Alberta Biodiversity
Monitoring Institute

www.abmi.ca

# Alberta Backfilled Wall-to-Wall Vegetation Layer (Version 4) Metadata

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This document was created by Daiyuan Pan, Jim Schieck, and Shawn Morrison.

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# 1 SUMMARY

The Alberta Biodiversity Monitoring Institute (ABMI) tracks changes in biodiversity across the province of Alberta. One of the goals of the Institute is to provide credible and understandable information on the amount and location of multiple vegetation types to support natural resources management.

This document provides metadata related to the Backfilled Wall-to-Wall Vegetation Layer created by ABMI. This GIS polygon layer includes information on six main landscape characteristics:

1. Vegetation Types,
2. Percentage of Pine,
3. Wetland Types and Moisture Regime,
4. Year of Origin (age), and
5. Soil Types.

Using multiple sources of data (See Section 3), the human footprint on the landscape was removed and the vegetation that was predicted to be present in the absence of human footprint was used to create this backfilled vegetation layer. A second product was created in which the 2010 human footprint layer was stamped onto the backfilled layer, while the underlying backfilled vegetation information was retained (Section 8).

# 2 BACKGROUND ON THE ALBERTA BIODIVERSITY MONITORING INSTITUTE

The ABMI was initiated in 1997 through a broad partnership of industry, government and academia. ABMI is tasked with tracking status and change to biodiversity at local, regional and provincial scales, and providing relevant and objective information to policy makers, scientists and the general public.

The Institute collects information on thousands of terrestrial and aquatic species (mammals, birds, fish, mites, aquatic invertebrates, vascular plants, lichens, and moss), habitat structures, and human footprints at 1656 sites spaced systematically on a 20-kilometre grid across the entire province. The ABMI design strives to sample each of the 1656 sites every 5 years using a set of scientifically reviewed protocols. In addition, human footprint data are compiled across the province and summarized on an ongoing basis. This standardized data collection is designed to reduce duplication and increase cost efficiency for provincial and regional monitoring commitments, and to provide managers with better understanding of cumulative impacts on the environment from multiple industries and human activities.

# 3 BASE LAYERS

## 3.1 Vegetation Layers

The source layers of vegetation were: Extended Alberta Vegetation Inventory (AVIE), AVI Phase I, Grassland Vegetation Inventory (GVI), Primary Land and Vegetation Inventory (PLVI), Central Parkland Vegetation Inventory (CPVI), Wetland information (see Section 3.2), Alberta Ground Cover Characterization (AGCC), fire history (See Section 3.3), Government of Alberta

Base Layers for hydropolys, and the Alberta Wall-to-Wall Land Cover Polygon vector layer created by the ABMI Remote Sensing Group that described the land cover conditions in Alberta as of 2000[1]. The vegetation information in the national parks was derived from the Ecological Land Classifications layers provided by Parks Canada Agency[2]. Detailed information of each layers are presented in the Section 5.

### 3.2 Wetland Layers

The source layers for wetlands were: Government of Alberta Base Layers for hydropolys and streamlines, Alberta Canadian Wetland Classification System (CWCS) Merged Wetland Inventory, AVI, GVI, CPVI, and the Digital Elevation Model Derived (DEM) Riparian Layer.

### 3.3 Date of Origin (Stand Age) Layers

The source layers for stand age were: AVIE, PLVI, Provincial Historical Wildfire Data Layer, and the 2010 Human Footprint Layer.

### 3.4 Soil Type (Ecosite) Layers

The source layers for Soil Type were: GVI_sitetypes_layers (see Section 6.5) and Agriculture Region of Alberta Soil inventory Database (AGRASID).

### 3.5 2010 Human Footprint Layer

The ABMI has created a GIS polygon layer that contains all human footprints in Alberta up to December 31, 2010. Human footprint refers to the areas of Alberta that have lost their natural vegetation cover (permanently or temporarily) due to human activities (e.g., cities, roads, agricultural land, industrial areas, forestry, seismic lines, or surface mining). This layer was a) used during the backfilling processes described in Section 5, and b) was "stamped" onto the backfilled layer such that human footprint codes and cutblock years were added to the attribute table (FEATURE_TY, CutYear; see Section 8) where appropriate.

## 4 CREATION OF BACKFILLED LAYER

To create the backfilled layer, the GIS data from various source layers was modified to:

1) Replace (or 'backfill') the vegetation classified as "shrubland" and "grassland" in cutblocks with the expected pre-disturbance vegetation type (i.e., the forest type expected to be present prior to harvest).
2) Replace linear features (e.g., roads, rail line, pipelines, transmission lines, seismic lines, etc.) with the vegetation type that was adjacent to them.
3) Replace human developed polygons (e.g., cities, mines, industrial sites, agriculture, etc.) with the vegetation type that was expected to be present prior to disturbance.
4) Improve the overall quality of water polygons[3].
5) Add supplementary information to the backfilled layer's attribute table, including:
    i. Wetland Types (WET) and moisture regime (MOIST_REG),

[1] The base layer filename is ABMIw2wLCV2000 (Version 2.1) and may be download from http://abmi.ca.

[2] Source: Parks Canada Agency. Unpublished Data. Reproduced with the permission of Parks Canada Agency. This product was produced by or for the Alberta Biodiversity Monitoring Institute based on data provided by Parks Canada Agency.

[3] The Alberta base features layer contained higher resolution data on water polygon features.

ii. Percentage of pine (PCT_P),
iii. Polygon year of origin and origin types (ORIGIN_YEAR, ORIGIN_TYPE), and
iv. Soil type for Grassland and Parkland Natural Regions and Dry Mixedwood Natural Subregion (SOIL_TYPE)

The backfilled layer containing the supplemental information is referred to as the '*Alberta Backfilled Wall-to-Wall Vegetation Layer (Version 4)*'. The following sections describe in detail the various procedures and sources of information used in the creation of this layer.

# 5 REMOVAL OF HUMAN FOOTPRINT ('BACKFILLING')

## 5.1 Extended Alberta Vegetation Inventory (AVIE) layer

### 5.1.1 Natural vegetation identification and classification for AVIE layer

The Extended AVI layer[4] (AVIE, provided by AESRD[5] in January, 2014) was used, and the following three GIS operations were applied to exclude the human-disturbed polygons:

1. Anthropogenic vegetated polygons were excluded by selecting polygons where 'ANTH_VEG" was blank. This rule had the effect of excluding polygons described as industrial ('CIP' and 'CIW') or agricultural ('CA', 'CP', and 'CPR').
2. Anthropogenic non-vegetated polygons were excluded by selecting polygons where "ANTH_NON was blank. This rule had the effect of excluding polygons described as settlement areas ('ASC' and 'ASR') or industrial development ('AIE', 'AIF', 'AIG', 'AIH', 'AII', and 'AIM').
3. Human disturbed forest polygons were excluded by selecting polygons where MOD1 or MOD2 was not equal to clearcut ('CC'), clearings ('CL'), site improved ('SI'), scarification ('SC'), planted or seeded ('PL'), and thinned ('TH').

[4] Description available at: http://esrd.alberta.ca/lands-forests/documents/AVI-ABVegetation3-InventoryStan-Mar05.pdf
[5] Environment and Sustainable Resource Development, Government of Alberta; URL: esrd.alberta.ca

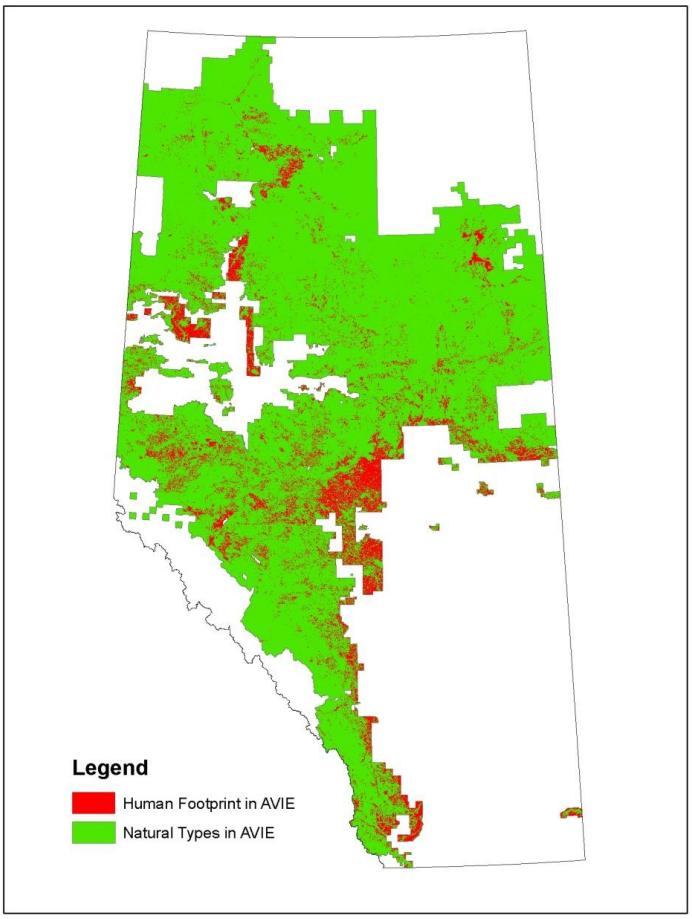


***Figure 1 Extent of the Extended Alberta Vegetation Inventory layer showing natural vegetation types and human footprint for backfilling.***

The vegetation types included in the backfilled layer were derived from the AVIE layer according to the rule-set in Table 1. A python script was developed and is available upon request.

***Table 1: Definition of vegetation types derived from the AVIE.***

| Vegetation Type | Description |
|---|---|
| Pine | Stands where the combined pine (P, Pl, Pa, Pj, Pf) are the leading species in stand, and deciduous species comprise ≤ 20% |
| Black spruce | Stands where black spruce is the leading species in stand, and deciduous species comprise ≤ 20% |
| White spruce | Stands where the combined White Spruce (Sw) and Engelmann spruce (Se) are the leading species in stand, and deciduous species comprise ≤ 20% |
| Fir | Stands where the combined Fir (Fa, Fb, Fd) are leading species in stand, and deciduous species comprise ≤ 20% |
| Larch | Stands where the combined Larch (Lt, La, Lw) are leading species in stand, and deciduous species comprise ≤ 20% |

| | |
|---|---|
| Deciduous | Stand where the combined deciduous species ≥80% |
| Mixedwood | Stands where the combined deciduous species >20%, and combined conifer species > 20% |
| Shrubland | Non-Forested Land (NFL) Classifier = Open Shrub (SO) or Closed Shrub (SC) |
| Grassland | Non-F (NFL) Classifier = Herbaceous Grassland (HG), Herbaceous Forbs (HF), or Bryophytes /Lichens (BR) |

### 5.1.2 Origin Year and Origin Type from AVIE

The origin year of each polygon was defined from the fields ORIGIN, MOD1_YR, MOD2_YR, UMOD1_YR, or UMOD2_YR. This origin year was used for backfilling the AVIE layer. It was also used in the "ORIGIN_TYPE" and "ORIGIN_YEAR" fields, where the provincial fire layer was incorporated (See Section 6.4). In single layered stand, the ORIGIN field was replaced by MOD1_YR or MOD2_YR if the extent (field MOD1_EXT or MOD2_EXT) indicated the loss of crown closure was ≥ 76% (i.e., values of 4 or 5), and the type (field MOD1 or MOD2) indicated a burn ('BU'), windfall ('WF') or insect kill ('IK'). If both MOD1 and MOD2 met the criteria, the most recent year was used for the ORIGIN_YEAR. For the horizontal stand and multilayer stand where the understory was the dominant layer, UMOD1_YR or UMOD2_YR were used with the same rule-set as above.

### 5.1.3 Backfilling AVIE layer

The human-disturbed polygons (i.e., human footprint, shown in red in Figure 1) were divided into four groups: linear, cutblock, peat, and others, with each group backfilled according to a group-specific set of procedures and rule sets (Table 2).

***Table 2: Backfilling rules for four human footprint types from the AVIE.***

| **Human Footprint Type** | **Backfilling Rules** |
|---|---|
| Cutblock | Only old upland forest types, i.e. Pine, White spruce, Fir, Deciduous, Mixedwood with origin year less than 1930, were assigned. |
| Peat | Only lowland vegetation types, i.e. Black Spruce, Larch, and Shrubland, were assigned. Moisture was assumed to be wet. |
| Linear Human Footprint | Any Vegetation Types could be assigned. |
| Others | Any Vegetation Types could be assigned. |

#### 5.1.3.1 Linear Human Footprint

Linear polygons were identified by selecting: 1) Permanent rights of way; roads, highways, railroads, dam sites, reservoirs ("ANTH_NON" or "UANTH_NON" = 'AIH'), or 2) Pipelines, transmission lines, airstrips, microwave tower sites that have been seeded to perennial grasses ("ANTH_VEG" or "UANTH_VEG"= 'CIP').

### 5.1.3.2 Cutblocks

Cutblock polygons were derived by clipping the original AVIE layer (both Red and Green shown in Figure 1) with the cutblock polygons in the 2010 human footprint layer. Using the cutlbock polygons in the 2010 human footprint layer as the template ensures old forest types underneath all the cutblocks in the final layer.

### 5.1.3.3 Peat

Peat polygons were selected where "ANTH_NON" = 'AIE'.

### 5.1.3.4 Backfilling Process

A "multipart to Singlepart" GIS operation was run first to make sure each polygon had a single unique corresponding record in the attribute table. Another natural vegetation layer derived from Phase 1 Alberta Vegetation Inventory layer (also known as the Broad Inventory layer, originally produced as a hardcopy map in 1957) was also created. The derived natural vegetation layer from Phase 1 had three vegetation types (i.e., Coniferous, Deciduous, and Mixedwood; see Figure 2 and Table 3).

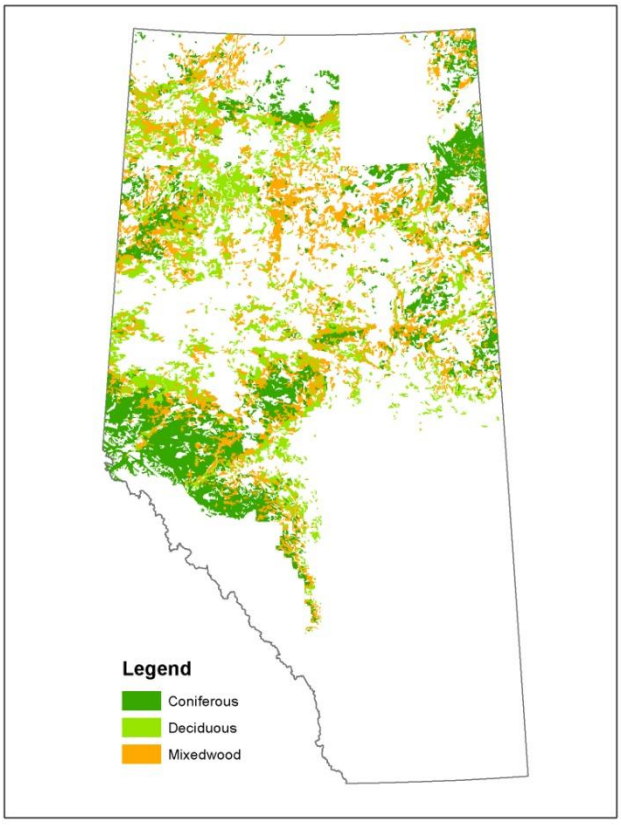


***Figure 2 Natural vegetation types (i.e., coniferous, deciduous, and mixedwood) derived from the AVI Phase I layer. The definitions for each type are given in Table 3.***

***Table 3: Phase I layer classes and merging rules for the vegetation types.***

| Phase 1 Class | Description | Vegetation Types |
|---|---|---|
| 10 | Agriculture and other improved lands | |
| 14 | Barren above timberline | |
| 7 | Burns - 1941 to 1957 inclusive | |
| 2 | Coniferous stands over 60’ height | Coniferious |
| 1 | Coniferous stands up to 60' height | Coniferious |
| 6 | Deciduous stands over 60' height | Deciduous |
| 5 | Deciduous stands up to 60' height | Deciduous |
| 15 | Indian Reserves | |
| 16 | Lakes and Rivers | |
| 4 | Mixedwood stands over 60' height | Mixedwood |
| 3 | Mixedwood stands up to 60' height | Mixedwood |
| 11 | Muskeg and Marsh | |
| 17 | National Park | |
| 9 | Old burn - productive and non-productive | |
| 8 | Old burn and brushland | |
| 12 | Rock barren | |

### 5.1.3.5 Backfilling cutblock polygons in AVIE:

The cutblocks were filled with the information from the natural vegetation layers derived from AVIE and from Phase 1 based on the flow chart in Figure 3. Only old upland forest types (i.e., Pine, White spruce, Fir, Deciduous, Mixedwood with origin year prior to 1930) were backfilled to the cutblocks. Age and moisture info was also backfilled except those polygons backfilled with Phase I. Large polygons (> 500 ha) were first cut into smaller polygons with the ArcGIS dice tool before backfilling.

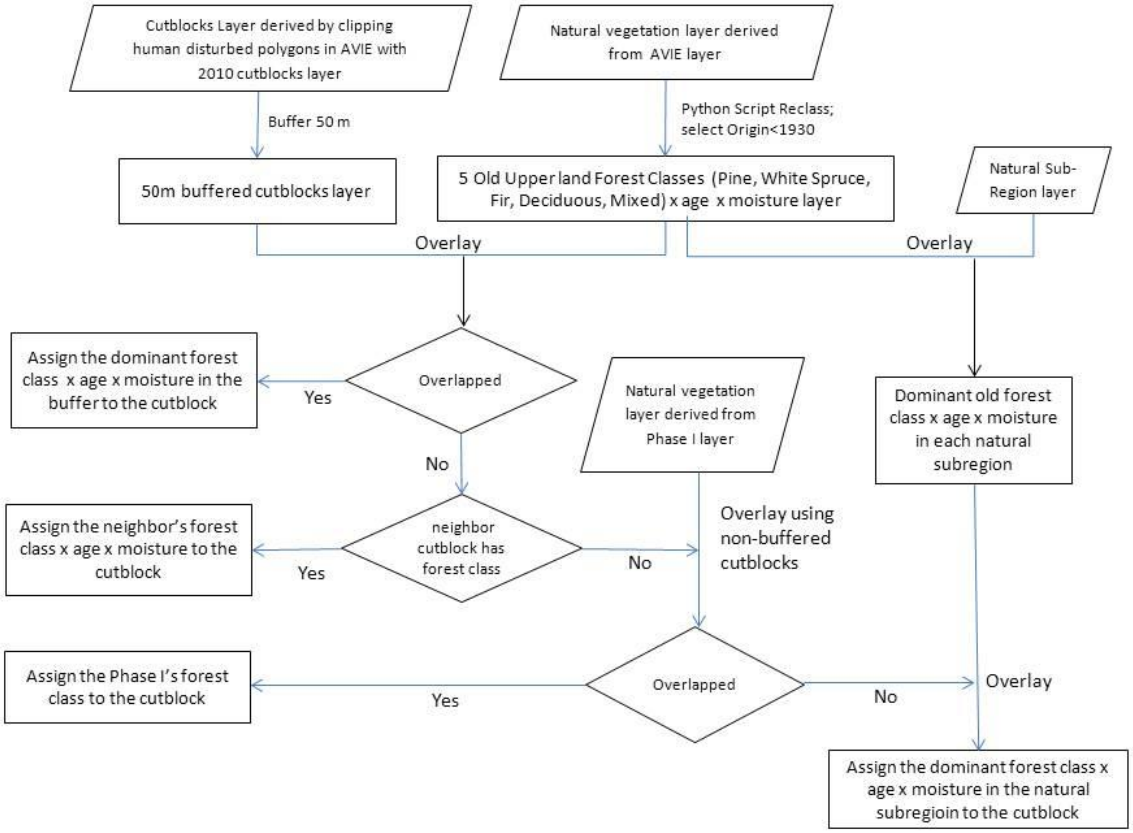


***Figure 3: Flow chart illustrating the rule set used in backfilling polygons identified as forest harvest operations with pre-harvest vegetation conditions in AVIE and Phase I.***

The dominant upland old forest type, moisture regime and age derived from AVIE in each natural sub-region are shown in Table 4.

***Table 4 Dominant old Vegetation Type, moisture regime (MOIST_REG) and Origin Year in each natural sub-region (NSRNAME) used for backfilling cutblocks in AVIE.***

| NSRNAME | Vegetation Type | MOIST_REG | Origin Year |
|---|---|---|---|
| Alpine | White Spruce | m | 1870 |
| Athabasca Plain | Pine | m | 1920 |
| Boreal Subarctic | White Spruce | m | 1890 |
| Central Mixedwood | Deciduous | m | 1930 |
| Central Parkland | Deciduous | m | 1930 |

| | | | |
|---|---|---|---|
| Dry Mixedwood | Deciduous | m | 1930 |
| Foothills Fescue | Deciduous | m | 1920 |
| Foothills Parkland | Deciduous | m | 1920 |
| Kazan Uplands | Pine | m | 1930 |
| Lower Boreal Highlands | Deciduous | m | 1920 |
| Lower Foothills | Deciduous | m | 1900 |
| Mixedgrass | Deciduous | m | 1910 |
| Montane | Pine | m | 1920 |
| Northern Mixedwood | Deciduous | m | 1920 |
| Peace River Parkland | Deciduous | m | 1920 |
| Subalpine | Pine | m | 1900 |
| Upper Boreal Highlands | Pine | m | 1910 |
| Upper Foothills | Pine | m | 1890 |

#### 5.1.3.6 Backfilling other human disturbed polygons excluding cutblocks, peat and linear types

The procedures for backfilling other human disturbed polygons excluding cutblocks, peat extraction sites and linear features ("Others" in Table 2) followed similar steps (Figure 4) to those used for cutblocks (Figure 3) with the exception that 1) vegetation type was not constrained to old upland forests (Table 5), and 2) large agriculture polygons (AIF, CA, CP, CPR) that exceeded 50 ha were first cut into smaller polygons with ArcGIS dice tool before backfilling.

For Rough Pasture areas (CPR), it was found that more areas were assigned as forest in the initial backfilling than expected based on visual interpretation using Valtus satellite images. In order to limit the area backfilled to forest in CPR, all forest types backfilled in CPR were changed into Shrubland or Grassland with the backfilled ABMIw2wLCV2000 layer.

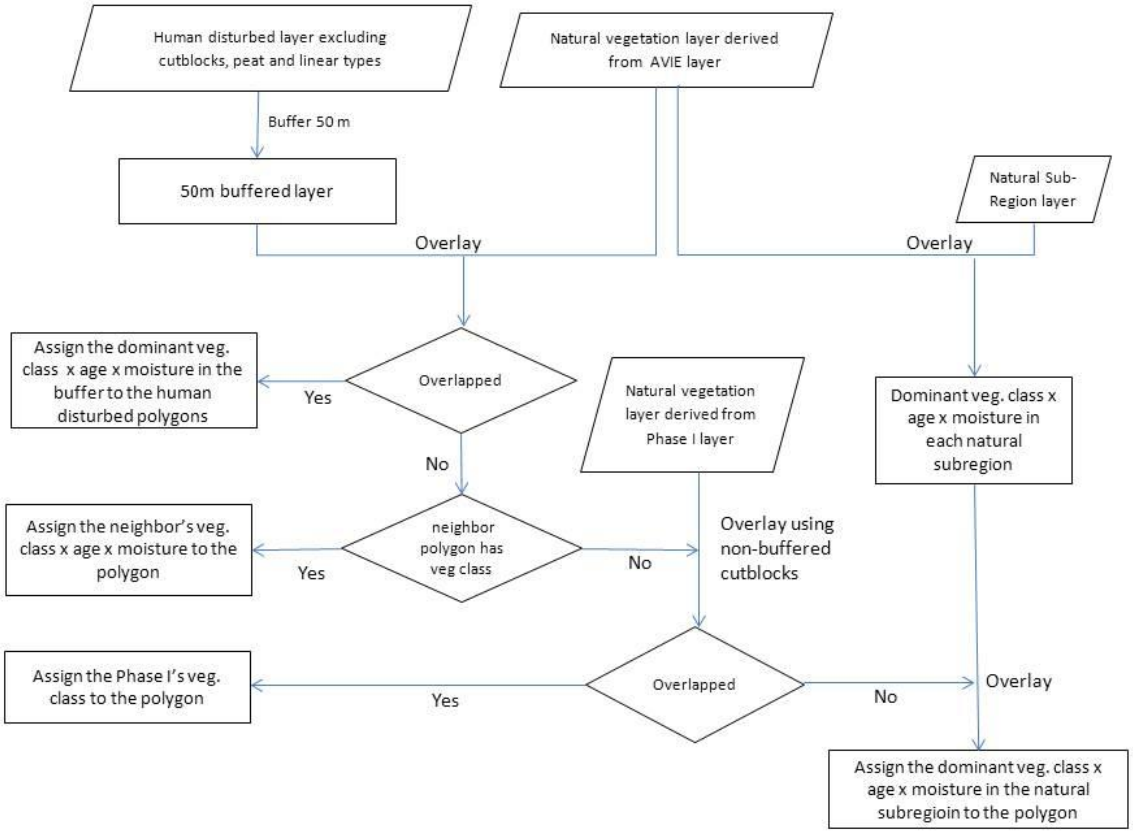


***Figure 4: Flow chart illustrating the rule set used in backfilling other human disturbed polygons excluding cutblock, peat and linear types in AVIE.***

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The dominant vegetation type, moisture regime and age derived from AVIE in each natural sub-region are shown in Table 5.

***Table 5 Dominant vegetation type, moisture regime and origin year in each natural sub-region used for backfilling other human footprint (i.e., not cutblock, peat, or linear) in AVIE.***

| NSRNAME | Vegetation Type | MOIST_REG | Origin Year |
|---|---|---|---|
| Alpine | White Spruce | m | 1870 |
| Athabasca Plain | Pine | m | 1981 |
| Boreal Subarctic | Black Spruce | w | 1860 |
| Central Mixedwood | Deciduous | m | 1940 |
| Central Parkland | Deciduous | m | 1960 |
| Dry Mixedwood | Deciduous | m | 1940 |

| | | | |
|---|---|---|---|
| Foothills Fescue | Grassland | d | missing |
| Foothills Parkland | Grassland | d | missing |
| Kazan Uplands | Pine | m | 1930 |
| Lower Boreal Highlands | Black Spruce | w | 1940 |
| Lower Foothills | Deciduous | m | 1940 |
| Mixedgrass | Grassland | m | missing |
| Montane | Pine | m | 1920 |
| Northern Mixedwood | Black Spruce | w | 1900 |
| Peace River Parkland | Deciduous | m | 1940 |
| Subalpine | Pine | m | 1900 |
| Upper Boreal Highlands | Black Spruce | w | 1940 |
| Upper Foothills | Pine | m | 1890 |

### 5.1.3.7 Backfilling peat polygons in AVIE

Only 18 peat polygons were present in the AVIE layer. They were backfilled with black spruce, larch, or shrubland vegetation types according to the procedure described in Figure 5.

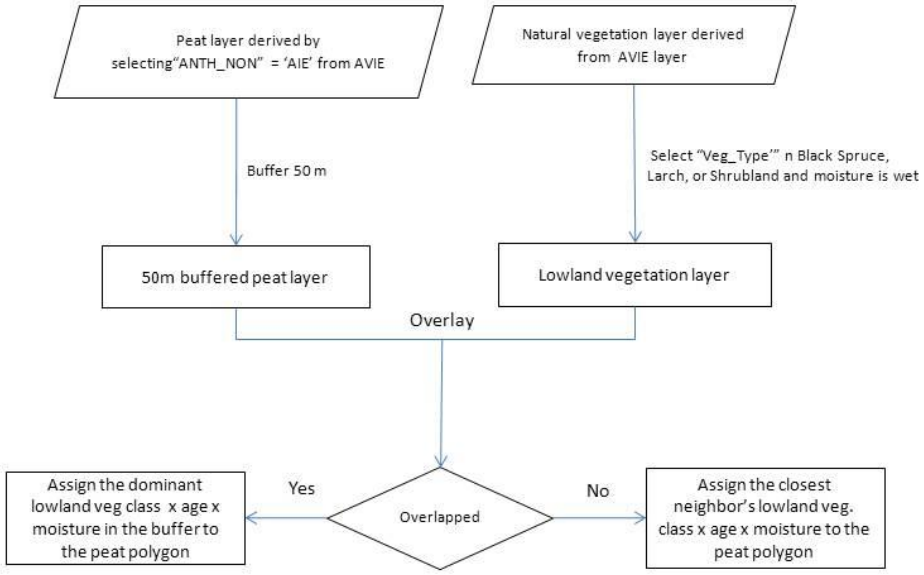


***Figure 5: Flow chart illustrating the rule set used in backfilling peat polygons in AVIE.***

### 5.1.3.8 Backfilling linear types in AVIE

The linear human-disturbed vegetation types were backfilled using the neighbouring vegetation type, age and moisture information. The linear polygons are first cut into smaller segments with the "Dice" tool in ArcMap. The neighboring natural vegetation layer was assembled from the natural vegetation layer derived from AVIE, the backfilled cutblocks, the backfilled peat, and the backfilled other human disturbed polygons described above. The "eliminate" tool in ArcGIS was repeatedly used until no human-disturbed linear features remained that could be backfilled.

### 5.1.4 New water boundaries for backfilled AVIE layer

The open water polygons from AVIE were combined with more detailed polygons obtained from the Government of Alberta Base Layers for hydropoly and stream lines. This open water polygon layer was stamped onto the backfilled AVIE layer. All open water polygons from the original AVIE layer that fell outside of the new open water boundaries (i.e., from the Government of Alberta Base Layer Database) were still kept as water since AVI interpretation of water was also thought to be accurate.

The hydropoly sub-layer in the more detailed water polygon layer contained polygons of multiple feature types (see Table 6), not all of which were relevant to updating open water boundaries. Therefore, feature types indicating islands ('ISLAND-LAKE', 'ISLAND-RECUR', and 'ISLAND-RIV') and wetlands ('WETLAND') were not classified as open water.

The stream line sub-layer in the more detailed water polygon layer was buffered according to Table 7.

***Table 6: List of feature types (FEATURE_TY) contained within the Government of Alberta hydropoly layer, and whether they were used to update the boundaries of open water areas in the backfilled layer.***

| Feature Type | Used to Update Open Water Boundaries? |
|---|---|
| CANAL-MAJ | Yes |
| DUGOUT | Yes |
| ICEFIELD | Yes |
| ISLAND-LAKE | No |
| ISLAND-RECUR | No |
| ISLAND-RIV | No |
| LAGOON | Yes |
| LAKE-PER | Yes |
| LAKE-RECUR | Yes |
| OXBOW-PER | Yes |
| OXBOW-RECUR | Yes |
| QUARRY | Yes |
| RESERVOIR | Yes |
| RIV-MAJ | Yes |
| WETLAND | No |

***Table 7: Buffer sizes (m) used in the stream line layer added to the backfilled layer to improve the accuracy of open water boundaries.***

| **Feature Type** | **Buffer size to each side (m)** |
|---|---|
| AQUEDUCT | 1 |
| CANAL | 1 |
| DITCH | 1 |
| ICEFIELD-REP-PRI | 1 |
| OXBOW-RECUR | 1 |
| STR-RECUR | 1 |
| CANAL-MAJ-REP-SEC | 2 |
| OXBOW-PER | 2 |
| RIV-MAJ-REP-SEC | 2 |
| SPILLWAY | 2 |

| | |
|---|---|
| CANAL-MAJ-REP-PRI | 3 |
| LAKE-REP-PRI | 3 |
| RIV-MAJ-REP-PRI | 3 |
| FLOW-ARB-DEM | 0.5 |
| FLOW-ARB-MANUAL | 0.5 |
| STR-INDEF | 0.5 |
| STR-PER | 1.5 |

### 5.1.5 Wetland vegetation types for backfilled AVIE layer

Two steps were applied to generate the wetland vegetation types in the backfilled AVIE layer. First, the wetland vegetation types were derived from the vegetation type and moisture regime in the AVIE layer itself (See Table 8 for details). Second, the wetland vegetation types were derived from the vegetation types in AVIE and the five wetland classes in the Alberta CWCS Merged Wetland Inventory layer (see section 6.2.3 for this layer and Table 9). Step 2 over-wrote Step 1 for any overlapping wetland area. The wetland vegetation types were stored in the field EC_Type together with the upland vegetation types from the Veg_Type field.

***Table 8 Wetland vegetation type rule-set from Alberta Vegetation Inventory (AVI) layer.***

| **Backfilled Vegetation types** | **AVI Moisture regime** | **AVI Wetland vegetation types** |
|---|---|---|
| Black Spruce | a (aquatic) or w (wet) | TreedBog |
| Larch | a or w | TreedFen |
| Shrubland | a or w | ShrubSwamp |
| Grassland | a | Marsh |

***Table 9 Wetland vegetation types naming rules based on the combination of information in the CWCS Merged Wetland Layer and the derived AVI vegetation type.***

| Vegetation Type | | Wetland Types in CWCS Merged Wetland Layer | Resulting Wetland Classification |
|---|---|---|---|
| Forest | Pine, Black spruce, White spruce, Fir, Larch, Deciduous, Mixedwood | Bog | TreedBog |
| | Pine, Black spruce, White spruce, Fir, Larch, Deciduous, Mixedwood | Fen | TreedFen |
| | Balck spruce | Marsh | SwampBSpr |
| | Larch | | SwampLarch |
| | Pine, White spruce, Fir | | SwampCon |
| | Deciduous | | SwampDec |
| | Mixedwood | | SwampMix |
| | Balck spruce | Swamp | SwampBSpr |

| | | | |
|---|---|---|---|
| | Larch | | SwampLarch |
| | Pine, White spruce, Fir | | SwampCon |
| | Deciduous | | SwampDec |
| | Mixedwood | | SwampMix |
| Shrubland | | Bog | ShrubBog |
| | | Fen | ShrubFen |
| | | Marsh | Marsh |
| | | Swamp | ShrubSwamp |
| Grassland | | Bog | OpenBog |
| | | Fen | GrassFen |
| | | Marsh | Marsh |
| | | Swamp | SwampDec |
| Shrubland or Grassland with origin_year >1980 (New Burns) | | Bog | TreedBog |
| | | Fen | TreedFen |

### 5.1.6 Post cleaning up backfilled AVIE layer

Polygons with area less than 100 square meters were backfilled with the same information as its neighbor polygon.

## 5.2 Primary Land and Vegetation Inventory (PLVI) layer[6]

### 5.2.1 Natural vegetation identification and classification for PLVI layer

The natural vegetation polygons in the PLVI layer (Figure 6) were identified by selecting polygons in which the field "Land Class 1" indicated the land cover was Naturally Wooded (NAW), Wetland (WET), or Naturally Non-wooded (NNW).

The Vegetation Types were generated according to the rule-set in Table 10. A python script was developed and is available upon request.

[6] Available from: http://esrd.alberta.ca/forms-maps-services/maps/resource-data-product-catalogue/biophysical.aspx

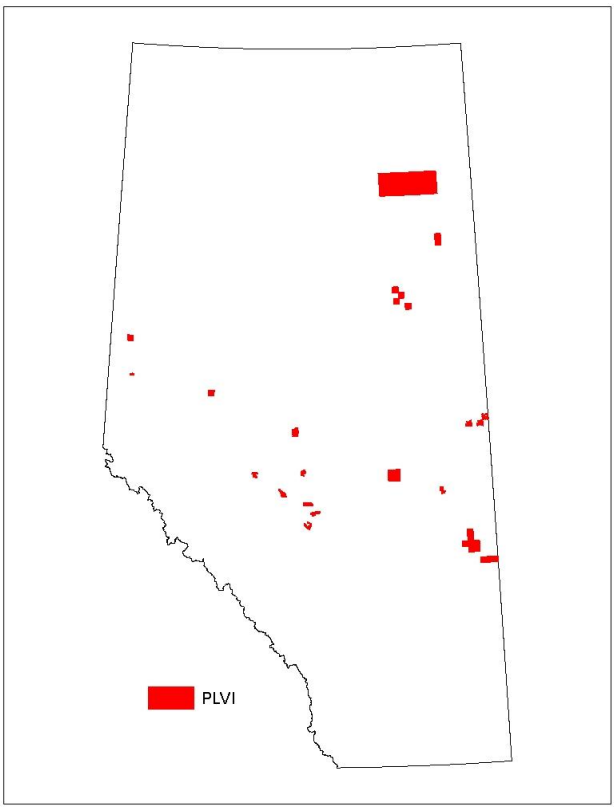


***Figure 6: Extent of the Primary Land and Vegetation Inventory (PLVI).***

***Table 10 Definitions of the vegetation types derived from the Primary Land and Vegetation Inventory (PLVI).***

| Vegetation Type | Description |
|---|---|
| Pine | Coniferous Percent 1 > 80% and Leading Species 1 in (P, Pl, Pa, Pj, Pf) and Site Type 1 are forested (FT), Treed wetland (WT) or Treed Fens (TF) |
| Black spruce | Coniferous Percent 1 > 80% and Leading Species 1 is Black Spruce (Sb) and Site Type 1 are forested (FT), Treed wetland (WT) or Treed Fens (TF) |
| White spruce | Coniferous Percent 1 > 80% and Leading Species 1 is White Spruce (Sw) and Site Type 1 are forested (FT), Treed wetland (WT) or Treed Fens (TF) |
| Fir | Coniferous Percent 1 > 80% and Leading Species 1 in (Fa, Fb, Fd) and Site Type 1 are forested (FT), Treed wetland (WT) or Treed Fens (TF) |
| Larch | Coniferous Percent 1 > 80% and Leading Species 1 in (Lt, La, Lw) and Site Type 1 are forested (FT), Treed wetland (WT) or Treed Fens (TF) |
| Deciduous | Coniferous Percent 1 ≤ 20% and Site Type 1 are forested (FT), Treed |

| | |
|---|---|
| | wetland (WT) or Treed Fens (TF) |
| Mixedwood | Coniferous Percent 1 > 20% and ≤ 80%, and Site Type 1 are forested (FT), Treed wetland (WT) or Treed Fens (TF) |
| Shrubland | Site Type 1 are Shrub Bog (WS), Shrub Fens (SF), Open Shrub (OS), Medial Shrub (MS), or Closed Shrub (CS) |
| Grassland | Site Type 1 are Grass Fens (GF), or Herbaceous Grass (HG) |
| Marsh | Site Type 1 is Marsh (M). Note, this type is not used for backfilling |
| Swamp | Site Type 1 is Swamp (SW). Note, this type is not used for backfilling. This type does not exist in current PLVI coverage. |

The Origin Year was derived from the fields Disturbance Year 1, Pioneering Succession Stage 1, and Serial Succession Stage 1. If the field "Disturbance Percent 1" was ≥ 80%, the Origin Year was copied from the field "Disturbance Year 1". The Origin Years for the remaining polygons were then generated from the field "Pioneering Succession Stage 1", or the field "Seral Succession Stage 1", according to the rules in Table 11 and Table 12.

***Table 11 Forest age derived from pioneering tree species successional stage.***

| **Successional Stage** | **ORIGIN YEAR** |
|---|---|
| Stand Initiation (SI) | 5 years before image year. If no image year, 2010 was used. |
| Stem Exclusion (SE) | 25 years before image year. If no image year, 2010 was used. |
| Mature (MA) | 70 years before image year. If no image year, 2010 was used. |
| Breakup (BP) | 150 years before image year. If no image year, 2010 was used. |
| No pioneer (XP) | Not Applicable |

***Table 12 Forest age derived from serial tree species succession stage.***

| **Successional Stage** | **ORIGIN YEAR** |
|---|---|
| Recruitment (RC) | 5 years before image year. If no image year, 2010 was used. |
| Intermediate (IM) | 25 years before image year. If no image year, 2010 was used. |
| Mature (MT) | 70 years before image year. If no image year, 2010 was used. |

| | |
|---|---|
| Climax (CM) | 150 years before image year. If no image year, 2010 was used. |
| No seral (XS) | Not Applicable |

The MOIST_REG field was copied from the field "Map Code 1". In PLVI, the map codes were used by the photo interpreter to describe ecological sites, which has both Moisture Regime (2 – Xeric, 3 – Subxeric, 4 – Submesic , 5 –Meisc, 6 – Subhygric, 7 – Hygric, 8 – Subhydric, and 9 - Hydric) and Nutrient Regime (A - Very Poor, B - Poor , C – Med. , D - Rich, and E –Very rich). For more information on Map Codes, refer to the PLVI metadata documents.

### 5.2.2 Backfilling the PLVI layer

The following procedures only apply to PLVI in the Parkland and Boreal natural region. No backfilling was done for the PLVI layer in the Grassland region.

The human-disturbed polygons in the PLVI layer were first backfilled using data from its own attribute table if the fields "Site Type 2" or "Site Type 3" indicated natural vegetation types. This approach was based on the assumption that the information from that attribute table was a better approximation of natural vegetation types than information from neighboring polygons.

Attribute table fields with names ending with "2" (i.e., "Coniferous Percent 2", "Leading Species 2", and "Site Type 2") were first used to generate the natural vegetation types by applying the rule set provided in Table 10 with the additional constraints list in Table 13. Attribute table fields with names ending as 3 (i.e., "Coniferous Percent 3", "Leading Species 3", and "Site Type 3") were used subsequently for the remaining un-backfilled polygons by following the same procedure. The Origin Year and moisture fields were also backfilled with the same procedure.

***Table 13 Constraints for backfilling human disturbed polygons with their own attribute data in the Primary Land and Vegetation Inventory (PLVI) layer***

| Human Footprint Group | Site Type 1 | Valid vegetation Types from Coniferous Percent 2", "Leading Species 2", and "Site Type 2" |
|---|---|---|
| Cutblock | Recent Harvest (CC), Regeneration (CR) | Only Pine, White spruce, Fir, Mixed, and Deciduous and ORIGIN_YEAR ≤1940 |
| Linear Human Footprint | Transportation Surface (AIH), Non-treed Clearings (CIP), Treed Clearings (CIT) | No backfilling with its own fields |
| Others | Annual Crops (CA), Tame Pasture (CP), Rough Pasture ( CPR), Settlement Tracts (ASC), Industrial Tracts (AII) | Any vegetation types |

The remaining un-backfilled human disturbed polygons, after backfilled from its own fields in the attribute table, were divided into 3 groups: cutblock, linear and others. The grouping rules followed those in Table 13, except for cutblocks which were identified by clipping with the 2010 cutblock polygons in the 2010 Human Footprint Layer.

Each of the three groups above (cutblock, linear, and other) were backfilled with the same procedures as for backfilling the AVIE layer (See Section 5.1.3).

### 5.2.3 Water boundaries for the backfilled PLVI layer

The open water polygons in the PLVI layer were combined with more detailed polygons obtained from the Government of Alberta Base Layers for hydropoly and stream lines. See detailed information for this open water polygon layer at Table 6 and Table 7 in Section 5.1.4. This open water polygon layer was stamped onto the backfilled PLVI layer. All open water polygons from the original PLVI layer that fell outside of the new open water boundaries (i.e., from the Government of Alberta Base Layer Database) were still kept as water were retained since the PLVI mapping was assumed to be accurate.

### 5.2.4 Wetland vegetation types for backfilled PLVI layer

Two steps were applied to generate the wetland vegetation types in the backfilled PLVI layer. First, the wetland vegetation types in the backfilled PLVI layer were derived from the "Site Type" in the original PLVI layer (See Table 14 for details). Second, The wetland vegetation types were derived from the vegetation type in PLVI and the five wetland classes in the Alberta CWCS Merged Wetland Inventory layer with the same rule at AVIE (see section 6.2.3 for this layer and Table 9 for wetland type naming rules). Step 2 over-wrote Step1 for any overlapped wetland area. The wetland vegetation types were stored in the field EC_Type together with the upland vegetation types from the Veg_Type field.

***Table 14 Wetland vegetation types naming rules in the Primary Land and Vegetation Inventory (PLVI) layer.***

| Site Types in the original PLVI layer | Wetland Types in the backfilled PLVI layer |
|---|---|
| WT(Treed Bog) | TreedBog |
| WS(Shrub Bog) | ShrubBog |
| TF(Treed Fens) | TreedFen |
| SF(Shrub Fens) | ShrubFen |
| GF(Grass | GrassFen |

| | |
|---|---|
| Fens) | |
| M (Marsh) | Marsh |
| SW (Swamp) | ShrubSwamp |

5.2.5 Post cleaning up backfilled PLVI layer

Polygons with areas <100 $m^2$ were backfilled with the same information as its neighbouring polygon.

## 5.3 Grassland Vegetation Inventory Layer (GVI)

5.3.1 Extended GVI layer

The GVI layer contained polygon data for southern Alberta (Figure 7). Detailed information for each polygon was not stored in the attribute table of the GVI "LANDSCAPE_POLYGON" layer. Therefore, to assist with vegetation classification and backfilling, the GVI "LANDSCAPE_POLYGON" layer was extended by adding several fields (Table 15) to the attribute table. These 19 additional fields were derived either from the GVI tables "SITES" and "VEGETATION", or the GVI "View_Rangeland" layer. The definitions of these new fields and the processing steps were described below and in Table 15.

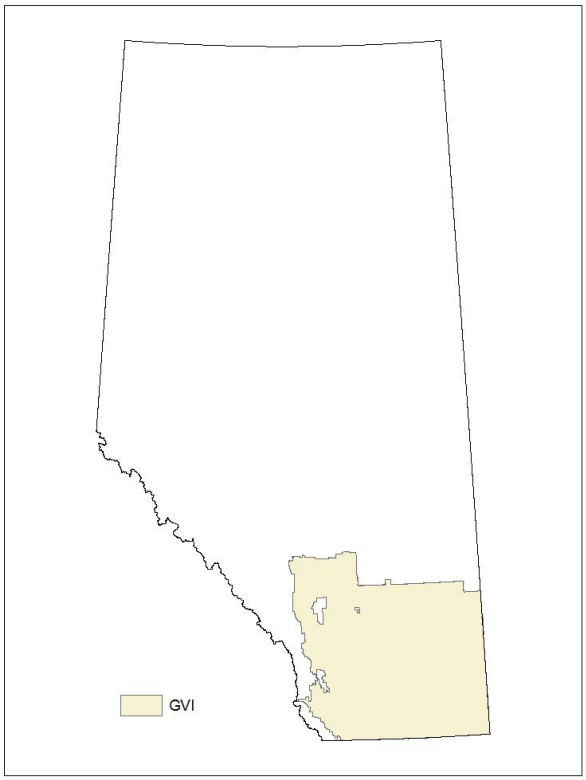


***Figure 7 Extent of the Grassland Vegetation Inventory (GVI) in Alberta.***

A "LinkID" field was added to the attribute table of GVI "LANDSCAPE_POLYGON" layer and a unique ID number was assigned to each of the GVI polygons. This "LinkID" was used as a table key to link various derived intermediate tables during processing in Microsoft Access. The "GLOBALID" field in the table was used only to link the "LANDSCAPE_POLYGON" layer with the GVI "View_Rangeland" layer and "SITES" and "VEGETATION" tables in the GVI file geo-database.

***Table 15 Fields added to the attribute table of the Grassland Vegetation Inventory (GVI) "LANDSCAPE_POLYGON" layer***

| Field Name | Description |
|---|---|
| PctTrees | Percentage of trees coverage in the polygon. Note, The sum of PctTrees, PctShrubs, PctGrass, PctNonVeg and PctWater equals to 100. |
| PctShrubs | Percentage of shrub coverage in the polygon. |
| PctGrass | Percentage of grass coverage in the polygon. |

| | |
|---|---|
| PctNonVeg | Percentage of non-vegetation coverage in the polygon. |
| PctWater | Percentage of water coverage in the polygon. |
| SumOfEachTreePct | The sum up of the next 7 columns. The value should be 100 or 0 (This field is used for Quality Assurance only) |
| BlackSpruce | Percentage of total trees areal coverage that was Black Spruce. |
| Coniferous | Percentage of total trees areal coverage that was coniferous trees. |
| Dec | Percentage of total trees areal coverage that was deciduous trees. |
| Fir | Percentage of total trees areal coverage that was Fir. |
| Larch | Percentage of total trees areal coverage that was Larch. |
| Pine | Percentage of total trees areal coverage that was pine. |
| WhiteSpruce | Percentage of total trees areal coverage that was White Spruce. |
| ABMIWet | Percentage of ABMI wetland site types coverage in the polygon. The ABMI wetland site types include LenS, LenSP, LtcS, and LtcH (See Table 17 for ABMI Moisture regime) |
| LtcRLenWPct | Percentage of site types LtcR and LenW coverage in the polygon. |
| LtcCDPct | Percentage of site types LtcC and LtcD coverage in the polygon. |
| LtcSHPct | Percentage of site types LtcS and LtcH coverage in the polygon. |
| HFPct | Percentage of Human Footprint coverage in the polygon. |
| DomNatSiteType | Dominant Natural site type which had maximum coverage. |

The fields Dec, Fir, Larch, Pine, WhiteSpruce, and Coniferous were derived from the VEGETATION table using the following three steps:

1. First, each row (i.e., one species) of the vegetation table was assigned to one of seven tree types (Table 15.

2. Second, the percentage of this species in the GVI polygon was then calculated with the equation "PCT_OF_CLASS" * "PCT_TREES" (in the site) * "PCT_OF_Polygon" (of this site in the polygon)/TotalPctOfTrees.

3. Finally, the percentage of each tree types on the GVI polygon is derived with a crosstab operation by summing up the percentage of each species (row) on the polygon.

For the dominant natural site type field (Field DomNatSiteType), when there was more than one natural site type with the same maximum coverage, the dominant type was determined manually by an expert with the aid of the ABMI Soil Types layer (See Section 6.5 for this layer).

### 5.3.2 Natural vegetation identification and classification for GVI layer

The natural vegetation types in the GVI layer were derived according to the rule set in Table 16. A python script was developed and is available upon request.

***Table 16 Definition of Vegetation Types derived from the Grassland Vegetation Inventory (GVI)***

| Vegetation Type | Description |
|---|---|
| Pine | PctTree >= 20 and Dec_ < 20 and Pine > BlackSpruce, WhiteSprice, Fir and Larch. |
| Black spruce | PctTree >= 20 and Dec_ < 20 and BlackSpruce > Pine, WhiteSprice, Fir and Larch. |
| White spruce | PctTree >= 20 and Dec_ < 20 and WhiteSpruce > BlackSpruce, Pine, Fir and Larch. |
| Fir | PctTree >= 20 and Dec_ < 20 and Fir > BlackSpruce, WhiteSprice, Pine and Larch. |
| Larch | PctTree >= 20 and Dec_ < 20 and Larch > BlackSpruce, WhiteSprice, Fir and Pine. |
| Deciduous | PctTree >= 20 and Dec_ >80 |
| Mixedwood | PctTree >= 20 and Dec_<=80 and >= 20. |
| Coniferous | PctTree >= 20 and Dec_ < 20 |
| Shrubland | PctTree < 20 and PctShrub >= 20 |
| Grassland | PctTree < 20 and PctShrub < 20 and PctNonVeg <80 |
| Bareland | PctTree < 20 and PctShrub < 20 and PctNonVeg>= 80 |
| Swamp | PctTree >= 20 and PctABMIwet+PctLtcRLenW>=60 |

| | |
|---|---|
| Marsh | PctTree < 20 and PctABMIwet+PctLtcRLenW>=60 |
| Alkali | PctTree < 20 and PctABMIwet+PctLtcRLenW>=60 and DomSiteType =LenA |
| Lotic Shrub | PctTree < 20 and and PctShrub >= 20 and PctABMIwet+PctLtcRLenW>=60 and DomSiteType =LtcS |
| Lotic Herb | PctTree < 20 and and PctShrub < 20 and PctABMIwet+PctLtcRLenW>=60 and DomSiteType =LtcH |

Data for the MOIST_REG field was copied from dominant natural site type (Field DomNatSiteType). A conversion rule was developed to convert the dominant natural site type into the ABMI moist regime (Table 17).

***Table 17 Conversion from the Grassland Vegetation Inventory (GVI) Site Type to the ABMI moisture regime***

| GVI Site Type | GVI Code | GVI ID | ABMI Moisture Regime |
|---|---|---|---|
| Lentic - Temporary | LenT | 1 | Mesic |
| Lentic - Seasonal | LenS | 2 | wet |
| Lentic - Alkali | LenA | 3 | Alkali |
| Lentic - Semi to Permanent | LenSP | 4 | wet |
| Lentic - Open water | LenW | 5 | Open water |
| Lotic - River | LtcR | 6 | Open water |
| Lotic - Coniferous | LtcC | 7 | Mesic |
| Lotic - Deciduous | LtcD | 8 | Mesic |
| Lotic - Shrub | LtcS | 9 | wet |
| Lotic - Herbaceous | LtcH | 10 | wet |
| Subirrigated | Sb | 11 | Mesic |
| Overflow | Ov | 12 | Mesic |
| Clayey | Cy | 13 | Mesic |
| Loamy | Lo | 14 | Mesic |
| Sandy | Sy | 15 | dry |
| Limy | Li | 16 | Mesic |
| Sandy | Sa | 17 | dry |
| Blowouts/Solonetzic | BlO | 18 | dry |
| Choppy Sandhills | CS | 19 | dry |
| Thin Breaks | TB | 20 | dry |
| Shallow to Gravel | SwG | 21 | dry |
| Saline Lowland | SL | 22 | Mesic |
| Gravel | Gr | 23 | dry |
| Badlands /Bedrock | BdL | 24 | dry |

### 5.3.3 Backfilling the GVI layer

Any polygons in which the total percentage of human footprint exceeded 80% were excluded. The processes for backfilling these excluded areas is described in section 5.5. The remaining polygons all had vegetation types assigned according to the rules in Table 16, and therefore no further backfilling processing was required.

### 5.3.4 New Water Boundaries for the Backfilled GVI layer

The open water polygons were first identified with the rule of Lentic – Open water (LenW) + Lotic – River (LtcR) >=80. The open water polygons in GVI were combined with more detailed polygons obtained from the Government of Alberta Base Layers for hydropoly and stream lines. See detailed information for the open water polygon layer at Table 6 and Table 7 in Section 5.1.4. This open water polygon layer was stamped onto the backfilled GVI layer. All open water polygons from the original GVI layer that fell outside of the new open water boundaries (i.e., from the Government of Alberta Base Layer Database) were retained as water.

### 5.3.5 Wetland Vegetation Types for the Backfilled GVI layer

Two steps were applied to generate the wetland vegetation types in the backfilled GVI layer. First, the wetland vegetation types identified in the GVI natural vegetation types were retained with the exception of "Swamp" which was recoded as "SwampDec". Second, the wetland vegetation types were derived from the vegetation type in GVI and the five wetland classes in the Alberta CWCS Merged Wetland Inventory layer with the same rule at AVIE (see Section 6.2.3 for this layer and Table 9 for wetland vegetation types naming rules). Step 2 over-wrote Step1 for any overlapped wetland area. The wetland vegetation types were stored in the field EC_Type together with the upland vegetation types from the Veg_Type field.

### 5.3.6 Post cleaning up backfilled GVI layer

Polygons with area <100m$^2$ were eliminated with the same information as its neighbouring polygon.

## 5.4 Vegetation in National Parks

### 5.4.1 Wood Buffalo National Park

The vegetation types and wetland types in Wood Buffalo National Park were derived from the Wood Buffalo Nation Park ecosite layer (See Table 18 for naming rules).

For wetland vegetation types, an additional step was applied by referring to the Alberta CWCS Merged Wetland Inventory layer (see section 6.2.3 for this layer) and the vegetation types with the same rule set as AVIE (See Table 9). Any overlapped wetland area was over-written by this step. The wetland types were stored in the field EC_Type together with the upland types from the Veg_Type field.

***Table 18 Ecosite classes in the Wood Buffalo National Park ecosite layer and naming rules for vegetation types and wetland types.***

| Grid code | Ecosite | Veg_Type | WET | EC_Type |
|---|---|---|---|---|
| 0 | Unclassified | (excluded from the layer) | | |
| 5 | Wetlands | Shrubland | Swamp | |
| 6 | Mud | RockSandMud | | |
| 7 | Sand | RockSandMud | | |
| 8 | Rock | RockSandMud | | |
| 9 | Cloud | (excluded from the layer) | | |
| 10 | Cloud -shadow | | | |
| 11 | Water | Water | WBNP_Water | Water |
| 12 | Urban | (excluded from the layer) | | |
| 14 | Access Major | | | |
| 16 | Agricultural | | | |
| 18 | Cut Block | | | |
| 19 | Burn | | | |
| 20 | Black Spruce | Black Spruce | Bog | TreedBog |
| 21 | Jack Pine | Pine | | |
| 22 | White Spruce | White Spruce | | |
| 23 | Deciduous | Deciduous | | |
| 24 | Deciduous Dominated | Deciduous | | |
| 25 | Shrubby Poor Fen | Shrubland | Fen | ShrubFen |
| 26 | Shrubby Rich Fen | Shrubland | Fen | ShrubFen |
| 28 | Dwarf Birch/Sedge/Willow | Shrubland | Swamp | ShrubSwamp |
| 29 | Willow/Sedge | Shrubland | Swamp | ShrubSwamp |
| 30 | Willow/Reed Grass | Shrubland | Swamp | ShrubSwamp |
| 31 | Sedge Fen | Grassland | Fen | GrassFen |
| 32 | Reed Grass Fen | Grassland | Fen | GrassFen |
| 33 | Rare true grasslands on solonetzic or chernozemic soils | Grassland | | |
| 34 | Cattail Wetlands | Grassland | Marsh | Marsh |
| 35 | Reed Grass Wetlands | Grassland | Marsh | Marsh |
| 36 | Bullrush na Wetlands | Grassland | Marsh | Marsh |
| 37 | Sb-Pj hygric | Black Spruce | Bog | TreedBog |
| 38 | Sb treed | Black Spruce | Bog | TreedBog |
| 39 | Treed Bog | Black Spruce | Bog | TreedBog |
| 40 | Pj lichen | Pine | | |
| 41 | Pj-Sb | Pine | | |
| 42 | Pj-Aw blueberry | Pine | | |
| 43 | Cranberry Sw | White Spruce | | |
| 44 | Dogwood Sw | White Spruce | | |
| 45 | Horsetail Sw | White Spruce | | |
| 46 | Sw-Pj | White Spruce | | |
| 47 | Aw(Bw) submesic | Deciduous | | |
| 48 | Aw cranberry | Deciduous | | |
| 49 | Pb-Aw dogwood | Deciduous | | |
| 50 | Pb-Aw horsetail | Deciduous | | |
| 51 | Aw-Sw blueberry | Deciduous | | |

| | | | | |
|---|---|---|---|---|
| 52 | Aw-Sw cranberry | Deciduous | | |
| 53 | Pb-Sw dogwood | Deciduous | | |
| 54 | Pb-Sw horsetail | Deciduous | | |
| 55 | Treed rich fen | Larch | Fen | TreedFen |
| 56 | Treed poor fen | Larch | Fen | TreedFen |
| 57 | Shrubby Bog | Shrubland | Bog | ShrubBog |
| 58 | Cutlines | (excluded from the layer) | | |
| 60 | Immature Jack Pine | Pine | | |

No backfilling was done using the Wood Buffalo National Park ecosite layer. The polygons with types Unclassified, Burn, and Human Disturbed types were filled from the backfilled ABMIw2wLCV2000 layer (see Section 5.5).

## 5.5 Remaining Areas

The areas outside the extents of AVI, GVI, PLVI and National Parks were backfilled primarily based on the ABMI Wall-to Wall land cover layer (ABMIw2wLCV2000). This section describes the backfilling process for the ABMIw2wLCV2000 for the full extent. This layer was overwritten (in order of precedence) by AVI, GVI, PLVI and the National Parks layers where they overlapped.

### 5.5.1 Backfilling cutblocks in ABMIw2wLCV2000

Cutblock polygons in the ABMIw2wLCV2000 were usually coded as shrubland or grassland. Cutblocks in ABMIw2wLCV2000 were identified by overlying with the 2010 ABMI Human Footprint layer. Vegetation within cutblock polygons was backfilled with vegetation polygons from the ABMIw2wLCV2000 layer according to the rule-set illustrated in Figure 8. In general, if the cutblock polygon had a harvestable forest class within 50m of the cutblock boundary, it was backfilled with the dominant forest class in the neighbouring 50m buffer. Otherwise, it was backfilled with the dominant harvestable forest class of the Natural Subregion.

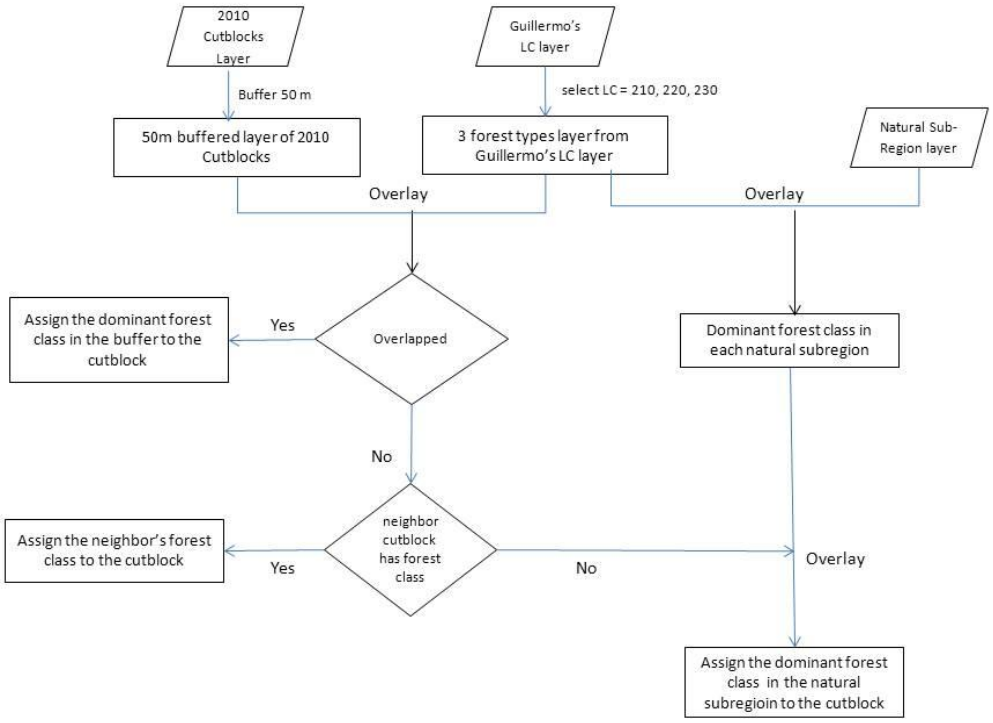


***Figure 8: Flow chart illustrating the rule set used in backfilling polygons identified as forest harvest operations with pre-harvest vegetation conditions in ABMIw2wLCV2000.***

### 5.5.2 Backfilling mines and industrial area in ABMIw2sLCV2000

Mines and industrial areas were identified with the 2010 ABMI Human Footprint layer and were backfilled with the vegetation that was expected to exist prior to disturbance based on the Phase 1 AVI layer (also known as the Broad Inventory layer, originally produced as a hardcopy map in 1957, see Figure 2). Where Phase 1 information was unavailable, the dominant forest type for the Natural Subregion was used. To ensure compatibility among the ABMIw2wLCV2000 and Phase 1 classes, a rule set was developed to convert the Phase 1 classes into the ABMIw2wLCV2000 land cover classes (Table 19).

***Table 19: Alberta Vegetation Inventory (AVI) Phase 1 classes and descriptions and grouping rule to ABMIw2wLCV2000 layers.***

| Phase 1 Class | Phase 1 Class Description | ABMIw2wLCV2000 Land Cover Class | ABMIw2wLCV2000 Land Cover Class Definition |
|---|---|---|---|
| 10 | Agriculture and other improved lands | | |
| 14 | Barren above timberline | 32 | Rock/Rubble |
| 7 | Burns - 1941 to 1957 inclusive | 220 | Broadleaf Forest |
| 2 | Coniferous stands over 60' height | 210 | Coniferous Forest |
| 1 | Coniferous stands up to 60' height | 210 | Coniferous Forest |
| 6 | Deciduous stands over 60' height | 220 | Broadleaf Forest |
| 5 | Deciduous stands up to 60' height | 220 | Broadleaf Forest |
| 15 | Indian Reserves | | |
| 16 | Lakes and Rivers | | |
| 4 | Mixedwood stands over 60' height | 230 | Mixed Forest |
| 3 | Mixedwood stands up to 60' height | 230 | Mixed Forest |
| 11 | Muskeg and Marsh | 210 | Coniferous Forest |
| 17 | National Park | | |
| 9 | Old burn - productive and non-productive | 230 | Mixed Forest |
| 8 | Old burn and brush land | 230 | Mixed Forest |
| 12 | Rock barren | 32 | Rock/Rubble |

### 5.5.3 Backfilling linear human footprint areas in ABMIw2wLCV2000

The linear human footprint areas (roads and rails, etc.) were contained in the category "Developed" (Class 34) in the ABMIw2wLCV2000 layer. A 60m inside buffer was applied to the ABMIw2wLCV2000 "Developed" class and a threshold with Area/Length ration <60 was used to identify linear footprint areas. Linear footprint areas were then backfilled based on the type of vegetation in the neighbouring polygons (Figure 9).

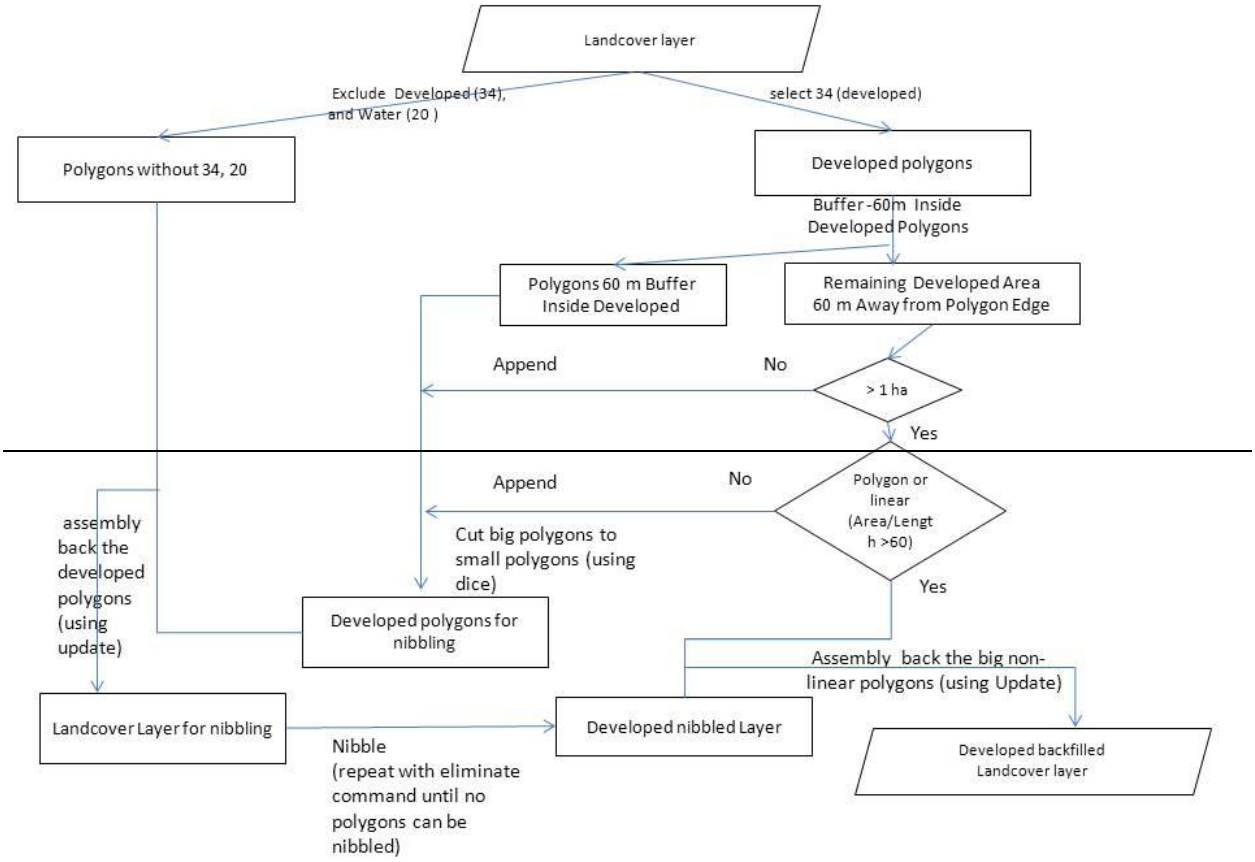


***Figure 9: Flow chart illustrating the rule set used in backfilling polygons identified as linear (roads and rails, etc.) with pre-disturbance vegetation conditions in ABMIw2wLC2000.***

5.5.4 Cultivated and Developed areas outside the 2010 ABMI Human Footprint Layer

Polygons in the ABMIw2wLCV2000 layer that were either "Cultivated" (class 120) or "Developed" (class 34) and which fell outside of the ABMI 2010 Human Footprint layer were assumed to be errors. These polygons were backfilled with vegetation according to the following rule set:

1. "Cultivated" and "Developed" polygons located outside of the 2010 Human Footprint Layer and which were within the Boreal, Shield, Foothills, and Rocky Mountain Natural Regions were backfilled using Alberta Vegetation Inventory (AVI). If there were no data for a particular polygon (i.e., the polygon and AVI layers did not overlap), then the dominant land cover type for that Natural Subregion was used (conversion rules are given in Table 20).

***Table 20: Rule set used to convert AVI to vegetation types for natural regions of Boreal, Shield, Foothills and Rocky Mountain in ABMIw2wLCV2010.***

| Vegetation Type | Rule set |
|---|---|

| | |
|---|---|
| Coniferous Forest | Stands where the combined coniferous species ≥ 80% |
| Deciduous Forest | Stands where the combined deciduous species ≥ 80% |
| Mixedwood Forest | Stands where the combined deciduous species > 20%, and combined conifer species > 20% |
| Shrubland | Non-Forested Land (NFL) Classifier = Open Shrub (SO) or Closed Shrub (SC) |
| Grassland | Non-Forested Land (NFL) Classifier = Herbaceous Grassland (HG), Herbaceous Forbs (HF), or Bryophytes and lichens (BR) |

2. "Cultivated" and "Developed" polygons located outside of 2010 Human Footprint Layer and which were within the Parkland and Grassland Natural Regions were backfilled with the following GIS layers (in order of precedence)[7]:
    i. Grassland Vegetation Inventory (GVI). Data from the GVI layer were converted to ABMIw2wLCV2000 land cover classes by:
        1. Calculating the area-weighted sum of PCT_TREES, PCT_SHRUBS, PCT_GRASS_OR_HERBACEOUS of each polygon. The field PCT_OF_POLYGON was used as the weights in the summation process.
        2. Following the summation process, the dominant GVI vegetation class was converted to a ABMIw2wLCV2000 land cover class as:
            a. GRASS_OR_HERBACEOUS = Grassland,
            b. SHRUBS = Shrubland, and
            c. TREES = Broadleaf Forest.
    ii. Central Parkland Vegetation Inventory (CPVI). Data from the GEN_CLASS field within the CPVI layer was converted to the ABMIw2wLCV2000 land cover types as follows:
        a. N_Conif = 'Coniferous Forest',
        b. N_Decid = 'Broadleaf Forest', and
        c. N_Grass = 'Grassland'.

    iii. Native Prairie Vegetation Inventory (NPVI; 1/4 section grid). Areas classified as 'TREED' in the NPVI layer were reclassified as 'Broadleaf Forest'. For other vegetation classes, backfilling and conversions of vegetation types differed according to Natural Region:
        1. For polygons within the Grassland Natural Region, if the sum of GRAMINOID + WETLAND + RIPARIAN areas was dominant over other vegetation types, then those polygons were reclassified as 'Grassland". If SHRUB was dominant, then the polygon was reclassified as 'Shrubland'.
        2. For polygons within the Parkland Natural Region, if the sum of SHRUB + WETLAND + RIPARIAN areas was dominant over

[7] The GVI, CPVI, and NPVI layers' metadata can be downloaded from: http://srd.alberta.ca/MapsPhotosPublications/Maps/ResourceDataProductCatalogue/ForestVegetationInventories.aspx

other vegetation types, then those polygons were reclassified as 'Shrubland'. If GRAMINOID was the dominant vegetation type, then the polygon was reclassified as 'Grassland'.

iv. ABMIw2wLCV2000. The dominant natural land cover class from ABMIw2wLCV2000 for the Natural Subregion was assigned to the "Cultivated" and "Developed" polygons outside of the ABMI2010 Human footprint layer when information was not available from GVI, CPVI, or NPVI.

### 5.5.5 Backfilling "Cultivated" and "Developed" polygons located within the ABMI 2010 Human Footprint layer

All remaining unfilled "Cultivated" and "Developed" polygons that were located within the bounds of the 2010 ABMI Human Footprint layer were backfilled with the rules described in Table 21.

***Table 21 Rule set used to backfill Human Footprint based on soil type.***

| Natural Region | Rule set |
|---|---|
| Grassland | Coniferous = LtcC<br>Deciduous = LtcD, Ltc<br>Shrub = LenSP, LtcS, Ov, Sb, TB, Len<br>Grass/Herb = BdL, BlO, CS, Cy, Gr, LenA, LenS, LenT, LenW, Li, Lo, LtcH, LtcR, SL, Sa, SwG, Sy |
| Parkland | Coniferous = LtcC<br>Deciduous = BdL, Gr, Li, Lo, LtcD, Ov, Sa, Sb, SwG, Sy, Ltc<br>Shrub = CS, Cy, LenS, and LenSP, Len, TB<br>Grass/Herb = BlO, LenA, LenW, LtcR |
| Dry Mixed and Lower Foothills | Coniferous = LtcCXXXus = BlO, CS, LctD,TB<br>Mixedwood = BdL, Cy, Gr, Li, Lo, LctR, Ov, Sa, Sb, SwG, Sy<br>Shrub = LenSP, Len<br>Grass/Herb = LenW |

### 5.5.6 Reclassifying Exposed Land

The ABMIw2wLCV2000 layer contained an 'Exposed Land' category (i.e., Land Cover Class 33). Many of these polygons have vegetation, or at least had vegetation historically, and were thus reclassified in the backfilled layer. First, the exposed land polygons were overlaid with i) the 2010 Mines and Industries layer, ii) the 2010 cutblock layer with a 50m buffer, and iii) the fire layer (Section 6.4) with a 100m buffer.

The 'Exposed Land' polygons falling within the buffered cutblock layer were assigned the backfilled vegetation type of that cutblock. Exposed polygons falling inside the a) buffered mine

and industries polygons or b) buffered fire polygons, were assigned the vegetation types from the Phase 1 inventory layer which were subsequently converted according to Table 19.

Other exposed land polygons (generally <1 ha) were backfilled according to the following criteria:

1. If the polygon was <100m from a 2010 human footprint polygon, then data from the Phase 1 inventory layer were used for backfilling. In Grassland and Parkland regions Phase 1 inventory was not available, and same procedures as was used for cultivation in Grassland and Parkland Natural Regions were used (see Section 5.5.4).
2. If the polygon was within the Rocky Mountain Natural Region, and within 500m of a Rock/Rubble polygon, then it was classified as 'Rock/Rubble'
3. If the polygon was within the Canadian Shield Natural Region the classification was assumed to be correct it and remained classified as 'Exposed'.
4. If the polygon was within a riparian area, as determined by the DEM-derived riparian layer, the classification was assumed to be correct it and remained classified as 'Exposed'.

### 5.5.7 Open Water

Open water polygons were amalgamated with more detailed polygons obtained from the Government of Alberta Base Layers for hydropoly and stream lines. Detailed information for this open water polygon layer is provided in Table 6 and Table 7. The open water polygon layer was stamped onto the backfilled ABMIw2wLCV2000 layer. All open water polygons from the original ABMIw2wLCV2000 layer that fell outside of the new open water boundaries (i.e., from the Government of Alberta Base Layer Database) were classified as Shrub (Class 50).

### 5.5.8 Wetland vegetation types

Some areas that were outside of wetlands determined by AVI, GVI, PLVI and the Alberta CWCS Merged Wetland Inventory layer, were still considered to be wetlands based on the hydropoly information and/or the DEM riparian information. These additional wetlands were classified by referring to wetland types (field WET, see Section 6.2) and the ABMIw2wLCV2000 vegetation types with the rule-set in Table 22. These wetland types are stored in the field EC_Type with upland types copied from the Veg_Type field.

***Table 22 Grouping rules for wetland vegetation types for ABMIw2wLCV2000 layer.***

| Veg_Type | WET | EC_Type |
|---|---|---|
| Grassland | Hydro_wetland | OpenBog |
| Coniferous, Deciduous, Mixedwood | Hydro_wetland | TreedBog |
| (others) | Hydro_wetland | ShrubSwamp |
| Coniferous | CPVI_wet | SwampCon |
| Deciduous | CPVI_wet | SwampDec |
| Mixedwood | CPVI_wet | SwampMix |
| | CPVI_water | Water |
| (others) | CPVI_wet | Marsh |
| Coniferous | DEM-rip, | SwampCon |

| | | |
|---|---|---|
| | Also DEM_WET_BOUND = 'a' | |
| Deciduous, Grassland | DEM-rip, Also DEM_WET_BOUND = 'a' | SwampDec |
| Mixedwood | DEM-rip, Also DEM_WET_BOUND = 'a' | SwampMix |
| (others) | DEM-rip, Also DEM_WET_BOUND = 'a' | ShrubSwamp |
| Coniferous, Deciduous, Mixedwood | Bog | TreedBog |
| Shrubland | Bog | ShrubBog |
| (others) | Bog | OpenBog |
| Deciduous | Marsh | SwampDec |
| (others) | Marsh | Marsh |
| Coniferous, Deciduous, Mixedwood | Fen | TreedFen |
| Shrubland | Fen | ShrubFen |
| (others) | Fen | GrassFen |
| | | |
| Coniferous, | Swamp | SwampCon |
| Deciduous | Swamp | SwampDec |
| Mixedwood | Swamp | SwampMix |

# 6 DATA ADDITIONS

Additional data were added to the attribute table for each polygon to increase its usefulness as a vegetation map of Alberta and to aid ABMI analyses. The supplementary data included information on the percentage of pine (PCT_P), polygon year of origin (ORIGIN_YEAR), and soil type (SOIL_TYPE). Additional information about wetlands was also added.

## 6.1 Pine (PCT_P)

Information regarding the location of pine throughout Alberta was obtained from two main sources:

1. Extended AVI layer (AVIE, provided by AESRD in January, 2014), and
2. Alberta Ground Cover Characterization (AGCC, provided by the Earth Observation Systems Laboratory[8] at the University of Alberta).

Data from the AVIE layer were preferentially used in areas where it was available. Pine information in AVIE cutblocks was based on backfilled info (see above). Data from the AGCC layer were used in areas outside of the AVIE boundary.

[8] http://www.eosl.eas.ualberta.ca/index.html

### 6.1.1 Processing the AVIE layer

1. Polygons in the AVIE layer in which PCT_P was >0 were selected.
2. Cutblock polygons were first backfilled with preharvest vegetation types (see Section 5.1.3.5). The cutblocks with backfilled types as Pine were selected. The PCT_P value was coded as 9 (i.e., corresponding to a polygon comprised of 90% pine).
3. The layer created by Step 1 was 'stamped' onto the layer in Step 2.

### 6.1.2 Processing the AGCC layer

1. A new pine layer was created by selecting AGCC polygons coded as either '52' or '152'.
2. The boundaries of the AVIE polygon layer was used to clip the AGCC pine layer created in step 1 to generate a new raster layer limited to pine data for areas beyond the AVIE boundary.
3. The clipped AGCC layer was converted from raster format to a vector layer.
4. Polygons >0.5 ha were selected from Step 3.
5. The layer in step 4 was clipped with Grassland and Parkland Natural Region boundaries to ensure no pine from AGCC layer occurred within those Regions.

### 6.1.3 Combining layers

The pine sub-layers from Sections 6.1.1 (AVIE) and 6.1.2 (AGCC) above were combined to a single layer representing the location of pine throughout the Province. The data values[9] include 0, 1-10, 52, 152, 252, and 9999. Values 1-10 indicates the percentage of pine canopy cover from 10 to 100% respectively from AVIE (where 1 = 10%, 2 = 20%, …, and 10 = 100%). Values of '52' and '152' are from the AGCC layer; '52' refers to 'Closed Pine' and '152' refers to 'Open Pine' areas. Values of '252' are those polygons classified as "Pine" in PLVI, GVI, or the layers in national parks. Values 0 or 9999 refer to polygons with no pine.

## 6.2 Wetland type (WET)

A new sub-layer was created from multiple data sources (Table 23) to describe the wetland types throughout Alberta. This new wetland information was added as the field (WET) in the attribute table of the backfilled vegetation layer. All areas that do not have wetland characteristics (i.e., non-wetlands) were blank.

***Table 23: Source layers (listed in order of precidence) used in the creation of the wetlands sub-layer. Note that the DEM-Derived riparian data were coarse and included some upland habitat; it was used only when no other data were available.***

| Order | Source layer | Data Extraction Rule Set | Attribute Names |
|---|---|---|---|
| 1 | Hydropoly water | All data excluding 'ISLAND-LAKE', 'ISLAND-RECUR', and 'ISLAND-RIV') | See Table 6 |

[9] Data for pine are contained within the PCT_P field of the backfilled layer.

| | | | |
|---|---|---|---|
| 2 | Stream Lines (buffered layer) | All data | See Table 7 |
| 3 | AVI water | NWL, NWF, and NWR | AVI_water |
| 4 | GVI water | Type 5 (LenW) and Type 6 (LtcR)>=80% | GVI_water |
| 5 | CPVI water | Water type from the attribute table | CPVI_water |
| 6 | PLVI_water | SiteType1 = 'NW" and SitePct1 >=8 | PLVI_water |
| 6 | Hydropoly_wetland | All data | Hydro_wetland |
| 7 | Alberta CWCS Merged Wetland Inventory | All data | Marsh, Open Water, Bog, Fen, Swamp |
| 8 | AVI | See Section 6.2.4 | AVI_wet |
| 9 | GVI | Type 2-6 + type 9-10 >=60% | GVI_wet |
| 10 | CPVI wetland | Wetland type from attribute table | CPVI_wet |
| | PLVI_wetland | LAND_CLS1 = "WET" and SitePct1>=6 | PLVI_plus wetland code (See Table 14). |
| 11 | DEM_Derived riparian | All data | DEM_rip |

A description of each data source listed in Table 23, along with the steps involved in data processing and extraction, is described below.

### 6.2.1 Hydropoly Layer

The hydropoly layer was derived from the provincial Base Layer Database. Two sub-layers were derived from this layer based on feature types (FEATURE_TY) in the attribute table:

1. The 'Hydropoly_water' sub-layer (Figure 10) was created by removing all polygons that indicated either a) islands (i.e., FEATURE_TY = 'ISLAND-LAKE', 'ISLAND-RECUR', 'ISLAND-RIV') or b) wetlands (i.e., FEATURE_TY = 'WETLAND').
2. The 'Hydropoly_wetland' sub-layer (Figure 11) was created by extracting all wetland polygons (i.e., FEATURE_TY = 'WETLAND').

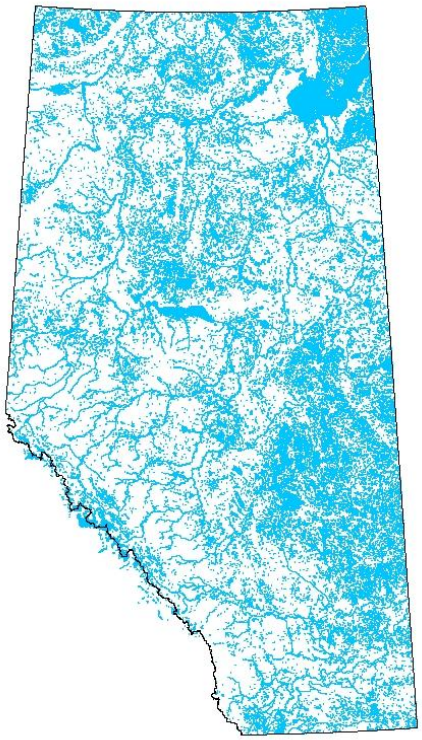

***Figure 10: Distribution of water features contained within the Hydropoly_water sublayer.***

***Figure 11: Distribution of wetlands contained within the Hydropoly_wetland sub-layer.***

### 6.2.2 Stream Line Layer

The Stream Line layer was created from the provincial Base Layer Database by extracting the feature types listed in Table 7. The initial polyline format was converted to a polygon format by adding buffers to each line; width of each buffer varied by feature type (Table 7).

### 6.2.3 Alberta CWCS Merged Wetland Inventory

The Alberta CWCS Merged Wetland Inventory[10] (Figure 12) is a polygon layer with five classes of wetland defined according to the Canadian Wetland Classification System (CWCS)[11]. The five classes are 1) marsh, 2) open water, 3) bog, 4) fen, and 5) swamp.

This layer contained data from four sources:

1. Ducks Unlimited Canada (DUC)-Boreal Enhanced Wetland Classification System (EWC). The minimum mapping unit was 1 ha.
2. Landsat-Canadian Wetland Classification System (CWCS). The minimum mapping unit was 1 ha.

[10] The layer and associated metadata may be downloaded from: http://srd.alberta.ca/MapsPhotosPublications/Maps/ResourceDataProductCatalogue/Biophysical.aspx

[11] National Wetlands Working Group. 1997. The Canadian Wetland Classification System, 2nd Edition. Warner, B.G. and C.D.A. Rubec (eds.), Wetlands Research Centre, University of Waterloo, Waterloo, ON, Canada. 68 p.

3. SPOT (Systeme Pour l'Observation de la Terre) Grassland Vegetation Inventory (GVI) Lentic Classification. The minimum mapping unit was 0.04 ha.
4. High resolution (1:15,000 to 1:30,000 scale) air photography. The minimum mapping unit was 0.02 ha.

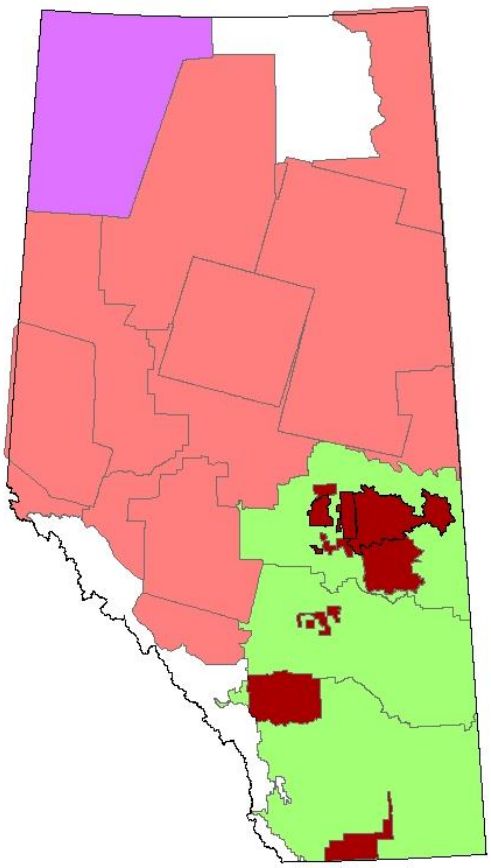

***Figure 12: Distribution of wetlands contained within the Alberta CWCS Merged Wetland Inventory layer. Colors represent individual sources of data (purple: Landsat-CWCS, red: DUC-EWC, green: SPOT-GVI, dark brown – High-Resolution, and white: no data).***

### 6.2.4 Alberta Vegetation Inventory (AVI)

Wetland information was extracted from the AVIE layer (Figure 1) by creating two sub-layers that were then recombined.

The first sub-layer was created by selecting polygons in which:

1. The Timber Productivity Rating was classified as 'Unproductive' (i.e., TPR = U), and
2. The Moisture Regime was classified as either Wet or Aquatic. (i.e., MOIST_REM = 'w' or 'a').

The second sub-layer was created by selecting polygons in which the summed percentage of Black Spruce (Sb) and Tamarack (Lt) was at least 70%.

The first AVI sub-layer described above was then used to update the second sub-layer with overlaps removed.

### 6.2.5 Grassland Vegetation Inventory (GVI)

Wetland information was extracted from the GVI layer (Figure 7) by selecting polygons where the summed percentage of lentic site types and Lotic types (i.e., Site Types 2-6; and 9-10; Table 24) was ≥ 60% of the total polygon area.

***Table 24: Site type numbers, definitions, and codes used to extract wetland polygons from the Grassland Vegetation Inventory layer.***

| Site Type | Definition | Code |
|---|---|---|
| 2 | Lentic Seasonal | LenS |
| 3 | Lentic Alkali | LenA |
| 4 | Lentic Semi-Permanent to Permanent | LenSP |
| 5 | Lentic Open Water | LenW |
| 6 | Lotic – River | LtcR |
| 9 | Lotic – Shrub | LtcS |
| 10 | Lotic – Herbaceous | LtcH |

### 6.2.6 Central Parkland Vegetation Inventory (CPVI)

The Central Parkland Vegetation Inventory (CPVI) is a layer intended to capture vegetation information for the Central Parkland Natural Subregion in Alberta (Figure 13). The wetland and water information was extracted directly from the attribute table of the CPVI layer. The polygons were coded as “CPVI_wet” if the field “PNV_CODE” equalled “Wetland”. The polygons were coded as “CPVI_water” if the field “PNV_CODE” equalled “Water”.

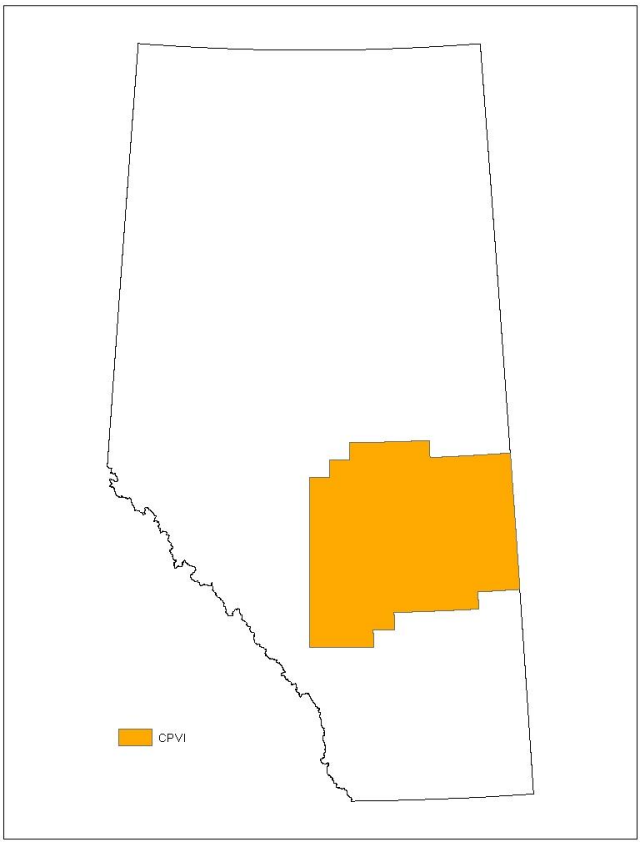


***Figure 13: Extent of the Central Parkland Vegetation Inventory (CPVI) layer.***

### 6.2.7 Digital Elevation Model (DEM) Derived Riparian Layer

This polygon layer identifies potential riparian areas associated with lotic and lentic features such as steams, rivers and lakes. The polygons were generated from the slopes derived from the Base Features Derived Partially Filled Hydrologically Corrected Digital Elevation Model grid using satellite imagery to determine thresholds for the floodplains.

This layer covers all of Alberta and was developed by Caslys Consulting Ltd. under contract to Alberta Sustainable Resource Development, Government of Alberta. Merging and cleanup procedures were performed by Alison Fraser at the Resource Information Management Branch.

The DEM-derived wetland information was used only for areas where the Alberta CWCS Merged Wetland Inventory or the Hydropoly_wetlands were not mapped and also outside of AVI, GVI, PLVI, and Wood buffalo national park extent. (see next section)

## 6.3 DEM-derived wetland extent (DEM_WET_BOUND)

A sublayer was created to identify areas having wetlands but these areas were not mapped either in the Alberta CWCS Merged Wetland Inventory or in the Hydropoly_wetlands and outside of the AVI, GVI, PLVI and Wood Buffalo National Park (Figure 14). In these areas, it was necessary to use the DEM derived riparian information (See Section 6.2.7: Digital Elevation Model (DEM) Derived Riparian Layer).

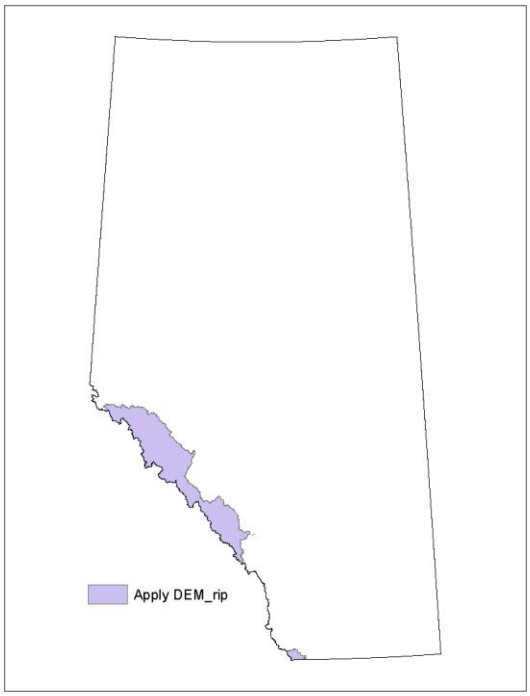


***Figure 14: Map showing DEM-derived wetland application extent.***

This unmapped wetland extent was identified by using the Hydropoly_wetland, CWCS Merged Wetland layers, AVI, GVI, PLVI, and the Wood Buffalo National Park ecosite layer. The area outside of these layers were coded as "a" (applicable) in the "DEM_WET_BOUND" field in the attribute table.

### 6.4 Date of Origin (ORIGIN_YEAR)

A sub-layer was created that described the year of polygon origin throughout Alberta. This information was added to the backfilled layer as two new fields (ORIGIN_YEAR, ORIGIN_TYPE).

The sub-layer was derived from three primary data sources:

1. Extended AVI Layer[12] (AVIE),
2. PLVI
3. Provincial Historical Wildfire Data Layer[13].

The 'year of origin' information for the backfilled Cutblocks (see Section 5.1.3.2) was also added to this sub-layer. The processing steps for the AVIE and PLVI were described in Sections 5.1.1 and section 5.2.1 respectively. The steps for wildfire data are described below.

[12] The AVIE layer was provided by Bev Wilson from AESRD (August, 2012).
[13] Downloadable from: http://www.srd.alberta.ca/Wildfire/WildfireStatus/HistoricalWildfireInformation/SpatialWildfireData.aspx.

This layer was originally organized into eight layers according to decade (e.g., layers for 1931-1939, 1940-1949, etc.). A combined layer was created by:

1. First, the ORIGIN_YEAR and ORIGIN_TYPE fields were added to the attribute table of each individual layer. For each layer, the ORIGIN_TYPE was coded as "SRD_FIRE" and the value of ORIGIN_YEAR was copied from the field YEAR.
2. Next, the 1931-1939 layer was "stamped" by the 1940-1949 layer[14].
3. The resultant combined layer of 1931-1949 from Step 2 (above) was "stamped" by the 1950-1959 layer from Step 1.
4. The general process in 2) and 3) above was repeated with each combined layer being stamped (updated) by the layer from the following decade. This process ended when the 1930-1999 combined layer was stamped by the 2000-2009 layer.

Where year of origin information was available from AVIE or PLVI, this was used in preference to wildfire data. However, when the AVI/PLVI image year was older than the wildfire year, the year of origin information derived from Fire was stamped over the origin information derived from AVIE and PLVI.

## 6.5 Soil Type (SOIL_TYPE)

A new sub-layer was created that described the soil type for polygons in the Grassland, Parkland and Dry Mixedwood Natural Regions/Subregions. The soil type data was critical for backfilling vegetation into cultivated and developed areas (see section 5.5.4). Overall, there were six wetland and eighteen natural upland GVI soil types (24 types in total; see Table 25).

***Table 25 Soil Types from the Grassland Vegetation Inventory (GVI) layer.***

| Primary Class | Land Sub-Class | Site Type | Description | Soil Type Code |
|---|---|---|---|---|
| Open Water | Lentic | Standing water | Permanent open standing-water with no emergent vegetation, generally larger than 1.0 ha and >15 cm deep. | LenW |
| | Lotic | River | Open water of rivers, generally rivers wider than 20 m. | LtcR |
| Native / Natural Lentic | Lentic | Temporary | Water present <3 weeks (dry by July) <15 cm deep. | LenT |
| | | Seasonal | Water usually present >3 weeks (usually dry by July) >15 cm deep. | LenS |
| | | Alkali | Water present >3 weeks and >15 cm deep | LenA |
| | | Semi-Permanent to Permanent | Throughout the year except during periods of extreme drought (present in autumn in 70% of the years); often occurs adjacent to LenW; includes the march zones; water is generally >15 cm deep; if open water is present it is smaller than 1.0 ha | LenSP |
| Native / Natural Lotic | Lotic | Coniferous | Coniferous trees with a combined canopy cover of greater than 25%. | LtcC |
| | | Deciduous | Deciduous trees with a combined canopy cover of greater than 25%. | LtcD |
| | | Shrub | Shrubs have a combined cover of at least 10%. | LtcS |
| | | Herbaceous | Herbaceous species (including sedges) have a combined cover of at least 5%. | LtcH |
| Native / Natural Grassland | Grassland | Subirrigated | Water table is close to surface during growing season, but rarely above. Does not have a defined depressional edge. | Sb |
| | | Overflow | Areas subject to water spreading and sheet flow. Typically on gentle inclines or terraces above the frequent flood zone. For locations where flood frequency is less than once every ten years. | Ov |

[14] The layers were combined using the 'Update' command in ArcGIS.

| Primary Class | Land Sub-Class | Site Type | Description | Soil Type Code |
|---|---|---|---|---|
| | | Clayey | Clayey-textured soils including silty clay, sandy clay, clay, and heavy clay. Generally >40% clay. | Cy |
| | | Loamy | Includes loam, silt loam, silt, clay loam, sandy clay loam, and silty clay loam. | Lo |
| | | Sandy | Sandy-loam-textured soils. | Sy |
| | | Limy | Eroded or immature soils with free lime ($CaCO_3$) at the soil surface. Soil pH generally >7.5. | Li |
| | | Sand | Loamy sand and sand soils, and not with a duned surface. | Sa |
| | | Blowouts/ Solonetzic Order | Areas with Solonetzic (hardpan) soils. The surface may or may not have eroded pits. | BlO |
| | | Choppy Sandhills | Loamy sand and sand soils with a duned land surface. | CS |
| | | Thin Breaks | Areas with bedrock at or near the soil surface. Amount of vegetation is intermediate between Limy and Badlands. TB may include thin, eroded or immature soils on gentle to steep slopes. | TB |
| | | Shallow to Gravel | Soil with 20 to 50 cm of a sandy or loamy surface overlying a gravel or cobble- rich substrate. | SwG |
| | | Saline Lowland | Areas with negligible vegetation due to electrical conductivity (salts) and/or sodium adsorption ratio limitations. | SL |
| | | Gravel | Dominated by gravels or cobbles (>50% coarse fragments). May be covered by a mantle <20 cm thick with some gravels. | Gr |
| | | Badlands/ Bedrock | Nearly barren or barren lands, with exposures of soft rock, hard rock, or surficial geology. Includes steep valley walls. | BdL |

Soil type information was combined from two sources (Figure 15):

1. A geodatabase[15] that provided detailed soil type information across eleven map units, each with a single layer. These 11 maps were cleaned and merged into a single layer.
2. The soil types in the areas outside of the boundaries of the detailed soil information (#1 above) were derived from the Agricultural Region of Alberta Soil Inventory Database (AGRASID 30)[16].

The layers from source 1 and source 2 were merged into a single soil type layer.

[15] The geodatabase ("GVI_sitetypes_from_soils.gdb") was provided by O. Castelli from SRD in Lethbridge, AB.
[16] Downloaded from: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag3252?opendocument

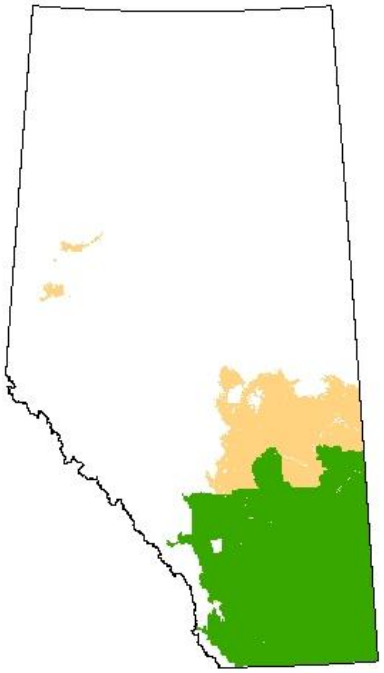

***Figure 15: Extent of soil type information derived from 1) the SRD geodatabase 'GVI_sitetypes_from_soils.gdb' (green) and 2) AGRASID layers (brown).***

## 7 COMBINATION OF SUB-LAYERS

The five new GIS sub-layers created in Section 6 were combined with the original vegetation layer described in Section 5[17] (Figure 16, Figure 17). Within the attribute table (Figure 16), the field 'Veg_Type' records the vegetation classes and the field 'EC_Type" records both upland and wetland vegetation classes.

[17] The layers were combined using the 'Union' command in ArcGIS.

| OBJECTID * | Shape * | DEM_WET_BOUND | Veg_Type | source | ORIGIN_TYPE | ORIGIN_YEAR | PCT_P | SOIL_TYPE | WET | MOIST_REG_2 | EC_Type | Shape_Length | Shape_Area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 333 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 603.302499 | 5463.187687 |
| 334 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 599.508563 | 3500.727735 |
| 335 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 141.189787 | 488.334186 |
| 336 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 737.571496 | 9932.334818 |
| 337 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 729.844793 | 5762.825903 |
| 338 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 363.725409 | 2314.968115 |
| 339 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 319.808949 | 2977.636266 |
| 340 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 395.240227 | 4488.122515 |
| 341 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 275.411832 | 1385.948244 |
| 342 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 500.452957 | 5561.915863 |
| 343 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 23.582166 | 13.201188 |
| 344 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 827.410814 | 6437.795585 |
| 345 | Polygon | | Grassland | LC | | 0 | 0 | Lo | DEM_rip | | Grassland | 874.685634 | 8187.958155 |
| 346 | Polygon | | Grassland | LC | | 0 | 0 | Lo | Marsh | | Marsh | 297.977574 | 3335.582784 |
| 347 | Polygon | | Grassland | LC | | 0 | 0 | TB-Li- | | | Grassland | 863.021663 | 17520.401184 |
| 348 | Polygon | | Lotic Herb | GVI | | 0 | 0 | | GVI_wet | LtcH | Lotic Herb | 2423.025301 | 68546.587918 |
| 349 | Polygon | | Lotic Herb | GVI | | 0 | 0 | | GVI_wet | LtcH | Lotic Herb | 1259.502579 | 24172.415686 |
| 350 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | GVI_wet | LtcH | Lotic Herb | 103.851422 | 266.252358 |
| 351 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | GVI_wet | LtcH | Lotic Herb | 101.411729 | 562.407779 |
| 352 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | GVI_wet | LtcH | Lotic Herb | 77.151709 | 91.985317 |
| 353 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | GVI_wet | LtcH | Lotic Herb | 2794.275985 | 264636.174052 |
| 354 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | GVI_wet | LtcH | Lotic Herb | 23.377585 | 17.375535 |
| 355 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | GVI_wet | LtcH | Lotic Herb | 266.283857 | 3146.824687 |
| 356 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | GVI_wet | LtcH | Lotic Herb | 1898.362558 | 30683.33691 |
| 357 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | Marsh | LtcH | Marsh | 482.987006 | 4347.67125 |
| 358 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | Open Wa | LtcH | Water | 96.992143 | 245.807831 |
| 359 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | Open Wa | LtcH | Water | 148.775191 | 316.186274 |
| 360 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | Open Wa | LtcH | Water | 82.360716 | 167.819254 |
| 361 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | Open Wa | LtcH | Water | 15.364749 | 10.500977 |
| 362 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | Open Wa | LtcH | Water | 15.752859 | 11.264615 |
| 363 | Polygon | | Lotic Herb | GVI | | 0 | 0 | Lo | Open Wa | LtcH | Water | 119.083471 | 254.400491 |
| 364 | Polygon | | Lotic Shrub | GVI | | 0 | 0 | | GVI_wet | LtcS | Lotic Shrub | 217.632726 | 792.379351 |
| 365 | Polygon | | Lotic Shrub | GVI | | 0 | 0 | | GVI_wet | LtcS | Lotic Shrub | 499.661728 | 11368.681522 |
| 366 | Polygon | | Lotic Shrub | GVI | | 0 | 0 | | GVI_wet | LtcS | Lotic Shrub | 219.951041 | 1244.092407 |
| 367 | Polygon | | Lotic Shrub | GVI | | 0 | 0 | | GVI_wet | LtcS | Lotic Shrub | 90.079323 | 300.704901 |
| 368 | Polygon | | Lotic Shrub | GVI | | 0 | 0 | Li-Lo- | GVI_wet | LtcS | Lotic Shrub | 307.219033 | 895.061023 |
| 369 | Polygon | | Lotic Shrub | GVI | | 0 | 0 | Li-Lo- | GVI_wet | LtcS | Lotic Shrub | 826.194068 | 30916.849464 |
| 370 | Polygon | | Lotic Shrub | GVI | | 0 | 0 | Li-Lo- | GVI_wet | LtcS | Lotic Shrub | 330.759061 | 980.185334 |
| 371 | Polygon | | Lotic Shrub | GVI | | 0 | 0 | Li-Lo- | GVI_wet | LtcS | Lotic Shrub | 975.105613 | 4499.09789 |
| 372 | Polygon | | Lotic Shrub | GVI | | 0 | 0 | Li-Lo- | GVI_wet | LtcS | Lotic Shrub | 388.139813 | 2606.26484 |

***Figure 16:Attribute table of the backfilled vegetation layer.***

The backfilled layer is available two formats: 1) a single layer that spans all of Alberta, and 2) a tiled version.

## 7.1 Attribute Table Definitions

**ORIGIN_YEAR**

**Definition:** Year of last known disturbance in which vegetation age would have been reset to zero.

**Values:** Integers between 1500 and 2000. The values '1500' refers to areas that did not have information on the year of last disturbance and were assumed to be undisturbed in recent history.

**ORIGIN_TYPE**

**Definition:** Data source for ORIGIN_YEAR field.

**Values:** Categorical values. Acceptable values are: AVI_BURN, AVI_ORIGIN, CUTBLOCK, SRD_FIRE

**PCT_P**

**Definition:** Percentage of pine; based on canopy cover.

**Values:** Integers include 0, 1-10, 52, 152, 252, and 9999. Values 1-10 indicates the percentage of pine in increments of 10% (where 1 = 10%, 2 = 20%, …, and 10 = 100%). Values of '52' and '152' refer to 'Closed Pine' and 'Open Pine' areas, respectively. Values of '252' are those polygons classified as "Pine" in PLVI, GVI, or the layers in national parks. Values 0 or 9999 refer to polygons with no pine.

**WET**

**Definition:** Indicates wetland types and sources.
**Values:** Categorical values. See Table 23.

**DEM_WET_BOUND**

**Definition:** Areas having wetlands but these areas were not mapped either in the Alberta CWCS Merged Wetland Inventory or in the Hydropoly_wetlands and outside of the extent of AVI, GVI, PLVI and Wood Buffalo National Parks
**Values:** 'a'

**SOIL_TYPE**

**Definition:** Soil type based on GVI and AGRASID data.
**Values:** Categorical; see Appendix B

**Veg_Type**

**Definition:** Backfilled vegetation classes
**Values:** Categorical; see Table 1 for the values from AVI, Table 10 for the values from PLVI, Table 16 for the values from GVI and Table 20 for ABMIw2wLCV2010.

**EC_Type**

**Definition:** Backfilled vegetation classes including both upland and wetland types
**Values:** Categorical; see Table 9 and Veg_Type values.

**Source**

**Definition:** Source layers for the vegetation information
**Values:** Categorical; AVI, GVI, LC, WBNP. See Figure 17.

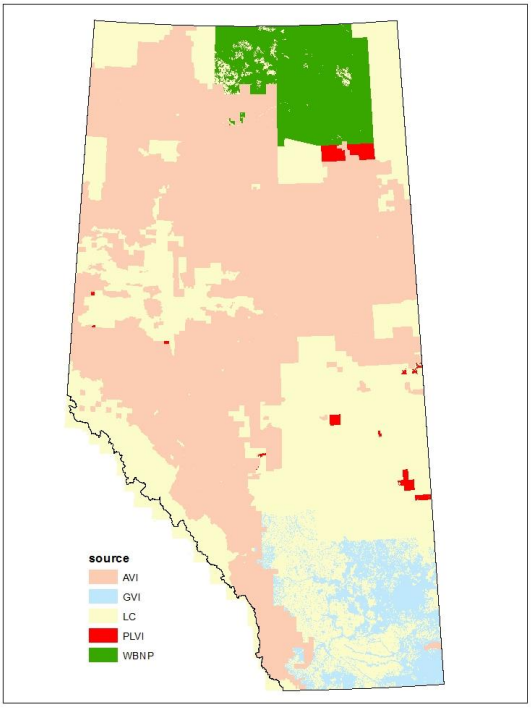


***Figure 17: Source layers used in the backfilled vegetation information***

## 8 ADDITION OF 2010 HUMAN FOOTPRINT LAYER

The ABMI 2010 Human Footprint (Version 1.3) was "stamped' on the backfilled layer created in Section 7[18]. The attribute table of this layer is the same as for the backfilled layer with the addition of the field 'FEATURE_TY', which records the 2010 Human Footprint types, and field "Cut_Year", which records the year of harvest for cutblock polygons.

The current version has a few cutblock polygons with non-forest types in the backfilled layer because the backfilling procedure used an earlier (and incorrect) version of the ABMI 2010 Human Footprint layer (Version 1.2). This issue will be fixed in the next release. As an interm "fix" two additional rules were applied to cutblock polygons for the field "EC_Type" or "FEAUTRE_TY" so that all cutblock polygons have an appropriate upland forest type. First, if the cutblock polygon was labeled with a wetland vegetation type derived from CWCS Merged wetland layer, the "FEATURE_TY" was recoded as blank (ie., to not being a cutblock). Second, if the wetland vegetation type was derived from other sources, the "EC_Type" was recoded using the upland vegetation type (i.e., from field "Veg_Type").

The backfilled layer with the added 2010 human footprint is available two formats: 1) a single layer that spans all of Alberta, and 2) a tiled version.

[18] The ArcGIS commend 'Update' was used in this step.