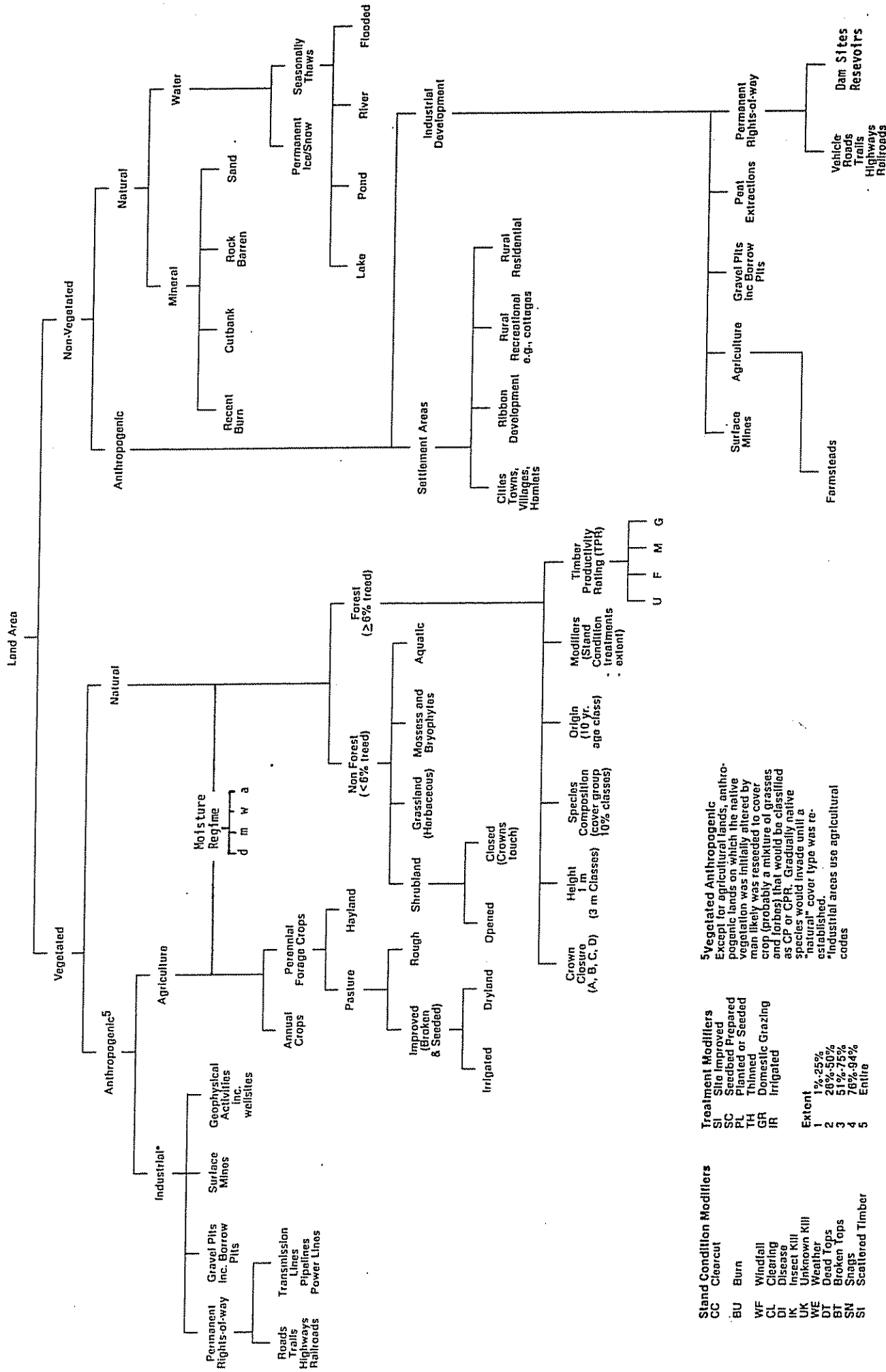
The interpreter's assessment of moisture regime is based on plant indicators or environmental factors and soil properties.

Moisture regime is correlated with the following factors: micro-variations on topoclimate, slope position (macro and meso relief), slope gradient, depth of surface humus layers, soil texture (including the content of coarse fragments), soil depth and the presence of an impermeable layer. In general, the most influential factor of moisture regime is the position of the

Timber Productivity	Interpretation and Database Code
Good	G
Medium	M
Fair	F
Unproductive	U

TRP is interpreted for forest stands less than 20 years old and for suppressed trees released due to the removal of their overstorey. TRP is interpreted by utilizing site conditions and/or nearby stands or historical data (pre-harvest conditions).

The code "I" must be attached when TRP is interpreted
e.g. 1980-M-I.



Stand Condition Modifiers
 CC Clearcut
 BU Burn
 WF Windfall
 CL Clearing
 DI Disease
 IK Insect Kill
 UK Unknown Kill
 WE Weather
 DT Dead Tops
 BT Broken Tops
 SN Snags
 SI Scattered Timber

Treatment Modifiers
 SI Site Improved
 SC Seeded Prepared
 PL Planted or Seeded
 TH Thinned
 GR Domestic Grazing
 IR Irrigated

Extent
 1 1%-25%
 2 26%-50%
 3 51%-75%
 4 76%-94%
 5 Entire

5 Vegetated Anthropogenic
 Except for agricultural lands, anthropogenic lands on which the native vegetation was initially altered by man likely was seeded to cover crop (probably a mixture of grasses and forbes) that would be classified as CP or GPP. Gradually native species would invade until a "natural" cover type was re-established.
 *Industrial areas use agricultural codes

Figure 1. Alberta Vegetation Inventory Primary Classification, November, 1991

When the same predominant species occur in the overstorey and understorey, the understorey receives the same rating as the overstorey (applies to only multi-storey stands). If the predominant species in the overstorey and understorey are different, the TPR class is determined for each storey.

When <6% crown closure of trees are present on the site (non-stocked forest land), TPR is determined from residual stands, adjacent stocked forest land or existing information (e.g., soils maps, air photos acquired prior to the depletion). This would be the case only if the reference trees appear to be growing on land apparently equal in productivity.

Productive Timber Stands

Productive timber stands are determined using the TPR of one of five major species (Appendix 3). If the stand TPR is "G, M or F" the stand is considered productive.

Unproductive Timber Stands

Unproductive timber stands are determined using the TPR of one of five major species (Appendix 3). If the TPR class is "U" the stand is considered unproductive.

2.2.2.2 Crown Closure

This is the percentage of ground area covered by a vertical projection of tree crowns onto the ground.

Crown Closure (%)	Interpretation and Database Code
6 - 30	A
31 - 50	B
51 - 70	C
71 - 100	D

2.2.2.3 Height

Stand height is interpreted or determined through field measurements and recorded to the nearest metre. Stand height is the average height of the dominant and codominant trees of the leading species. Adjacent stands separated on the basis of height alone must have a difference equal to or greater than 3 meters

2.2.2.4 Species Composition

List species (five maximum) in decreasing order based on crown closure. Indicate the percentage of each species to the

nearest 10% with a subscript, e. g., $Sw_3Aw_2 = 80\% Sw, 20\% Aw$. The subscripts must add to 10 (100%).

When more than five species occur in a stand, these additional coniferous or deciduous species are added to the appropriate dominant coniferous or deciduous species in the cover type. Appropriate combinations include Aw, Pb, Bw and Sw, Sb, Fb, Lt, Fd. For example, a stand composed of 24% Sw, 20% P, 16% Sb, 14% Pb, 10% Bw, 9% Aw, 7% Fb would be labelled $Sw_3P_2Pb_2Sb_2Bw_1$.

Tree Species	Interpretation and Database Code
White spruce <i>Picea glauca</i>	Sw
Engelmann spruce <i>Picea engelmannii</i>	Sw (Se)
Black spruce <i>Picea mariana</i>	Sb
Lodgepole pine <i>Pinus contorta</i>	P (Pl)
Jack pine <i>Pinus banksiana</i>	P (Pj)
White-bark pine <i>Pinus albicaulis</i>	P (Pa)
Limber pine <i>Pinus flexilis</i>	P (Pf)
Balsam fir <i>Abies balsamea</i>	Fb
Alpine fir <i>Abies lasiocarpa</i>	Fb (Fa)
Douglas fir <i>Pseudotsuga menziesii</i>	Fd
Alpine larch <i>Larix lyallii</i>	Lt (La)
Tamarack <i>Larix laricina</i>	Lt
Western larch <i>Larix occidentalis</i>	Lt (Lw)
Trembling aspen <i>Populus tremuloides</i>	Aw
Balsam poplar <i>Populus balsamifera</i>	Pb
Paper (white) birch <i>Betula papyrifera</i>	Bw
<i>Populus</i> sp. - undifferentiated	

NOTE: 1) "A" symbol cannot be used in conjunction with any other differentiated *populus* species. For example, $mC18Aw_5A_5$ or $mB16Pb_5A_5$ cannot occur. However, it may be used in conjunction with the betula species. For example, $mC18A_5Bw_5$.

2) Where a stand has been field checked or where the species is known, complete species differentiation of both coniferous and deciduous trees is shown. See species

code in "brackets" under "Interpretation and Database Codes" above. For example:

mB20P1₅Pj₅ , mC19Fa₇Se₃
 86-M 82-F

2.2.2.5 Origin

Since age changes each year, the inventory uses 10-year origin classes. The origin class of a stand is its average "birth year" less the first and last numbers, e. g., a stand of 1876 origin is mapped 87.

BIRTH YEAR	INTERPRETATION CODE	DATABASE* CODE
1980-89	98	1980
1970-79	97	1970
1960-69	96	1960
1950-59	95	1950
1940-49	94	1940
1930-39	93	1930
ETC.	ETC.	ETC.

* Actual year of origin is coded when it is known, e. g. 1933.

The age adjustment factor to account for the growth of the tree to reach breast height must be added to breast height age as follows, for various tree species:

SPECIES	ADJUSTMENT
Fir, Lt, Sw	15 years
Pine	10 years
Sb	20 years
Deciduous	6 years

2.2.2.6 Stand Structure/Understorey

The correct use and application of stand structure description codes will be covered during comprehensive exercises in annual interpretation courses.

Single and two-storey stands were recognized in previous Alberta timber inventories. Horizontal and complex stand structures are identified in this inventory to aid in future timber volume sampling.

<i>Structure</i>	Single storey
<i>Interpretation and Database Code</i>	Inferred, therefore no code.
<i>Definition</i>	Stands generally of even height with only one canopy layer.

<i>Structure</i>	Multi-layer canopy (two-storey).
<i>Interpretation and Database Code for</i>	Inferred, therefore no code on air photo. Database code is "M". <i>The "M" database code multi-layered attributes must be coded for the upper vegetation layer on the AVI coding sheet.</i>

<i>Definition</i>	Understoreys are identified if they are clearly observable on air photos or if they have been confirmed through ground observations.
-------------------	--

Stands in which two or more distinct layers are visible. Most have only two layers. Generally, the two layers are intermixed, i.e., when viewed vertically, one layer is above the other. The average height of the top layer must differ from the average height of the lower layer by 3 m or more.

Each part of a two-storey stand is given an independent description. Multistorey stands with three or more distinct layers are rare. These are generally classed as complex structures or two-storey stands. A non-forest land understorey may be recognized with a less than 3 m height difference from the overstorey but only in the absence of commercial understorey species. If a non-forest land understorey is identified, the TPR of the understorey will be the same as the overstorey. Anthropogenic vegetated land and non-vegetated land can both be used in two-storey situations providing that commercial species are absent. *In two-storey attributes, the tallest vegetation layer is indicated as the upper layer. The same moisture regime is assigned to both layers of a two-storey stand. If the predominant species are the same for both layers of a multi-storey stand, the same TPR is assigned to both layers; otherwise ratings may differ.*

For example, Two-storey structure

mB25Sw ₅ Aw ₄	WA13Pb ₁₀	m3SO ₄ -U
<u>87-M</u>	<u>91-F</u>	<u> </u>
mB21Sw ₇ Aw ₃	w2S05-F	mHg-U
87-M		

Structure

Complex

Interpretation and
Database Code

C

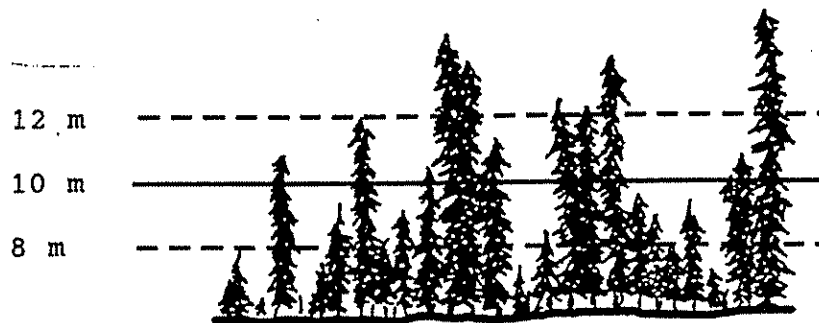
Definition

Complex structured stands are those where multiple layers form a pattern or mosaic that cannot be described using the criteria for two-storey or horizontal structured stands. These stands are often a pattern of different heights that are intermixed throughout the stand, e.g. black spruce stands growing around a muskeg site. To describe these stands, see the example below. A stand midpoint is estimated and the average height is coded in the attribute. Immediately following the "C" code is the height range from the mid-point of the upper layer to the mid-point of the lower layer. *Complex structures may only be used in timber attributes.*

The use of complex structures is restricted to polygons containing Sb and/or Lt, Fb and old growth Sw.

Overstorey Midpoint

Estimated Midpoint
(or average height)
Understorey Midpoint



Stand described as:

wC10Sb₅Lt₅-C4
87-U ||
 ||
 | 4 m height range
 |
 complex structure

Figure 2. Complex stand structure.

Structure Horizontal

Interpretation and Database Code H

Definition The use of stand structure codes, particularly H structures, are easily misused or applied incorrectly. Interpreters are to describe stand structures only when such structures are significant and observable in vegetation polygons both on air photos and on the ground.

The occurrence of horizontal stand descriptions can be reduced by applying the minimum polygon size guidelines (Section 2.5).

Stands with this structure are composed of numerous homogeneous stands within other distinctly different homogeneous stands, but both or each individual stand are too small to delineate at the 1:20 000 mapping scale. For example, a 30 ha pine stand may have <2 ha clones of aspen scattered throughout which account for 20% of the stand area for the entire polygon.

The pine would therefore be one portion of the horizontal structure with the aspen as the other.

Example of a stand with a horizontal structure - described as:

```

mC19P10-H8-----
  88-M                | Must combine to 100%
-----              |
mC18Aw10-H2-----
  91-M
  
```

The interpretation code for this type of stand would indicate a horizontal relationship between the substands instead of a two-storey or complex structure. The percentage of stand area in 10% increments, attributed by each structure to the entire polygon, is also assigned following the "H" code. The total of each structure's percentage must combine to equal 100% stand area. A 3 m height difference is not required between the structures. Moisture regime and TPR can differ between component structures. The tallest vegetation structure is coded in the upper part of the attribute. Non-forest land, and naturally non-vegetated anthropogenic lands are also described if they occur as a component of a horizontal structured stand.

NB. Caution is suggested in the overuse of horizontal structures. Horizontal structures describe timber vegetation accurately but horizontal structures do not inform the AVI user of where the structures occur spacially within a polygon.

For example, horizontal structures:

$$\frac{mC22Sw_8Aw_2-H3}{87-M}$$

$$\frac{mC22Aw_5Pb_5-H7}{92-G}$$

$$\frac{mC13Sb_{10}-H5}{86-M}$$

$$\frac{wB10Lt_5Sb_5-H5}{86-U}$$

$$\frac{mC15Aw_8Bw_2-H8}{93-M}$$

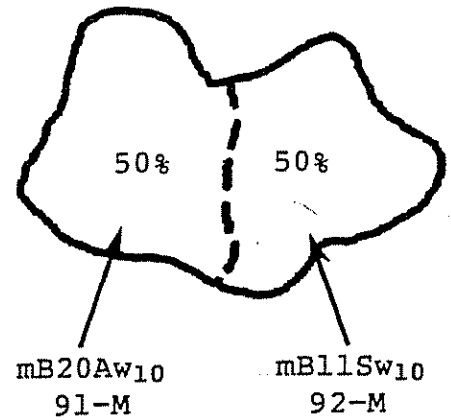
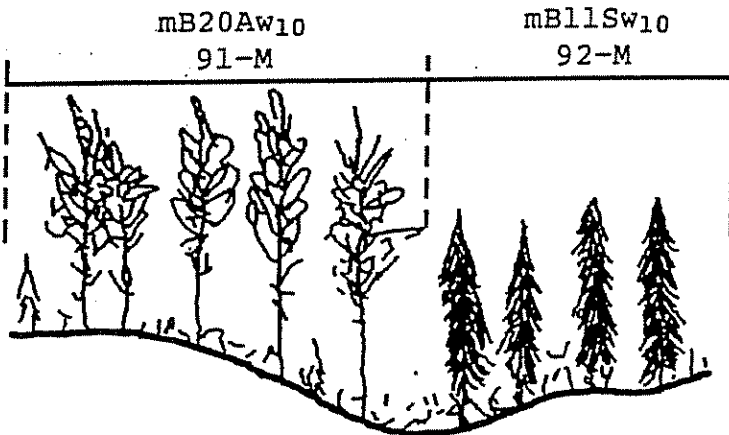
$$AIF-H2$$

$$\frac{w2SO_3-F-CPR-H7}{mHg-M-H3}$$

Example 1

Horizontal View

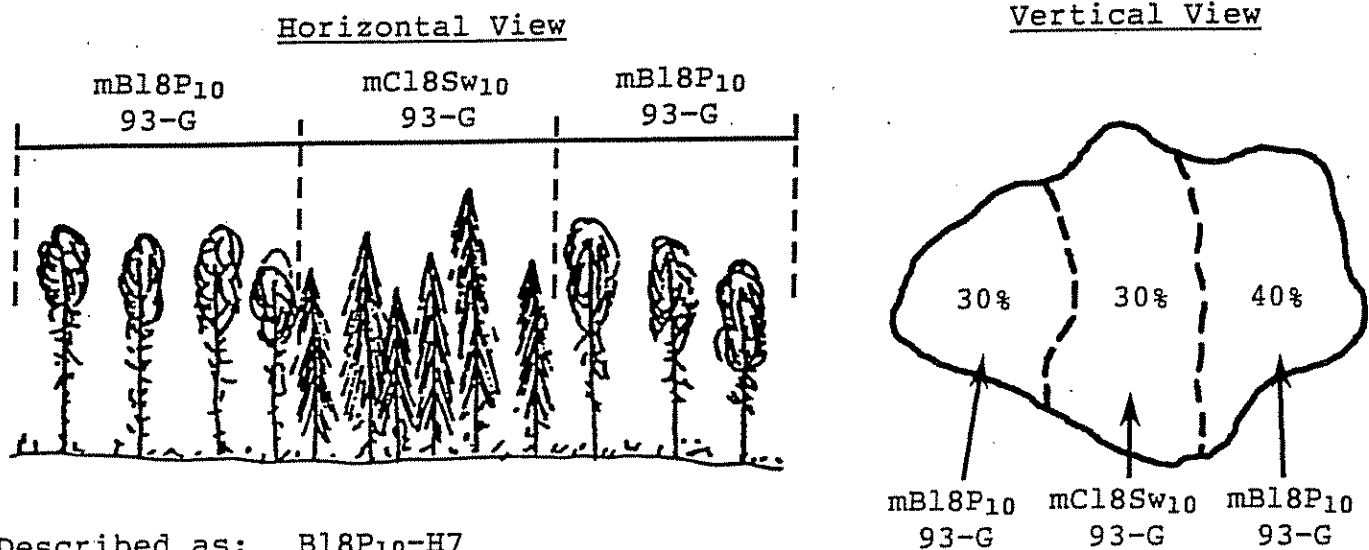
Vertical View



Described as: $\frac{B20Aw_{10}-H5}{91-M}$
 $\frac{B11Sw_{10}-H5}{92-M}$

Figure 3. Horizontal stand structure.

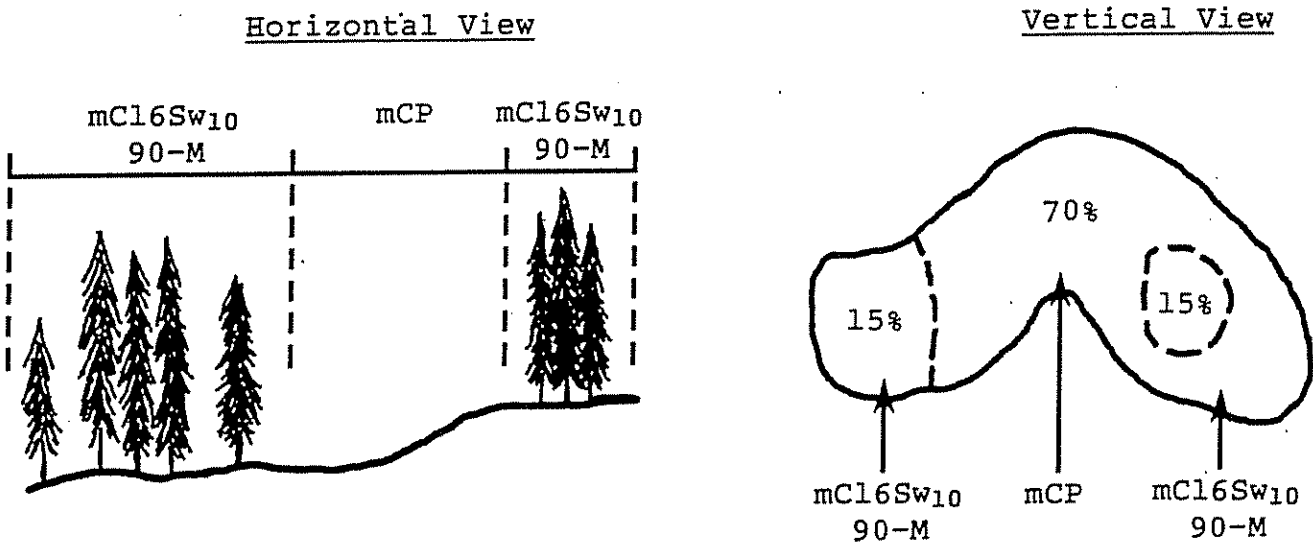
Example 2



Described as: $\frac{B18P_{10}-H7}{93-G}$
 $\frac{C18Sw_{10}-H3}{93-G}$

Figure 4. Horizontal stand structure

Example 3



Described as: $\frac{mC16Sw_{10}-H3}{90-M}$
 $\frac{mCP-H7}{90-M}$

Figure 5. Horizontal stand structure.

2.2.2.7 Existing Stand Data and Confirmation of Attributes

When AVI attributes have been confirmed or existing stand data is available to confirm attributes, codes are used to describe the data source. The reference year for the data sources is also coded if known, e.g. f-1990 (interpreter plot measured in 1990).

Data Source	Interpretation and Data Base Code
Interpreter plot	F
PSP	P
Volume plot	V
Cruise data	C
Supplementary photography	S
Air call	A
Large-scale photography	L
Interpreted TPR	I

The reference year for the above data sources is also coded if known, e.g. f --- 1990 (interpreter plot measured in 1990).

When attributes have been confirmed through "interpreter plots", a black "x" is inked on the air photo and the air photo is pin pricked at the plot location within + 10 m ground distance. A "2000" series number is written on the front and back of the air photo adjacent to the pin hole with black ink.

Interpreter timber plot data is recorded on Cruise Tally Sheet (77) - CSTM 28 (Rev. 4/90). -or equivalent- (Figure 6).

2.2.2.8 Examples of Stand Descriptions

Example 1. Basic - single storey:

```

Crown closure class
| Height
| | Species composition
| | |
| | |
B21SW10 -- % of species
87-M
| |
| TPR class
Origin class
    
```

- moisture regime is inferred to be mesic since it is not coded in this vegetation description.

CRUISE TALLY SHEET (77)

										①	② Transator No.				
										0 4	CR				
③ Management Unit		④ Cruise Order No.		⑤ Twp		Rge		M		⑥ Inv.		⑦ Stand No.		⑧ Sub.	
										⑨ B.A.F.		or ⑩ Area (m ²)		⑪ Plot No.	
Date: Yr. Mo. Day Name:												LS		Sec.	
⑫ Page No.	⑬ Tree No.	Species	D.B.H.	Total Height	Crown Class	Visible Saw Defect %	Cull Suspect Class	Total Age	Slump Diameter	Sample Tree		Special Use Codes			
										Increment Width		1	2	3	
										cm/10 Years					
										⑭ 0-10	⑮ 11-20	⑯	⑰	⑱	
01															
02															
03															
04															
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15															
16															
17															
18															
19															
20															
New Page No. Required if cont'd Tally							Overstorey					Understorey			
Field Type															
Start or Tie Point:															

Figure 6. Cruise tally sheet (77) - CSTM 28 (Rev. 4/90)

(G, M, F or U) is assigned to all non-forest land cover types (see 2.2.2.1). Moisture regime is required.

Interpretation and
Database Code

Shrubs - multiple-stemmed woody plants (i.e., alder, willow, bog birch, shrub cover) predominant (>25%) and tree cover is <6%.

- height descriptors of 1 m to 6 m will only apply to shrub cover 1-6
- closed shrub (crowns of most shrubs interlocking) SC
- open shrub (crowns of most shrubs not touching each other) SO
- shrub cover subscript indicating to the nearest 10%, shrub crown closure within the polygon (e.g., m2SC₉-F denotes 90% closed shrub with an average 2 m canopy height, mesic moisture regime) 1-10

Interpretation and
Database Code

Herbaceous (Grassland) - natural meadow and grassland and/or sedges, graminoids predominant. HG

Herbaceous (Forbs) - natural herbaceous plant cover dominated by forbs (not graminoids). Forbs include aquatic plants (e.g., aHF symbolizes pond weeds, water-lilies, etc.) living in shallow water (aquatic). HF

Bryophyte - mosses and/or bryophytes BR

2.2.4 Anthropogenic Vegetated Land

Anthropogenic vegetation has been influenced by man, usually in areas that have been planted with cultivated species (i.e., crops in fields). Areas cleared (e.g., for pasture) but not broken and seeded to non-native (cultivated) plant species would be

included in the natural, non-forest land category (2.2.3). No TPR is required for any of the following anthropogenic vegetated land. Exception is CPR. Moisture regime is required when the CPR code is used. CPR must be used in conjunction with SO and SC

Agriculture

Interpretation and Database Code

Annual Crops - cultivated farmland, or farmland planted with annual crop species.

CA

Perennial Forage Crops - reclaimed lands, farmland planted with cultivated grasses and/or legumes. These lands are used primarily for grazing livestock and or may have the cultivated species harvested at least once a year. These lands contain < 10% crown closure of woody cover (shrubs). These lands also include pastures that have been irrigated or otherwise treated to improve their productivity.

CP

Rough Pasture - similar to improved pasture with > 10% woody cover. Normally, this pasture has not been irrigated, fertilized or cultivated to improve productivity. An open or closed shrub notation must be added to indicate the height, extent and type of shrub cover. In this instance the annotation will be written in reverse in order to facilitate the standardized coding form used for data input. The TPR is included because of the shrub notation (e.g. w2SC5-F-CPR indicates that 50% (5) of the polygon is covered by 2-m high shrubs having a closed canopy, wet moisture regime and a fair site). Agriculture codes may also be used in horizontal structures in conjunction with other vegetated and non-vegetated lands. CPR must be used in conjunction with SO and SC.

CPR

Industrial

Interpretation and Database Code

Pipelines, transmission lines, airstrips, microwave tower sites that have been seeded to perennial grasses.

CIP

Geophysical activities including well sites that have been seeded to perennial grasses.

CIW

2.2.5 Non-Vegetated Land

Those cover types with <6% plant cover are considered non-vegetated.

2.2.5.1 Anthropogenic Non-Vegetated Land

No moisture regime or TPR is required.

Interpretation and
Database Code

These are created by man. They include:

Settlement Areas

Cities, towns, villages, hamlets ASC

Ribbon development, rural recreation (e.g., rural stores and isolated housing subdivisions, cottages, rural residential, acreage owners, (agriculture is not the primary source of income). ASR

Industrial Development

Permanent right of way; roads, highways, railroads, dam sites, reservoirs. AIH

Peat Extractions AIE

Gravel pits including borrow pits AIG

Farmsteads (related to agriculture) AIF

Surface Mines AIM

Industrial (plant sites), sewage lagoons AII

2.2.6 Naturally Non-Vegetated Land

These are natural cover types that have <6% plant cover. They are divided into cover types that are primarily water and those that are mineral. *No TPR or moisture regime is required.*

Interpretation and
Database Code

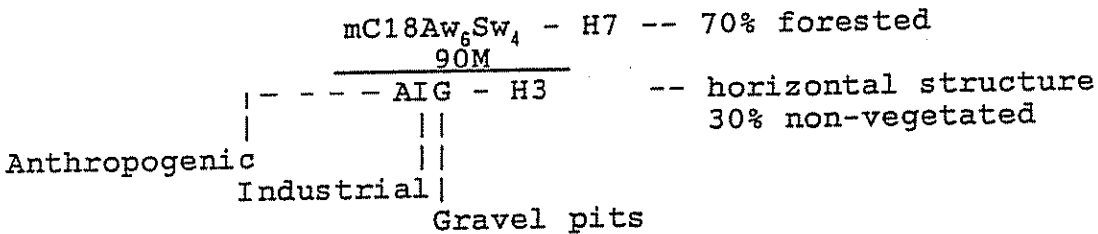
Water

Permanent Ice/Snow	NWI
Seasonally thaws: Lakes, ponds	NWL
River	NWR
Flooded (areas periodically inundated with water). Snag modifier and snag extent are included if snags are present.	NWF

Mineral

Recent Burn including snag modifier and snag density (to date no recovery of vegetation); if present. <i>Moisture regime and TPR are required.</i>	NMB
Cutbank	NMC
Rock Barren	NMR
Sand	NMS

The above non-vegetated lands may also be used in a horizontal structure with vegetated lands. Example:



If non-vegetated lands become vegetated, then even though the dominant feature remains obvious such as well sites or gravel pits, these lands are no longer classified as non-vegetated. None of the non-vegetated symbols may be used since these lands are now vegetated.

2.3 Modifiers to Land Classification

Modifiers are symbols that occur in parenthesis at the end of a cover type code. Two types of modifiers are used to describe additional information: stand condition, treatment. A maximum of two conditions modifiers/treatments or combinations of both may be used. In addition, an extent code is used to describe the extent

of the condition or treatment. Modifiers are used for all lands except non-vegetated lands.

2.3.1 Stand Condition

Stand condition presents additional information about the origin or condition of the cover type. If the cover type developed as a result of timber harvesting (either clear or selective cutting), it is represented by CC and extent. If the year of harvesting is known then it must be shown. For example, a 1951 clearcut on a medium TPR containing tall, dense shrub cover is represented by:

m6SC₇-M(CC5-1951)

Similarly, a wet site burned in 1978 with a "U" timber productivity rating, and a low shrub cover would be shown as:

w1SO₄-U(BU5-1978)

Stand condition modifiers are:

Condition	Interpretation and Database Code
Clearcut/partial cut	CC
Burn/partial burn	BU
Windfall	WF
Clearing (extent not required)	CL
Disease	DI
Insect kill	IK
Unknown kill	UK
Weather (e.g. red belt)	WE
Discoloured/dead tops	DT
Broken tops	BT
* Snags	SN
** Scattered timber	ST

**Snag: A standing tree \geq 6.1 m tall, broken top, with leaves and most of the limbs fallen off. Snag modifiers and snag density are used only when snags are clearly observable on airphotos or were identified on the ground.*

***Scattered timber: This modifier is intended for use in anthropogenic vegetated land attributes. Extent code used is land area affected.*

Three types of extent codes are used based on one of the following:

- a) percent loss of crown closure
- b) percent land areas affected (for use only with scattered timber)
- c) snag density (for use only with snags).

See Section 2.3.4 for details.

2.3.2 Treatment

Treatment modifiers indicate treatments that have been applied to a stand.

Treatment	Interpretation and Database Code
Site improved (e.g. fertilization, drainage)	SI
Seedbed prepared (e.g. scarification, weed control)	SC
Planted and/or seeded (regardless of success)	PL
Thinned	TH
Developed for grazing domestic livestock	GR
Irrigated	IR

2.3.3 Peatland

Peatlands are not interpreted or identified during AVI photo interpretation. Peatlands may be computer identified at a later date based on moisture regime and vegetation cover type.

Peatland Definition: An accumulation of organic material resulting from excess moisture with peat depths generally greater than 40 cm. Dominant peat materials may consist of mosses, bryophytes, sedges, grasses and woody material forming distinct wetland vegetation cover types.

Vegetation cover types that will be identified (in conjunction with the wet moisture regime modifier) as potential peatlands are as follows:

Forested - Black Spruce, Tamarack, Western Larch.

Non-Forested - Mosses and Bryophytes, Grassland (herbaceous), Shrubland (open and closed).

Agriculture - Annual Crops, Perennial Forage Crops,

Pasture - Rough, Pasture and Highland. Includes Cultivated and Recent Clearing.

2.3.4 Extent and Condition, Treatment or Snag Density

Extent	Snag Density (Per 100 ha)	Interpretation & Database Code
Nil	< 5	
Light - 1%-25% loss of crown closure or land area affected	5-99	1
Moderate - 26%-50% loss of crown closure or land area affected	100-299	2
Heavy - 51%-75% loss of crown closure or land area affected	300-499	3
Severe - 76%-94% loss of crown closure or land area affected	500-700	4
Entire - entire crown or land area is affected	> 700	5

Use a two-part symbol incorporating the stand condition/treatment/snag density modifier, severity (i.e., extent) code and year (if known), e.g., WF1(1949).

If two conditions/treatments/snag densities occur in a polygon, they are listed in order of occurrence with the most recent appearing last, e.g. mB24AW₁₀-CC2-PL4(1988). This example indicates that the stand was harvested and then planted. A snag modifier may be used in conjunction with a maximum of two conditions/treatments.

2.4 Interpretation of Linear Clearing

Linear clearings for communication, transmission and exploration routes are delineated during the interpretation process.

The way in which a linear clearing is handled for mapping and area measurement depends upon its width.

Width	Example	Treatment	Classified
< 30 m	Seismic lines, most roads, pipelines	Not delineated	No reduction of crown closure rating
≥ 30 m	Major highways	Delineated edge of clearing forms boundary, splitting stands in two	Treated as independent "cleared land" units (AIP)

2.5 Minimum Polygon Size

The minimum polygon size is determined by the descriptions of adjacent polygons. Polygons are delineated to minimum polygon sizes of (a) 2 ha, (b) 10 ha, or (c) 20 ha according to the following criteria.

A. 2 ha minimum if one of the following occurs:

- unproductive forest land occurs within productive forest land.
- non-forest land
- anthropogenic land
- productive forest land occurs within unproductive forest land, non-forest or anthropogenic lands.
- coniferous or mixedwood type within a deciduous type.
- deciduous or mixedwood types within a coniferous type.

B. If adjacent polygons do not meet any of the above, 10 ha minimum areas can be delineated if one of the following occurs:

- the crown closure differs by a minimum of 2 classes.
- the composition percentage of one species within the cover type differs by a minimum of 20%.
- the origin differs by a minimum of 2 classes.
- the height differs by a minimum of 6 metres.

or if 2 or more of the following occurs:

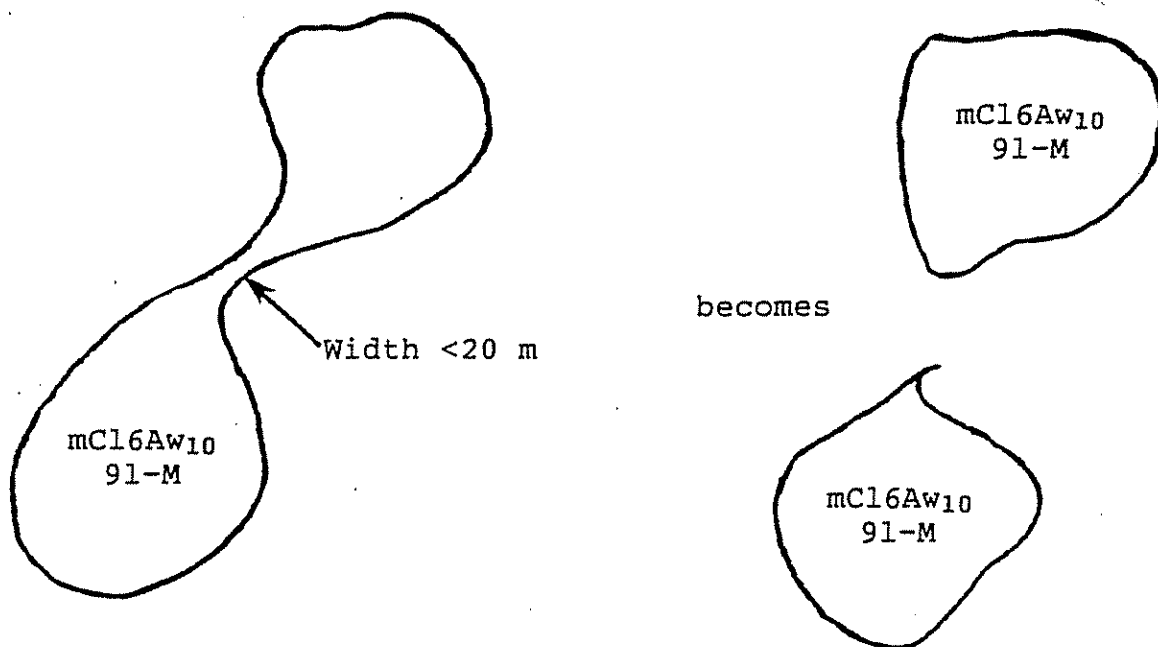
- the crown closure differs by one class.
- the composition percentage of one species within the cover type differs by 10%.
- the origin differs by 1 class.

C. If adjacent polygons do not meet any of the above, 20 ha minimum areas can be delineated if one of the following occurs:

- the crown closure differs by 1 class.
- the composition percentage of a single species within the cover type differs by 10%.
- the origin differs by 10 years.
- the height differs by 3, 4 or 5 m.

D. Numerous other codes and attributes exist in the AVI Standards Manual and these have not been included with criteria for minimum polygon size. Interpreters are asked to delineate polygons by considering the significant and observable differences between these polygons. Otherwise, the above criteria for minimum polygon size applies for forest land.

20 m Constrictions or Narrow Areas in Types



Due to physical limitations in digitizing forest type boundaries, no constrictions or areas <20 m can occur in any type units.

2.6 AVI Digital Attribute Data Base

Table 1 identifies the Alberta Vegetation Inventory coding parameters (November 1, 1991). Table 2 is an example of the Alberta Vegetation Inventory Coding Sheet (November 1, 1991) which is used to create the AVI digital attribute data base files.

NB. AVI Coding sheet credit - W. R. Dempster and Associates Ltd.

Table 1. Alberta Vegetation Inventory coding parameters, November 1, 1991 (Version 2.1)

Parameter	No. Byte	Field Type*	Field Position	Allowable Codes
Meridian	1	N	1	4-6
Range	2	N	2-3	1-30
Township	3	N	4-6	1-126
Polygon Number	4	N	7-10	1-9999
Moisture Regime	1	C	11	d, m, w, a
Crown Closure	1	C	12	A, B, C, D
Height	2	N	13-14	1-99
Species 1 - species	2	C	15-16	Sw, Se, Sb, P, Pl, Pj, Pa, Pf, Fb, Fa, Fd, Lt, La, Lw, A, Aw, Pb, Bw
- percent	2	N	17-18	2-10
Species 2 - species	2	C	19-20	Sw, Se, Sb, P, Pl, Pj, Pa, Pf, Fb, Fa, Fd, Lt, La, Lw, A, Aw, Pb, Bw
- percent	1	N	21	1-5
Species 3 - species	2	C	22-23	Sw, Se, Sb, P, Pl, Pj, Pa, Pf, Fb, Fa, Fd, Lt, La, Lw, A, Aw, Pb, Bw
- percent	1	N	24	1-3
Species 4 - species	2	C	25-26	Sw, Se, Sb, P, Pl, Pj, Pa, Pf, Fb, Fa, Fd, Lt, La, Lw, A, Aw, Pb, Bw
- percent	1	N	27	1-2
Species 5 - species	2	C	28-29	Sw, Se, Sb, P, Pl, Pj, Pa, Pf, Fb, Fa, Fd, Lt, La, Lw, A, Aw, Pb, Bw
- percent	1	N	30	1-2
Stand Structure - type	1	C	31-32	M, C, H
- percent/range	2	N		1-9
Origin	4	N	33-36	1000-9999
Timber Productivity Rating (TPR)	1	C	37	G, M, F, U
Interpreters Initials	2	C	38-39	AA-ZZ
Non-Forest Vegetated - type	2	C	40-41	SC, SO, HG, HF, BR
- shrub closure	2	N	42-43	1-10
Naturally Non-Vegetated	3	C	44-46	NWI, NWL, NWR, NWF, NMB, NMC, NWR, NMS
Anthropogenic Vegetated	3	C	47-49	CA, CP, CPR, CIP, CIW
Anthropogenic Non-Vegetated	3	C	50-52	ASC, ASR, AIH, AIE, AIG, AIF, AIM, AII
Stand Modifier 1 - condition/treatment	2	C	53-54	CC, BU, WF, CL, DI, IK, UK, WE, DT, BT, SN, ST, SI, SC, PL, TH, GR, IR
- extent	1	N	55	1-5
- year	4	N	56-59	1000-9999
Stand Modifier 2 - condition/treatment	2	C	60-61	CC, BU, WF, CL, DI, IK, UK, WE, DT, BT, SN, ST, SI, SC, PL, TH, GR, IR
- extent	1	N	62	1-5
- year	4	N	63-66	1000-9999
Data Source	1	C	67	F, P, V, C, S, A, L, I blank
- data reference year	4	N	68-71	1000-9999

* N = Numeric, C = Character

ALBERTA VEGETATION INVENTORY CODING SHEET

MERCIDIAN	RANGE	TOWNSHIP	POLYGON NUMBER	MOISTURE REGIME	CROWN CLOSURE	HEIGHT	TIMBER LAND COMPOSITION					STAND STRUCTURE	ORIGIN	T.P.R.	INTERCEPTORS	NON-FOREST VEGETATED			ANTHROPOGENIC		STAND MODIFIER 1			STAND MODIFIER 2			EXISTING DATA																																																				
							SPECIES 1	SPECIES 2	SPECIES 3	SPECIES 4	SPECIES 5					NATURALLY NON-VEGETATED	VEGETATED LAND	NON-VEGETATED LAND	CONDITION	TREATMENT	EXTENT	YEAR	CONDITION	TREATMENT	EXTENT	YEAR	SOURCE	YEAR																																																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

NOTE: Numbers are RIGHT justified and characters are LEFT justified

NOVEMBER, 1991 (Version 2.1)

Table 2. Alberta Vegetation Inventory coding sheet (November 1, 1991)

3.0 DATABASE CONSIDERATIONS

Inventory users identified that a comprehensive land database must be available in order to make informed decisions.

The following section summarizes a proposed list of database content requirements.

3.1 Defined Database Requirements

The following items are necessary in a database and are previously defined in the photo interpretation standards.

Field Plots

- ground truthing, volume sampling and permanent sample plots.
- location, number, data contents

Aerial Photography

- flight lines/AS number
- photo centers
- year of photography being interpreted/orthophoto
- scale of photography being interpreted/orthophoto

Interpreter

- name
- date of interpretation

Location

- township
- UTM grid
- polygon number (full UTM-coordinate)

Map Scale

Moisture Regime

Forest Land Classification

Crown Closure

Height

Species

Timber Productivity Rating

Origin

Stand Structure/Understorey

Field Checked

- if a stand has been field checked, it is an indication that additional data about the stand are available.

Non-Forest Land Classification

Anthropogenic Vegetated Land Classification

Non-Vegetated Land Classification

Modifiers to Land Classification

3.2 Undefined Database Requirements

3.2.1 Ecosystem Typing/Stand Assessment

Basic indicators of ecosystem/stand assessment type should be collected during timber cruising. Data to be collected and stored should include:

Depth

- water
- root-restricting layer
- effective rooting
- duff

Soil Texture

- A horizon
- B horizon

Drainage

- (five classes)

Herbaceous and Low Shrub Vegetation

- competition classes
- species

Overstorey

- age structure
- condition

Understorey

- age structure
- condition

- canopy position
- maturity class

Topography

- aspect
- slope
- elevation

Erosion Potential

- light, medium, high

Merchantable Sound Windfall

Local Commercialism

- sawlog
- pole
- post
- pulp
- other

Logging Chance

- inoperable
- poor
- marginal
- fair
- good

Recommendations

- Alternate Clean Cut
- Progressive Clear Cut
- Partial cut
- Retain
- Reject

Biogeoclimatic Type

Definition of the ecosystem type for each polygon based on a ground survey. The classification scheme should be similar to that defined by Corns and Annas.

3.2.2 Volume and Stem Data

Provincial Stand and Stock Tables

Provincial stand and stock tables providing stem and volume data compiled at a strata and Volume Sampling Region (VSR) level should be included. Accuracy will be defined at +20% allowable error at the 90% confidence level for 15+/11 mean gross volume/ha. Strata will be defined by VSR, density, height and first three

species. Appropriate cull and merchantability (e.g., pulp and saw) factors should be available to modify volume information. 2.5 cm classes are desirable. A minimum of three plots should be established in each stand or polygon sampled for volume to ensure an estimate for variability can be derived.

Local Stand and Stock Tables

Local stand and stock tables should be available to provide volume and stem information at a stand level. Accuracy will be defined at +20% allowable error at the 90% confidence level for mean 15+/11 gross volume/hectare. Stand specific cull and merchantability to be available in 2.5 cm classes. A minimum of three plots should be established in each stand or polygon sampled for volume, to ensure an estimate of variability can be derived.

3.2.3 Silvicultural Records

- stocking
- information on silviculture treatment, year cut, year reforested, block number for cutblocks defined in the inventory.
- regeneration > 2 m height
- regeneration > 3 m height
- tree quality for seed.

3.2.4 Base Map Features

Township Grid

- UTM grid - NAD83

Hydrography

- identification of streams by stream width classes.

Access

- all linear clearings must be defined by classification and width (± 20 m accuracy)

Digital Elevation Data

- slope at 5° intervals
- aspect
- topography at 10 m contours
- slope position

Watershed Boundaries

- watersheds to be defined by a common classification - e.g., Phase 3 scheme.

3.2.5 Soils/Geology/Landform

- soil family
- soils data as defined by soil surveys, physical land classification and biophysical survey.
- seepage areas
- erosion hazard/sensitivity
- effective rooting depth

3.2.6 Geo-Administrative Boundaries/Features

Definition of any boundary significant to company or departmental operations, including:

- grazing reserves
- Forest Management Unit
- company working circles/operating unit
- Eastern Slopes Integrated Plans Zones
- Integrated Resource Planning Zones
- Green/White Area boundaries
- forest reserve
- FMA
- counties, MDs
- Wildlife Management Unitss
- Public Lands regions and districts (on map)
- Fish and Wildlife regions and districts (not on map)
- irrigation districts
- traplines (owners) (not mapped)
- park
- recreation area/natural areas
- Permanent Sample Plot
- land status - e.g., private, lease, municipal, federal
- ecological reserves

3.2.7 Fish and Wildlife Information

- habitat regions, subregions, Districts
- mineral licks
- fish-bearing streams
- spawning areas
- key wildlife/critical habitat (not mapped)

3.2.8 Plot Data

3.2.9 Climate Data

- temperature
- precipitation
- frost-free days
- winter climate

3.2.10 Fire Incidence Map

3.2.11 Grazing/Range Inventory Map

3.2.12 CLI, Wildlife and Recreation Capability

3.2.13 Peatland Inventory Maps

3.2.14 Nonrenewable Reserves/Fields

3.3 Inventory Update Cycle

3.3.1 Inventory Cycle

Annually, an average of 1/20th of the land area in an FMA will be totally replaced with new vegetation inventory.

Inventory will be enhanced with ground survey information for all areas to be harvested in the next five years, and for all areas of Fish and Wildlife or Public Lands operations.

3.3.2 Update Cycle

Harvesting - annual update.

Clearing/Access/Geophysical - annual update for high activity areas. Maximum of five years in low activity areas.

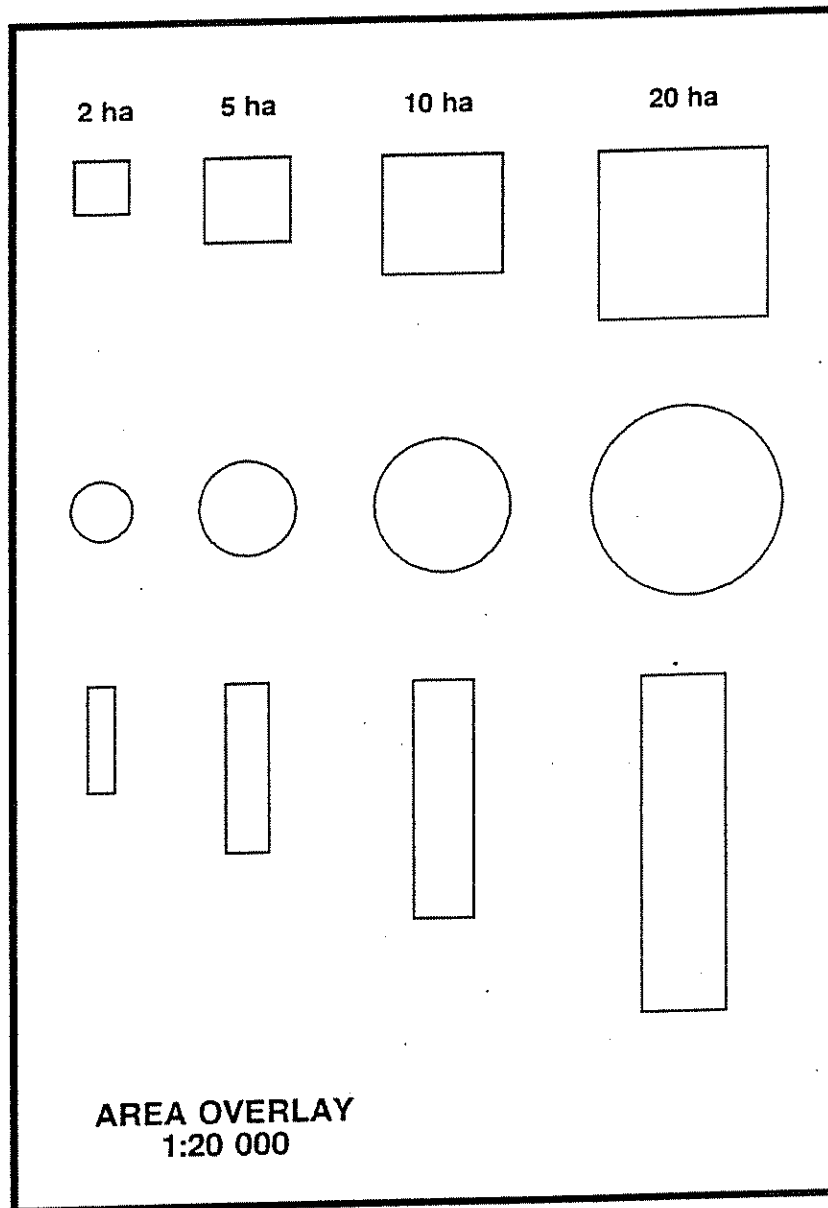
Disturbance (insect, disease, fire, windfall) - annual update.

Geo-Administrative and Land Status - annual update.

Silviculture - annual update for new silvicultural activity and survey results.

APPENDIX 1
EXAMPLES OF POLYGON SIZE

EXAMPLES OF AREAS AT 1:20 000 SCALE



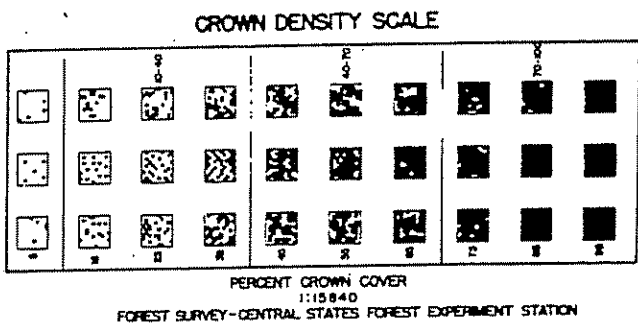
DISTANCES AT 1:20 000 SCALE

1 mm = 20 m
1 cm = 200 m

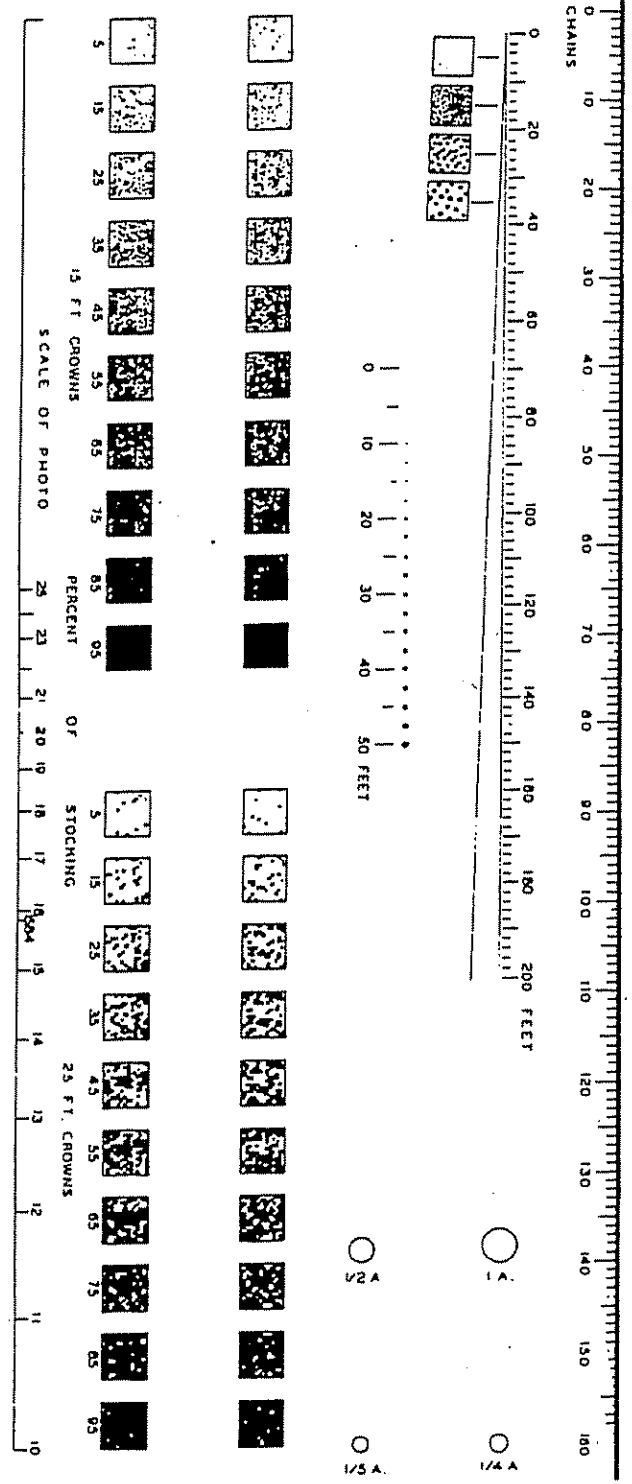
5 x 5 mm x 10 000 m₂ = 1 hectare

APPENDIX 2
CROWN CLOSURE GUIDE

CROWN CLOSURE GUIDE



UNIVERSITY OF MICHIGAN SCHOOL OF NATURAL RESOURCES PHOTO INTERPRETER'S SCALE



APPENDIX 3
TIMBER PRODUCTIVITY RATING TABLES

FORMULAS FOR CALCULATING TPR FOR THE FIVE (5) MAIN SPECIES GROUPS

1. Aw, Bw, Pb, A

$$\begin{aligned}
 SI50 = & 1.3 + 17.0100096 + 0.878406 * (THEIGHT-1.3) \\
 & + 1.836354 * LOG(BR_HEI_AGE) \\
 & - 1.401817 * (LOG(BR_HEI_AGE))**2 \\
 & + 0.437430 * LOG (THEIGHT-1.3)/BR_HEI_AGE
 \end{aligned}$$

TPR	SI AGE	RANGE
U	50	5.00-10.05
F	50	10.05-14.05
M	50	14.05-18.05
G	50	18.05-30.00

2. Sw, Fd, Fb, Fa

$$\begin{aligned}
 SI50 = & 1.3 + 10.398053 + 0.324415 * (THEIGHT-1.3) \\
 & + 0.00599608 * LOG (BR_HEI_AGE) * BR_HEI_AGE \\
 & - 0.838036 * (LOG(BR_HEI_AGE))**2 \\
 & + 27.487397 * (THEIGHT-1.3)/BR_HEI_AGE \\
 & + 1.191405 * LOG(THEIGHT-1.3)
 \end{aligned}$$

TPR	SI AGE	RANGE
U	50	3.00- 6.05
F	50	6.05-10.55
M	50	10.55-15.55
G	50	15.55-25.00

3. Pine

$$\begin{aligned}
 SI50 = & 1.3 + 10.940796 + 1.675298 * (THEIGHT-1.3) \\
 & - 0.932222 * (LOG(BR_HEI_AGE))**2 \\
 & + 0.005439671 * LOG (BR_HEI_AGE) * BR_HEI_AGE \\
 & + 8.228059 * (THEIGHT-1.3) / BR_HEI_AGE \\
 & - 0.256865 * (THEIGHT-1.3) * LOG(THEIGHT-1.3)
 \end{aligned}$$

TPR	SI AGE	RANGE
U	50	3.00- 7.05
F	50	7.05-12.05
M	50	12.05-16.05
G	50	16.05-25.00

4. Sb

$$\begin{aligned}
 SI50 = & 1.3 + 4.903774 + 0.811817 * (THEIGHT-1.3) \\
 & - 0.363756 * (LOG(BR_HEI_AGE))**2 \\
 & + 24.030758 * (THEIGHT-1.3)/BR_HEI_AGE \\
 & - 0.102076 * (THEIGHT-1.3) * LOG(THEIGHT-1.3)
 \end{aligned}$$

TPR	SI AGE	RANGE
U	50	1.00- 6.05
F	50	6.05- 7.05
M	50	7.05-10.05
G	50	10.05-20.00

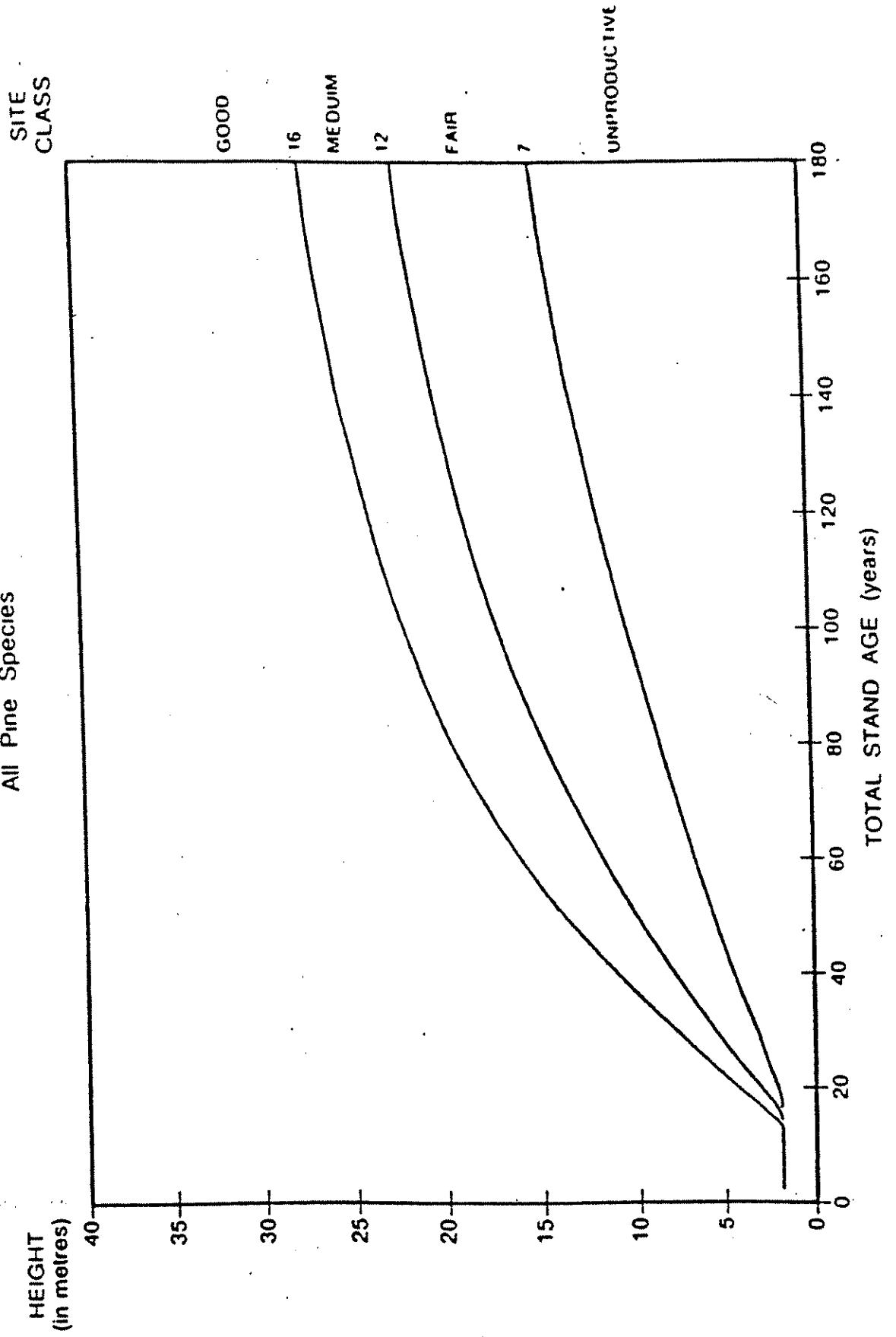
5. Lt

$$\begin{aligned}
 SI50 = & 1.3 + 4.903774 + 0.811817 * (THEIGHT-1.3) \\
 & - 0.363756 * (LOG(BR_HEI_AGE))**2 \\
 & + 24.030758 * (THEIGHT-1.3)/BR_HEI_AGE \\
 & - 0.102076 * (THEIGHT-1.3) * LOG(THEIGHT-1.3)
 \end{aligned}$$

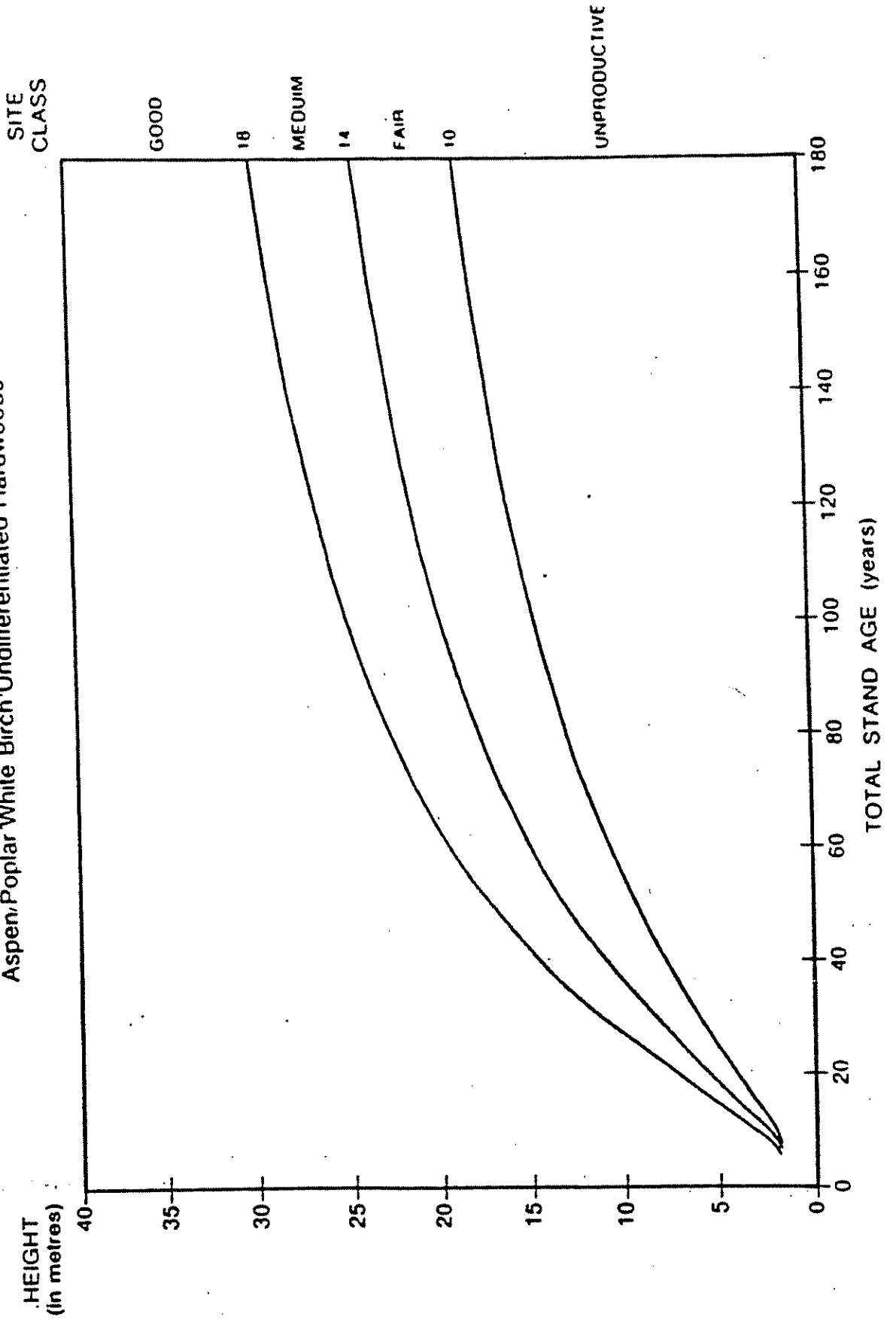
TPR	SI AGE	RANGE
U	50	1.00- 6.05
F	50	6.05- 7.05
M	50	7.05-10.05
G	50	10.05-20.00

COLLECTIVE VEGETATION INVENTORY - SITE INDEX CURVES

All Pine Species

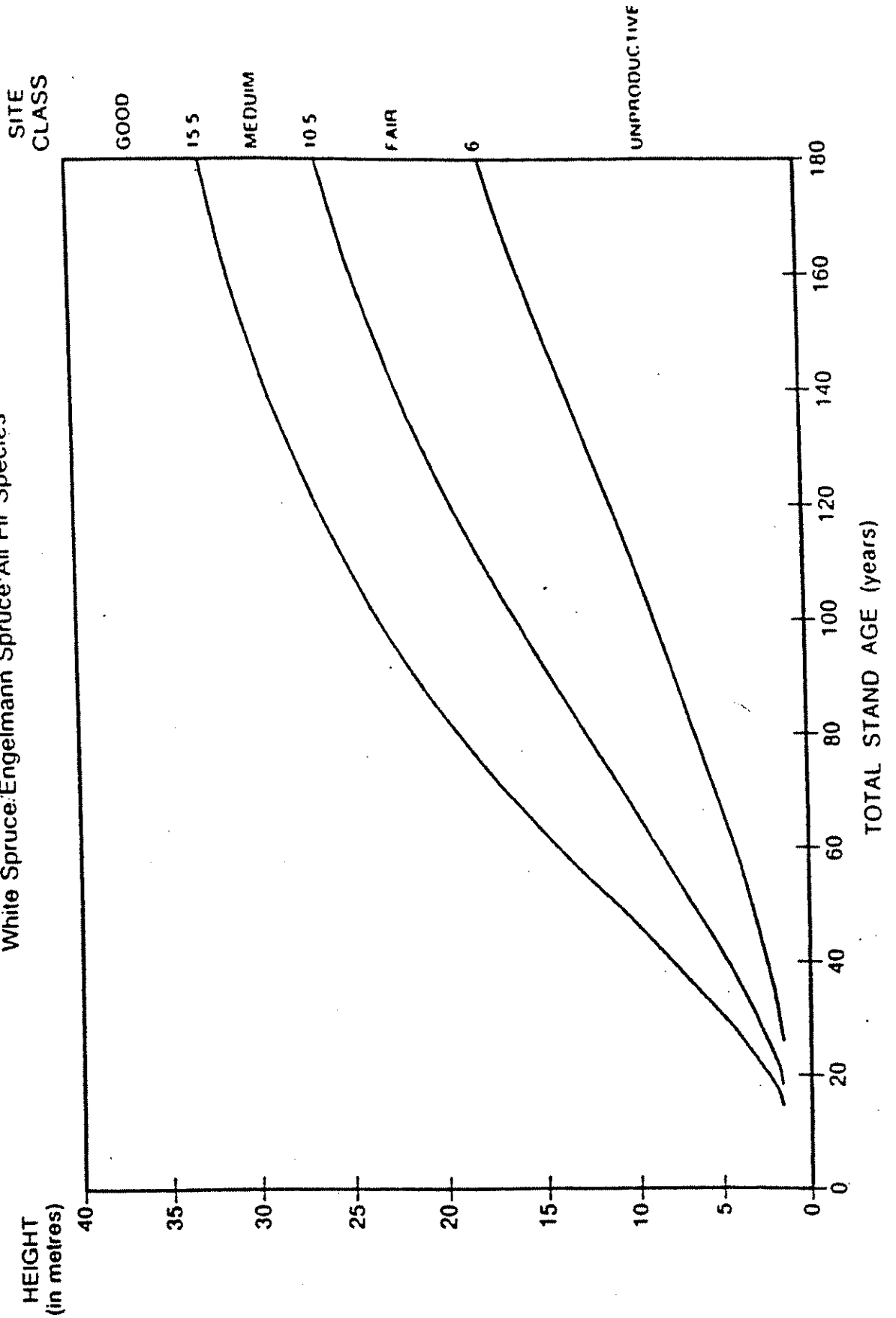


COLLECTIVE VEGETATION INVENTORY - SITE INDEX CURVES
 Aspen/Poplar White Birch Undifferentiated Hardwoods

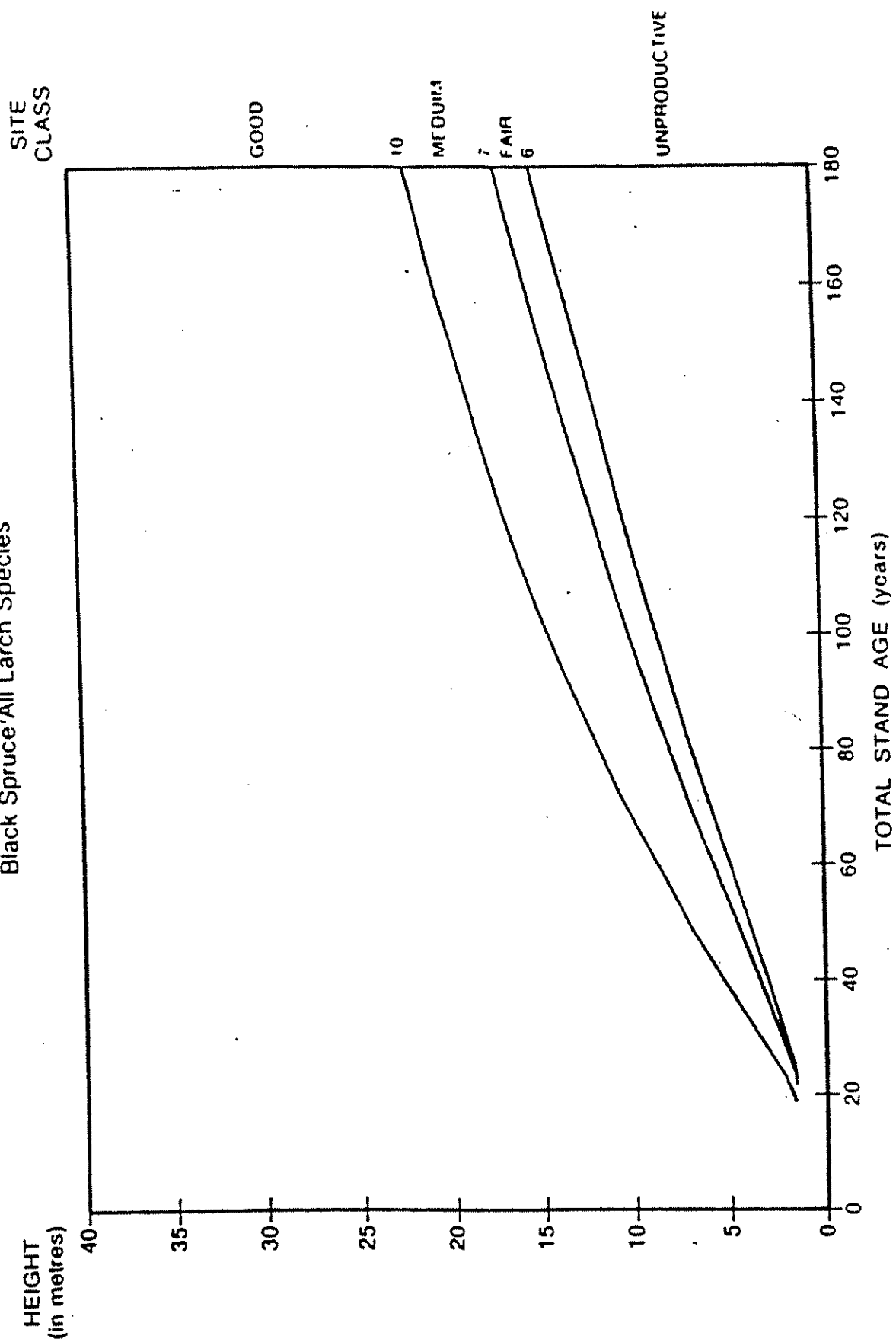


COLLECTIVE VEGETATION INVENTORY - SITE INDEX CURVES

White Spruce:Engelmann Spruce:All Fir Species



COLLECTIVE VEGETATION INVENTORY - SITE INDEX CURVES
 Black Spruce/All Larch Species



APPENDIX 4

ECOLOGICAL MOISTURE REGIME

ECOLOGICAL MOISTURE REGIME
(Adapted from Klinka, 1977 and Utzig et al. 1978)

Ecological moisture regime (hygrotype), relative to the specific macroclimatic conditions representing a biogeoclimatic subzone or any other biogeoclimatic unit, signifies the available moisture supply to plant growth. At present, there has been little quantitative investigation of the classes described here. Assuming that, within a given subzone, climatic variables such as temperature and precipitation are essentially constant (or vary within narrow ranges), the subzone variation of available moisture results from the redistribution of precipitation by edaphic factors. Sites that have a specific amount of available moisture that reflects the given climate, and have average conditions of slope, moisture translocation and texture, have a mesic moisture regime; those with less than normal available moisture grade to xeric, and those with more than normal available moisture grade to hydric (see Table 4.1).

The ecological moisture regime is a relative ranking of sites based on their available moisture supply (available moisture is that held between 1/3 bar and 15 bars metric potential). The moisture regime is assessed regardless of osmotic potential (i.e., salt content is not considered). Because available moisture is a dynamic property that varies throughout the year, the intent of the assessment is to evaluate available moisture on the basis of the growing season as a whole, not at any particular time.

The ecological moisture regime integrates many interrelated environmental and biotic parameters that, when combined, determine the actual amount of available moisture. The field assessment is ideally completed by evaluating a combination of environmental factors, soil properties and indicator plants. However, the assessment can be made on the basis of plant indicators or environmental factors and soil properties alone. A schematic illustration of the influence of these factors is given in Figure 4.1.

Ecological moisture regime is correlated with the following factors: micro-variations in topoclimate, slope positions (macro- and meso-relief), slope gradient, soil drainage, depth of surface humus layers, soil texture (including the content of coarse fragments), soil depth and the presence of an impermeable layer. Factors related to internal soil properties can be evaluated in a soil pit, on road cuts or in disturbed spots. In general, the most influential factor is the position on the slope. On ridges and upper slopes, precipitation is the main source of water since moisture passes quickly downslope and little, if any, moisture is retained. Middle slopes receive, in addition to precipitation, some seepage from up-slope which is usually discontinued during the summer. The lower slopes, flats and depressions are usually

Table 3. Ecological moisture regime class

CVI MOISTURE REGIME CODES	MOISTURE REGIME	DEFINING CHARACTERISTICS		FIELD CHARACTERISTICS						SLOPE GRADIENT
		DESCRIPTION	PRIMARY WATER SOURCE	SOIL PROPERTIES						
				SLOPE POSITION	TEXTURE	DRAINAGE	DEPTH TO PERMEABLE LAYER	SURFACE HUMUS DEPTH	AVAILABLE WATER STOR. CAP.	
d u m w a	VERY XERIC	Water removed extremely rapidly in relation to supply; Soil is moist for a negligible time after ppt	Precipitation	ridge crests shedding	very coarse (gravelly-s) abundant coarse fragments	very rapid	very shallow (< 0.5 m)	very shallow	extremely low	very steep (especially on south aspects)
	XERIC	Water removed very rapidly in relation to supply; Soil is moist for brief periods following ppt	Precipitation			rapid				
	SUBXERIC	Water removed rapidly in relation to supply; Soil is moist for short periods following ppt	Precipitation	upper crests shedding	coarse to mod. coarse (LS-SL) mod. coarse fragments	rapid to well	shallow (< 1 m)	shallow	very low	steep
	SUBMESIC	Water removed readily in relation to supply; water available for moderately short periods following ppt	Precipitation						low	
	MESIC	Water removed somewhat slowly in relation to supply; soil may remain moist for a significant, but sometimes short period of the year. Available soil moisture reflects climatic inputs.	Precipitation in moderately to fine-textured soils & limited seepage in coarse-textured soils	mid-slope normal rolling to flat	moderate to fine (L-SIL) few coarse fragments	well to moderately well	moderately deep (1-2 m)	moderately deep	moderate	moderate
	SUBHYGRIC	Water removed slowly enough to keep the soil wet for a significant part of the growing season; some temporary seepage and possibly mottling below 20 cm	Precipitation and seepage			moderately well to imperfect	deep (> 2 m)	deep	high	
	HYGRIC	Water removed slowly enough to keep the soil wet for most of the growing season; permanent seepage and mottling present; possibly weak gleying	Seepage	lower slopes receiving	variable depending on seepage	imperfect to poor	variable depending on seepage		variable depending on seepage	slight
	SUBHYDRIC	Water removed slowly enough to keep the water table at or near the surface for most of the year; gleying mineral or organic soils; permanent seepage less than 30 cm below the surface	Seepage			poor to very poor		very deep		
HYDRIC	Water removed so slowly that the water table is at or above the soil surface all year; gleying mineral or organic soils	permanent water table	depressions receiving	variable depending on seepage	very poor		variable depending on seepage	variable depending on seepage	flat	

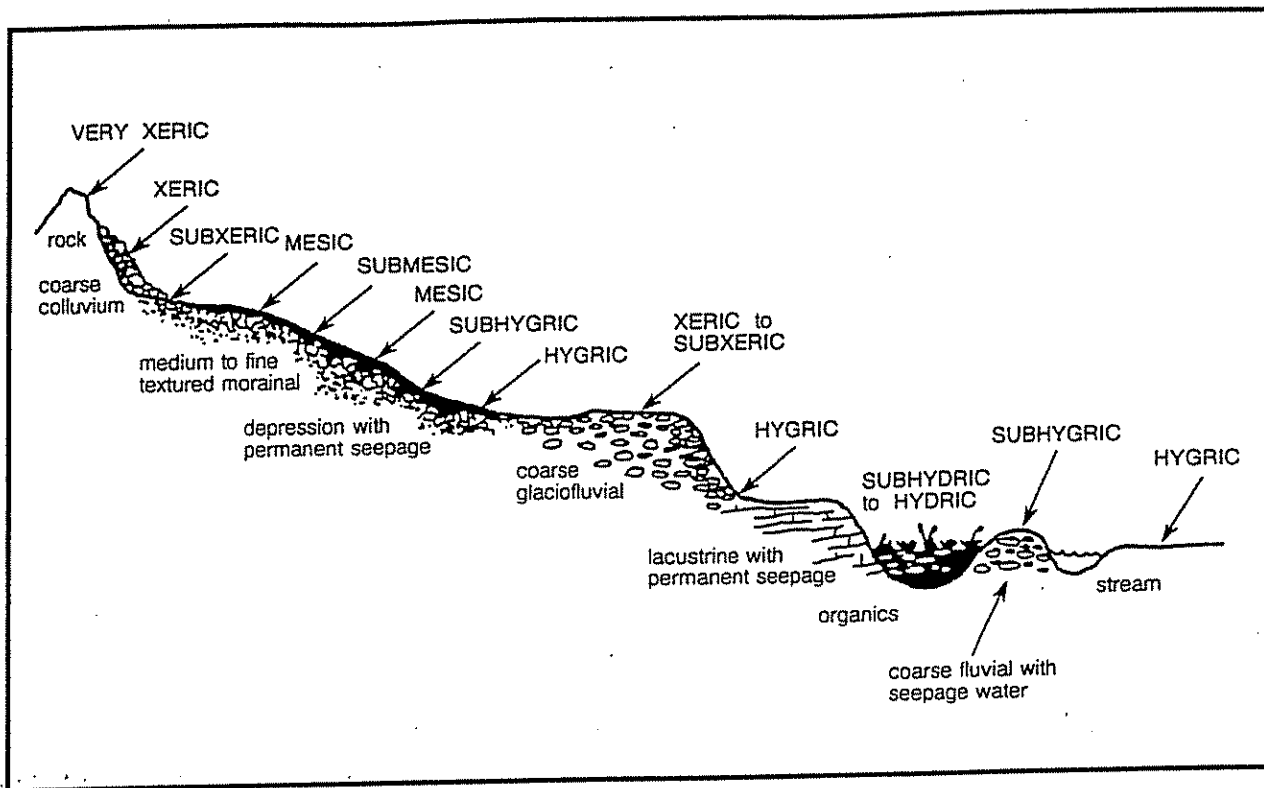


Figure 9. Ecological moisture regime in relation to landscape position and geologic material.

enriched by a temporary or permanent seepage waterflow. The other factors can be considered as compensating this general pattern, i.e., affecting to a varying degree the ultimate ecological moisture regime.

The amount of available moisture often increases with decreasing slope gradient, decreasing soil particle size (i.e., from coarse to fine-textured soils), decreasing content of coarse fragments, increasing soil depth, and increasing thickness of humus layers (in particular with the thickness of colloidal and humified H-layer). The presence of an impermeable layer (e.g. bedrock, compacted till, cemented layer) may inhibit soil water storage, or create conditions for temporary or permanent seepage if subsurface water flow seepage is present. This can also result in an increase of available moisture. The ecological moisture regime classes and potentially identifying characteristics are given in Table 4.1.

The use of plant indicators for assessing ecological moisture regimes requires an existing vegetation classification scheme for the subzone under consideration or a reconnaissance of the areas sufficient to establish relationships between vegetation indicators and the range of edaphic conditions. When assessing sites near subzone boundaries, care must be taken to differentiate between seepage inputs and increases in precipitation or decreases in evapotranspiration demands. For example, plants normally found on

mesic sites in one subzone can occur on subhygric sites in an adjacent subzone with lower precipitation or higher temperatures. Care must also be taken to assess the plant community as a whole. Some species may have a limited rooting depth and may not reflect the presence of deeper seepage waters, while others may reflect changes in nutrient availability rather than available moisture. Even when extensive vegetation information is available, it is always best to consider the environmental factors as well.