

3.1.5. Ecological Land Classification

Ecological Land Classification (ELC) is a process of delineating and describing ecologically distinctive areas based on landforms, soils, vegetation, and climate in an ecologically meaningful way. The ELC system involves an integration of all these components and is not simply an overlay of them. Expressing ecosystems as units on a map provides a basis for understanding their structure and composition (Wiken 1996). This holistic approach to land classification can be applied incrementally on a scale-related basis from site-specific ecosystems to very broad ecosystems.

3.1.5.1 Canadian Ecological Land Classification

The Canadian Ecological Land Classification (ELC) system is based on a hierarchy, with ecosystems nested within ecosystems, providing hierarchical units (Table 3.8). These ecosystems form part of a "nested hierarchy" at multiple scales, where smaller ecosystems are encompassed within successively larger ecosystems.

Table 3.8 Canadian Ecological Land Classification system hierarchy (highest to lowest level).

Ecological Land Classification Level and number of polygons in Canada	Mapped by	Description
Ecozones 15 terrestrial & 5 marine ecozones	Canadian Ecological Land Classification	The most generalized level (<i>e.g.</i> Boreal Plain ecozone). Global or continental climate as reflected by vegetation.
Ecoprovince 53		A sub-division of ecozones. Encompasses areas of uniform climate, geological history, and physiography. <i>Note:</i> boundaries of the ecoprovinces do not correspond to the political borders of Canadian provinces
Ecoregions 194		Large order landforms as expressed through similar climate, soils, and vegetation (<i>e.g.</i> Mid-Boreal Upland ecoregion).
Ecodistricts 1021		sub-division of ecoregions characterized by distinctive assemblages of relief, geology, landform, soils and vegetation (<i>e.g.</i> EcoDistrict polygon #715 - Duck Mountain)
Ecoassociations	base polygons for Soil Landscapes of Canada	mappable entity. Stand aggregates. Scale 1:50,000+ a repeating pattern of landform, topography, soils and vegetation throughout an ecodistrict
Ecosites	Forest Lands Inventory 2002	Stand-level. Mappable entity at operational scales (1:15,000 or 1:20,000). Soils <u>and</u> vegetation combined.
Ecoelements	not mapped (field guide only)	(V-types) vegetation-types and S-types (soil-types) below the stand level (applies to a 0.01 ha area - 10 m X 10 m) <i>e.g.</i> Forest Ecosystem Classification for Manitoba (Zoledeski <i>et al.</i> 1995)

3.1.5.1.1 *Ecozones*

Ecozones are the most generalized, and highest-level of ecological land classification. Figure 3.15 shows the various Ecozones of Canada.

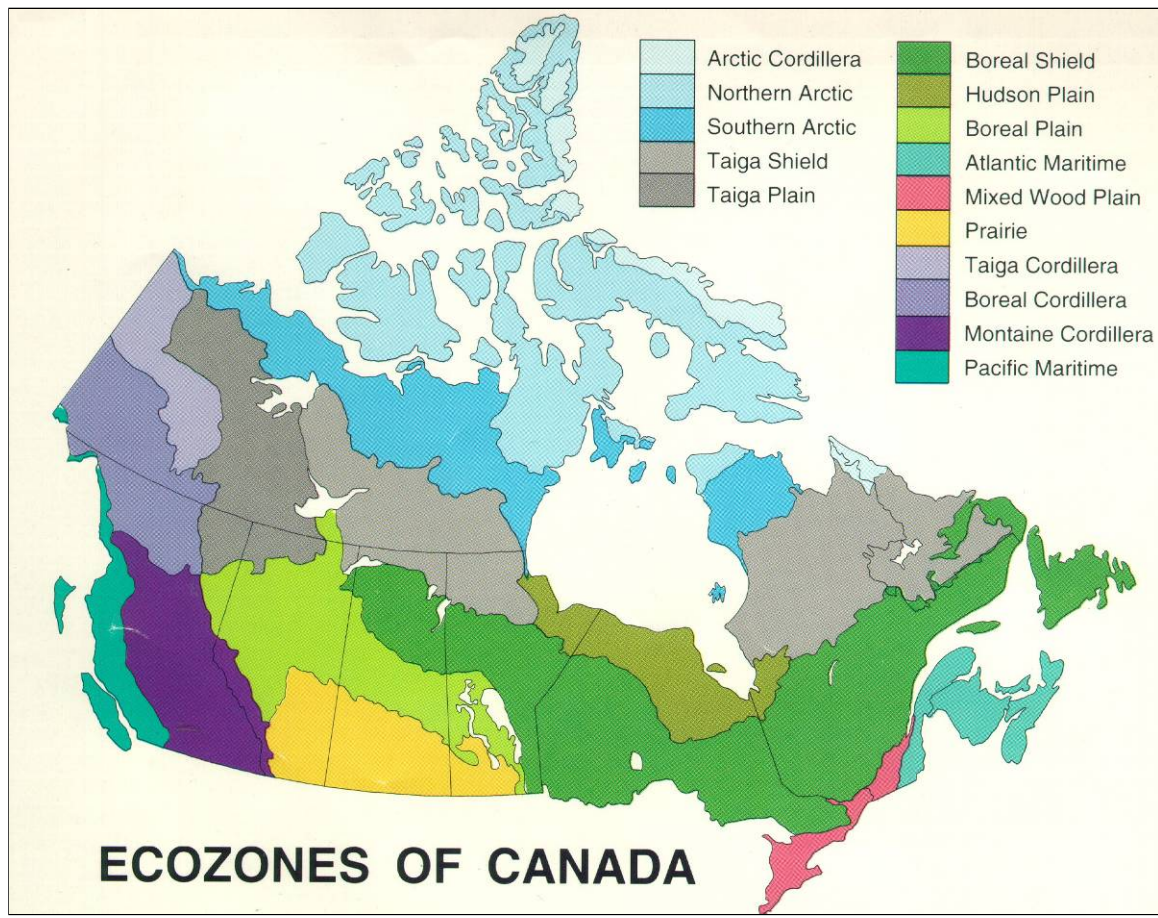


Figure 3.17 Terrestrial ecozones of Canada, showing the Boreal Plain (light green) and Prairie (yellow) ecozones.

Only two Ecozones are present within FML #3 (Figure 3.16), the Boreal Plain Ecozone and the Prairie Ecozone.

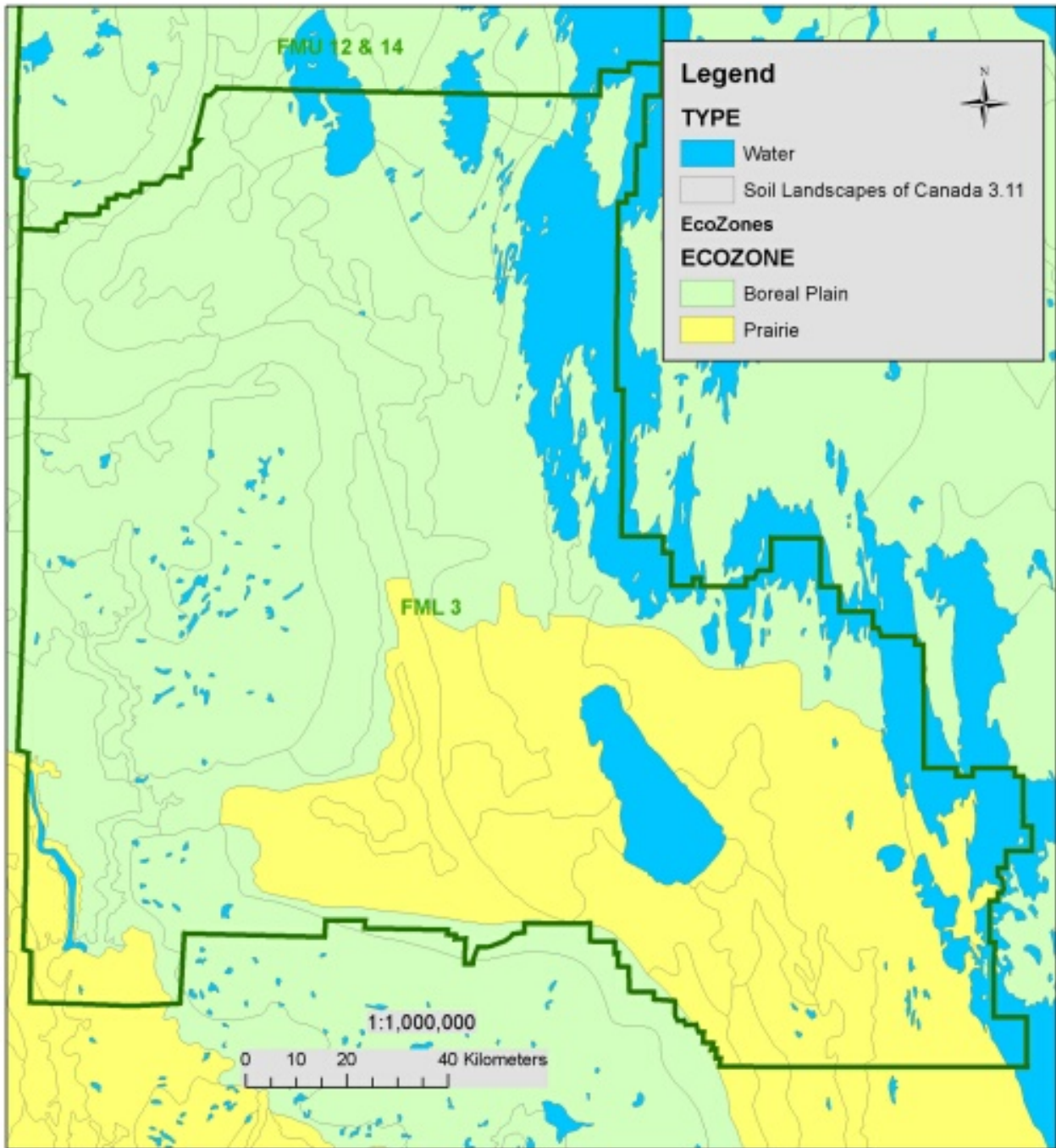


Figure 3.18 Boreal Plain and Prairie ecozones within FML #3.

3.1.5.1.2 Ecoprovince

An Ecoprovince is a biogeographic unit smaller than an ecozone and contains one or more ecoregions. An ecoprovince encompasses areas of uniform climate, geological history and physiography (*i.e.* mountain ranges, large valleys, plateaus). Their size and broad internal uniformity make them ideal units for the implementation of natural resource policies.

3.1.5.1.3 Ecoregions

Within the Boreal Plain ecozone, lies the Mid-Boreal Upland ecoregion, which encompasses the Duck Mountain Provincial Forest. Other ecoregions with FML #3 include the Boreal Transition, Interlake Plain, Lake Manitoba Plain, and a small portion of the Mid-Boreal Lowlands (Figure 3.17). Within the Prairie ecozone is a single ecoregion, the Aspen Parklands.

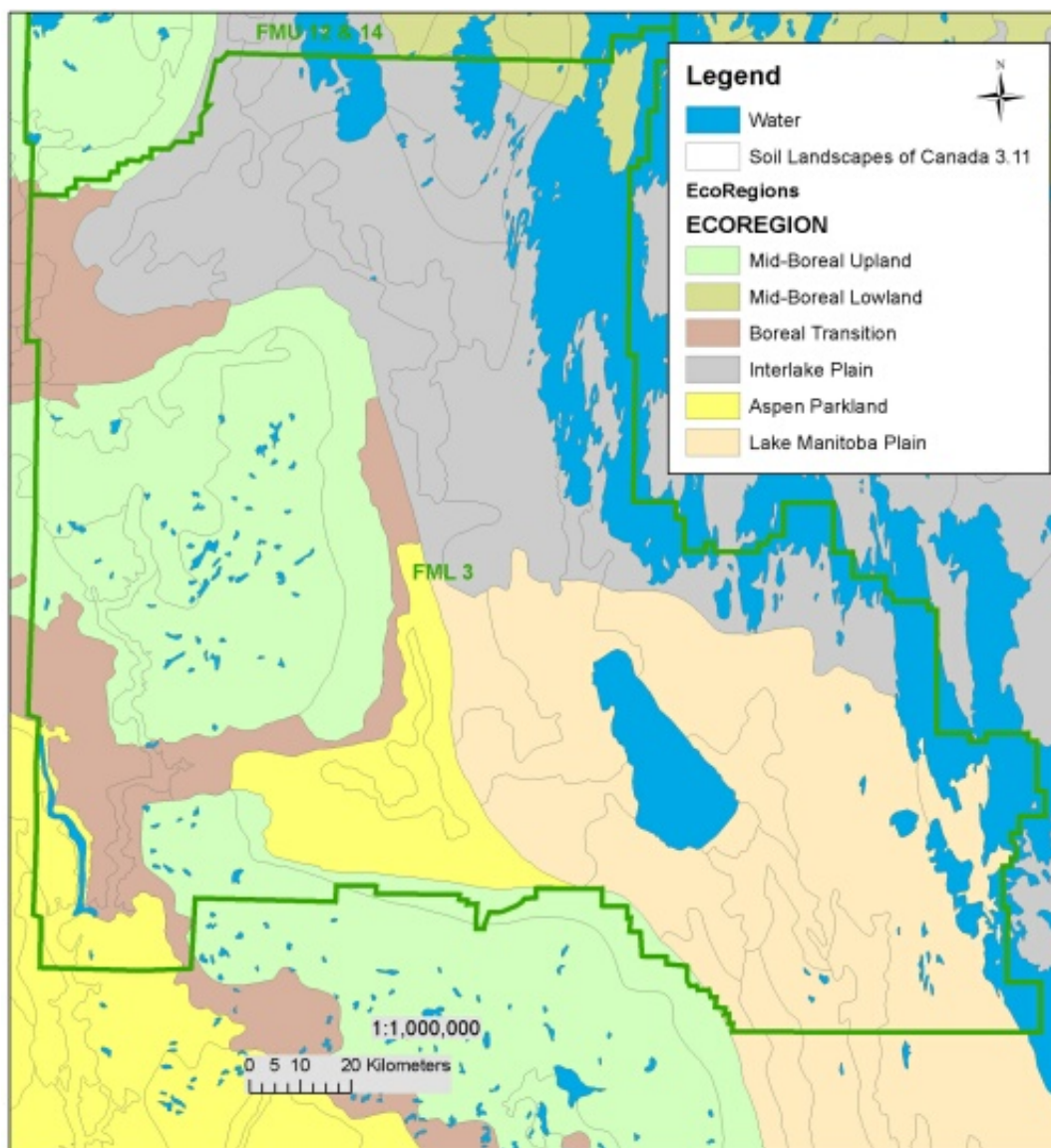


Figure 3.19 Ecoregions within FML #3.

3.1.5.1.4 *Ecodistricts*

Ecodistricts are subdivisions of ecoregions. There are 1021 mapped ecodistricts across Canada. The ecodistricts selected for use in describing Canadian forests are those featuring ecosystems that have predominantly woody vegetation, and does not take into consideration the commercial value of the trees. Ecodistricts also include wetlands. Note that the Duck Mountain forms a single, unique ecodistrict (Figure 3.18).

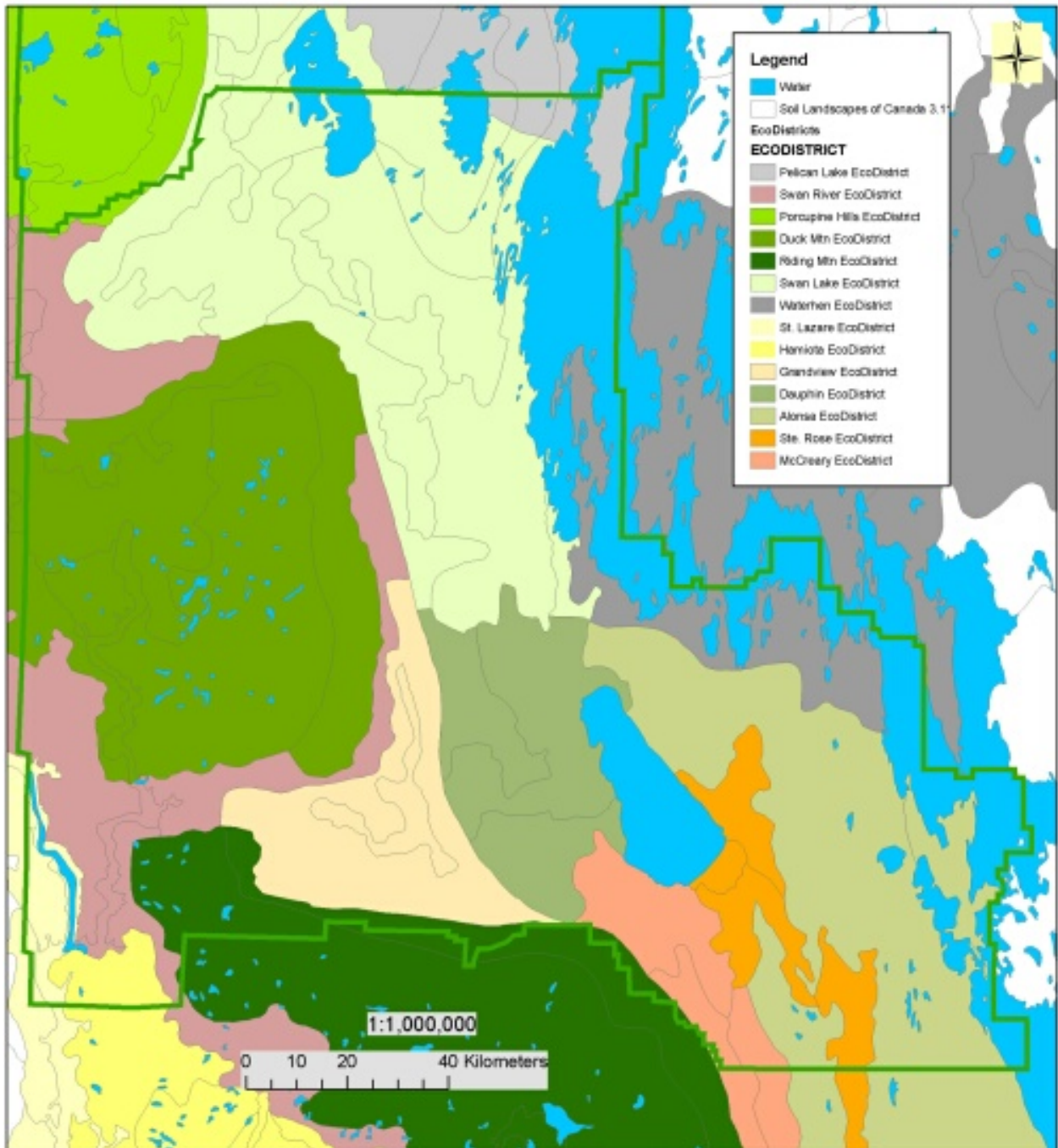


Figure 3.20 Ecodistricts within FML #3.

3.1.5.1.5 *Ecoassociations*

Ecoassociations are a repeating pattern of landform, topography, soils, and vegetation. Ecoassociations are the lowest level polygons in the Ecological Land Classification hierarchy. Higher-order polygons (*i.e.* ecozones, ecoprovinces, ecoregions, and ecodistricts) are created by aggregating similar ecoassociation polygons. The ecoassociations of FML #3 are shown in Figure 3.19.

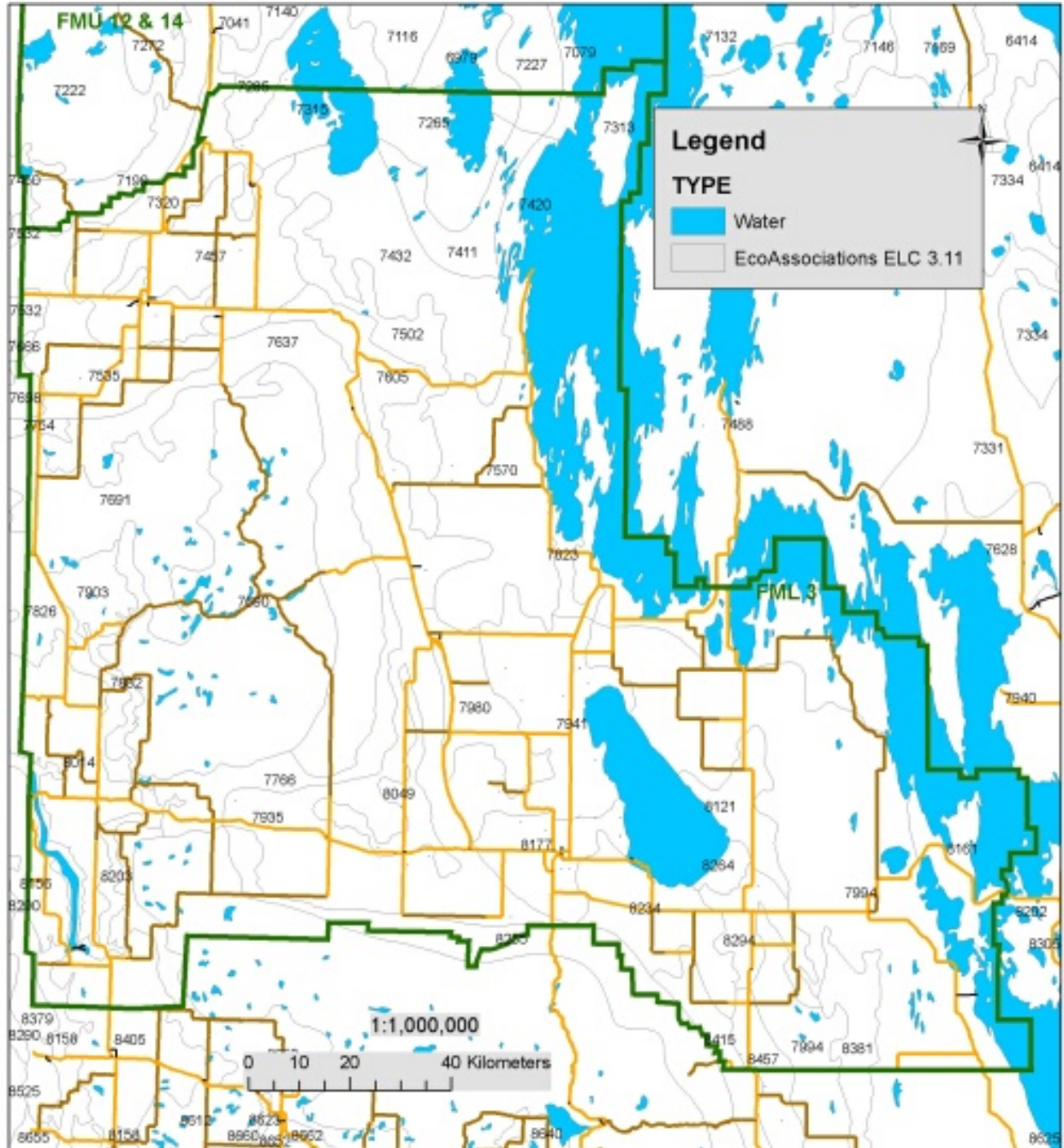


Figure 3.21 Ecoassociations within FML #3.

3.1.5.2 FML #3 Ecological Land Classification

Localized Ecological Land Classification (ELC) was developed for the Duck Mountain Provincial Forest (Arnup *et al.* 2006) in conjunction with the creation of the Forest Lands Inventory (2002). This work was developed at the ecosite or stand level, within the Canadian Ecological Land Classification described in the above section.

3.1.5.2.1 Ecosites

Ecosites are a hierarchical unit within the Canadian Ecological Land Classification system, but are not mapped across Canada by the Canadian ELC system. Ecosites are groupings of soils and vegetation that are mappable at an operational scale (1:15,000) or stand-level. Mapped ecosites in the Duck Mountain range from 2 to 200 hectares in size, although some wetland ecosites are smaller.

An ecosite classification system and ecosite mapping system was developed (Table 3.9) for ecosites of the Mid-Boreal Upland Ecoregion of Manitoba (Arnup *et al.* 2006). This work was done in conjunction with an ecological inventory of the same area (Forest Lands Inventory, 2002).

Table 3.9 Summary table of all ecosite characteristics.

	Ecosite Number	Soil Moisture Class	Soil Texture Class	Vegetation
non-forested wetlands	W1	wet	n/a	Open Bog (low shrub)
	W2	wet	n/a	Open Poor Fen (low shrub)
	W3	wet	n/a	Open Rich Fen
	W4	wet	n/a	Thicket Swamp
	W5	wet	n/a	Shore Fen
	W6	wet	n/a	Meadow Marsh
	W7	wet	n/a	Sheltered Marsh
	W8	wet	n/a	Exposed Marsh
	W9	wet	n/a	Open Water Marsh (floating leaf - peat substrate)
	W10	wet	n/a	Open Water Marsh (submergent - mineral substrate)
forested uplands	11	Dry-Fresh	sandy	TA-BA hardwood
	12	Dry-Fresh	sandy	TA-JP-Spruce mixedwood
	13	Dry-Fresh	sandy	JP-BS feathermoss
	21	Fresh	coarse loamy-silty	WB mixedwood
	22	Fresh	coarse loamy-silty	TA hardwood
	23	Fresh	coarse loamy-silty	TA-WS mixedwood
	24	Fresh	coarse loamy-silty	JP-BS mixedwood
	31	Fresh	Clayey (lacustrine)	TA-BA hardwood / mixedwood
	32	Fresh	fine loamy (till or stratified)	TA-BA hardwood
	33	Fresh	fine loamy (till or stratified)	TA-BA mixedwood
	34	Fresh	fine loamy (till or stratified)	WS-BF mixedwood
	35	Fresh	fine loamy (till or stratified)	JP-BS mixedwood

	Ecosite Number	Soil Moisture Class	Soil Texture Class	Vegetation
	36	Fresh	fine loamy (till or stratified)	BS-JP-(WS-BF) Labrador tea-feathermoss
	41	Moist	sandy to silty	TA-BA hardwood
	42	Moist	sandy to silty	WS (BF) mixedwood
	43	Moist	sandy to silty	BS-JP-feathermoss
	44	Moist	coarse loamy to clayey	Other hardwoods (AG-AE-MM)
	51	Moist	fine loamy to clayey	TA-BA hardwood
	52	Moist	fine loamy to clayey	TA-WS-JP mixedwood
	53	Moist	fine loamy to clayey	BS-feathermoss-Labrador-tea
forested wetlands	61	Wet	fibric-mesic organic	BS-(WS) -Lab tea - Fmoss - Sphagnum
	62	Wet	mesic organic	BS-Alder-Herb Rich
	63	Wet	fibric organic	TL-BS-Sedge (Treed Fen)
	64	Wet	fibric organic	BS-(JP)-Ericaceous-Sphagnum
non-forested uplands	71	Dry - Moist	any mineral soil texture	Open Shrub
	72	Dry - Moist	any mineral soil texture	Closed Shrub
	73	Dry - Moist	any mineral soil texture	Grassland

Figure 3.20 shows the how the landbase was split into non-forested uplands, forested uplands, non-forested wetlands, and forested wetlands based on soil moisture regime and crown closure. Soil Moisture Regime (SMR) separates wetlands (SMR 7, 8, & 9) from uplands (SMR theta to 6). Crown closure separates forested (6% to 100%) from non-forested (0% to 5% crown closure).

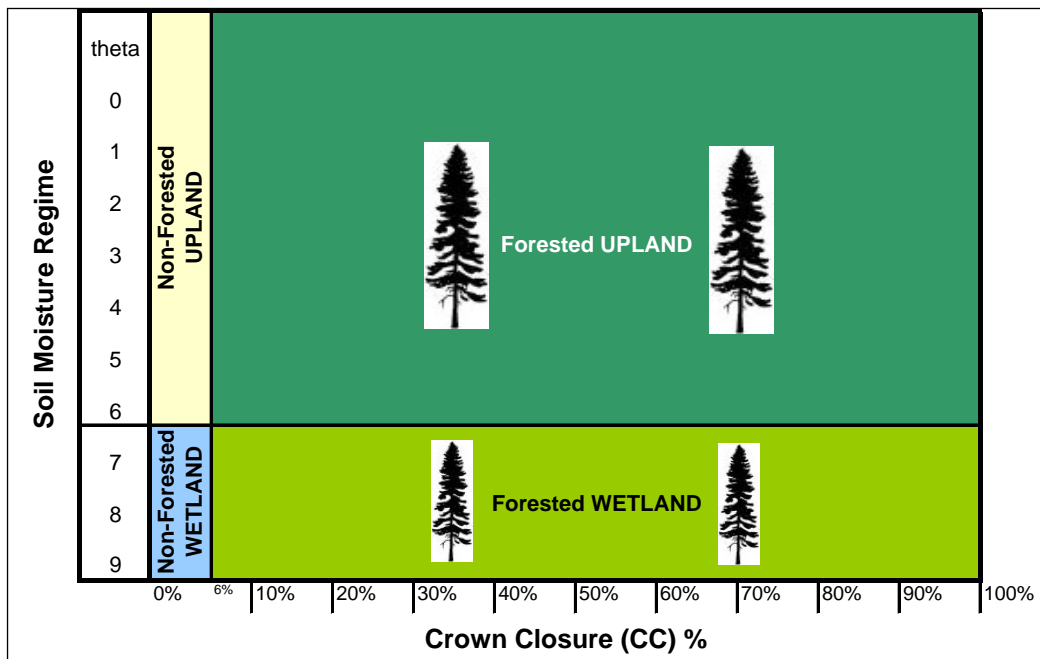


Figure 3.22 Division of entire Duck Mountain landbase into combinations of upland or wetland, and forested or non-forested.

Table 3.10 ranks the mapped ecosites from most common (greatest % area) to rare (least % area).

Table 3.10 Total and percent area by ecosites, sorted from abundant to rare in the Duck Mountain Provincial Forest and Park.

Ecosite Frequency	Ecosite Number	Vegetation	Total Area (ha)	Percent
Abundant	32	TA-BA hardwood	99,838.4	26%
Abundant	33	TA-BA mixedwood	46,577.7	12%
Abundant	31	TA-BA hardwood / mixedwood	37,087.2	10%
Moderate	53	BS-feathermoss-Labrador-tea	26,436.8	7%
Moderate	36	BS-JP-(WS-BF) Labrador tea-feathermoss	24,691.6	7%
Moderate	6	meadow marsh	17,172.6	5%
Moderate	61	BS-(WS) -Lab tea - Fmoss - Sphagnum	17,080.7	5%
Moderate	34	WS-BF mixedwood	15,394.3	4%
Infrequent	22	TA hardwood	7,518.3	2%
Infrequent	63	TL-BS-Sedge (Treed Fen)	6,462.1	1.7%
Infrequent	52	TA-WS-JP mixedwood	6,444.7	1.7%
Infrequent	23	TA-WS mixedwood	6,186.2	1.6%
Infrequent	35	JP-BS mixedwood	6,126.9	1.6%
Infrequent	7	sheltered marsh	5,350.0	1.4%
Infrequent	64	BS-(JP)-Ericaceous-Sphagnum	5,239.7	1.4%
Infrequent	4	thicket swamp	4,248.3	1.1%
Infrequent	72	Closed Shrub	4,116.2	1.1%
Infrequent	62	BS-Alder-Herb Rich	3,799.2	1.0%
Infrequent	51	TA-BA hardwood	3,606.8	1.0%
Infrequent	24	JP-BS mixedwood	3,151.2	0.8%
Infrequent	21	WB mixedwood	2,941.9	0.8%
Infrequent	5	shore fen	2,591.6	0.7%
Infrequent	43	BS-JP-feathermoss	1,854.1	0.5%
Infrequent	9	open water marsh - floating leaved/peat substrate	1,787.3	0.5%
Infrequent	73	grassland, prairie savannah	1,734.4	0.5%
Infrequent	2	open poor fen - low shrub	1,479.1	0.4%
Rare	10	open water marsh - submergent mineral substrate	919.0	0.2%
Rare	42	WS (BF) mixedwood on moist, coarse soil	859.9	0.2%
Rare	3	open rich fen	772.2	0.2%
Rare	8	exposed marsh	636.4	0.2%
Rare	41	TA-BA hardwood on moist, coarse soil	475.3	0.1%
Rare	11	TA-BA hardwood on dry, coarse soil	374.1	0.1%
Rare	71	Open Shrub	148.3	0.0%
Rare	12	TA-JP-Spruce mixedwood on dry, coarse soil	125.6	0.0%
Rare	1	open bog - low shrub	64.8	0.0%
Rare	13	JP-BS feathermoss on dry, coarse soil	1.2	0.0%
Rare	44	Other hardwoods (Green Ash-American Elm-Manitoba Maple)	0.0	0.0%

Areas by ecosite are summarized in Table 3.11.

Table 3.11 Area summary by ecosite for the Duck Mountain Provincial Forest and Park.

	Forest Management Unit 13 Duck Mountain Provincial Forest		Duck Mountain Provincial Forest	Duck Mountain Provincial Park			Total Area (ha)
			Area (ha)	Backcountry Zone	Recreation Zone	Resource Zone	
	Ecosite	Ecosite Description		Area (ha)	Area (ha)	Area (ha)	
Non-Forested Wetlands	1	open bog - low shrub	55	2	0	8	65
	2	open poor fen - low shrub	974	91	8	405	1,479
	3	open rich fen	704	12	4	53	772
	4	thicket swamp	2,708	827	67	640	4,242
	5	shore fen	1,922	89	30	547	2,588
	6	meadow marsh	10,224	2,560	212	4,162	17,158
	7	sheltered marsh	4,270	288	168	619	5,346
	8	exposed marsh	570	29	0	37	636
	9	open water marsh - floating leaved/peat substrate	693	107	48	939	1,787
	10	open water marsh - submergent mineral substrate	817	35	17	50	919
Forested Uplands	11	TA-BA hardwood	308	36	0	29	373
	12	TA-JP-Spruce mixedwood	47	12	3	63	126
	13	JP-BS feathermoss	0	0	0	1	1
	21	WB mixedwood	2,670	59	26	177	2,931
	22	TA hardwood	6,241	843	35	322	7,442
	23	TA-WS mixedwood	4,574	1,017	75	511	6,177
	24	JP-BS mixedwood	1,431	357	1	1,363	3,152
	31	TA-BA hardwood / mixedwood	17,877	7,209	636	11,342	37,064
	32	TA-BA hardwood	73,346	12,971	1,471	11,687	99,474
	33	TA-BA mixedwood	32,358	5,475	1,568	7,132	46,533
	34	WS-BF mixedwood	10,376	1,932	474	2,611	15,392
	35	JP-BS mixedwood	2,610	483	159	2,874	6,126
	36	BS-JP-(WS-BF) Labrador tea-feathermoss	12,013	1,895	396	10,386	24,690
	41	TA-BA hardwood	404	52	0	15	471
	42	WS (BF) mixedwood	562	197	6	93	858
	43	BS-JP-feathermoss	1,032	123	12	684	1,851
	44	Other hardwoods (AG-AE- MM)	0	0	0	0	0
	51	TA-BA hardwood	2,544	686	26	339	3,596
	52	TA-WS-JP mixedwood	4,495	883	111	952	6,442
	53	BS-feathermoss-Labrador- tea	12,199	2,315	610	11,298	26,422

	Forest Management Unit 13 Duck Mountain Provincial Forest		Duck Mountain Provincial Forest	Duck Mountain Provincial Park			
				Backcountry Zone	Recreation Zone	Resource Zone	
Forested Wetlands	61	BS-(WS) -Lab tea - Fmoss - Sphagnum	6,150	1,250	169	5,187	12,757
	62	BS-Alder-Herb Rich	1,313	237	11	1,318	2,879
	63	TL-BS-Sedge (Treed Fen)	2,934	604	79	2,841	6,458
	64	BS-(JP)-Ericaceous-Sphagnum (Treed Bog)	2,282	1,040	112	1,804	5,238
Non- Forested Uplands	71	Open Shrub	148	0	0	1	148
	72	Closed Shrub	2,470	578	155	906	4,109
	73	grassland, prairie savannah	953	277	18	482	1,730
	82	cutbanks	1	0	0	0	1
	88	lakes and ponds	8,443	2,176	1,836	4,401	16,855
	89	rivers	72	37		6	115
	92	transmission lines, tower sites, other cleared land	173	7	21	73	274
	93	roads, gravel pits, other	863	147	184	369	1,563
Totals			233,826	46,938	8,749	86,728	376,240

3.1.5.2.2 Non-Forested Wetland Ecosites

Ten non-forested wetland ecosites (Table 3.12) were based on the Canadian Wetland Classifications System (1997). The non-forested wetland ecosites were photo-interpreted at a scale of 1:15,000 across the Duck Mountain landbase (Figure 3.21). Ecosite primary data (*e.g.* soil moisture, soil texture, vegetation) were mapped by photo interpretation. Field data from 152 non-forested wetland plots collected by Locky *et al.* (2005) were used to populate fact sheet summaries for the 10 wetland ecosites.

Table 3.12 List of Non-Forested Wetland Ecosites.

Wetland Class (Canadian Wetlands Classification System 1997)	Ecosite Number	Description
OPEN BOGS	WE 1	open bog – low shrub
ISOLATED FENS	WE 2	open poor fen – low shrub
	WE 3	open rich fen
TERRESTRIAL THICKET SWAMPS	WE 4	thicket swamp
FENS & MARSHES ADJACENT TO WATER FEATURES	WE 5	shore fen
	WE 6	meadow marsh
	WE 7	sheltered marsh
	WE 8	exposed marsh
OPEN WATER MARSHES	WE 9	open water marsh – floating leaved/peat substrate
	WE 10	open water marsh – submerged mineral substrate

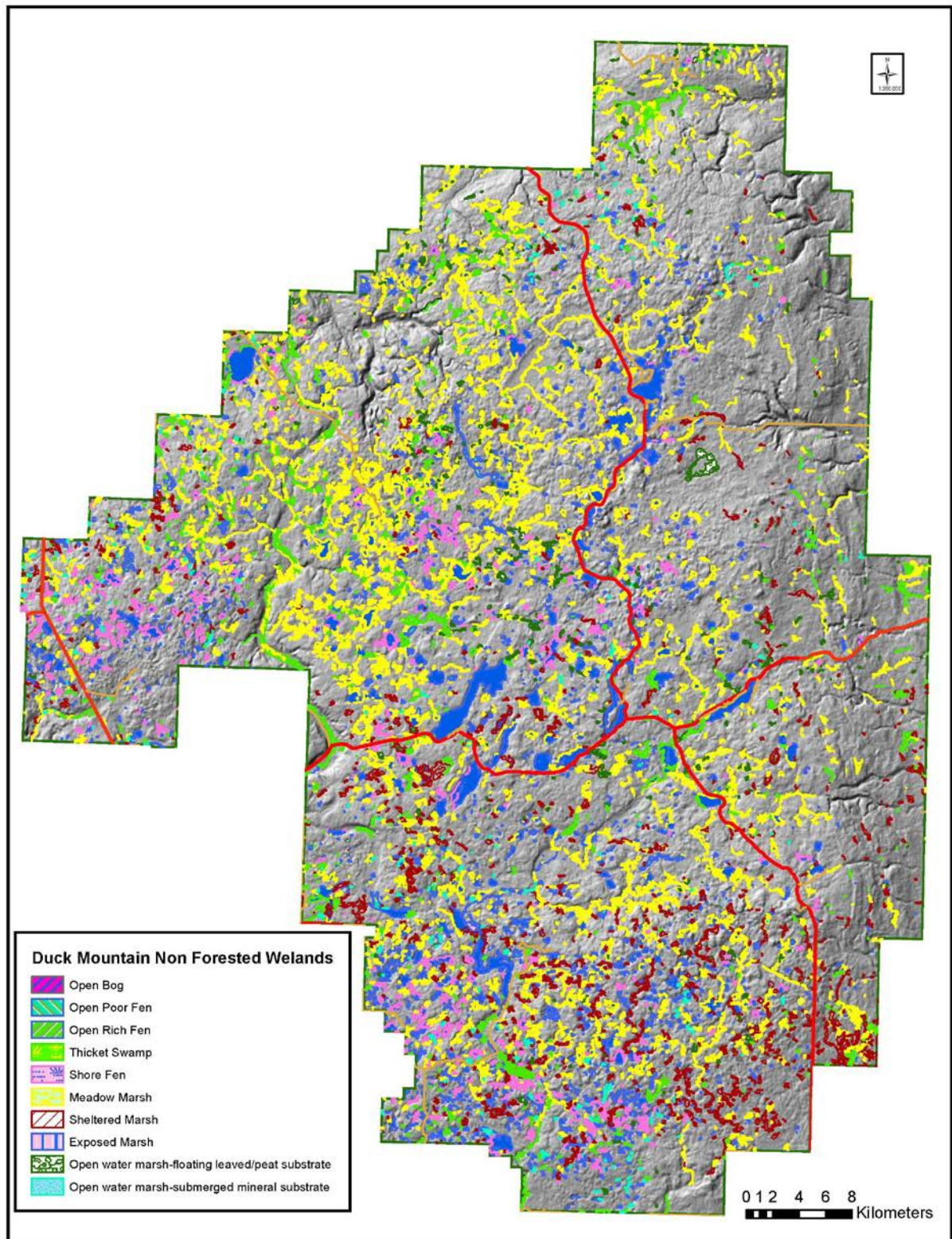


Figure 3.23 Non-forested wetlands in the Duck Mountain Provincial Forest.

Ducks Unlimited Canada classified uplands and wetlands (Smith, 2005). The satellite imagery was 30 m resolution LANDSAT images taken in 2003.

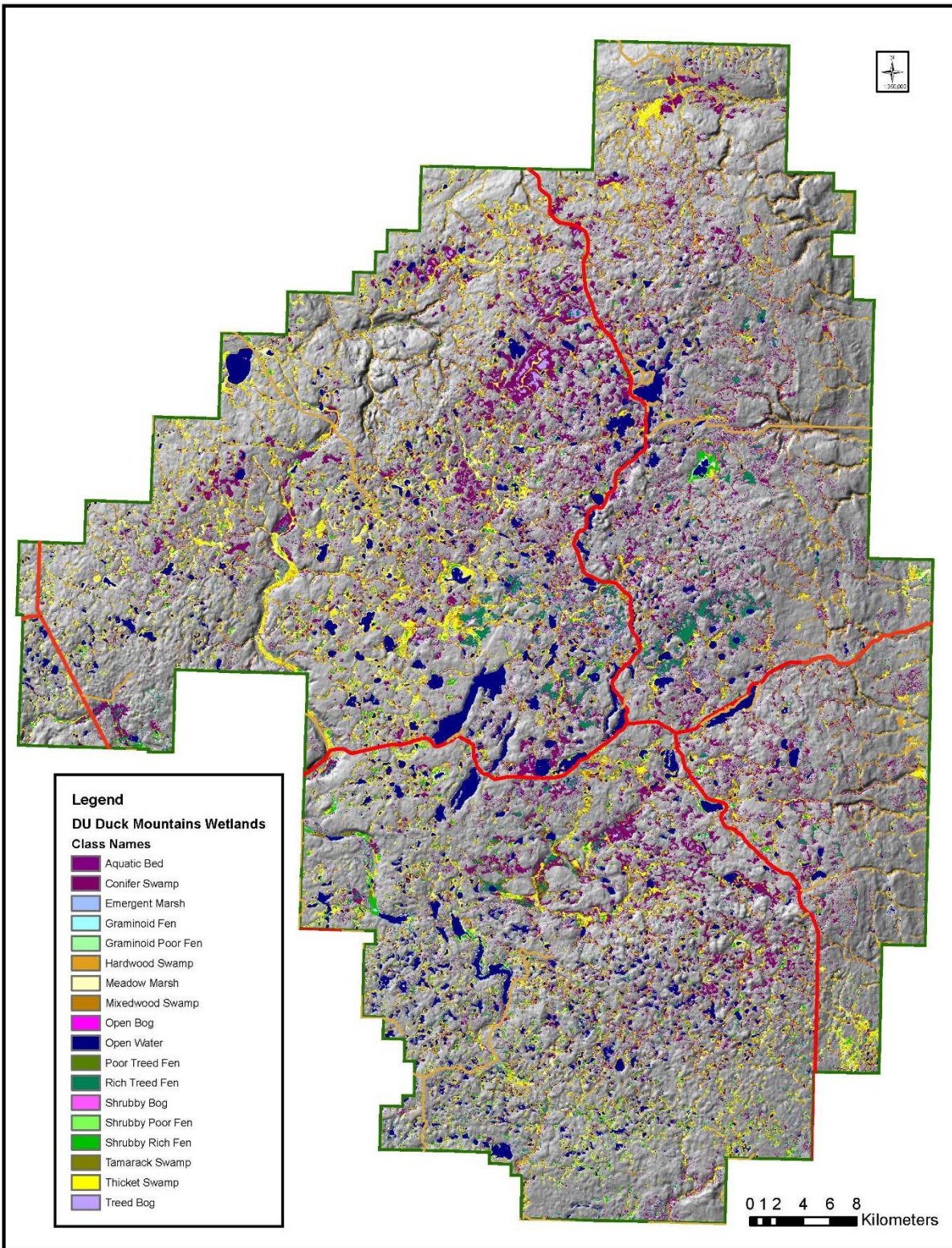


Figure 3.24 Types and Distribution of Wetland Classes within the Duck Mountain Provincial Forest (Ducks Unlimited Canada).

Wetlands provide a wide variety of habitat types, and are rich in both plant and animal biodiversity. Wetlands are also very important in regulating surface and ground water flow within watershed systems. These systems purify water by removing excess nutrients and other pollutants from surface and subsurface water sources.

Wetland Types

Key characteristics of each of the wetland types provided by Smith *et al.* 2007 have been summarized below.

Peat Soil Wetlands

Bogs

Bogs have been created through the accumulation of peat (primarily weakly decomposed *Sphagnum* mosses). This accumulation creates a raised surface compared to the surrounding area. Bogs are hydrologically isolated, because the only water input is precipitation, and no surface or groundwater flows enter the bogs. The water table is generally at or just below the surface of the bog. Bogs can be treed (ecosite 64), shrubby or open (ecosite WE 1) depending on the interaction between the soils, water and nutrient supply. Bogs are not common in the Duck Mountain Provincial Forest, and are frequently adjacent to fens (Figure 3.23).

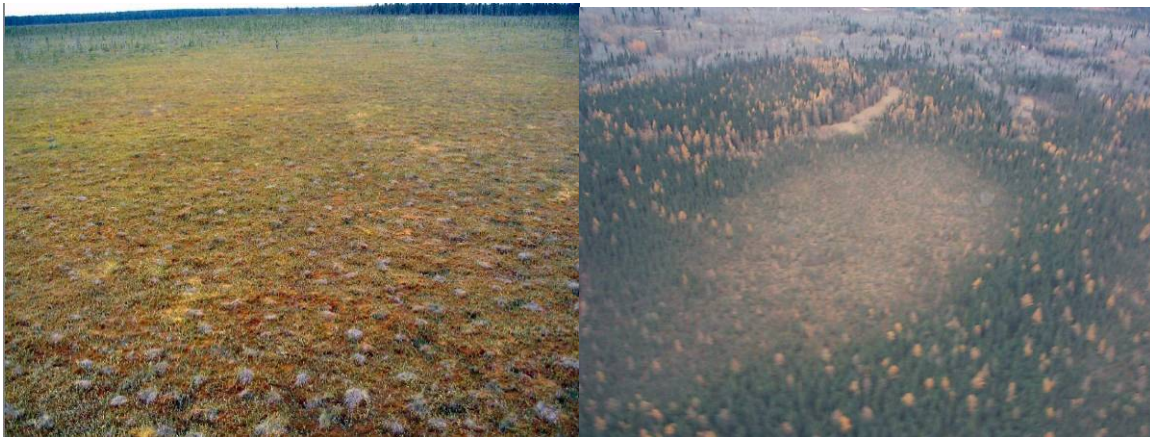


Figure 3.25 Example of open wet bogs (ecosite WE 1) (left photo: Ducks Unlimited Canada)

Fens

Isolated fens are also created through the accumulation of peat. However, fens are level with the surrounding terrain, while bogs are raised. The water table in fens is not stagnant, but moves through the peat very slowly by seepage. Mineral-rich water, through surface or groundwater sources, flows through the fens. The nutrient inputs can create a range of environmental conditions related to fen development. For instance, fens that are in close contact with mineral rich water sources have been classified as rich fens (ecosite WE 3). Rich fens are generally comprised of more brown mosses with some *Sphagnum* mosses. Fens that are in less contact with nutrient rich water sources are poor fens (ecosite WE 2 Figure 3.24), which are typically comprised of *Sphagnum* mosses, ericaceous shrubs, and black spruce, but may also contain tamarack and bog birch. Treed fens (ecosite 63) are dominated by mixtures of black spruce and tamarack trees, and commonly have sedges.

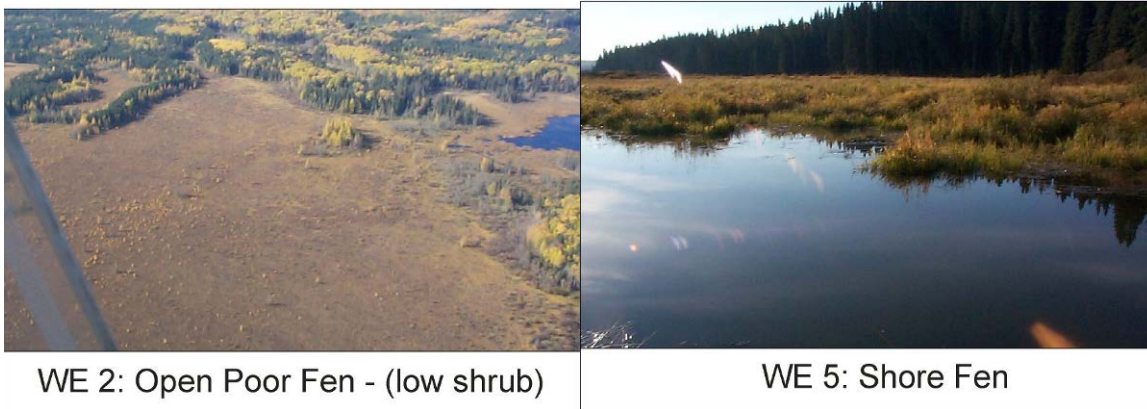


Figure 3.26 Examples an open poor fen (left) and a shore fen (right).

Shore fens are peat deposits on the shore of open water. The surface peat is usually greater than 2 m in depth, does not float, and is firmly anchored. Shore fens usually contain moderately to well-decomposed sedge, and bryophytic or aquatic vascular plants. Mosses or herbaceous plants occur closest to the water and trees. Shrubs, if present, are farther away from the lake or pond edge.

Mineral Soil Wetlands

Swamps

Swamps are areas that are in contact with minerotrophic water in either peatland or mineral soils. Swamps are dominated by woody vegetation (trees or shrubs) in percentages greater than 30% and up to 100% of canopy cover. Treed swamps (ecosites 61 and 62) have black spruce trees and a variety of understory plants. Shrub or thicket swamps (ecosite WE 4) are dominated by shrub species such as willows, alders, and swamp birch (Figure 3.25).



Figure 3.27 Examples of thicket swamps (oblique photo - left) and ground-level photo - right).

The presence of woody vegetation in swamps is generally due to the increased influence or contact with water, nutrients, and aerated soils. Peat soils in swamps are highly decomposed

(humic peat) compared to the fibric and mesic peat in bogs and fens. Swamps fluctuating water tables allow for more oxygen, and therefore increased decomposition.

Marshes

Marshes are mineral wetlands (Figure 3.26) that are subjected to temporal periods of flooding (seasonal to annual). Water inputs within a marsh may come from a variety of sources, such as inflows, surface runoff, groundwater discharge, precipitation, and/or flooding. The dissolved minerals and aeration provide the conditions for high productivity and decomposition of vegetative material. Marshes are commonly associated with shallow/open water classes or lacustrine or riverine systems in depressions or low-lying areas. Emergent macrophytes such as reeds, grasses, sedges, broad-leaved emergents, floating-leaved emergents, and submergent vegetation are most common in these wetlands.



WE 6: Meadow Marsh



WE 7: Sheltered Marsh



WE 8: Exposed Marsh

Figure 3.28 Examples of different kinds of marshes (top left) meadow marsh; (top right) sheltered marsh; and (bottom left) an exposed marsh.

Shallow Open Water

Shallow open water wetlands are transitional areas between the emergent marsh within the littoral zone of waterbodies and the profundal/ benthic zone or permanent deep waterbodies (Figure 3.27). Shallow open water wetlands are flooded perennially and may be vegetated with

floating or submerged vegetation or can be observed as mudflats during seasonal drawdown periods.



Figure 3.29 An example of shallow and open water within the Duck Mountain.

3.1.5.2.3 Forested Wetland Ecosites

There are four forested wetland ecosites (Table 3.13). All four forested wetlands have conifers on organic soil, and have different levels of decomposed organic soils, and different understory vegetation (Figure 3.28). A map of the forested wetland ecosites across the Duck Mountain is shown in Figure 3.29

Table 3.13 Forested wetland ecosite characteristics.

	Ecosite Number	Soil Moisture Class	Soil Texture Class	Vegetation
forested wetlands	61	Wet	fibric-mesic organic	BS-(WS) -Lab tea - Feathermoss - Sphagnum
	62	Wet	mesic organic	BS-Alder-Herb Rich
	63	Wet	fibric organic	TL-BS-Sedge (Treed Fen)
	64	Wet	fibric organic	BS-(JP)-Ericaceous-Sphagnum (Treed Bog)



Figure 3.30 Forested wetland ecosites 61, 62, 63, and 64 (clockwise from top left).

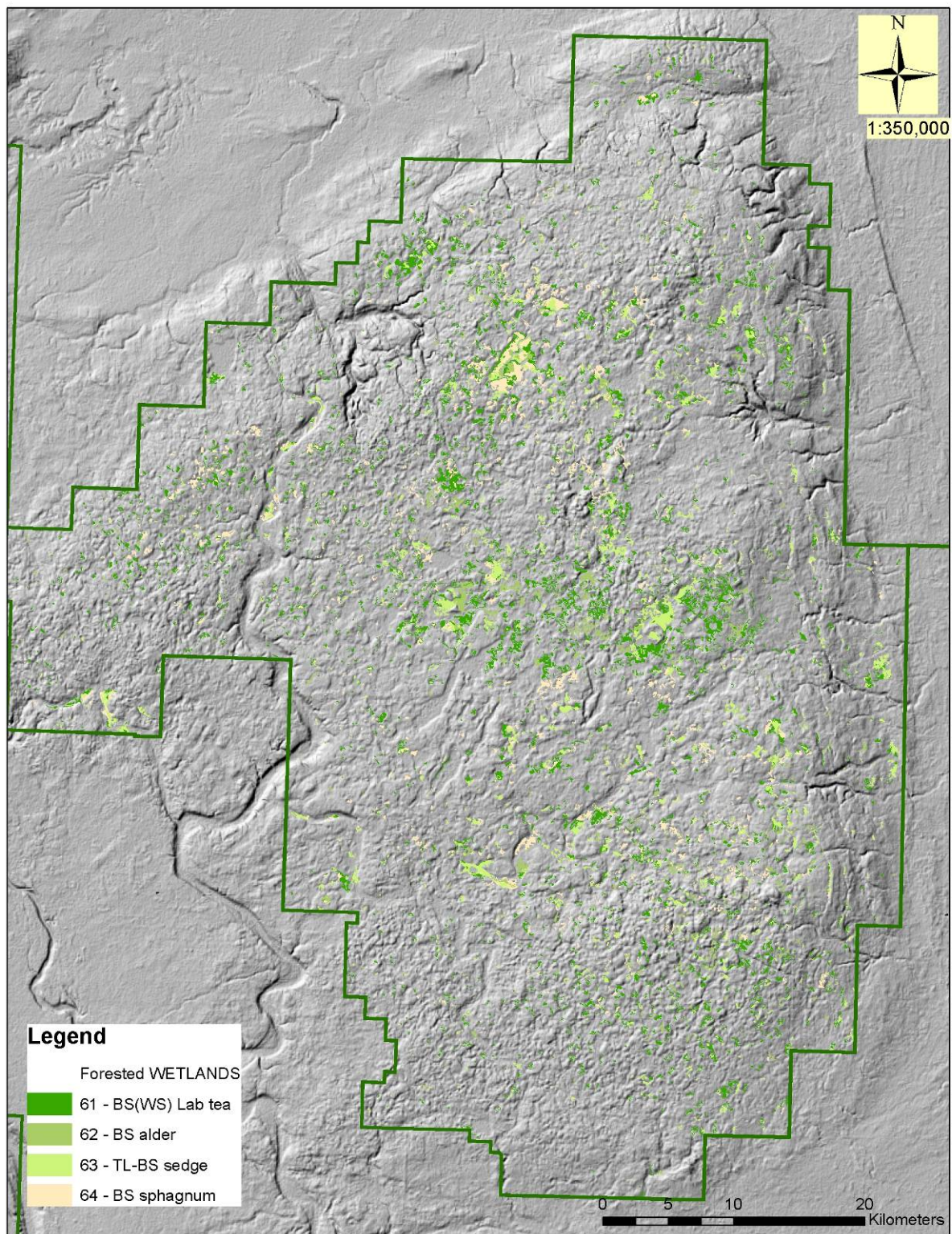


Figure 3.31 Forested wetland ecosites of the Duck Mountain.

3.1.5.2.4 Forested Upland Ecosites

Ecosite plot data on 536 forested wetland and forested upland plots were also collected and used to create 24 distinct and unique forested ecosites (Table 3.14). A field key was created, based on the classification results. The forested ecosites (Figure 3.30) are summarized in fact sheets (Figure 3.31). Ecosite assignments are available for all forested polygons in the Forest Lands Inventory using ecosite primary data and an ecosite key.

Table 3.14 Forested upland ecosite characteristics.

	Ecosite Number	Soil Moisture Class	Soil Texture Class	Vegetation
forested uplands	11	Dry-Fresh	sandy	TA-BA hardwood
	12	Dry-Fresh	sandy	TA-JP-Spruce mixedwood
	13	Dry-Fresh	sandy	JP-BS feathermoss
	21	Fresh	coarse loamy-silty	WB mixedwood
	22	Fresh	coarse loamy-silty	TA hardwood
	23	Fresh	coarse loamy-silty	TA-WS mixedwood
	24	Fresh	coarse loamy-silty	JP-BS mixedwood
	31	Fresh	Clayey (lacustrine)	TA-BA hardwood / mixedwood
	32	Fresh	fine loamy (till or stratified)	TA-BA hardwood
	33	Fresh	fine loamy (till or stratified)	TA-BA mixedwood
	34	Fresh	fine loamy (till or stratified)	WS-BF mixedwood
	35	Fresh	fine loamy (till or stratified)	JP-BS mixedwood
	36	Fresh	fine loamy (till or stratified)	BS-JP-(WS-BF) Labrador tea-feathermoss
	41	Moist	sandy to silty	TA-BA hardwood
	42	Moist	sandy to silty	WS (BF) mixedwood
	43	Moist	sandy to silty	BS-JP-feathermoss
	44	Moist	coarse loamy to clayey	Other hardwoods (AG-AE-MM)
	51	Moist	fine loamy to clayey	TA-BA hardwood
	52	Moist	fine loamy to clayey	TA-WS-JP mixedwood
	53	Moist	fine loamy to clayey	BS-feathermoss-Labrador-tea

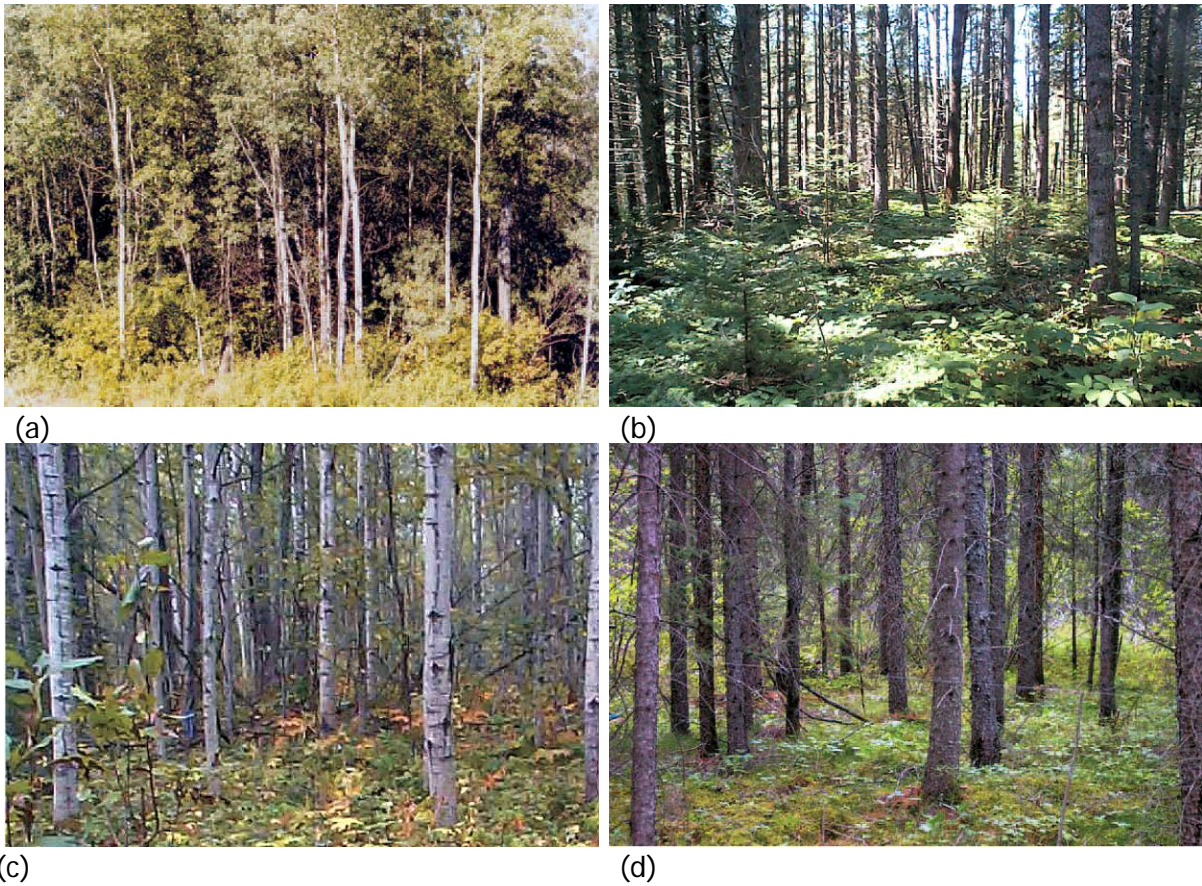
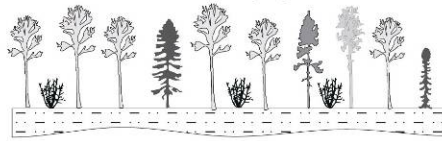


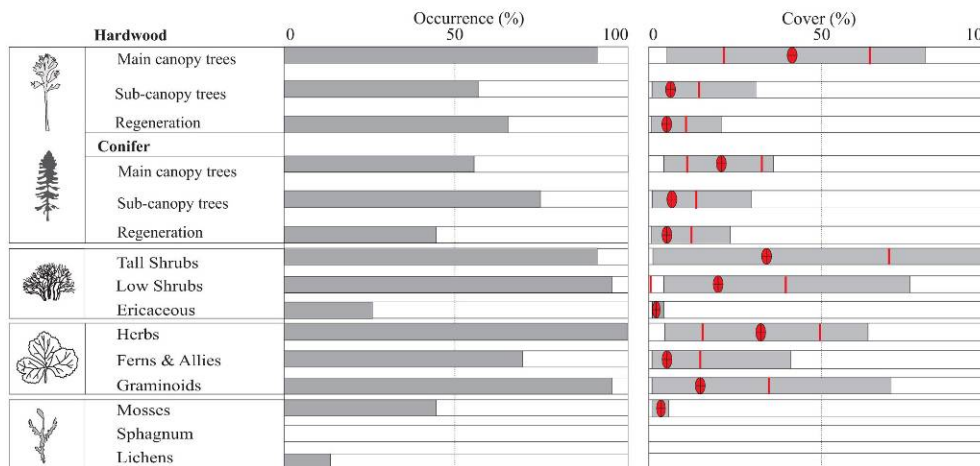
Figure 3.32 Examples of common forested upland ecosites within FML #3
 (a. ecosite 32 – aspen on mesic clay; b. ecosite 34 – white spruce mixedwood; c. ecosite 31 – aspen on clay, and d. ecosite 53 – spruce-jack pine on moist soils).

ES 31

Trembling Aspen Hardwood - Mixedwood on Fresh Clayey Soil



General Description: Mixedwood stands dominated by trembling aspen on fresh clayey soils. Herb rich with abundant tall and low shrubs (n=23).



Overstory: Trembling aspen 6, White spruce 2, Jack pine 1, (Balsam poplar, Black spruce) 1
Shrubs: Green alder, Beaked hazel, Wild red raspberry, Squashberry, Bristly wild rose, Speckled alder, Common snowberry, Swamp red currant, Bristly black currant, Red osier dogwood, Twining honeysuckle
Herbs: Purple reed grass, Sarsaparilla, Rough-leaved rice grass, Hairy wild rye, Northern bluebells, Dwarf raspberry, Bunchberry, Canada violet, Wild strawberry, Naked mitrewort, Twinflower, Common pink wintergreen, Fireweed, Ciliolate aster, Fragrant bedstraw, Northern bedstraw, Wild lily-of-the-valley, Red baneberry, Arctic coltsfoot, Palmate-leaved coltsfoot, Creamy pea-vine, Dandelion
Mosses: Red-stemmed feathermoss, Woodsy leafy moss
Vegetation Types: 5 4, 9 3, 8 2, (1, 17) 1
Average No. of Species: 31 **Total No. of Species:** 119
Shannon Weiner Index: 2.31 ± 0.10

Soil and Site Features

Ground Surface: Deciduous litter 6, graminoids 2, coniferous litter 1, others 1
Landforms: Occurs on gentle to moderate slopes on clayey lacustrine landforms, in locally depressed terrain, or randomly interspersed with fine-textured moraine.
Soil Types: 6 10, Characteristic soil types is ST 6. Common inclusions in polygons are ST 10 and 5.

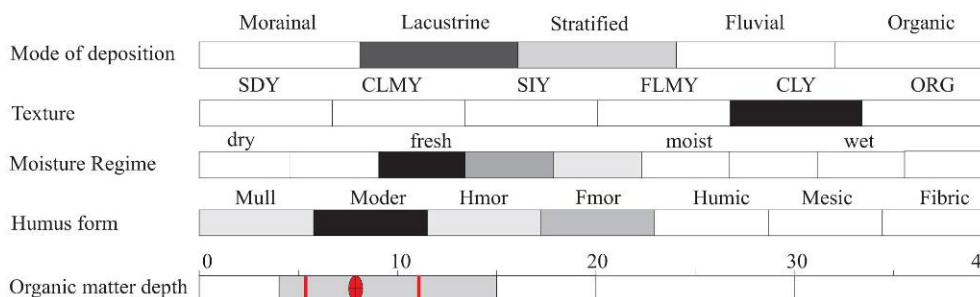


Figure 3.33 Example ecosite fact sheet (Arnup *et al.* 2006).

3.1.5.2.5 Non-Forested Upland Ecosites

Three non-forested uplands ecosites were classified (Table 3.15), and include open shrub, closed shrub, and grasslands (Figure 3.32).

Table 3.15 Non-forested upland ecosite characteristics.

	Ecosite Number	Soil Moisture Class	Soil Texture Class	Vegetation
non-forested uplands	71	Dry - Moist	any mineral soil texture	Open Shrub
	72	Dry - Moist	any mineral soil texture	Closed Shrub
	73	Dry - Moist	any mineral soil texture	Grassland



Figure 3.34 Closed shrub (left) and grassland (right) ecosites within the Duck Mountain.

Grasslands account for 0.5% of the area of the Duck Mountain Provincial Forest. These grasslands in the Duck Mountain Provincial Forest and Duck Mountain Provincial Park are relatively permanent. These ecosystems have coarse, dry soils where grasses have a competitive advantage, and tree species struggle for survival.

Natural succession has been occurring in the absence of natural disturbances, such as fires in the grassland ecosystems. Areas such as Jumper Plains have seen succession of trees into the grassland areas.

3.1.5.2.6 *Ecoelements*

Ecoelements are the smallest entity in the Ecological Land Classification hierarchy. Operationally, they are smaller than a forested stand, because typically, there are multiple ecoelements within a forested stand. Ecoelement efforts in Canada are included in the Forest Ecosystem Classification (FEC) guides in western and central Canada. FEC plots are 10 m X 10 m (or 100 m² area), which is much smaller than most forest stands. Manitoba has a FEC guide (Zoladeski *et al.* 1995) that was adapted from the northwestern Ontario FEC guide (Sims *et al.* 1990). However, vegetation and soil-types are described, but not mapped. The user must use the guide to field map the vegetation and soil-types. Field mapping works well with existing field efforts such as pre-harvest surveys. However, it is impractical and prohibitively expensive to field map large areas.

Vegetation-type incorporates characteristics of forest overstory and understory vegetation. Plots may be assigned to a vegetation type using a dichotomous classification key. The key is primarily based on the overstory species and major understory components. 33 forest vegetation types across all of Manitoba are described by Zoladeski *et al.* 1995, including:

- Predominantly hardwood (V1 to V5);
- Hardwood mixedwood (V6 to V10);
- Conifer mixedwood (V11 to V18); and,
- Predominantly conifer (V19 to V33).

A set of factsheets in the FEC manual for Manitoba describes each of the 33 vegetation types in Manitoba. The factsheets list the most important characteristics of each type in terms of forest composition, stratification, and relationship to other types.

Soil-type incorporates soil moisture and soil texture. Soils are allocated to a soil type using a soil key. The soil type key is almost identical across FEC guides in Alberta, Saskatchewan, Manitoba, Ontario, and some Maritime Provinces. The major criteria used in soil type recognition include soil depth, texture, moisture regime and parent material. 22 soil types are defined across Manitoba (Zoladeski *et al.* 1995), including:

- Deep soils (> 1 m soil) that are dry-very fresh moisture (S1 to S6);
- Deep soils (> 1 m soil) that are moderately moist to very moist (S7 to S11);
- Deep soils (> 1 m soil) that are wet organic (S12F and S12S); and
- Shallow soils (< 1 m soil) (SS1 to SS9).

Soil type factsheets describe soil and site details, typical soil profiles, and forest management interpretations (i.e. soil compaction hazard, puddling hazard, and erosion hazard).

The FEC system uses units of vegetation and soil types to organize ecological silvicultural and practical forest management knowledge. The FEC V-types and S-types can be aggregated or considered in various combinations for forest management interpretations.

Canadian Forest Ecosystem Classification

The Canadian Forest Ecosystem Classification is standardizing the classification of Canadian forest and woodland ecosystems at the ecoelement level of the vegetation community. The objective of the Canadian Forest Ecosystem Classification is to correlate the 4,000 forest and woodland community types across Canada into a common national system. It is also

standardizing definitions and descriptions that will provide a common framework for the exchange of ecological information about Canadian forest and woodland conditions at regional and national scales for a broad range of applications, by exchanging forest management information across provincial and territorial boundaries and identifying ecosystems with high potential for biodiversity conservation: <http://cnvc-cnvc.ca/>

3.1.6. Habitat Element Strata

There are over 100,000 ecosystem polygons in FML #3. In order to model and manage all these polygons, we needed to combine similar ecosystems into meaningful groups. The choice of stratifying the ecosystem polygons need to be meaningful both now and up to 200 years in the future. Therefore, ecosites were chosen as the Forest management Plan strata, due to their combination of soils (texture and moisture) being ecologically meaningful and having long-term stability. Ecosites also define meaningful vegetation groups (*e.g.* aspen-hazel), in addition to the soils (*e.g.* clay).

There are 24 forested ecosites, which was deemed too many strata or too much detail for landscape-level long-term modeling. Therefore the 24 ecosites were combined into 13 ecological strata (Figure 3.33 and

Table 3.16) for the 20-year Forest Management Plan. The mapping of ecosystems in the Forest Lands Inventory (2002), allowed the various planning teams (modeling, water, biodiversity, soils, and climate change) to utilize the very robust ecologically-based strata. The modeling planning team feels ecological strata is a significant step forward in Ecosystem-Based Management.

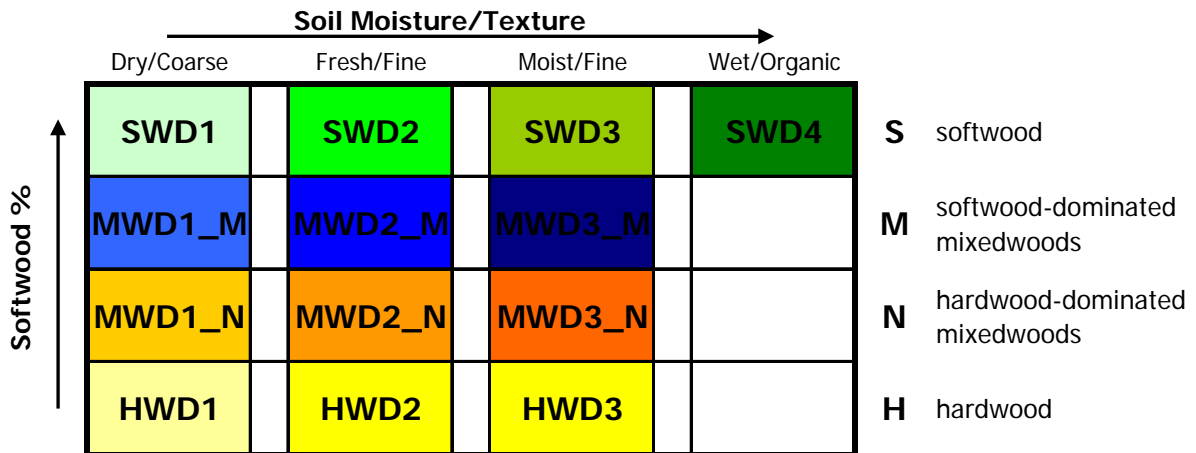


Figure 3.35 Habitat Element Curve (HEC) ecological strata used in all aspects of modeling in the 20 Year Forest Management Plan.

Table 3.16 Description of ecosites aggregated into Habitat Element Strata.

Upland or Wetland	Forested or Non Forested	Eco Series	ECOSITE NUMBER	Soil Moisture Class	Soil Type	Soil Texture Class	Description	Cover Group	Habitat Element Curve Strata
Upland	Forested	10	11	Dry-fresh	MINERAL	sandy	TA-BA hardwood	H	HWD1
Upland	Forested	20	21	Fresh	MINERAL	coarse loamy-silty	WB mixedwood	H	HWD1
Upland	Forested	20	22	Fresh	MINERAL	coarse loamy-silty	TA hardwood	H	HWD1
Upland	Forested	30	32	Fresh	MINERAL	fine loamy (till or stratified)	TA-BA hardwood	H	HWD2
Upland	Forested	40	41	Moist	MINERAL	sandy to silty	TA-BA hardwood	H	HWD3
Upland	Forested	40	44	Moist	MINERAL	coarse loamy to clay	Other hardwoods (AG-AE-MM)	H	HWD3
Upland	Forested	50	51	Moist	MINERAL	fine loamy to clay	TA-BA hardwood	H	HWD3
Upland	Forested	10	12	Dry-fresh	MINERAL	sandy	TA-JP-Spruce mixedwood	N	MWD1_N
Upland	Forested	20	23	Fresh	MINERAL	coarse loamy-silty	TA-WS mixedwood	N	MWD1_N
Upland	Forested	30	31	Fresh	MINERAL	clay (lacustrine)	TA-BA hardwood / mixedwood	N	MWD2_N
Upland	Forested	30	33	Fresh	MINERAL	fine loamy (till or stratified)	TA-BA mixedwood	N	MWD2_N
Upland	Forested	50	52	Moist	MINERAL	fine loamy to clay	TA-WS-JP mixedwood	N	MWD3_N
Upland	Forested	30	34	Fresh	MINERAL	fine loamy (till or stratified)	WS-BF mixedwood	M	MWD2_M

Upland or Wetland	Forested or Non Forested	Eco Series	ECOSITE NUMBER	Soil Moisture Class	Soil Type	Soil Texture Class	Description	Cover Group	Habitat Element Curve Strata
Upland	Forested	30	35	Fresh	MINERAL	fine loamy (till or stratified)	JP-BS mixedwood	M	MWD2_M
Upland	Forested	40	42	Moist	MINERAL	sandy to silty	WS (BF) mixedwood	M	MWD3_M
Upland	Forested	10	13	Dry-fresh	MINERAL	sandy	JP-BS feathermoss	S	SWD1
Upland	Forested	20	24	Fresh	MINERAL	coarse loamy-silty	JP-BS mixedwood	S	SWD1
Upland	Forested	30	36	Fresh	MINERAL	fine loamy (till or stratified)	BS-JP-(WS-BF) Labrador tea-feathermoss	S	SWD2
Upland	Forested	40	43	Moist	MINERAL	sandy to silty	BS-JP-feathermoss	S	SWD3
Upland	Forested	50	53	Moist	MINERAL	fine loamy to clay	BS-feathermoss-Labrador-tea	S	SWD3
Wetland	Forested	60	61	Wet	ORGANIC	fibric-mesic organic	BS-(WS) -Lab tea - Fmoss - Sphagnum	S	SWD4
Wetland	Forested	60	62	Wet	ORGANIC	mesic organic	BS-Alder-Herb Rich	S	n/a
Wetland	Forested	60	63	Wet	ORGANIC	fibric organic	TL-BS-Sedge (Treed Fen)	S	n/a
Wetland	Forested	60	64	Wet	ORGANIC	fibric organic	BS-(JP)-Ericaceous-Sphagnum (Treed Bog)	S	n/a
Upland	Non-Forested	70	71	Dry to Moist	MINERAL	sand to clay	Shrub - open	n/a	n/a
		70	72	Dry to Moist	MINERAL	sand to clay	Shrub - closed	n/a	n/a
		70	73	Dry to Moist	MINERAL	sand to clay	grassland	n/a	n/a

>= 6% crown closure is forested

<=5% crown closure is non-forested

Habitat element curve strata were mapped across the forested areas of FML #3 (Figure 3.34).

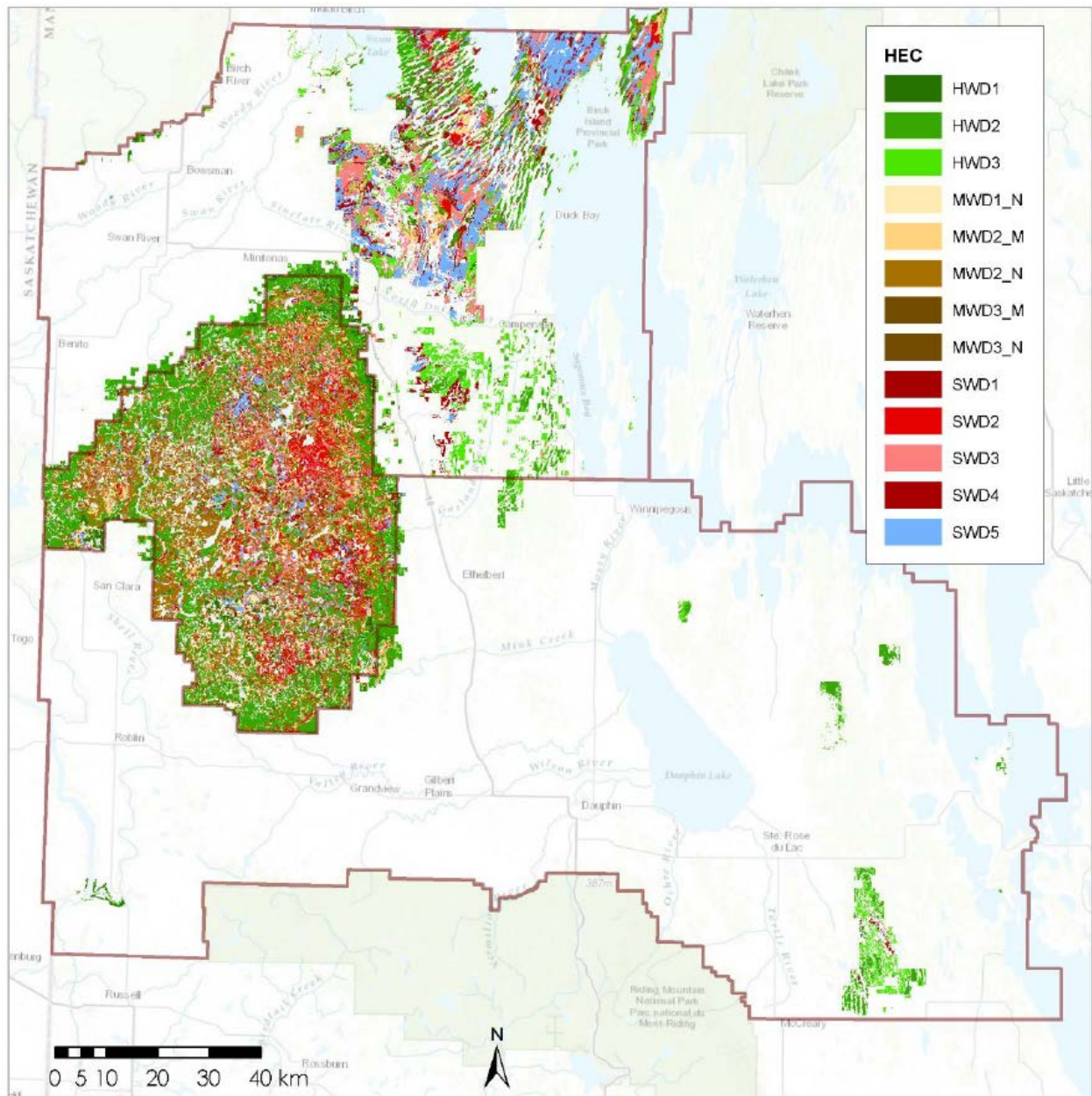


Figure 3.36 Map of Habitat Element Curve strata in FML #3 (ForSite Consulting, 2018) for open crown land.