Alberta Biodiversity
Monitoring Institute

www.abmi.ca

Manual for Reporting Human Footprint

Version 2012-03-26

March 2012

Acknowledgements
The present document was created by Gillian Holloway and Dave Huggard. Technical input was provided by Erin Bayne, Jim Schieck and Jim Herbers.

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Suggested Citation: Alberta Biodiversity Monitoring Institute. 2012. Manual for Estimating Human Footprint Intactness (20030), Version 2012-03-26. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at: abmi.ca [Date Cited].

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Summary

The Alberta Biodiversity Monitoring Institute (ABMI) tracks changes in human footprint across the province of Alberta. One of the main goals of the institute is to provide credible and understandable indices which summarize information on the amount and location of multiple human footprints to support natural resources management. This document details how ABMI assesses and reports on the status of human footprints, based on remote sensing and information collected during field sampling. The methods presented here are continuously in revision, and updated versions of this document will be released periodically.

1. Background on the Alberta Biodiversity Monitoring Institute

The Alberta Biodiversity Monitoring Institute (ABMI) was initiated in 1997 through a broad partnership of industry, government and academia. ABMI is tasked with providing an effective way to track status and change to biodiversity at 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, invertebrates, vascular plants, lichens, moss, and fungi), habitat structures, and human footprints at 1656 sites spaced systematically on a 20-kilometre grid across the entire province. Each of the 1656 sites is sampled once every 5 years using a set of scientifically reviewed protocols. In addition, human footprint is 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 a more complete understanding of cumulative impacts on the environment from multiple industries and human activities.

This document describes the methods used to report on human footprint from both remotely sensed and field information. There are companion documents describing the detailed protocols for measuring human footprint elements using remotes sensing and during field surveys.

2. Human Footprint Reporting

2.1 Footprints

Human footprint refers to the geographic extent of areas under human use that have either lost their natural cover (e.g., cities, roads, agricultural land, industrial areas) or whose natural cover is periodically or temporarily replaced by resource extraction activities (e.g., forestry, seismic lines, surface mining). An area altered by humans that has recovered to the point of being indistinguishable from surrounding natural habitats is not included as footprint area. Human footprint areas can maintain many species, particularly as temporary disturbances recover through time. ABMI monitoring of species and habitat elements includes the components of biodiversity that occur in these areas. In this document, we are concerned only with reporting on human footprint areas that are still visible in air photos or satellite images as footprints.

Human footprint is recorded at 3 levels: 1) Province-wide, based on a variety of mapped data sources, 2) At each ABMI sampling site, based on air-photo interpretation, 3) On the ground when each ABMI site is sampled, including the systematic terrestrial sites, nearby wetland sites and winter snow-tracking sites.

<u>Province-wide</u>: Human footprints (described in Appendix A) are mapped across the entire province using existing data layers from: 1) the provincial government on roads, powerlines, pipelines, well pads, seismic lines and other energy infrastructure, 2) the federal government on cultivated land, 3) the forest industry on forestry cutblocks, 4) air photo interpretation by the ABMI of urban areas, individual rural residences, and industrial features. This province-wide map ensures that human footprint is described for all locations in Alberta. However, this map is

only as accurate as the underlying layers that were used during creation. Province-wide mapping of human footprint will be updated as new information becomes available from governments and others.

For data summary, human footprints are combined into 9 broad categories (Table 1). These 9 categories are further summarized as "successional" types in which natural vegetation regenerates after the human use, and "alienating" types which are maintained permanently with altered vegetation.

Table 1. Coarse level human footprint types used in province-wide mapping.

Successional Footprint Types

1500 Soft & Wide Linear Features
1600 Soft & Narrow Linear Features
2200 Pasture & Forage
3000 Managed Forest

Alienating Footprint Types

1100 Urban and Rural Features
1200 Industrial & Resource Extraction Features
1300 Hard & Wide Linear Features
1400 Hard & Narrow Linear Features
2100 Cultivated Crops

ABMI site level: The location and extent of human footprint types (described in Appendix B) are determined in 3km x 7km rectangles encompassing each ABMI monitoring site by manually interpreting 1:30,000 air photos. This information is more accurate than the province-wide map because the air photos have a finer resolution than the satellite imagery used for the province-wade mapping. In addition, human footprints that are no longer visible on the air photos are removed/not mapped whereas footprints are seldom removed from the layers used to generate the province-wide map.

Information from the 3km x 7km rectangles is summarized to provide an estimate (~4% sample of the landscape) of the amount of disturbance by each footprint type in a region. This information will be updated during each round of ABMI data collection (scheduled to occur every 5 years) and change over time reported. For data summary, the detailed human footprint types recorded from air photos at ABMI sites are grouped into the same 9 categories and 2 types as used for the province-wide summary (Table 1). Province-wide footprint information and the 3km x 7km footprint information are cross-checked to ensure both produce similar results.

In addition, footprints are extracted from the province-wide mapping in buffers around ABMI wetland sites and winter mammal-track transects. These footprint values are used for developing footprint relationships for the biotic taxa and calculating intactness (see ABMI species manual), not for general reporting on footprint. For wetlands, buffers of 100m, 250m and 2km around the edge of the wetland open-water zone are used, because the location of that edge of open water

are readily identified from available digital imagery. For track transects, human footprints are summarized within a 250m buffer of the mammal transects.

Field information: When surveying birds at each of the 9 point count stations at each terrestrial ABMI site, observers record the percent cover (0, 1, 1-5, 5-10…95-100%) of human disturbance types: forest harvest, seismic lines, well pads, roads, trails, cultivated crop fields, pasture, residential, urban and industrial areas. Within 20m of wetland shores, observers record the percent cover of paths and livestock trails, vehicle trails, roads, recreation facilities, cultivated land, pasture, residences, industrial facilities, seismic lines and other linear features, forest harvesting, bare soil from other human activities and other human disturbances. These field-measured footprint variables are used for detailed modeling of biotic responses, and assessing disturbance changes over time that may not be visible from air-photos (especially for wetlands).

2.2 Summaries

To summarize human footprint provincially or regionally, three aspects of human footprint are summarized: 1) area of human footprint type within each ecosystem or habitat type, 2) spatial distribution of human footprint, 3) distances from non-footprint areas (areas without visible human use) to the nearest human footprint area.

2.2.1 Ecosystem types

The most basic summary for a region is the area of each of the human footprint types in each ecosystem unit. Both human footprints and ecosystem classifications are hierarchical. Human footprint types can be combined into 9 broader types, then into successional/alienating groups and finally into total footprint. Ecosystem classifications typically have 3 or 4 levels, ending in large regions like "boreal forest". Different levels of footprint and ecosystem classification are used for different communication purposes, from detailed technical reports at fine classification levels, to overview reports that use only the broadest levels of the two hierarchies.

Alberta has a number of ecological classifications, with no one system dominant across the province. For forested systems, we are currently using natural sub-regions (Natural Regions Committee 2006) as the basic unit of summary for the province-wide footprint. Ecosites are a finer-level ecosystem classification. Footprint can only be summarized by ecosite at surveyed ABMI sites, because ecosite mapping is not presently available province-wide.

In grassland and extensively disturbed parkland areas, major soil types (Alberta Soil Information Center (ASIC). 2001) within natural subregions delineated by experts are the most appropriate currently available basic ecological units. Other classification systems may be adopted when these are developed in the future, particularly ways of predicting where riparian forest and wetlands used to occur in these zones. Because human footprint is so extensive in grassland and parkland areas, we have no way of determining habitat types that existed prior to human disturbance.

2.2.2 Spatial distribution

Because footprint information is available across the province, we can present the spatial distribution of human footprint across regions or the whole province with maps and histograms,

at various scales. Summaries include the distribution of area of human footprint types by townships (roughly 10km x 10km), including such values as the maximum and minimum footprint levels by township in a region, and maps of footprint at finer spatial resolutions.

2.2.3 Distances to nearest footprint

Human footprint can have effects on adjacent undisturbed areas, with the distance of the effect differing by which species or other ecological feature is being affected, and by the type of adjacent human footprint. To describe the degree to which native habitats may be affected by human development, human footprints were mapped throughout Alberta, and the intervening areas classified as native habitat. The distance from all points of native habitat to the nearest human footprint is calculated, separately for the 9 coarse footprint categories. Many summaries are possible for these distances to edge, including mean distance and percentages of native habitat area that are >50m, >200m or >2km from each footprint type. These distances correspond, respectively, to typical edge-effect distances reported in studies of biota, maximum edge effect distances for detectable physical effects such as microclimate, and a large distance capturing the idea of "wilderness". The latter distance is a social value, but may also represent distances hunters and poachers travel from access features, and spread of some invasive plants.

3. References

Alberta Soil Information Center (ASIC). 2001. AGRASID 3.0. Agricultural Region of Alberta Soil Inventory Database Version 3.0. Edited by J.A. Brierley, T.C. Martin, and D.J. Spiess. Agriculture and Agri-Food Canada, Research Branch, and Alberta Agriculture, Food and Rural Development, Conservation and Development Branch, Edmonton, Alberta.

Natural Regions Committee 2006. Natural Regions and Subregions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852.

Appendix A. Human footprint types province-wide determined from existing GIS layers.

Each of these 29 discrete human footprint types are extracted from existing government, industry and other GIS layers or mapped by ABMI from satellite images.

1000 Urban & Industrial Features & Infrastructure

1100 *Urban & Rural Features (habitats where people live, non-industrial)*

1101 Urban. Residential Urban (residential areas in cities, towns, villages, cottages, ribbon developments, etc; areas that are dominated by dwellings – usually >1 building per ha)

1102 Rural. Residential Rural Dominated by Buildings (usually >1 building per ha; eg. farmstead, ranch, acreages, lodges, etc)

1103 Urban/Rural Greenspace – grave yards, religious areas, golf courses, campgrounds, shelterbelts, ski hills, DND exercise areas, low vegetation surrounding airport runways, clearings from old industrial activity that is now vegetated, etc.)

1200 *Industrial & Resource Extraction Features (habitats associated with heavy industrial development)*

1204 Commercial/Industry (High human density). Intense industrial & commercial development (airports, industrial parks, factories, refineries, hydro generating stations, pulp & paper mills, pump stations, malls, parking lots, zoos, etc.)

1205 Industry (Low human density). Bare and/or Vegetated Ground clear for Industry (coal and mineral surface mines, oil and gas well pads, wind mills, communication towers, gravel pits, heavy oil sand development, spoil piles, etc.)

1300 *Hard & Wide Linear Features (length >50 times the width, >10m wide, hard surface /non-vegetated [gravel road, paved road, railway, paved airport runway, etc.])*

1301 Lin20Hard. Linear road/rail/industrial features >20 m wide

1302 Lin10Hard. Linear road/rail/industrial features 10-20 m wide

1400 *Hard & Narrow Linear Features (length >50 times the width, ≤10m wide, hard surface /non-vegetated [gravel or paved linear feature])*

1401 Lin5Hard. Linear road/trail/path/rail/industrial features 2-10 m wide

1500 *Soft & Wide Linear Features (length >50 times the width, >10m wide, soft surface /vegetated [packed soil, pipeline right of way, transmission line, etc.], not including roads)*

1501 Lin20Soft. Linear urban/industrial features >20 m wide

1502 Lin10Soft. Linear urban/industrial features 10-20 m wide

1600 *Soft & Narrow Linear Features (length >50 times the width, ≤10m wide, soft surface /vegetated [packed soil, pipeline right of way, transmission line, etc.], not including roads)*

1601 Lin5Soft. Linear urban/industrial features 2-10 m wide

1700 *Vegetated Roads, Verges and Ditches (unimproved vegetated roads and the areas along the edge of roads)*

1701 VegetatedRoad. Roads, trails and paths with unimproved surfaces

1702 RoadVerge. Vegetated verges and ditches along roads

1900 *Human-created Water Bodies*

1901 Dug-out

1902 Lagoon
1903 Reservoir
1910 Canal

2000 Agricultural Cover Types *(soil cultivated)*

2100 *Cultivated Crops (must be evidence of cultivation visible during the photo interpretation)*

2101 Crop. Annual cereal crop
2102 Irrig. Irrigated land
2103 Other agriculture (orchard, horticulture, etc)
2104 ArgBare. Bare soil that is created as part of agricultural activities

2200 *Cultivated Pasture & Forage*

2205 Pasture
2206 Forage crop

3000 Managed Forest

3001 CBClear10. Clearcut block <10 years with no ground disturbance during reforestation (<20% of the live trees retained at harvest)
3002 CBStructure10. Structured cut block <10 years with no ground disturbance during reforestation (>=20% of the live trees retained at harvest, this includes tree retention harvest, thinning, & understory protection)
3011 CBClear 20. Clearcut block 11-30 years with no ground disturbance during reforestation (<20% of the live trees retained at harvest)
3012 CBStructure 20.Structured cut block 11-30 years with no ground disturbance during reforestation (>=20% of the live trees retained at harvest, this includes tree retention harvest, thinning, & understory protection)
3021 CBClear30. Clearcut block >30 years with no ground disturbance during reforestation (<20% of the live trees retained at harvest)
3022 CBStructure30. Structured cut block >30 years with no ground disturbance during reforestation (>=20% of the live trees retained at harvest, this includes tree retention harvest, thinning, & understory protection)
3031 CBClearUnknow. ClearCut block unknown years with no ground disturbance during reforestation
3032 CBStructureUnknow. Structured cutblock unknown years with no ground disturbance during reforestation

Appendix B. Vegetation and habitat types determined by manual interpretation of air-photos (3km x 7km area) around each ABMI site.

Human footprint and natural vegetation types are mapped based on air-photo imagery in the 3km x 7km area around each of the ABMI sites. Categories in the 1000 and 2000 ranges are identical to those in Appendix A. Human modified forest (categories in the 3000 range) are grouped differently than in Appendix A. Natural vegetation and land (categories in the 4000 to 10000 ranges) are not included in Appendix A, because there are no existing GIS layers for these features.

1000 Urban & Industrial Features & Infrastructure

1100 *Urban & Rural Features (habitats where people live, non-industrial)*

1101 Urban. Residential Urban (residential areas in cities, towns, villages, cottages, ribbon developments, etc; areas that are dominated by dwellings – usually >1 building per ha)

1102 Rural. Residential Rural Dominated by Buildings (usually >1 building per ha; eg. farmstead, ranch, acreages, lodges, etc)

1103 Urban/Rural Greenspace – grave yards, religious areas, golf courses, campgrounds, shelterbelts, ski hills, DND exercise areas, low vegetation surrounding airport runways, clearings from old industrial activity that is now vegetated, etc.)

1200 *Industrial & Resource Extraction Features (habitats associated with heavy industrial development)*

1204 Heavy Commercial/Industry (High human density). Intense industrial & commercial development (airports, industrial parks, factories, refineries, hydro generating stations, pulp & paper mills, pump stations, malls, parking lots, zoos, etc.)

1205 Heavy Industry (Low human density). Bare Ground clear for Industry (coal and mineral surface mines, oil and gas well pads, communication towers, gravel pits, heavy oil sand development, spoil piles, etc.)

1300 *Hard & Wide Linear Features (length >50 times the width, >10m wide, hard surface /non-vegetated [gravel road, paved road, railway, paved airport runway, etc.])*

1301 Lin20Hard. Linear road/rail/industrial features >20 m wide

1302 Lin10Hard. Linear road/rail/industrial features 10-20 m wide

1400 *Hard & Narrow Linear Features (length >50 times the width, ≤10m wide, hard surface /non-vegetated [gravel or paved linear feature])*

1401 Lin5Hard. Linear road/trail/path/rail/industrial features 2-10 m wide

1500 *Soft & Wide Linear Features (length >50 times the width, >10m wide, soft surface /vegetated [packed soil, pipeline right of way, transmission line, etc.])*

1501 Lin20Soft. Linear urban/industrial features >20 m wide

1502 Lin10Soft. Linear urban/industrial features 10-20 m wide

1600 *Soft & Narrow Linear Features (length >50 times the width, ≤10m wide, soft surface /vegetated [packed soil, pipeline right of way, transmission line, etc.])*

1601 Lin5Soft. Linear urban/industrial features 2-10 m wide

1700 *Vegetated Roads, Verges and Ditches (unimproved vegetated roads and the areas along the edge of roads)*

1701 VegetatedRoad. Roads, trails and paths with unimproved surfaces

1702 RoadVerge. Vegetated verges and ditches along roads

1900 *Human-created Water Bodies*

1901 Dug-out
1902 Lagoon
1903 Reservoir
1910 Canal

2000 Agricultural Cover Types

2100 *Cultivated Crops (must be evidence of cultivation visible during the photo interpretation)*

2101 Crop. Annual cereal crop
2102 Irrig. Irrigated land
2103 Other agriculture (orchard, horticulture, etc)
2104 ArgBare. Bare soil that is created as part of agricultural activities

2200 *Pasture & Forage*

2205 Pasture
2206 Forage crop

3000. Human Modified Forest Land *(must be evidence of forest activities within the cutblock [eg. scarification, or trees in rows, etc] visible during the photo interpretation)* The stand is described by the regenerating vegetation (eg. pine, aspen, etc), and not the trees that were harvested. Each of these polygon types has 5 age categories: 0-10 years, 11-30 years, 31-55 years, 56-80 years, >80 years

3100 *Managed Coniferous Dominated Forest (>80% coniferous cover based on occurrence)*

3111/12/13/14/15 – MangClosedPine10/20/40/70/90. Closed pine - 0-10/11-30/31-55/56-80/>80 yr
3116/17/18/19/20 – MangOpenPine10/20/40/70/90. Open pine - 0-10/11-30/31-55/56-80/>80 yr
3121 – MangPineUnknown. Pine unknown years
3131/32/33/34/35 – MangClosedSpr10/20/40/70/90. Closed Spruce/Fir/Larch - 0-10/11-30/31-55/56-80/>80 yr
3136/37/38/39/40 – MangOpenSpr10/20/40/70/90. Open Spruce/Fir/Larch - 0-10/11-30/31-55/56-80/>80 yr
3141 – MangSprUnknown. Spruce/Fir/Larch unknown years
3151/52/53/54/55 – MangClosedCon10/20/40/70/90. Closed Undifferentiated Conifer - 0-10/11-30/31-55/56-80/>80 yr
3156/57/58/59/60 – MangOpenCon10/20/40/70/90. Open Undifferentiated Conifer - 0-10/11-30/31-55/56-80/>80 yr
3161 – MangConUnknown. Undifferentiated Conifer unknown years

3200 *Managed Deciduous Dominated Forest (>80% deciduous cover based on occurrence)*

3211/12/13/14/15 – MangClosedDecid10/20/40/70/90. Closed Aspen/Popular/Birch/Other - 0-10/11-30/31-55/56-80/>80 yr
3216/17/18/19/20 – MangOpenDecid10/20/40/70/90. Open Aspen/Popular/Birch/Other - 0-10/11-30/31-55/56-80/>80 yr
3221 – MangDecidUnknown. Aspen/Popular/Birch/Other unknown years

3300 *Managed Mixed Wood Dominated Forest (20 - 80% mixed wood cover based on occurrence)*

3311/12/13/14/15 – MangClosedCMix10/20/40/70/90. Closed Coniferous Dominated Mixedwood - 0-10/11-30/31-55/56-80/>80 yr

3316/17/18/19/20 – MangOpenCMix10/20/40/70/90. Open Coniferous Dominated Mixedwood - 0-10/11-30/31-55/56-80/>80 yr
3321 – MangCMixUnknown. Coniferous Dominated Mixedwood unknown years

3331/32/33/34/35 – MangClosedDMix10/20/40/70/90. Closed Decicuous Dominated Mixedwood - 0-10/11-30/31-55/56-80/>80 yr
3336/37/38/39/40 – MangOpenDMix10/20/40/70/90. Open Decicuous Dominated Mixedwood - 0-10/11-30/31-55/56-80/>80 yr
3341 – MangDMixUnknown. Decicuous Dominated Mixedwood unknown years

3400 *Managed Grasses/Herbs/Shrubs (area was modified by harvest activities)*

3401 – MangForGrass. Grasses/Herbs/Shrubs dominance in cutblocks prior to tree regeneration and growth

4000. Natural Non-Forest Grassland (<25% shrub cover and <6% tree cover) *(*no evidence of cultivation or harvest in the air photo*)*

4001 – GrassNonfor. Upland grass cover

5000. Natural Upland Non-Forest Forbs (<25% shrub cover and <6% tree cover and <6% graminoid) *(*no evidence of cultivation or harvest in the air photo*)*

5001 – ForbNonfor. Upland forb cover
5002 – BryoNonfor. Upland Bryophytes

6000. Natural Non-Forest Shrubland (>25% shrub cover and <6% tree cover) *(*no evidence of cultivation or harvest in the air photo*)*

6001 – ClosedRShrubNonfor. Closed Riparian Shrub
6002 – OpenRShrubNonfor. Open Riparian Shrub
6003 – ClosedUShrubNonfor. Closed Upland Shrub
6004 – OpenUShrubNonfor. Open Upland Shrub

7000. Natural Disturbed Forests in Very Early Stages of Succession (eg. burns, blowdown, pest-killed, flooded, etc. There must be extensive snags and/or downed logs in the polygon from the previous forest. The stand is described by the regenerating vegetation and not the trees that have been killed.)

7001 – GrassFor. Natural Forest Grassland
7002 – ForbFor. Natural Forest Forbland
7003 – ShrubFor. Natural Forest Shrubland

8000. Natural Forested Land (>6% tree cover) *(NO visible evidence of human disturbance)* Each of the polygon types has 5 age categories: 0-10 years, 11-30 years, 31-55 years, 56-80 years, >80 years.

8100 *Coniferous Dominated Forest (>80% coniferous cover based on occurrence)*

8111/12/13/14/15 – ClosedFir10/20/40/70/90. Closed Fir - 0-10/11-30/31-55/56-80/>80 yr
8116/17/18/19/20 – OpenFir10/20/40/70/90. Open Fir - 0-10/11-30/31-55/56-80/>80 yr
8121/22/23/24/25 – ClosedBSpr10/20/40/70/90. Closed Black Spruce - 0-10/11-30/31-55/56-80/>80 yr
8126/27/28/29/30 – OpenBSpr10/20/40/70/90. Open Black Spruce - 0-10/11-30/31-55/56-80/>80 yr
8131/32/33/34/35 – ClosedWESpr10/20/40/70/90. Closed White/Engelmann Spruce - 0-10/11-30/31-55/56-80/>80 yr

8136/37/38/39/40 – OpenWESpr10/20/40/70/90. Open White/Engelmann Spruce - 0-10/11-30/31-55/56-80/>80 yr
8141/42/43/44/45 – ClosedPine10/20/40/70/90. Closed Pine - 0-10/11-30/31-55/56-80/>80 yr
8146/47/48/49/50 – OpenPine10/20/40/70/90. Open Pine - 0-10/11-30/31-55/56-80/>80 yr
8151/52/53/54/55 – ClosedCon10/20/40/70/90. Closed Undifferentiated Conifer - 0-10/11-30/31-55/56-80/>80 yr
8156/57/58/59/60 – OpenCon10/20/40/70/90. Open Undifferentiated Conifer - 0-10/11-30/31-55/56-80/>80 yr

8200 *Deciduous Dominated Forest (>80% deciduous cover based on occurrence)*

8211/12/13/14/15 – ClosedAsp10/20/40/70/90. Closed Aspen - 0-10/11-30/31-55/56-80/>80 yr
8216/17/18/19/20 – OpenAsp10/20/40/70/90. Open Aspen - 0-10/11-30/31-55/56-80/>80 yr
8221/22/23/24/25 – ClosedBPop10/20/40/70/90. Closed Balsam Poplar - 0-10/11-30/31-55/56-80/>80 yr
8226/27/28/29/30 – OpenBPop10/20/40/70/90. Open Balsam Poplar - 0-10/11-30/31-55/56-80/>80 yr
8231/32/33/34/35 – ClosedBir10/20/40/70/90. Closed White Birch - 0-10/11-30/31-55/56-80/>80 yr
8236/37/38/39/40 – OpenBir10/20/40/70/90. Open White Birch - 0-10/11-30/31-55/56-80/>80 yr
8241/42/43/44/45 – ClosedDec10/20/40/70/90. Closed Undifferentiated Deciduous - 0-10/11-30/31-55/56-80/>80 yr
8246/47/48/49/50 – OpenDec10/20/40/70/90. Open Undifferentiated Deciduous - 0-10/11-30/31-55/56-80/>80 yr

8300 *Mixed Wood Dominated Forest (20 - 80% mixed wood cover based on occurrence)*

8311/12/13/14/15 – ClosedCMix10/20/40/70/90. Closed Coniferous Dominated Mixedwood - 0-10/11-30/31-55/56-80/>80 yr
8316/17/18/19/20 – OpenCMix10/20/40/70/90. Open Coniferous Dominated Mixedwood - 0-10/11-30/31-55/56-80/>80 yr
8321/22/23/24/25 – ClosedDMix10/20/40/70/90. Closed Deciduous Dominated Mixedwood - 0-10/11-30/31-55/56-80/>80 yr
8326/27/28/29/30 – OpenDMix10/20/40/70/90. Open Deciduous Dominated Mixedwood - 0-10/11-30/31-55/56-80/>80 yr
8331/32/33/34/35 – ClosedMix10/20/40/70/90. Closed Coniferous and Deciduous Co-dominant Mixedwood - 0-10/11-30/31-55/56-80/>80 yr
8336/37/38/39/40 – OpenMix10/20/40/70/90. Open Coniferous and Deciduous Co-dominant Mixedwood - 0-10/11-30/31-55/56-80/>80 yr

9000. Natural Wetlands & Bogs

9001 – Marsh. Emergent Wetlands (cattails)
9002 – Gram Fen. Graminoid Wetlands (sedges/grasses/forbs)
9003 – WoodFen. Woodland Fen Drainage Flow Patterns)
9004 – Swamp
9005 – Alkali
9006 – WetOther. Other/Undifferentiated Wetlands
9010 – BogOpen. Bog with <6 crown closure
9011 – BogTree. Bog with >6 crown closure

10000. Water & Barren (<6% Vegetation cover)

10100 – Water. Open Water (lake, pond, river and stream)

10200 – Ice. Permanent Ice and Snow
10300 – BarrenTerr. Terrestrial Barren (rock, talus, alluvial deposit, badland, blowout zone, upland dune field)
10400 – BarrenAq. Aquatic Barren (alkali flat, mud flat, beach)