Spray Lake Sawmills

Detailed Forest Management Plan
2001 – 2026

Chapter 2 – Landscape Assessment

December 15, 2006

Chapter 2 - Landscape Assessment

2.1 Introduction

The Spray Lakes FMA is naturally divided into two study areas - South FMA and North FMA (Figure 2.1)[1]. The South FMA occurs west of Calgary and south of the Bow River. It is nested within the eastern portion of Kananaskis Country and occupies 1,624-km^2. The North FMA is located north of the Bow River and the Stoney Indian Reserve, between Canmore and Cochrane and east of Banff National Park. The size of the North FMA is 1,730-km^2. This chapter provides an assessment of ecological attributes at a landscape level, and is intended to supply a baseline framework to develop the Detailed Forest Management Plan.

2.1.1 Administration Boundaries

The FMA encompasses two Forest Management Units (FMUs). The north overlaps the B9 FMU and the south overlaps the B10 FMU. Portions of 3 municipal jurisdictions generally overlap the FMA: the M.D. of Bighorn No. 8, Clearwater County and Kananaskis Improvement District. The FMA borders three addition municipal jurisdictions that are consulted for log haul purposes. They are: Mountain View County, the M.D. of Rocky View No. 44 and the M.D. of Foothills No. 31. (see Figure 1.1)

2.1.2 Climate

The climate of the area is characterized as a continental climate with cold winters and warm summers. The temperature ranges from an average low of –10C in January to an average high of 16C in July. The precipitation ranges from 450mm to 650mm annually with June generally being the wettest month. Strong southwesterly and westerly winds can cause drastic fluctuations in temperature in short time periods and can produce moisture stress during the growing season. (Alberta Forest Service, 1986 and Environment Canada, 2004)

[1] Scales on maps in the hardcopy may not be accurate. Please refer to digital copy on CD for actual size/scale

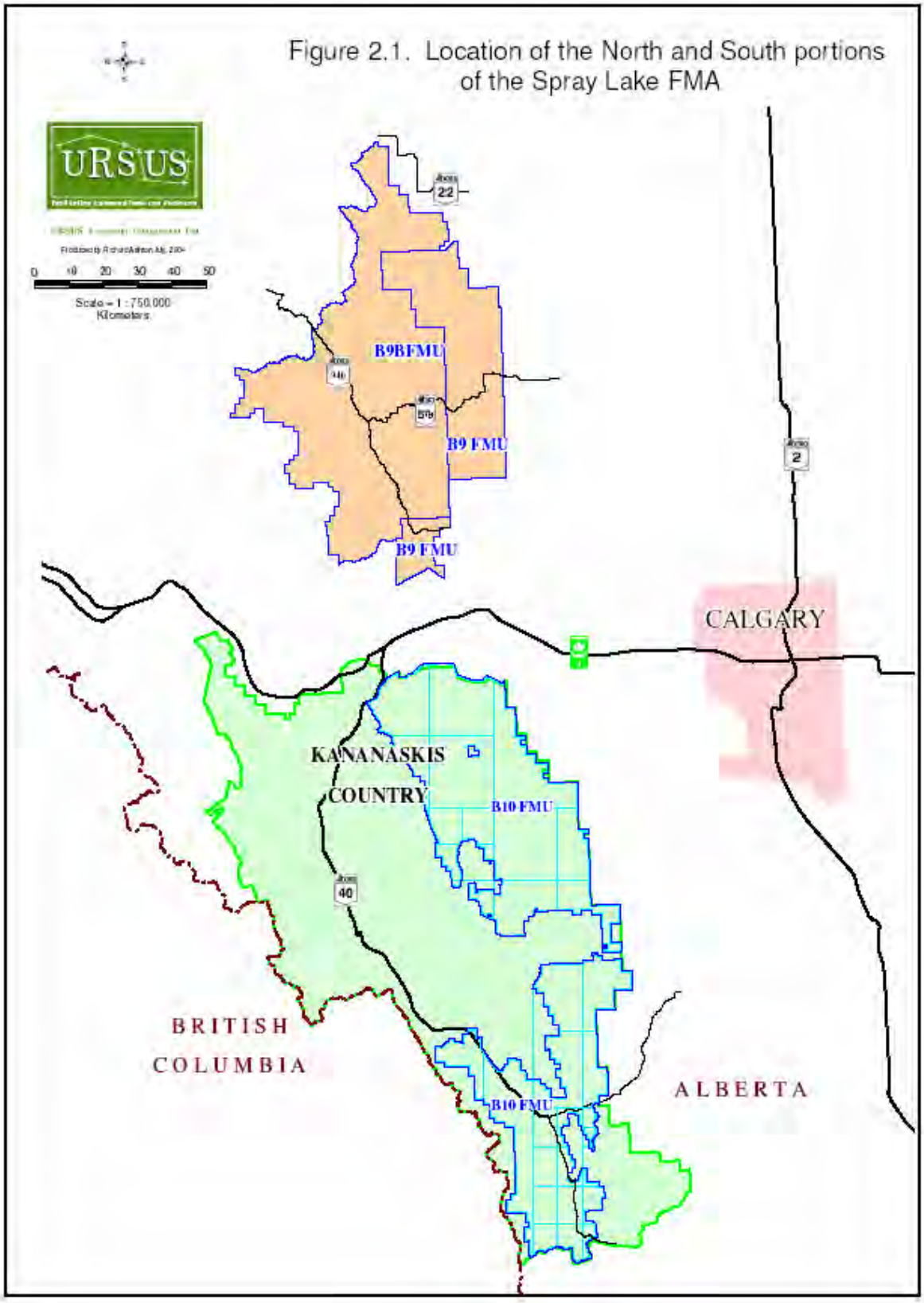


Figure 2.1. Location of the North and South portions of the Spray Lake FMA
URSUS
0 10 20 30 40 50
Scale – 1 : 750,000
Kilometers
B9BFMU
B9 FMU
B9 FMU
CALGARY
KANANASKIS COUNTRY
B10 FMU
B10 FMU
BRITISH COLUMBIA
ALBERTA
22
40
2

2.2 Ecological Land Classification

2.2.1 Definitions and Ecological Hierarchy

Ecological Land Classification (ELC) is a method of partitioning landscapes into manageable pieces for the purposes of ecological and land use management and planning. ELC is based on a hierarchical mapping framework that allows for various levels of land assessment. In Alberta the *natural region* is the most generalized level of classification, and focuses on regional climatic variations as expressed by broad vegetation zones. *Natural subregion* is the next level of classification, which groups land areas with similar landscape patterns included within a single natural region. Subregions are subdivided into *ecodistricts,* which are areas with similar patterns of relief, geology, geomorphology and genesis of soil parent materials. *Ecosections* are ecological units grouped by landform similarities, offering a useful medium-scale framework for planning that takes into account "enduring features" (Conservation Biology Institute 1997). *Ecosites* are parts of ecosections and are characterized by a relative uniformity of parent material, soil, hydrology and vegetation (Wiken 1986).

The wildlife habitat unit (WHU) type is the land unit used for the most detailed level of assessment in this study. The WHU is similar in scale and concept to the Ecosite Phase. Ecosite phase is described by Archibald et al. (1996) as follows:

> "An ecosite phase is a subdivision of the ecosite based on dominant tree species or variations of specific environmental influences. Differences in the phases of the same ecosite may be expressed as differences in plant species abundances or pedogenic processes. Ecosite phases, however, have a distinct range in tree canopy composition and understory floristic. Generally, ecosite phases can be mapped."

As is the case for the ecosite phase, the primary diagnostic attribute used for classifying WHUs was vegetation cover. Additional land attributes considered in classification were natural Subregion, aspect, forest age, forest canopy closure and moisture regime.

2.2.2. Ecological Land Supply in South FMA

Description of the South FMA is based on the *B10 FMU Baseline Terrestrial Ecosystem Management Project* (Collister and Kansas 2003) with subsequent analysis of forest stand age.

Natural Regions, Subregions and Ecodistricts

The South FMA occupies approximately 1624-km^2 and comprises three natural regions (Table 2.1): Rocky Mountains occupying 63.4%; Foothills occupying 36.0%; and Parkland occupying 0.6%. The Rocky Mountain natural region in the South FMA includes three natural subregions: Subalpine, Alpine, and Montane occupying 59.3%, 3.3%, and 0.8% of the South FMA respectively. The other two natural regions, Foothills and Parkland, are represented in the South FMA by one natural subregion each: Lower Foothills and Foothills Parkland respectively.

The ecodistricts most represented in the South FMA are Banff Mountains (59% of the South FMA) and Bragg Creek Foothills (36%). The Banff Mountains ecodistrict occurs within the Subalpine subregion of the Rocky Mountains Natural Region and the Bragg Creek Foothills Ecodistrict occurs within the Lower Foothills subregion of the Foothills Natural Region (Table 2.1). The Banff Mountains ecodistrict is characterized by coniferous forest as the dominant vegetation type and moraine-talus-and bedrock as the dominant landforms. The Bragg Creek ecodistrict is comprised mainly of inclined/rolling moraine landforms that support a mixed

coniferous-deciduous forest. The remaining 5% of the South FMA area is comprised of three ecodistricts: Crowsnest Mountains (Alpine subregion), Morley Foothills (Montane subregion) and Black Diamond Upland (Foothills Parkland subregion).

Ecosections

A total of seventy-five ecosections were mapped in the South FMA (McGregor 1984). More than 55% of the total area is represented by ten ecosections occurring within two natural subregions, eight of them belonging to the Subalpine subregion (Appendix 2.1). Ecosections 6M1, 6CM1, 6CM2, 6C2, 6M2, 6C9, 6C1, and 6C4 are characterized by closed and to a lesser extent open coniferous forests growing on colluvial and morainal parental materials. The remaining two ecosections are part of the Lower Foothills subregion. Ecosection 9MC3 is characterized by open and closed deciduous and mixedwood forest interspersed with grassland on morainal and colluvial parent materials. 9M2 has closed coniferous forest on morainal slopes.

Wildlife Habitat Units

Several ecological attributes were taken into account in order to classify, map, and assess wildlife habitat units in the study area. These attributes included natural subregion (elevation); vegetation cover type, slope angle, aspect and forest age. Vegetation cover type and forest age class were derived from Alberta Vegetation Inventory (AVI) and elevation, slope angle and aspect were derived from a digital elevation model. A total of 36,693 polygons were mapped in the South FMA with 200 distinct Wildlife Habitat Units (WHUs). These WHUs were of a scale and concept similar to the Ecosite level and recurred from 1 to 1991 times (Appendix 2.2). Polygon frequency as well as mean, minimum and maximum polygon ("patch") size are shown for each WHU in Appendix 2.2. The 200 WHUs were organized into 16 broad vegetation physiognomic cover types (Table 2.2). Detailed classification and mapping methods for WHUs in the South FMA are presented in Collister and Kansas (2003).

2.2.3 Ecological Land Supply in North FMA

Natural Regions, Subregions and Ecodistricts

The portion of the SLS FMA located north of Bow River (North FMA) occupies 1730-km^2. Two natural regions are represented in the North FMA: Foothills with 1411-km^2 (79.8% of the North FMA) and Rocky Mountains with 320-km^2 (20.2%) (Table 2.1). The Foothills natural region includes two natural subregions, Upper Foothills (60.5%) and Lower Foothills (19.3%). The Rocky Mountain natural region also includes two subregions, Montane and Subalpine. The North FMA occurs at generally lower elevations than the South FMA.

The Upper Foothills and Lower Foothills natural subregions are each represented by one ecodistrict (Table 2.1). The Ram River Foothills ecodistrict (60.5% of the North FMA) in the Upper Foothills subregion is characterized by closed coniferous forest on 16-45% slopes and ridged moraine landforms. The O'Chiese Upland ecodistrict (19.3%) in the Lower Foothills subregion is found on rolling moraine-organic and the dominant vegetation is closed mixedwood forest and shrubs on slopes <30%. The Montane and Subalpine natural subregions are each represented by one ecodistrict (Table 2.1). The Morley Foothills encompasses (12.9%) in the Montane subregion is characterized by closed mixedwood forest and grasslands on rolling/undulating moraines with slopes <15%. The Banff Mountains (7.3%) in the Subalpine subregion is characterized by coniferous forest as the dominant vegetation type and moraine-talus-bedrock as the dominant landforms.

Ecosections

Ecosections in the North FMA follow the land classification system prepared by Geographic Dynamics Corp. (2002). This system standardized ecosection classification units between sub-regional study areas for the Sunpine Forest Products Ltd. regional area – of which the southern portion includes the Spray Lake North FMA. Table 2.3 presents the original and standardized ecosections including land areas of each ecosection in the North FMA. A total of 53 ecosections (107 in the original classification) occur in the North FMA. Appendix 2.3 summarizes the landform, topography, parent material, slope % and vegetation cover associated with each ecosection.

The most common ecosections in the North FMA are:

- S.M9a (20.0%) characterized by moderate to steeply sloped (16%-100%) foothills with morainal and residual parental material. Vegetation cover is partially closed Lodgepole Pine Forest.
- S.M1a (18.0%) characterized by slightly to moderately sloped (0%-30%) bedrock controlled ground moraine; generally undulating to rolling. Vegetation cover is partially closed Lodgepole Pine Forest.
- B.M3c (7.4%) is distinguished by bedrock controlled ground moraine with slight to moderate slopes (6%-30%) generally rolling to inclined. Vegetation cover is closed Aspen, Aspen-White Spruce or White Spruce-Aspen Forest.
- G.M5a (6.9%) is characterized by steep foothills morainal deposits with 16-100% slopes. Vegetation cover is closed Lodgepole Pine Forest.
- G.M1c (6.7%) is distinguished by ground moraine and hummocky to rolling landforms. Slopes vary between 5% and 30% and vegetation cover is partially closed Aspen-Lodgepole Pine Forest.

Ecosites (Wildlife Habitat Units)

Wildlife Habitat Units (WHU) in the North FMA were created by subdividing the landscape based on: natural subregions, physiognomic and land cover types, aspect and slope, moisture regime, density, canopy closure, and age of origin. A total of 15,527 AVI map polygons were classified into 934 different wildlife habitat units. These WHUs are rank-ordered by land area in Appendix 2.4. Polygon frequency as well as mean, minimum and maximum polygon ("patch") size are shown for each WHU in Appendix 2.4. WHUs in the North FMA were grouped into 17 broad physiognomic vegetation cover types (Table 2.4).

Table 2.1 Natural Regions, Subregions and Ecodistricts

	Total area (km^2)	Natural Region	Natural Subregion	Ecodistrict	% of FMA[1]	Slopes	Dominant Vegetation
North FMA	1731	Foothills	Upper Foothills	Ram River Foothills	60.5	16 - 45%	Closed Conifer Forest
		Foothills	Lower Foothills	O'Chiese Upland	19.3	0 - 30%	Closed Mixedwood Forest/Shrub
		Rocky Mountain	Montane	Morley Foothills	12.9	0 - 15%	Closed Mixed Forest/Grassland
		Rocky Mountain	Subalpine	Banff Mountains	7.3	16 - >100%	Open/Closed Conifer Forest
South FMA	1624	Rocky Mountain	Subalpine	Banff Mountains	59.3	16 - >100%	Open/Closed Conifer Forest
		Foothills	Lower Foothills	Bragg Creek Foothills	36	6 - 70%	Closed Mixed Forest/Cleared
		Rocky Mountain	Alpine	Crowsnest Mountains	3.3	31 - >100%	Unvegetated/Shrub/Herbaceous
		Rocky Mountain	Montane	Morley Foothills	0.8	0 - 15%	Closed Mixed Forest/Grassland
		Parkland	Foothills Parkland	Black Diamond Upland	0.6	0 - 15%	Cleared Land/Shrub

[1] Percentages were calculated separately for each section of the FMA

Table 2.2 Vegetation Cover Types in South FMA

Physiognomic Cover Type	Area (ha)	Land Cover Type	Area (ha)	% of South FMA
Anthropogenic	896.6	Anthropogenic	896.6	0.6%
Barren - Natural	4378.3	Cutbank/Sand	172.3	0.1%
		Rock Barren	4206.0	2.6%
Clearcut / Selective Cut	7417.4	Graminoid Clearcuts	4569.6	2.8%
		Shrub-Sapling Clearcuts	1910.4	1.2%
		Treed Clearcuts	937.4	0.6%
Coniferous Dominated Mixedwood Forest	5404.6	Pine Mixedwood	3732.9	2.3%
		Spruce Mixedwood	1671.7	1.0%
Coniferous Forest	118922.5	Lodgepole Pine Forest	87482.0	53.9%
		Spruce Forest	30886.9	19.0%
		Subalpine Fir Forest	298.4	0.2%
		Subalpine Larch Forest	255.2	0.2%
Cultivated	109.2	Cropland	109.2	0.1%
Deciduous Dominated Mixedwood Forest	114.2	Aspen Mixedwood	114.2	0.1%
Deciduous Forest	10332.1	Aspen Forest	9486.8	5.8%
		Balsam Poplar Forest	845.3	0.5%
Forb Meadow	90.3	Forb Meadow	90.3	0.1%
Graminoid Meadow	8173.2	Grassland	7321.9	4.5%
		Wet Graminoid	851.3	0.5%
Natural Shrubland	5208.1	Shrub Meadow	2398.1	1.5%
		Shrub Wetland	2810.0	1.7%
Rangeland Clearing	430.1	Rangeland Clearing	430.1	0.3%
Reclaimed Industrial	73.5	Reclamated Vegetated	73.5	0.1%
Treed Bog / Fen	692.1	Treed Wetland	692.1	0.4%
Waterbody / Wetland	158.7	Flooded	119.8	0.1%
		Lakes/Ponds	34.6	0.0%
		Rivers	4.3	0.0%
Improved Pasture	26.4	Improved Pasture/Mixed Shrub	26.4	0.0%

Table 2.3 Ecosections in North FMA

Ecosection		Area (ha)	% of North FMA
Original	Standardized		
9XC1.RDJM	B.C1a	55.0	0.03
10F6.RDJM	B.F1b	11.2	0.01
9F5.RDJM	B.F1b	27.3	0.02
9F5.RDJM	B.F1b	143.5	0.08
9F2.GHST	B.F2b	180.3	0.10
9F2.GHST	B.F2b	1206.7	0.70
9FL1.RDJM	B.F2c	0.7	0.00
10FQ1.RDJM	B.F2c	25.8	0.01
9F1.GHST	B.F2c	89.5	0.05
10FQ1.RDJM	B.F2c	300.0	0.17
9F1.GHST	B.F2c	1053.1	0.61
9F1.RDJM	B.F3b	291.8	0.17
9F1.RDJM	B.F3b	759.7	0.44
9FQ1.RDJM	B.F5a	119.1	0.07
9FQ1.RDJM	B.F5a	153.7	0.09
9G1.RDJM	B.GF2b	440.1	0.25
9G1.RDJM	B.GF2b	997.7	0.58
9G2.RDJM	B.GF3a	58.1	0.03
10L2.RDJM	B.L1c	71.6	0.04
9L2.RDJM	B.L2b	11.3	0.01
9LM1.RDJM	B.L2b	14.0	0.01
9L2.RDJM	B.L2b	744.8	0.43
9LM1.RDJM	B.L2b	2266.2	1.31
9LQ1.RDJM	B.L3b	1416.5	0.82
9M3.GHST	B.M2b	1621.1	0.94
9M3.GHST	B.M2b	3603.4	2.08
9M4.GHST	B.M3c	123.0	0.07
9M1.GHST	B.M3c	1604.6	0.93
9M2.RDJM	B.M3c	3805.7	2.20
9M2.RDJM	B.M3c	7362.3	4.25
9M1.RDJM	B.M4a	691.5	0.40
6M1.GHST	B.M4a	831.1	0.48
9M2.GHST	B.M4c	1469.6	0.85
9M4.GHST	B.M4c	1547.6	0.89
9M2.GHST	B.M4c	1628.9	0.94
9M5.GHST	B.M4c	2047.2	1.18
9MC1.RDJM	B.M5b	1493.7	0.86
9MC1.RDJM	B.M5b	3610.0	2.09
9MG1.RDJM	B.M7a	1.9	0.00
9MG1.RDJM	B.M7a	137.6	0.08
6MQ1.GHST	B.M8a	69.8	0.04
9MH1.RDJM	B.M8a	182.8	0.11
6MQ1.GHST	B.M8a	223.9	0.13
10MQ1.RDJM	B.M8b	9.3	0.01
9MQ1.RDJM	B.M8c	411.5	0.24
9MQ1.RDJM	B.M8c	879.3	0.51
9Q2.GHST	B.Q1b	558.4	0.32
9Q1.RDJM	B.Q1d	93.9	0.05
6Q1.GHST	B.Q1d	449.4	0.26
9Q1.RDJM	B.Q1d	462.0	0.27
9Q1.GHST	B.Q1d	1287.1	0.74
10Q2.RDJM	B.Q2a	28.2	0.02
9Q2.RDJM	B.Q2a	283.5	0.16
9Q2.RDJM	B.Q2a	367.2	0.21
7R2.GHST	C.R1a	181.4	0.10
5C3.GHST	G.C2a	658.2	0.38
5F2.GHST	G.F1b	170.4	0.10
5F2.GHST	G.F1b	522.0	0.30
5F1.GHST	G.F2c	101.9	0.06
5F3.GHST	G.F3c	512.3	0.30
5F3.GHST	G.F3c	694.9	0.40
5G2.GHST	G.GF1a	1133.2	0.65
5G1.GHST	G.GF1b	89.3	0.05
5G1.GHST	G.GF1b	844.3	0.49
5M1.GHST	G.M1a	408.3	0.24
5M4.GHST	G.M1a	506.7	0.29
5M2.GHST	G.M1a	764.0	0.44
5M3.GHST	G.M1a	1370.4	0.79
5M1.GHST	G.M1a	2786.8	1.61
9M1.GHST	G.M1c	11534.8	6.67
5MX1.GHST	G.M5a	253.0	0.15
5MX1.GHST	G.M5a	3827.1	2.21
5MX2.GHST	G.M5a	7705.7	4.45
5QM1.GHST	G.M6a	1273.5	0.74
5Q1.GHST	G.Q1a	0.3	0.00
5Q1.GHST	G.Q1a	1040.3	0.60
6C1.GHST	R.C2a	254.8	0.15
6C5.GHST	R.C2b	184.7	0.11
5C1.GHST	R.C2b	421.8	0.24
6C3.GHST	R.C2c	375.1	0.22
6C2.GHST	R.C2c	529.6	0.31
6G1.GHST	R.GF2b	268.4	0.16
6M5.GHST	R.M1a	362.0	0.21
10F2.RDJM	S.F1d	49.9	0.03
6F2.GHST	S.F1d	1070.0	0.62
6F2.GHST	S.F1d	1147.5	0.66
6F3.GHST	S.F2a	2542.1	1.47
6F1.GHST	S.F2c	495.1	0.29
6F1.GHST	S.F2c	3808.5	2.20
5G3.GHST	S.GF2c	328.9	0.19
10MF1.RDJM	S.M13a	170.3	0.10
10MQ1.RDJM	S.M14b	345.6	0.20
6M2.GHST	S.M1a	7545.6	4.36
6M3.GHST	S.M1a	11501.6	6.65
6M1.GHST	S.M1a	12149.7	7.02
10M2.RDJM	S.M2a	38.8	0.02
10M2.RDJM	S.M2a	4658.7	2.69
10M1.RDJM	S.M3a	85.3	0.05
10M1.RDJM	S.M3a	1848.3	1.07
10MC1.RDJM	S.M8a	269.9	0.16
5MX2.GHST	S.M9a	2240.4	1.29
6MX1.GHST	S.M9a	4570.6	2.64
6MX1.GHST	S.M9a	26971.2	15.59
10Q1.RDJM	S.Q1c	55.9	0.03
5Q2.GHST	S.Q1c	845.6	0.49
10Q2.RDJM	S.Q1d	884.5	0.51
6Q1.GHST	S.Q1d	3320.5	1.92
Total		173042.2	100.00

Table 2.4 Vegetation Cover Types in North FMA

Physiognomic Cover Type	Area (ha)	Land Cover Type	Area (ha)	% of North FMA
Anthropogenic	1097	Human Settlement	8.92	0.01%
		Industrial Facilities	1088.31	0.63%
Barren - Natural	173	Cutbank	61.52	0.04%
		Rock	50.67	0.03%
		Sand	60.53	0.03%
Bryophytes	2	Bryophytes	1.82	0.00%
Clearcut / Selective Cut	15477	Graminoid Clearcut	11019.18	6.37%
		Selection Cut	1696.02	0.98%
		Shrub / Sapling Clearcut	1088.90	0.63%
		Treed Clearcut	1672.65	0.97%
Coniferous Dominated Mixedwood Forest	14480	Black Spruce - Aspen	111.91	0.06%
		Black Spruce - Balsam Poplar	14.13	0.01%
		Black Spruce - Poplar (Undifferentiated)	5.52	0.00%
		Engelmann Spruce - Aspen	86.76	0.05%
		Lodgepole Pine - Aspen	4548.91	2.63%
		Lodgepole Pine - Balsam Poplar	304.85	0.18%
		Pine (Undifferentiated) - Aspen	3974.83	2.30%
		Pine (Undifferentiated) - Balsam Poplar	613.30	0.35%
		Pine (Undifferentiated) - Poplar (Undifferentiated)	22.50	0.01%
		White Birch - Lodgepole Pine	11.75	0.01%
		White Spruce - Aspen	4230.22	2.44%
		White Spruce - Balsam Poplar	554.87	0.32%
Coniferous Forest	101425	Black Spruce	1175.07	0.68%
		Black Spruce - Engelmann Spruce	5.18	0.00%
		Black Spruce - Lodgepole Pine	98.35	0.06%
		Black Spruce - Pine (Undifferentiated)	109.54	0.06%
		Black Spruce - White Spruce	416.63	0.24%
		Engelmann Spruce	662.69	0.38%
		Engelmann Spruce - Balsam Fir	1.18	0.00%
		Engelmann Spruce - Lodgepole Pine	477.46	0.28%
		Engelmann Spruce - Subalpine Fir	238.30	0.14%
		Engelmann Spruce - White Spruce	0.49	0.00%
		Jackpine	1.42	0.00%
		Lodgepole Pine	45183.16	26.11%
		Lodgepole Pine - Engelmann Spruce	664.23	0.38%
		Lodgepole Pine - White Spruce	11649.48	6.73%
		Lodgepole Pine - Black Spruce	229.14	0.13%
		Pine (Undifferentiated)	15467.04	8.94%

Physiognomic Cover Type	Area (ha)	Land Cover Type	Area (ha)	% of North FMA
		Pine (Undifferentiated) - Black Spruce	393.26	0.23%
		Pine (Undifferentiated) - White Spruce	7722.96	4.46%
		White Spruce	7904.05	4.57%
		White Spruce - Black Spruce	925.54	0.53%
		White Spruce - Lodgepole Pine	5491.63	3.17%
		White Spruce - Pine (Undifferentiated)	2362.63	1.37%
		White Spruce - Subalpine Fir	245.44	0.14%
Cultivated	2139	Annual Cropland	70.71	0.04%
		Perennial Cropland	2068.54	1.20%
Deciduous Dominated Mixedwood Forest	9009	Aspen - Engelmann Spruce	20.75	0.01%
		Aspen - Lodgepole Pine	1671.51	0.97%
		Aspen - White Spruce	4442.98	2.57%
		Aspen - Black Spruce	72.17	0.04%
		Aspen - Pine (Undifferentiated)	2596.75	1.50%
		Balsam Poplar - Lodgepole Pine	41.52	0.02%
		Balsam Poplar - Pine (Undifferentiated)	32.19	0.02%
		Balsam Poplar - White Spruce	129.86	0.08%
		Poplar (Undifferentiated) - White Spruce	1.52	0.00%
Deciduous Forest	8248	Aspen	8129.83	4.70%
		Balsam Poplar	111.79	0.06%
		White Birch	6.18	0.00%
Forb Meadow	1127	Forb Meadow	1127.26	0.65%
Graminoid Meadow	4500	Dry Graminoid	1002.12	0.58%
		Mesic Graminoid	1350.88	0.78%
		Wet Graminoid	2146.87	1.24%
Natural Shrubland	12634	Low Shrubland	12486.81	7.22%
		Tall Shrubland	147.01	0.08%
Rangeland Clearing	688	Graminoid Clearing	468.89	0.27%
		Shrubby Clearing	24.48	0.01%
		Treed Clearing	194.15	0.11%
Recent Burn	906	Treed Burn	905.57	0.52%
Reclaimed Industrial	318	Reclaimed Industrial	318.27	0.18%
Treed Bog / Fen	102	Black Spruce - Tamarack	72.97	0.04%
		Tamarack - Black Spruce	29.06	0.02%
		Tamarack Fen	0.03	0.00%
UNCLASSIFIED	14	UNCLASSIFIED	13.57	0.01%
Waterbody / Wetland	702	Aquatic Flooded	195.92	0.11%
		Aquatic Forb	56.41	0.03%
		Aquatic Lake	134.78	0.08%
		Aquatic River	315.01	0.18%

2.3 Vegetation/Land Cover Types and Supply

The following summary of vegetation/land cover in the two portions of the FMA is based on area analysis from Wildlife Habitat Unit (WHU) mapping at a scale of 1:20,000.

2.3.1 South FMA

Overview of Vegetation/Land Cover Supply

A total of 16 broad 'physiognomic cover types' were identified in the South FMA (Table 2.2). These types represent the most general groupings of vegetation and land cover (e.g. coniferous, deciduous, coniferous and deciduous dominated mixedwood forest cover types). Physiognomic cover types were further sub-divided into 28 "land cover types" which for example broke coniferous forest into leading species such as Lodgepole Pine forest and White Spruce x Engelmann Spruce forest (Table 2.2). Land cover types for the South FMA are illustrated in Figure 2.2.

Coniferous forest is the most common physiognomic cover type comprising 73.3% of the South FMA. Lodgepole Pine forest and White x Engelmann Spruce forest are well distributed through the area, and are the most common coniferous forest cover types occupying 53.9% and 19.0% of the total area, respectively. The greatest diversity of vegetation cover types occurs in the eastern portion of the South FMA (Figure 2.2). In this lower elevation portion of the South FMA a combination of low elevation and natural/anthropogenic disturbances have resulted in a heterogeneous landscape with relatively small patches of different land cover types.

Deciduous forest (mainly aspen) and graminoid meadows occupy 6.3% and 5.0% of South FMA, while pine- and spruce-dominated mixedwood forests represent 3.3% of the area. Past timber harvest comprises 4.6% of the area and is dominated by relatively recent, graminoid and low shrub dominated clearcuts. Barren natural land cover occupies 2.7% of the South FMA and is located mainly in the Moose Mountain area and along major river valleys. The other 10 physiognomic cover types (anthropogenic, cropland, aspen dominated mixedwood forest, forb meadow, natural shrubland, rangeland clearings, reclaimed areas, treed bog, waterbodies and improved pasture) occupy the remaining 5.0% and are concentrated mainly in the eastern section of the South FMA.

Vegetation Descriptions/Supply by Land Cover Type

The following descriptions of vegetation cover types are based on summary and analysis of 1,715 detailed vegetation sampling-plots that were collected in Kananaskis Country within the framework of mapped Wildlife Habitat Units (WHUs) from 1994 to 2000. Detailed plot sampling methods are presented in Collister and Kansas (2003). Figure 2.2 illustrates the distribution and supply of vegetation/land cover types in the South portion of the FMA.

Lodgepole Pine Forest is the most abundant vegetation/land cover group (875-km^2 or 53.9% of the South FMA). It is most common at elevations below 1,900-m on NE-facing slopes (20%) (UFC1/7 and UFC1/8 types) and on SW-facing slopes (16%) (UFC1/4 and UFC1/5 types). Characteristic understory plant species are: *Alnus crispa, Shepherdia canadensis* and *Linnaea borealis* (shrubs); and *Elymus innovatus* and *Calamagrostis rubescens* (graminoids).

The second most abundant vegetation/land cover type is upland White and Engelmann Spruce Forest (309-km^2 or 19.0%). The UFC2/7, UFC2/8, and UFC2/9 wildlife habitat units are located on NE-facing slopes and best represent this group. The most common tree species are *Picea engelmannii, Picea glauca,* and *Pinus contorta* (at elevations <1900m) and *Picea engelmannii*

and *Abies lasiocarpa* (at elevations >1900m). Shrub, forb and graminoid species abundance varies according to elevation (Collister and Kansas 2003).

Deciduous forests (6.3%) commonly dominated by aspen (*Populus tremuloides*) with some scattered stands of balsam poplar (*Populus balsamifera*) also occur in the South FMA. Aspen forests are more common at lower elevations because of enhanced climate and soil conditions, especially on SW facing slopes and near-level terrain (UFD1/3 and UFD1/4). Balsam poplar stands are most common in riverine and riparian landforms.

Native upland grasslands (4.5%) are most common in the Subalpine subregion (<2200m) on SW-facing slopes. The wildlife habitat units in these areas are UHG1/2 and UHG2/2 with *Potentilla fruticosa* and *Rosa acicularis* as the most abundant shrubs, and *Arctostaphylus uva-ursi* and *Galium boreale* as characteristic forbs. Graminoids are best represented by *Elymus innovatus*, *Festuca scabrella*, and *Danthonia parryi*.

Clearcuts (4.6%) are most often located on areas with <15% slope in the Lower Foothills Subregion and lower portion of the Subalpine natural subregion. Graminoid-dominated clearcuts (<10 years old) located on near-level terrain (A3.1/1) are the most common harvested habitat unit. Characteristic forbs are *Epilobium angustifolium* and *Fragaria virginiana* while common graminoids include *Elymus innovatus*, *Poa spp*., and *Calamagrostis canadensis*. Shrubs are sparsely distributed (<10% cover).

Coniferous Mixedwood Forest (3.3%) is dominated in the South FMA by lodgepole pine with trembling aspen or balsam poplar as sub-dominant tree species. These habitats are well distributed over flat to gentle, SW- and NW-facing slopes. The most common coniferous mixedwood WHUs are: Pine Mixedwood on flat terrain in the Lower Foothills subregion (UFM2/1); Spruce Mixedwood on flat terrain in the Lower Foothills (UFM3/1); and, Pine Mixedwood on NE-facing slopes in the Lower Foothills (UFM3/5).

The other six vegetation/land cover types comprise <6% of the South FMA and include Wetlands (2.6%); Upland Shrublands (1.5%); Man-made Clearings (1.2%); Subalpine Fir Forest (0.2%); Subalpine Larch Forest (0.2%); and Deciduous Mixedwood Forest (0.1%).

Figure 2.2. Vegetation/Land Cover Types in the South FMA

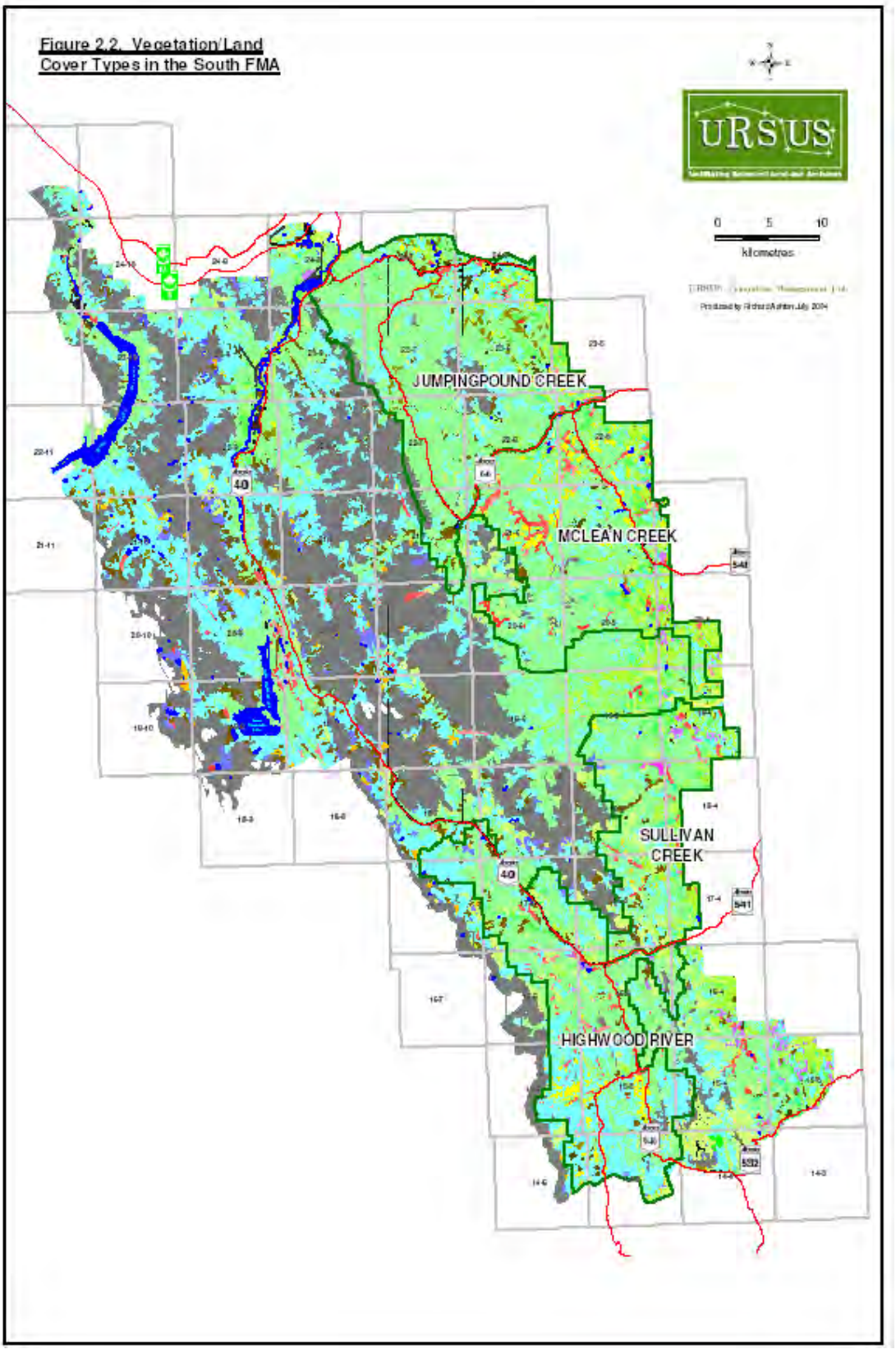


Figure 2.2 & 2.3 Legend

2.3.2 North FMA

Overview of Vegetation/Land Cover Supply

A total of 17 broad 'physiognomic cover types' were identified in the North FMA. The most common physiognomic cover type is coniferous forest occupying 58.6% of the North FMA. Within the coniferous forest type Lodgepole Pine-dominated stands (47.0% of North FMA) are the most common. Coniferous dominated mixedwood forest occurs on 8.4% of the North FMA and Lodgepole Pine-Aspen and White Spruce-Aspen mixedwood forests are the most common cover types in this class (Table 2.4). Approximately 8.9% of the North FMA is occupied by [timber] harvested lands. This cover type is dominated by recent (graminoid) clearcuts. Natural shrubland occupies 7.3% of the North FMA. Deciduous forest covers 4.8% of the North FMA and includes Aspen (4.7%), Balsam Poplar (0.1%), and White Birch (<0.01%). Deciduous dominated mixedwood forest occupies 5.2% of the North FMA. The remaining 11 cover types occupy 7.3% of the North FMA with cultivated areas and graminoid meadows the most common.

Vegetation Descriptions/Supply by Land Cover Type

Figure 2.3 illustrates the distribution and supply of vegetation/land cover types in the North portion of the FMA. Coniferous forest cover types comprise 361 of the 934 Wildlife Habitat Units (WHU) in the North FMA (Appendix 2.4). Mesic mid-seral Lodgepole Pine forests located in the Upper Foothills subregion are the most abundant coniferous forest habitat types in the North FMA. They occupy 7.6% of the North FMA on flat areas [UF(f)-PLc-ms(m)], 7.5% on south facing slopes [UF(s)-PLc-ms(m)], and 7.1% on north facing slopes [UF(n)-PLc-ms(m)].

Other abundant coniferous forest WHUs are: mesic mid-seral Lodgepole Pine forest located on flat terrain in the Lower Foothills [LF(f)-PLc-ms(m)] and the Montane [M(f)-PLc-ms(m)] subregions. They comprise 3.1% and 2.2% of the North FMA. Mesic mid-seral Lodgepole Pine-Black Spruce coniferous forest located in the Upper Foothills subregion on N-facing slopes [UF(n)-PL-MXc-ms(m)], S-facing slopes [UF(s)-PL-MXc-ms(m)] and flat terrain [UF(f)-PL-MXc-ms(m)] are also abundant, occupying 2.5%, 1.5% and 1.6% of the North FMA respectively. Mesic mid-seral Lodgepole Pine-Black Spruce coniferous forest on flat terrain [LF(f)-PL-MXc-ms(m)] comprises 2.1% of the North FMA (Appendix 2.4). The most common WHUs belonging to the harvested land cover type are graminoid-dominated clearcuts on flat terrain of the Lower Foothills [LF(f)-CC1-GR(m)] and Upper Foothills [LF(f)-CC1-GR(m)] natural subregions. Those WHUs comprise 3.4% and 1.4% of the North FMA respectively. Ninety-eight (10.5%) of the 934 WHUs in the North FMA are harvested types (Appendix 2.4)

Thirty-eight (38) WHUs were classified as natural shrubland. Of these the most abundant is wet low shrubland on flat terrain located in the Upper Foothills subregion [UF(f)-SC1(w)]. Other common WHUs are mesic low shrubland on flat terrain located in the Montane [M(f)-SC1(m)], Lower Foothills [LF(f)-SC1(m)], and Upper Foothills [UF(f)-SC1(m)] subregions. These types occupy 1.3%, 1.3%, and 1.1% of the North FMA, respectively.
The coniferous dominated mixedwood forest cover type includes 156 WHUs. The most common of these are mesic, mid-seral Lodgepole Pine-Aspen, White Spruce-Aspen and Aspen-White Spruce stands located on flat terrain of the Lower Foothills subregion [LF(f)-PL-AWc-ms(m); LF(f)-SW-AWc-ms(m); and LF(f)-AW-SWc-ms(m)]. These three types occupy 1.2%, 1.0%, and 0.9% of the North FMA respectively. The remaining 13 land cover types include 281 habitat types covering 50.3% of the North FMA. None of these WHUs exceeds 1% of the North FMA (Appendix 2.4).

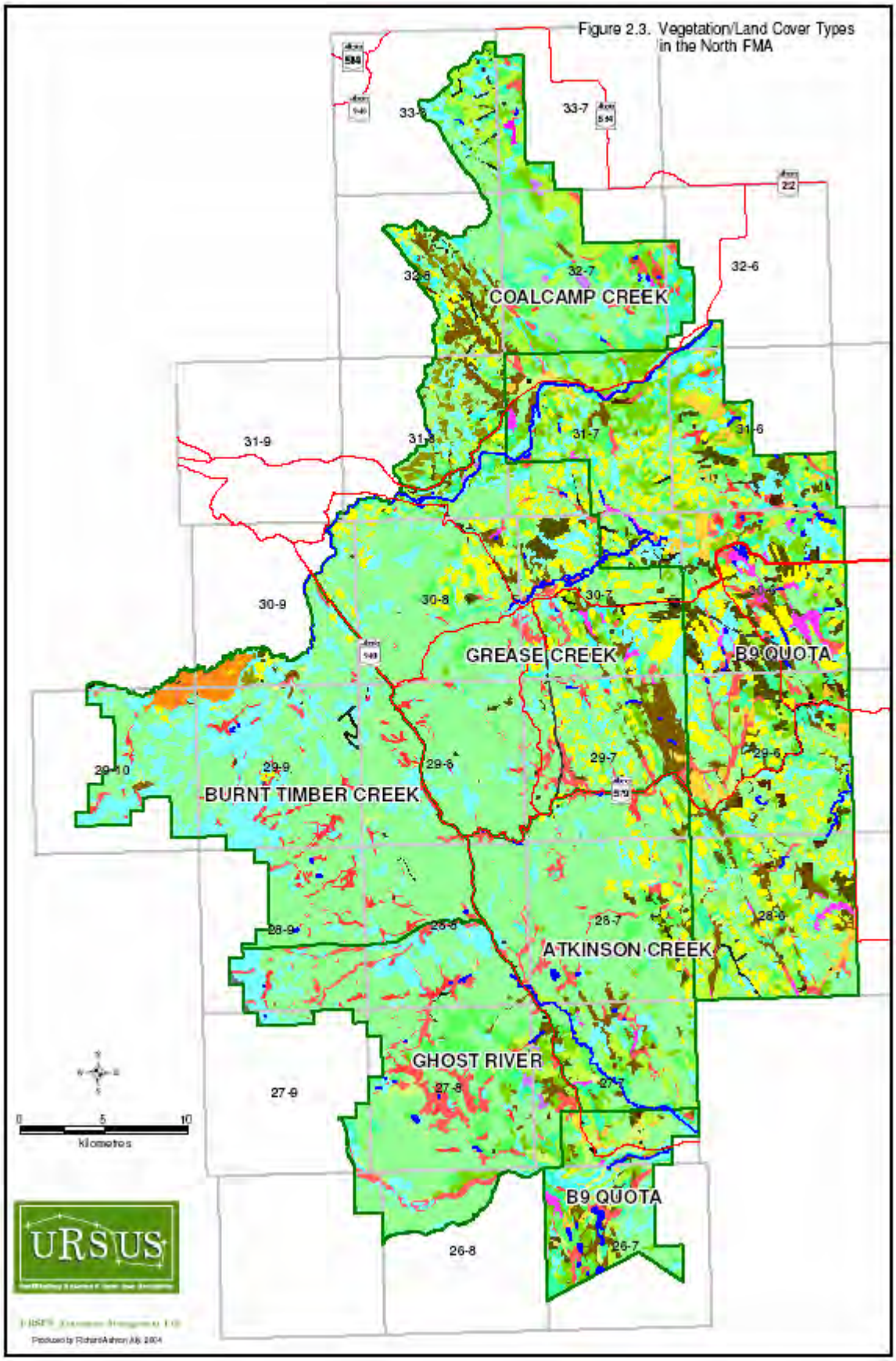


Figure 2.3. Vegetation/Land Cover Types in the North FMA
COALCAMP CREEK
GREASE CREEK
B9 QUOTA
BURNT TIMBER CREEK
ATKINSON CREEK
GHOST RIVER
B9 QUOTA
33-8
33-7
32-8
32-7
32-6
31-9
31-8
31-7
31-6
30-9
30-8
30-7
29-10
29-9
29-8
29-7
29-6
28-9
28-8
28-7
28-6
27-9
27-8
26-8
26-7
0 5 10
Kilometres
URSUS

Figure 2.2 & 2.3 Legend

2.3.3 Vegetation Supply Comparison - North and South FMAs

The main differences in the relative supply of vegetation/land cover types between the North and South portions of the FMA are:

- Rock barren habitat above treeline is more common in the South FMA;
- Timber harvest areas are approximately three times more common in the North FMA;
- Mixedwood forest are significantly (>5x) more common in the North FMA than in the South FMA – particularly for deciduous mixedwood forest;
- Mappable tracts of Black Spruce occurs in the North FMA but not in the South FMA;
- Cropland is much more common in the South FMA;
- Shrubby meadows are significantly (5x) more common in the North FMA;
- Wetlands are significantly (6x) more common in the North than in the South FMA.

The majority of these differences are due to the lower elevations that occur in the North FMA.

2.4 Vegetation Seral Stage Supply

2.4.1 FMA-Level Summary

Forest age exerts an influence on a range of ecological attributes including wildlife and rare plant habitat suitability and understory plant species richness. Current forest age class (seral stage) status was classified and mapped for the North and South portions of the FMA. Attribute data from Alberta Vegetation Inventory (AVI) mapping was used to assign a dominant forest cover type and age class to each map polygon.

Three seral stages (young seral, mature seral and old growth) were assigned to the forest cover types (e.g. lodgepole pine forest) within each broad vegetation cover type grouping. The following age classes were used to define seral stages:

For Coniferous forest cover types:

Young Seral	20 to 70 years
Mature Seral	71 to 170 years
Old Growth	>170 years

For Deciduous and Mixedwood (Conifer/Deciduous-dominated) forest cover types

Young Seral	20 to 50 years
Mature Seral	51 to 110 years
Old Growth	>110 years

A recent study of mature and old growth forests in the central Alberta Rockies (Morgantini and Kansas 2003) was used to establish mature seral and old growth age thresholds. Age class distinctions for deciduous and mixedwood forests was based on review of stand age/tree composition relationships from the Sunpine and Spray Lake AVI databases.

The Charts in Appendix 2.5 illustrate the relative land area supply of young seral, mid-seral and old growth age classes for each major forest cover type in the North and South portions of the FMA. Stand age classes for the major vegetation cover types are illustrated for the South and North FMA in Figure 2.4 and 2.5, respectively.

In both portions of the FMA mid-seral aspen forests are the most common deciduous forest cover type. Older (>100 years) aspen forest cover is relatively more common in the North FMA

than in the South, but still is approximately 3 times less common than mid-seral aspen forest. Young (20 – 70 years) deciduous forest cover (other than harvested) is very rare in both portions of the FMA.

Mid-seral pine mixedwood forest is the most common mixedwood forest type in both portions of the FMA. It is three to four times more common than old growth (>110 years) pine mixedwood forest. Aspen mixedwood forest is rare in the South FMA and only occurs in the mid-seral age class. Mid-seral aspen mixedwood forest is relatively common in the North FMA, rivaling pine mixedwood in land area. Spruce mixedwood forest is intermediate in land area between pine and aspen mixedwood. In the North FMA mid-seral spruce mixedwood forest is 4 times more common than old growth. Young seral spruce mixedwood (20 – 50 years) is almost absent in the North FMA. In the South FMA old growth spruce mixedwood forest is almost as common as mid-seral (Appendix 2.5).

Mid-seral Lodgepole Pine forest (71 - 170 years) dominates each of the North and South portions of the FMA – especially the North FMA. In the North FMA mid-seral pine forest is 41 times more common than young seral pine forest (21 - 70 years) and 64 times more common than old growth pine forest (>170 years). In the South FMA mid-seral Lodgepole Pine forest is five times more common than young seral and 66 times more common than old growth pine forest. The mid-seral age class (71 – 170 years) is also the most common of the White x Engelmann cover type. In the North FMA mid-seral White x Engelmann Spruce forest is 75 times more common than young seral spruce forest (21 - 70 years) and four times more common than old growth spruce forest (>170 years). In the South FMA mid-seral White x Engelmann Spruce forest is 26 times more common than young seral and five times more common than old growth spruce forest.

Recent clearcuts with graminoid cover dominate the land area of harvested forest in both the North (71.2% of harvested) and South (61.6% of harvested) portions of the FMA. Clearcuts dominated by shrubs comprise 21.8% of harvested areas in the North FMA and 25.8% of the South FMA harvested area. Clearcuts with >6% of trees greater than 5-m tall (‘treed clearcuts’) comprise a greater proportion of harvested areas in the North (21.8%) than in the South (12.6%).

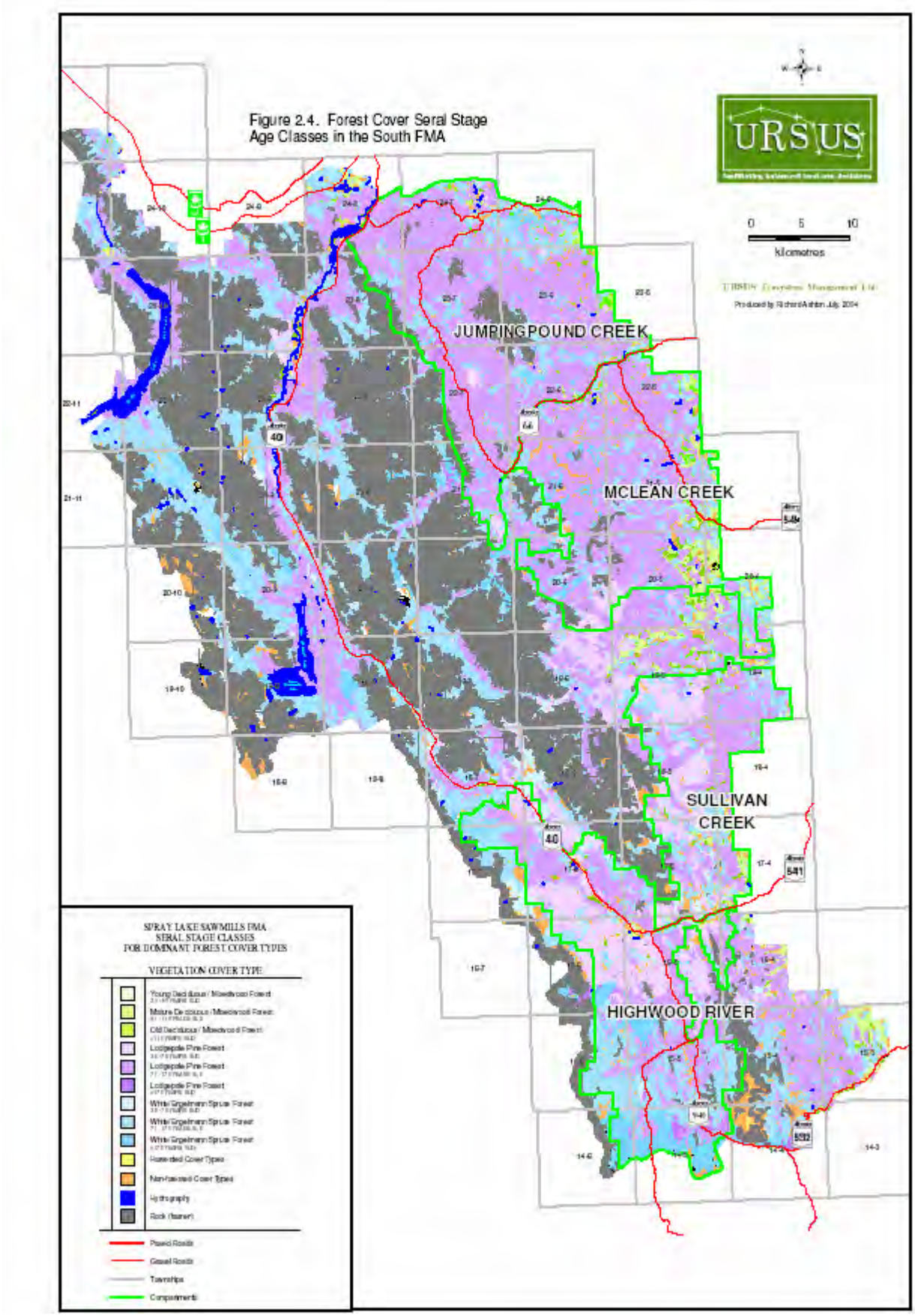
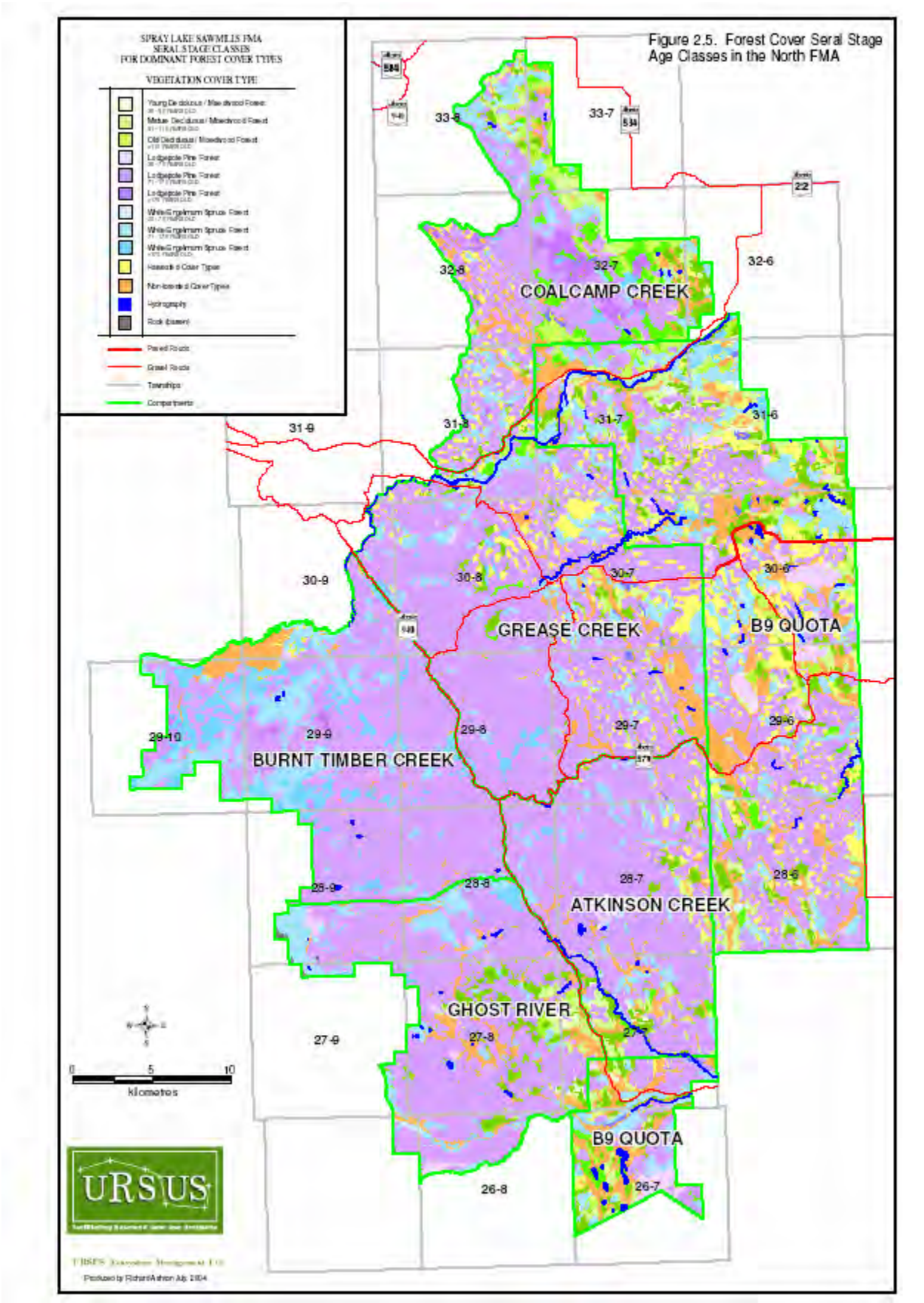


Figure 2.4. Forest Cover Seral Stage
Age Classes in the South FMA
URSUS
0 5 10
kilometres
JUMPINGPOUND CREEK
MCLEAN CREEK
SULLIVAN CREEK
HIGHWOOD RIVER
40
64
548
541
SPRAY LAKE SAWMILLS FMA
SERAL STAGE CLASSES
FOR DOMINANT FOREST COVER TYPES
VEGETATION COVER TYPE
Hydrography
Rock (barren)
Paved Roads
Gravel Roads
Townships
Compartments


SPRAY LAKE SAWMILLS FMA
SERAL STAGE CLASSES
FOR DOMINANT FOREST COVER TYPES
VEGETATION COVER TYPE
Young Deciduous / Mixedwood Forest
Mature Deciduous / Mixedwood Forest
Old Deciduous / Mixedwood Forest
Lodgepole Pine Forest
Lodgepole Pine Forest
Lodgepole Pine Forest
White/Engelmann Spruce Forest
White/Engelmann Spruce Forest
White/Engelmann Spruce Forest
Harvested Cover Types
Non-forested Cover Types
Hydrography
Rock (bare)
Paved Route
Gravel Route
Townships
Compartments
Figure 2.5. Forest Cover Seral Stage Age Classes in the North FMA
33-8
33-7
32-8
32-7
32-6
COALCAMP CREEK
31-9
31-8
31-7
31-6
30-9
30-8
30-7
30-6
GREASE CREEK
B9 QUOTA
29-10
29-9
29-8
29-7
29-6
BURNT TIMBER CREEK
28-9
28-8
28-7
28-6
ATKINSON CREEK
GHOST RIVER
27-9
27-8
27-7
B9 QUOTA
26-8
26-7
0 5 10
kilometres
URSUS

2.4.2 Compartment-Level Summary

Tables 2.5 and 2.6 summarize the land areas of vegetation cover types and forest seral age classes by planning compartment for the South and North portions of the FMA, respectively. Key vegetation cover and seral stage characteristics of each compartment are summarized below.

Table 2.5 Vegetation Cover Type and Seral Stage Land Areas by Compartment – South FMA

Land Cover Type	Seral Stage	Land Area by Compartment							
		Highwood		Jumpingpound		McLean		Sullivan	
		Area (ha)	% Compartment	Area (ha)	% Compartment	Area (ha)	% Compartment	Area (ha)	% Compartment
Anthropogenic		188.9	0.4%	503	1.0%	180.9	0.4%	23.7	0.1%
Cutbank/Sand		111.6	0.3%	24.2	0.0%	33.3	0.1%	3.2	0.0%
Rock Barren		680.1	1.6%	2672.4	5.1%	650.1	1.5%	203.4	0.8%
Graminoid Clearcuts		1381.5	3.2%	734.9	1.4%	2371.5	5.5%	81.7	0.3%
Shrub-Sapling Clearcuts		188.3	0.4%	1578	3.0%	120.7	0.3%	23.4	0.1%
Treed Clearcuts		252.2	0.6%	464.3	0.9%	202.8	0.5%	18.1	0.1%
Pine Mixedwood	Young	0	0.0%	7.6	0.0%	13.6	0.0%	0	0.0%
	Mid	246	0.6%	722.3	1.4%	966.5	2.3%	618.5	2.5%
	Old	0	0.0%	396.8	0.8%	360.2	0.8%	5.9	0.0%
Spruce Mixedwood	Young	0	0.0%	0	0.0%	0	0.0%	7.7	0.0%
	Mid	139	0.3%	21.5	0.0%	400	0.9%	373.1	1.5%
	Old	0	0.0%	342.5	0.7%	347.2	0.8%	40.6	0.2%
Lodgepole Pine Forest	Young	7071.7	16.2%	700	1.3%	1380.8	3.2%	5850.6	23.7%
	Mid	11212	25.7%	30926.1	59.3%	21691	50.6%	7563.9	30.7%
	Old	934.5	2.1%	145.1	0.3%	6.3	0.0%	0	0.0%
Spruce Forest	Young	544.4	1.2%	30.7	0.1%	21.6	0.1%	374.4	1.5%
	Mid	10470.7	24.0%	7324.1	14.0%	4149.6	9.7%	3048.5	12.4%
	Old	3675.5	8.4%	725.1	1.4%	522.4	1.2%	0	0.0%
Subalpine Fir Forest	Young	22.7	0.1%	0	0.0%	0	0.0%	0	0.0%
	Mid	1443.1	3.3%	21.1	0.0%	5.3	0.0%	77.9	0.3%
	Old	24.7	0.1%	0	0.0%	3.6	0.0%	0	0.0%
Subalpine Larch Forest	Young	0	0.0%	0	0.0%	0	0.0%	9	0.0%
	Mid	23.8	0.1%	0	0.0%	0	0.0%	105.9	0.4%
	Old	116.5	0.3%	0	0.0%	0	0.0%	0	0.0%
Cropland		0	0.0%	18.6	0.0%	88.4	0.2%	2.2	0.0%
Aspen Mixedwood	Young	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Mid	0	0.0%	0	0.0%	105.2	0.2%	9	0.0%
	Old	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Aspen Forest	Young	0	0.0%	13.3	0.0%	28	0.1%	0	0.0%
	Mid	327.5	0.7%	779.2	1.5%	4394.1	10.3%	2502.5	10.2%
	Old	1.2	0.0%	925.2	1.8%	503.1	1.2%	12.8	0.1%
Balsam Poplar Forest	Young	0	0.0%	0	0.0%	30.8	0.1%	0	0.0%
	Mid	246	0.6%	0	0.0%	225.8	0.5%	211.3	0.9%
	Old	0	0.0%	62.3	0.1%	69.2	0.2%	0	0.0%
Forb Meadow		0	0.0%	0	0.0%	1.7	0.0%	88.6	0.4%
Upland Grassland		2668.9	6.1%	1177.2	2.3%	1236.2	2.9%	2239.6	9.1%
Wet Graminoid		56.9	0.1%	61.4	0.1%	530.2	1.2%	43.7	0.2%
Shrub Meadow		574.1	1.3%	1123	2.2%	184.9	0.4%	516	2.1%
Shrub Wetland		755	1.7%	350.8	0.7%	1341.4	3.1%	362.8	1.5%
Rangeland Clearing		11.5	0.0%	133.3	0.3%	109.6	0.3%	175.7	0.7%
Reclamated Vegetated		18.5	0.0%	21.2	0.0%	28.7	0.1%	5.1	0.0%
Treed Wetland		292	0.7%	109.6	0.2%	405.3	0.9%	44.5	0.2%
Flooded		29.8	0.1%	33.7	0.1%	56.2	0.1%	0	0.0%
Lakes/Ponds		1.4	0.0%	5.6	0.0%	18.4	0.0%	9.3	0.0%
Rivers		0	0.0%	4.3	0.0%	56.2	0.1%	0	0.0%
Improved Pasture/Mixed Shrub		0	0.0%	0	0.0%	26.4	0.1%	0	0.0%
TOTALS		43710	100.0%	52158.4	100.0%	42867.2	100.0%	24652.6	100.0%

Table 2.6 Vegetation Cover Type and Seral Stage Land Areas by Compartment – North FMA

Land Cover Type Compartment= Cmpt	Seral Stage	Land Area by Compartment											
		Atkinson Creek		B9 Quota		Burnt Timber Creek		Coal Camp Creek		Ghost River		Grease Creek	
		Area (ha)	% Cmpt	Area (ha)	% Cmpt	Area (ha)	% Cmpt	Area (ha)	% Cmpt	Area (ha)	% Cmpt	Area (ha)	% Cmpt
Anthropogenic		162.3	0.8%	375.2	0.7%	99.6	0.4%	100.9	0.5%	52.7	0.2%	318.2	0.9%
Cropland		9	0.0%	2001.8	4.0%	0	0.0%	36.6	0.2%	25.6	0.1%	65.8	0.2%
Cutbank/Sand		38	0.2%	63.6	0.1%	12.7	0.0%	0	0.0%	0.8	0.0%	6.6	0.0%
Rock Barren		0	0.0%	0	0.0%	0	0.0%	0	0.0%	44.2	0.2%	6	0.0%
Graminoid Clearcuts		730	3.7%	5807.9	11.5%	249.7	0.9%	525.2	2.8%	0	0.0%	3706.4	10.8%
Shrub-Sapling Clearcuts		54.9	0.3%	24.4	0.0%	62.2	0.2%	902.3	4.8%	0	0.0%	45.3	0.1%
Treed Clearcuts		182.8	0.9%	1851.1	3.7%	25.5	0.1%	172.5	0.9%	0	0.0%	516.8	1.5%
Burn		0	0.0%	0	0.0%	905.6	3.2%	0	0.0%	0	0.0%	0	0.0%
Pine Mixedwood	Young	0	0.0%	244	0.5%	0	0.0%	0	0.0%	113.4	0.5%	2.6	0.0%
	Mid	780	4.0%	2568.1	5.1%	6	0.0%	476.6	2.5%	1846.4	8.6%	1036.7	3.0%
	Old	172.7	0.9%	924.1	1.8%	0	0.0%	1252.7	6.6%	0	0.0%	134.9	0.4%
Spruce Mixedwood	Young	3.4	0.0%	8.2	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Mid	257.6	1.3%	2537.2	5.0%	0	0.0%	571.7	3.0%	410.5	1.9%	466.9	1.4%
	Old	24.6	0.1%	179.2	0.4%	0	0.0%	555.1	2.9%	0	0.0%	242.4	0.7%
Lodgepole Pine Forest	Young	120.6	0.6%	1360.1	2.7%	28.2	0.1%	43.8	0.2%	307.1	1.4%	55.5	0.2%
	Mid	12341.2	62.6%	11020.6	21.8%	17274.1	61.8%	5963.2	31.6%	11798.5	55.1%	19814.5	57.5%
	Old	0	0.0%	1.4	0.0%	214.3	0.8%	1008.8	5.3%	0	0.0%	0	0.0%
White x Engelmann Spr	Young	0	0.0%	100.2	0.2%	0	0.0%	6	0.0%	20.9	0.1%	28.6	0.1%
	Mid	763.5	3.9%	3979.8	7.9%	3816.5	13.7%	1187.5	6.3%	1409.3	6.6%	2142.7	6.2%
	Old	0	0.0%	206.9	0.4%	2555.9	9.1%	152.2	0.8%	251.5	1.2%	324.1	0.9%
Black Spruce Forest		66.3	0.3%	735.1	1.5%	735.4	2.6%	0	0.0%	0	0.0%	353.2	1.0%
Black Spruce Mixedwood	Forest	0	0.0%	13.1	0.0%	0	0.0%	32.6	0.2%	0	0.0%	8.4	0.0%
Aspen Mixedwood	Young	54.6	0.3%	539.1	1.1%	0	0.0%	0	0.0%	126	0.6%	5	0.0%
	Mid	625.3	3.2%	3640.2	7.2%	17.3	0.1%	584.9	3.1%	550.9	2.6%	695.3	2.0%
	Old	126.7	0.6%	983.7	1.9%	0	0.0%	693.5	3.7%	0	0.0%	192.4	0.6%
Aspen Forest	Young	67.2	0.3%	201.4	0.4%	0	0.0%	8	0.0%	78.1	0.4%	15.6	0.0%
	Mid	846.8	4.3%	2883.6	5.7%	0	0.0%	1480.9	7.8%	370.9	1.7%	185.3	0.5%
	Old	88.7	0.5%	622.3	1.2%	0	0.0%	1104.1	5.8%	0	0.0%	176.9	0.5%
Balsam Poplar Forest	Young	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Mid	0	0.0%	0	0.0%	0	0.0%	53.3	0.3%	32	0.1%	0	0.0%
	Old	0	0.0%	0	0.0%	0	0.0%	4.5	0.0%	0	0.0%	21.9	0.1%
Balsam Poplar Mixedwo	Young	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Mid	0	0.0%	14.6	0.0%	0	0.0%	0	0.0%	99.5	0.5%	0	0.0%
	Old	0	0.0%	13.1	0.0%	0	0.0%	77.8	0.4%	0	0.0%	0	0.0%
White Birch Forest		0	0.0%	11.8	0.0%	0	0.0%	6.2	0.0%	0	0.0%	0	0.0%
Forb Meadow		48.7	0.2%	984.6	1.9%	0	0.0%	5.4	0.0%	0	0.0%	145	0.4%
Upland Grassland		162.5	0.8%	1349.6	2.7%	150.4	0.5%	186	1.0%	375.6	1.8%	128.6	0.4%
Wet Graminoid		135.5	0.7%	291.6	0.6%	996.2	3.6%	83.2	0.4%	378.2	1.8%	262.1	0.8%
Shrub Meadow		773.7	3.9%	2465	4.9%	76.5	0.3%	1011.6	5.4%	1336.6	6.2%	1625.7	4.7%
Shrub Wetland		756.1	3.8%	1375.1	2.7%	410.9	1.5%	356.6	1.9%	1038.9	4.9%	1404	4.1%
Rangeland Clearing		3.7	0.0%	500.8	1.0%	10.4	0.0%	40	0.2%	3.8	0.0%	9.7	0.0%
Reclamated Vegetated		27.8	0.1%	94.1	0.2%	30.9	0.1%	53.4	0.3%	7.2	0.0%	104.9	0.3%
Tamarack Forest		0	0.0%	0	0.0%	0	0.0%	29.1	0.2%	0	0.0%	0	0.0%
Treed Wetland		190.8	1.0%	207.2	0.4%	248	0.9%	99.1	0.5%	678.3	3.2%	102.1	0.3%
Flooded		15.4	0.1%	93.9	0.2%	9.5	0.0%	16.1	0.1%	23.7	0.1%	37.1	0.1%
Lakes/Ponds		23.4	0.1%	71.9	0.1%	14.6	0.1%	2.4	0.0%	19.6	0.1%	2.9	0.0%
Rivers		49.2	0.2%	177.9	0.4%	1.4	0.0%	0	0.0%	3.9	0.0%	82.2	0.2%
TOTALS		19703		50523.5		27951.8		18883.8		21404.1		34472.3	

Highwood (South FMA)

- Occurs at higher elevations in west portion of South FMA;
- Deciduous and deciduous mixedwood forests poorly represented;
- Higher proportion of White and Engelmann Spruce forest in coniferous land base;
- Relatively high proportion of old growth spruce forest;
- Subalpine Fir and Subalpine Larch forests most common in FMA.
- Subalpine grasslands relatively common.

Jumpingpound (South FMA)

- Largest representation of mid-seral Lodgepole Pine forests in South FMA;
- Relatively large proportion of rock barren due to Moose Mountain;
- Anthropogenic land cover (facilities) most common in South FMA;
- Limited amount of deciduous forest – no young seral deciduous forest.

McLean (South FMA)

- Largest amount of Aspen and Balsam Poplar forest in the South FMA;
- Shrubby wetlands relatively common;
- Largest supply of graminoid clearcuts in the South FMA;
- Moderate amounts of mid-seral Lodgepole Pine forest – no old growth pine;

Sullivan (South FMA)

- Very limited timber harvest in this compartment;
- Relatively abundant supply of young seral Lodgepole Pine forest;
- Relatively abundant supply of Aspen and Balsam Poplar forest-mainly mid-seral;
- Largest supply of upland grassland in the South FMA;
- Largest amount of rangeland clearings in the South FMA.

Atkinson Creek (North FMA)

- Highest proportion of Lodgepole Pine forest in North FMA – mainly mid-seral;
- Lowest relative amount of White x Engelmann spruce forest in the North FMA;
- Moderate levels of timber harvest – mostly recent clearcuts;

B9 Quota (North FMA)

- Easternmost compartment with high levels of human activity;
- Greatest abundance of cropland, timber harvest and rangeland clearings in the FMA;
- Most abundant supply of spruce mixedwood forest in North FMA – mainly mid-seral;
- Most abundant supply of aspen mixedwood forest in the North FMA – mid seral.
- Most abundant supply of upland grassland and forb meadow in the North FMA.

Burnt Timber Creek (North FMA)

- Only Compartment in the FMA with significant recent regenerating burned areas;
- Large supply of mid-seal Lodgepole Pine forest – very little young or old seral;
- Relatively abundant supply of Black Spruce forest;
- Most abundant supply of mid-seral and old growth White x Engelmann Spruce forest;

- Most abundant supply of wet graminoid meadows in FMA;
- Least supply of shrub meadow habitat in the North FMA.

Coal Camp Creek (North FMA)

- Most abundant supply of coniferous mixedwood forest in the FMA – large supply of old growth Pine Mixedwood forest;
- Largest supply of old growth Lodgepole Pine forest in North FMA;
- Largest supply of mid-seral and old growth aspen forest in the North FMA;
- Most abundant source of old aspen mixedwood in the North FMA.

Ghost River (North FMA)

- Currently no mapped timber harvest activity in this compartment;
- Relatively large supply of mid-seral Pine Mixedwood forest;
- Relatively small amounts of deciduous forest cover;
- Largest supply of upland shrub meadow in the North FMA;
- Largest supply of treed wetland in the North FMA.

Grease Creek (North FMA)

- Relatively abundant supply of recent (graminoid) clearcuts;
- Very limited occurrence of deciduous and mixedwood forest;
- Moderate to high supply of mid-seral Lodgepole Pine forest.

2.5 Soil Types

Since soil types are consistent from north to south within ecological regions, this section of the report describes soil conditions for the entire FMA. The soils information provided in this section was extracted from the ecological land classification and evaluation reports of Kananaskis country (McGregor 1984), Ghost River (McGregor et al. 1979), and Red Deer-James (Stelfox 1981). Of the nine soil orders occurring in Canada [Canadian Soil Survey Committee (CSSC 1978)] six are present in the study area.

Regosolic

Soils of the Regosolic order are common throughout the FMA. These soils have minimal profile development and are indicators of relatively unstable conditions (e.g. colluvial deposits on slopes). The most represented subgroup of this order is Orthic Regosol. These are soils of low productivity. This order is common on upper mountain slopes, gravel terraces, and fans.

Brunisolic

Brunisolic soils are the most common in the study area. They lack horizontal development and are very abundant under coniferous and mixedwood forest within the Montane and Subalpine natural subregions. Eutric Brunisoils are the most commonly represented subgroup of this order and are usually present on calcareous till and glacio-fluvial deposits of large mountainous river valleys. Brunisolic soils have moderate to low productivity for forest and grasslands.

Chernozemic

The Chernozemic soil order occurs in the Montane and Foothills Parkland natural subregions, which occur at lower elevations in the FMA. These soils are characterized by a dark colored, humus rich surface horizon at least 10-cm thick, and are generally highly productive, especially for grasslands.

Luvisolic

The Luvisolic order includes soils that have developed under forest cover and that have a horizon eluviated of clay and minerals. Gray Luvisols are found on calcareous parental material in foothills and montane terrain. The productivity of Luvisolic soils is moderate to high for mixedwood and coniferous forest.

Gleysolic and Organic

Gleysolic and Organic soil orders occur on poorly drained sites in saturated or near-saturated water conditions. These conditions are usually found in the eastern section of the south portion of the study area. Such soils are moderately to highly productive for wetlands dominated by graminoids (grasses, sedges and rushes) and shrubs.

2.6 Habitat Rarity/Abundance

Maintenance of an ecologically appropriate supply of native vegetation and habitat is a cornerstone of conservation biology and is generally considered to be the primary management tool for the protection of biological diversity (Meffe et al. 1997). Native habitats considered to be in short supply (rare) in a regional context are considered to be more significant than abundant habitats in the context of preserving landscape diversity and the plant and animal species that these landscapes support (Noss 1993; Council on Environmental Quality 1993; Noss and Cooperrider 1994). Rare, unique or sensitive biological communities are the most vulnerable elements of biological diversity (Salwasser and Pfister 1994) and are most likely to support rare plant species and communities (Packer and Bradley 1984). Therefore it is important to identify these habitats. Assessment for rarity was undertaken at both the Ecosection (1:100,000) and WHU (Ecosite) (1:20,000) levels.

2.6.1 South FMA

Ecosection Rarity/Abundance

The 75 ecosections mapped in the South FMA (Appendix 2.1) were rank-ordered by area and classified into five percentiles (20% each) representing levels of rarity (rare, scarce, uncommon, common, and abundant). Rare and scarce ecosections comprise 0.5% and 3.2% of the South FMA respectively. The locations of rare ecosections in the South portion of the FMA are mapped in Figure 2.6. Rare and scarce ecosections are found mainly along riparian areas of rivers and creeks in the eastern section of the South FMA. Rare ecosections occur on a wide range of landforms including fluvial (4), colluvial (3), bedrock (2), hummocky moraine (2), morainal slopes (2), glaciofluvial (1) and anthropogenic (1). Vegetation cover of rare ecosections is also variable and includes riparian shrub, grassland, mixedwood forest, deciduous forest and unvegetated.

Of the 15 ecosections with the greatest abundance in the South FMA, ten were dominated by colluvial landforms and five by morainal landforms (in most cases mixed with colluvium). Most

(12) of these ecosections were characterized by closed and to a lesser extent open coniferous forest interspersed with Subalpine grassland.

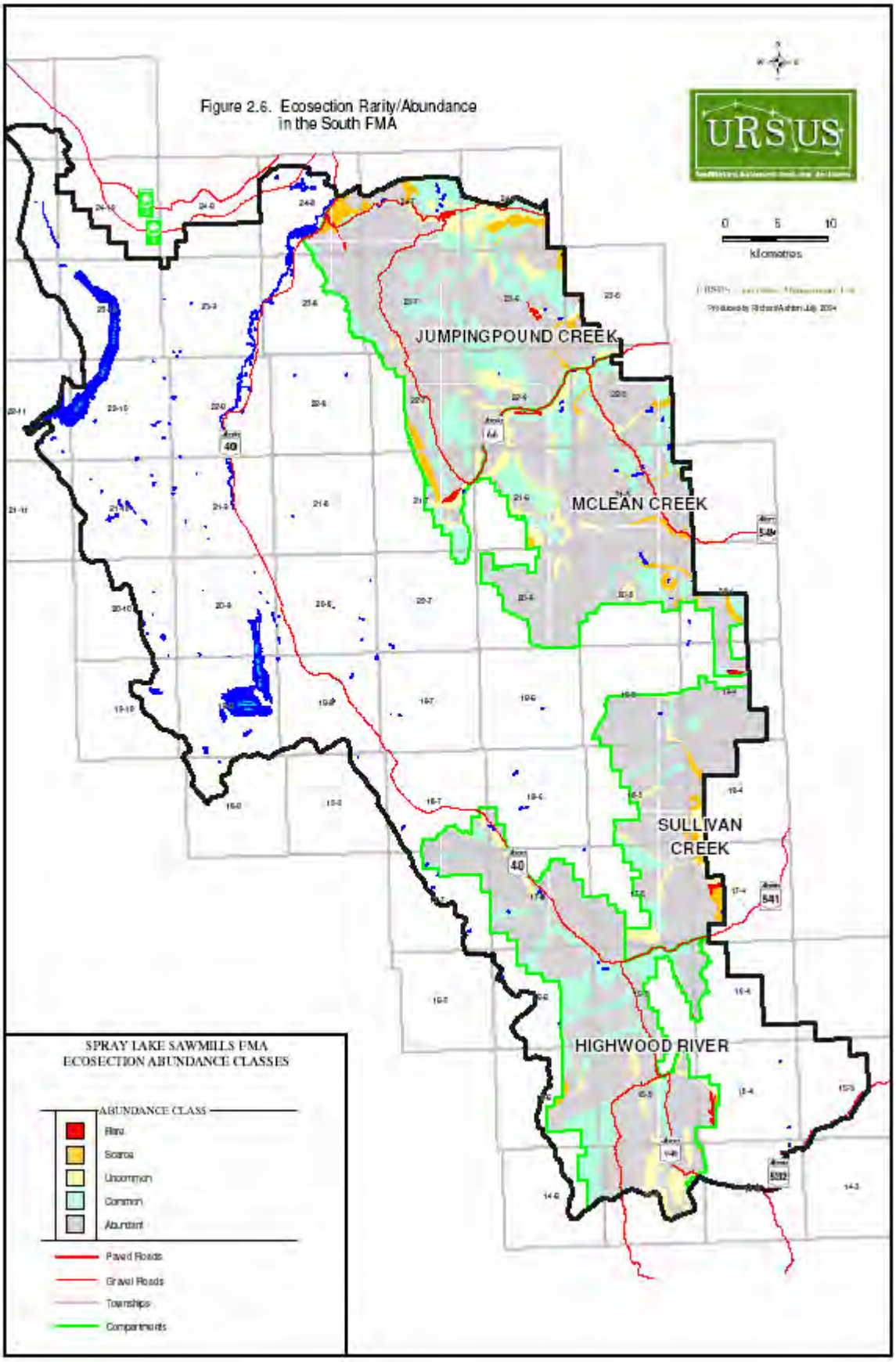


Figure 2.6. Ecosection Rarity/Abundance
in the South FMA
URSUS
0 5 10
kilometres
JUMPINGPOUND CREEK
MCLEAN CREEK
SULLIVAN
CREEK
HIGHWOOD RIVER
SPRAY LAKE SAWMILLS FMA
ECOSECTION ABUNDANCE CLASSES
ABUNDANCE CLASS
Rare
Scarce
Uncommon
Common
Abundant
Paved Roads
Gravel Roads
Townships
Compartments

Ecosite (WHU) Rarity/Abundance

The 200 WHUs in the South FMA were rank-ordered by land area and classified into five (20^{th}) percentiles representing five levels of rarity - rare, scarce, uncommon, common, and abundant (Appendix 2.2). Rare and scarce habitat types comprise 0.1% and 0.8% of the South FMA respectively. The locations of rare Wildlife Habitat Units in the South portion of the FMA are mapped in Figure 2.7. As was the case for rare ecosections, rare habitat types were mainly found along riparian zones of rivers and creeks in the eastern section of the South FMA where mixedwood and aspen forest are more prevalent. Of the 40 WHUs ranked as rare in the South FMA the most typical vegetation types were: Subalpine Fir forest (13), Aspen forest (6), Balsam Poplar forest (5), Spruce Mixedwood forest (4), Pine mixedwood forest (4), Subalpine Larch forest (3), Aspen Mixedwood forest (1), Shrub Meadow (1), and Lodgepole Pine forest (1). Thirty-eight of the 40 most rare WHUs were forest cover types with the majority being in the young seral (50%) and old growth (37%) age classes.

Of the 40 WHUs ranked as abundant in the South FMA the most common vegetation types were: Lodgepole Pine forest (14), White x Engelmann Spruce forest (12), Aspen forest (3), Graminoid Clearcuts (3), Upland Grasslands (2), Shrubby Clearcuts (1), Pine mixedwood forest (1), Shrub Wetland (2), Rock Barren (1) and Anthropogenic (1). Thirty of the 40 most abundant WHUs were forest cover types with the majority being in the mid seral (73%) age class. Nine of the 10 most abundant WHUs in the South FMA were Lodgepole Pine forest on a range of topographic positions. Eight of these were mid-seral age classes.

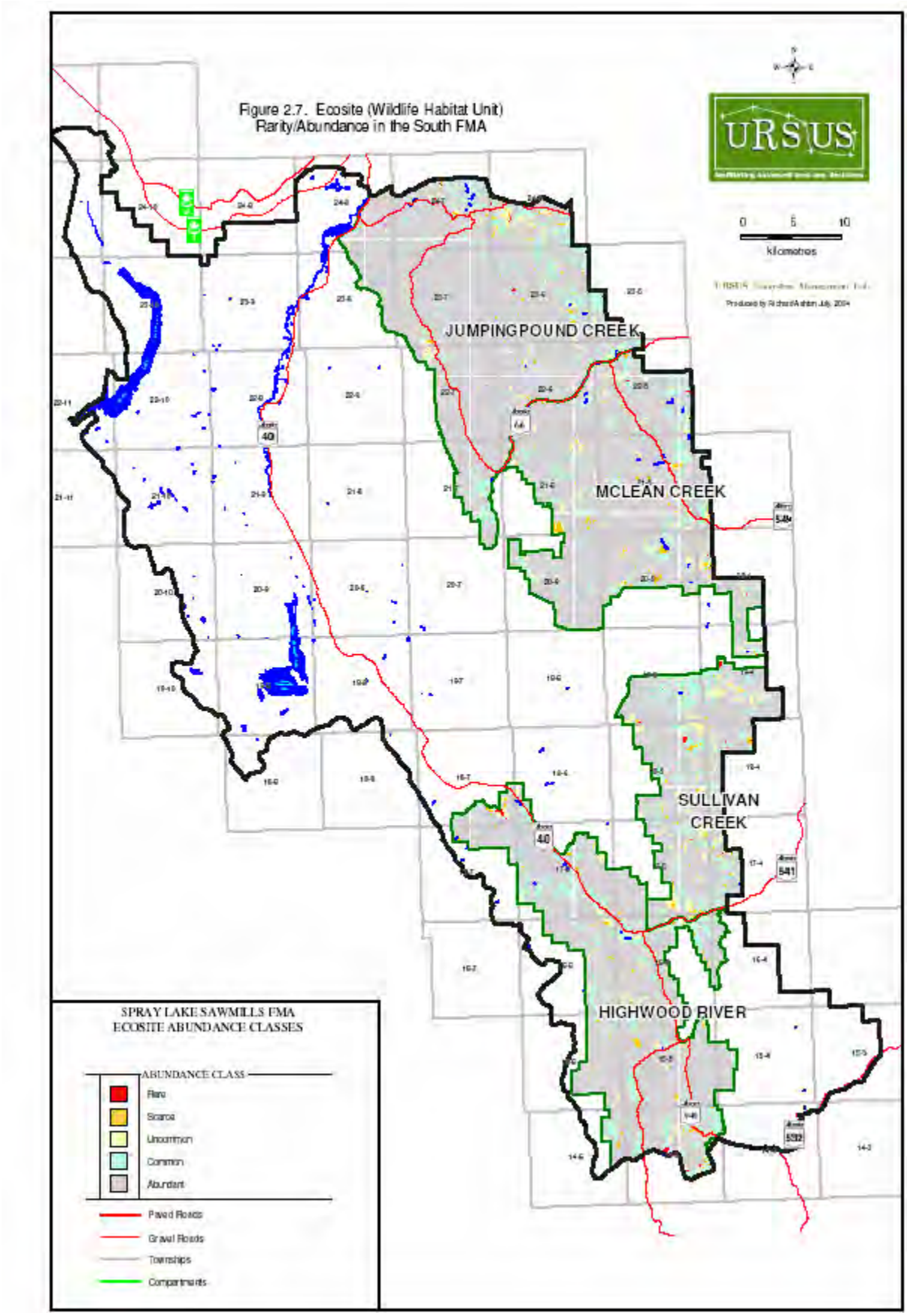


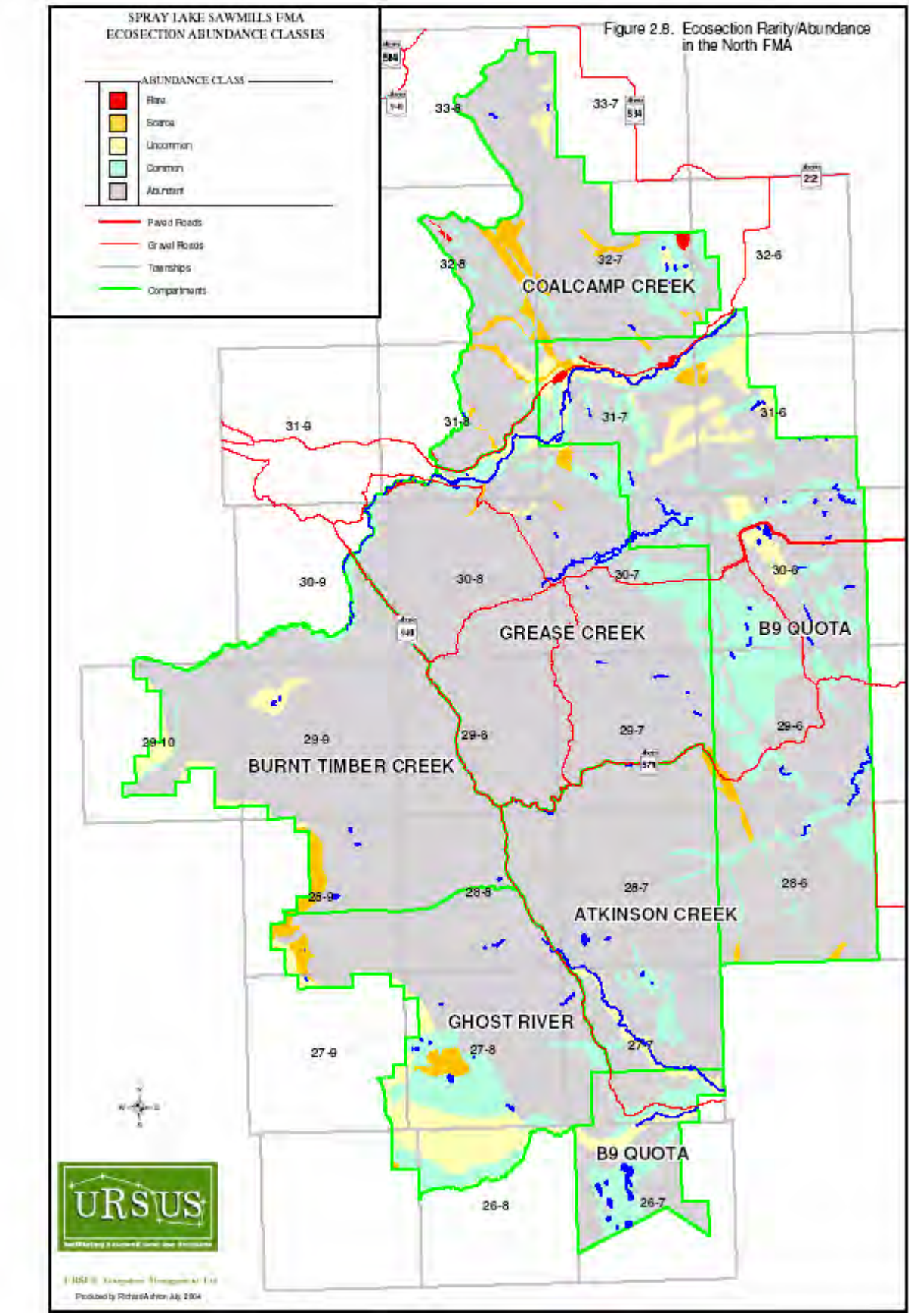
Figure 2.7. Ecosite (Wildlife Habitat Unit)
Rarity/Abundance in the South FMA
URSUS
0 5 10
kilometres
JUMPINGPOUND CREEK
MCLEAN CREEK
SULLIVAN CREEK
HIGHWOOD RIVER
SPRAY LAKE SAWMILLS FMA
ECOSITE ABUNDANCE CLASSES
ABUNDANCE CLASS
Rare
Scarce
Uncommon
Common
Abundant
Paved Roads
Gravel Roads
Townships
Compartments

2.6.2 North FMA

Ecosection Rarity/Abundance

The 53 ecosections found in the North FMA were rank-ordered by area and grouped into five (20^{th}) percentiles representing five rarity classes (rare, scarce, uncommon, common, and abundant). Rare and Scarce ecosections occupy 0.6% and 2.4% of the North FMA and range in area from 55-ha to 255-ha (rare) and 268-ha to 658-ha (scarce) respectively. The locations of rare ecosections in the North portion of the FMA are mapped in Figure 2.8. The 10 most rare ecosections occur on a wide range of landforms including three on moraine, two on fluvial, one on glaciofluvial, two on colluvial, one on lacustrine and one on bedrock. Vegetation cover of these 10 ecosections is variable and includes lodgepole pine forest, aspen forest, deciduous shrub, xeric grassland, and mixedwood forest. Three of the rare forested ecosections occur on very steep slopes.

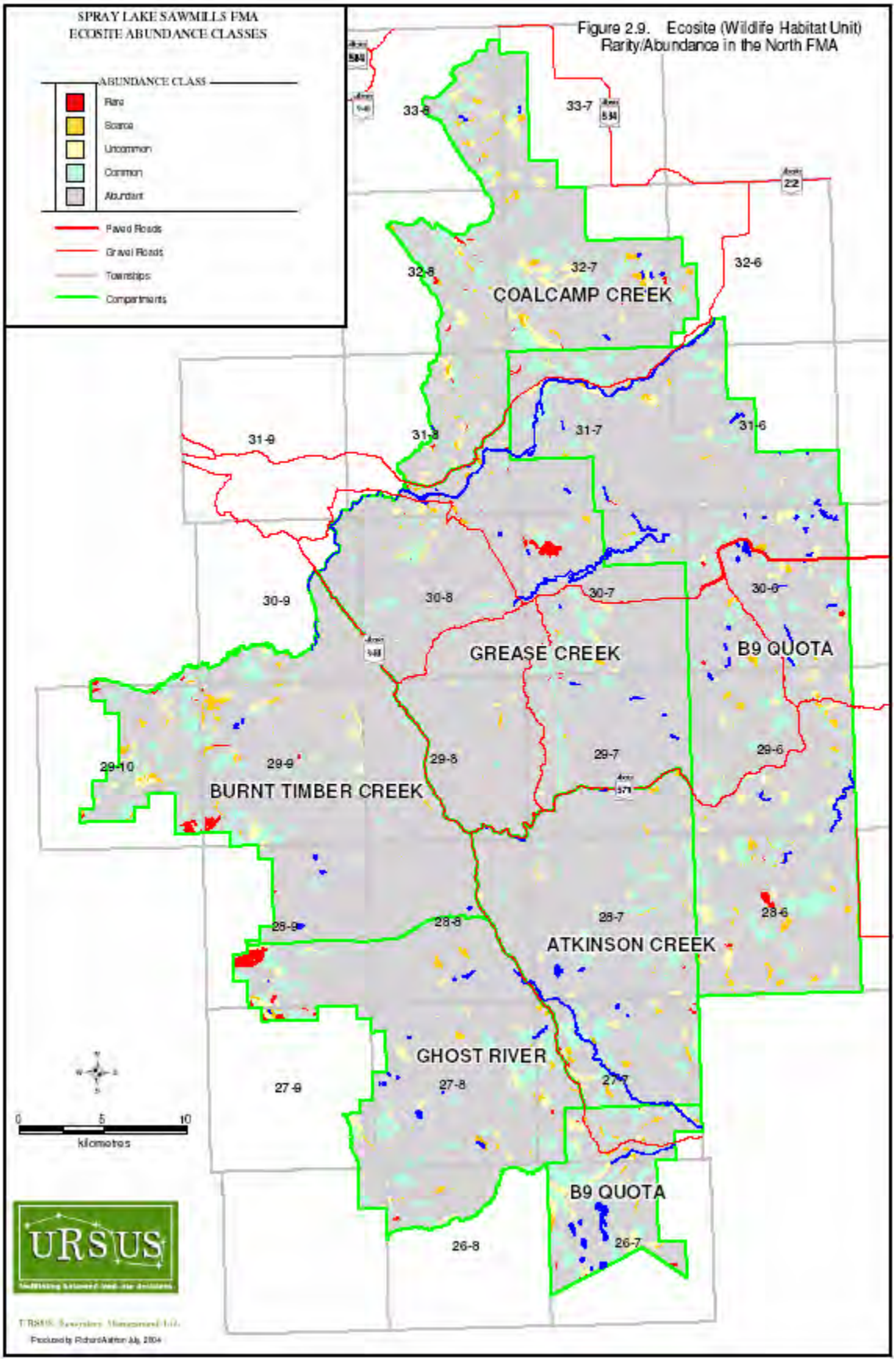
The 10 ecosections with the greatest abundance all include parent materials dominated by moraine - mostly bedrock controlled ground moraine. Slopes were primarily in the range of 0 to 45%. Vegetation on these abundant ecosections was primarily closed Lodgepole Pine (with sub-dominant White Spruce) and closed deciduous-dominated mixedwood forest.


SPRAY LAKE SAWMILLS FMA
ECOSECTION ABUNDANCE CLASSES
ABUNDANCE CLASS
Rare
Scarce
Uncommon
Common
Abundant
Paved Roads
Gravel Roads
Townships
Compartments
Figure 2.8. Ecosection Rarity/Abundance in the North FMA
33-8
33-7
32-8
32-7
32-6
COALCAMP CREEK
31-9
31-8
31-7
31-6
30-9
30-8
30-7
30-6
GREASE CREEK
B9 QUOTA
29-10
29-9
29-8
29-7
29-6
BURNT TIMBER CREEK
28-9
28-8
28-7
28-6
ATKINSON CREEK
GHOST RIVER
27-9
27-8
27-7
B9 QUOTA
26-8
26-7
URSUS

Ecosite (WHU) Rarity/Abundance

The 934 wildlife habitat units (WHUs) mapped in the North FMA were classified into five rarity classes (rare, scarce, uncommon, common, abundant) based on area using five (20^{th}) percentiles. Rare WHUs were <5.0 ha in land area and comprised only 0.21% of the North FMA. The locations of rare Wildlife Habitat Units in the North portion of the FMA are mapped in Figure 2.9. Scarce and uncommon WHUs had areas between 5.0-ha and 14.2-ha, and between 14.2-ha and 38.8-ha respectively. Scarce habitats occupy 0.95% and uncommon habitats 2.7% of the North FMA (Appendix 2.4). Of the 187 WHUs classified as rare one is a 1.8-ha bryophyte cover type on flat upper foothills; one is a 1.4-ha cultivated cover type; three are anthropogenic cover types including human settlement and industrial facilities; six are barren-natural cover types; twenty are clearcuts/selective cuts; twenty-three are coniferous-dominated mixedwood forest cover types; and eighty-three are coniferous forest types. Deciduous forest and deciduous-dominated mixedwood forest characterize fifteen and fourteen of the 187 rare types respectively.

Common and abundant habitat types were found in 7.5% and 88% of the North FMA respectively. Common types range from 39-ha to 132-ha and abundant types range from 133-ha to 13124-ha. A total of 18 of the most abundant WHUs supported each comprised 1.0% or more of the total land area of the North FMA (Appendix 2.4). Of these 18 most abundant WHUs, 10 were closed coniferous forest with nine being dominated by lodgepole pine or lodgepole pine with black spruce. Four of the most abundant 18 WHUs were low shrubland on near-level landforms and two were recently harvested areas dominated by graminoids.


SPRAY LAKE SAWMILLS FMA
ECOSITE ABUNDANCE CLASSES
ABUNDANCE CLASS
Rare
Scarce
Uncommon
Common
Abundant
Paved Roads
Gravel Roads
Townships
Compartments
Figure 2.9. Ecosite (Wildlife Habitat Unit) Rarity/Abundance in the North FMA
COALCAMP CREEK
GREASE CREEK
B9 QUOTA
BURNT TIMBER CREEK
ATKINSON CREEK
GHOST RIVER
B9 QUOTA
33-8
33-7
32-8
32-7
32-6
31-9
31-8
31-7
31-6
30-9
30-8
30-7
30-6
29-10
29-9
29-8
29-7
29-6
28-9
28-8
28-7
28-6
27-9
27-8
27-7
26-8
26-7
0 5 10
kilometres
URSUS

2.7 Vegetation Diversity

Extensive vegetation plot sampling for the Eastern Slopes Grizzly Bear Project (1,715 plots) from 1994 to 2000 made it possible to quantify plant species and structural diversity in the South FMA. Although similar plot sampling is not available for the North FMA, the information gained from the South FMA can ultimately be extrapolated to WHUs in the North FMA for the purposes of forest management planning.

2.7.1 Plant Species Richness

A fundamental principle of conservation biology is to protect sites that support high levels of local "species richness" (the number of organisms present in an area) (Council on Environmental Quality 1993; Noss 1990). Ecosystems that support a high level of diversity of plant species tend to be structurally diverse and productive (Meffe and Carroll 1997). These areas in turn support a wide variety and abundance of insect and animal forms.

WHUs in the South FMA were ranked and divided into five equal-sized diversity classes based on the mean number of species found in sampling plots. Twenty-four percent of the South FMA was rated as high (18.9%) or very high (5.5%) for plant species diversity; 35% was ranked as moderately diverse areas and the remaining 40% of the area was rated as low (29.8%) to very low (10.1%) diversity.

WHUs with very high plant species diversity averaged from 28.1 to 36.6 vascular plant species per sampling plot. Of the 21 WHUs with the highest plant diversity 10 were mixedwood forests including four pine-dominated mixedwood types (UFM2/5, UFM2/1, UFM2/6, and UFM2/2); three spruce-dominated mixedwood types (UFM3/2, UFM3/6, UFM3/3); and, two deciduous dominated mixedwood types (UFM1/3, UFM1/2 and UFM2/1). Five deciduous forest WHUs were ranked as having very high plant species diversity. Four of these were balsam poplar forests (UFD2/3, UFD2/5, UFD2/2, UFD2/1) and one was an aspen forest (UFD1/2). Two moderately sloping (15 – 45%) upland shrub meadows (USM3, USM5) and one steeply sloping shrub meadow type (USS5) were ranked as having very high plant species diversity. Other WHUs with very high plant diversity were NE-facing Subalpine larch forest (UFC6/3), treed wetland between 1600-m and 1900-m (W1.1/2), upper Subalpine NE-facing Subalpine fir forest (UFC3/9) and NE-facing grassland at elevations between 1600-m and 2200-m.

Habitat types with very low plant species diversity had an average of 5.0 to 18.6 plant species per sampling plot. Of the 21 WHUs ranked as having very low average plant species diversity six were Subalpine Fir forest types (UFC3/1, UFC3/5, UFC3/3, UFC3/2, UFC3/4 and UFC3/8); four were anthropogenic (disturbed) types (A2.1, A1.2, A2.3 and A1.1); and three were graminoid (W1.3/1, W1.3/2) and shrub-dominated (W1.2/1) wetlands. Other habitat types rated as having very low plant diversity were low elevation (<1600-m) NE-facing shrubland (USM4, USS4); flat Subalpine larch forests (UFC6/1); low elevation grassland on level to gentle slopes (UHG1/1); and NE-facing aspen forest at from 1600-m to 1900-m asl.

Although there are some ecological differences between the North and South portions of the FMA, it is likely that similar patterns of plant species richness occur between areas, certainly at the vegetation cover type level.

2.7.2 Structural Diversity

The structural complexity of plant communities is positively correlated with the diversity of animal life using the community (Meffe and Carroll 1994). The more complex the structure of the plant community the more potential habitat niches are available for wildlife use (e.g.

reproduction, forage, movement). Shannon-Wiener structural diversity coefficients from vegetation sampling plots were calculated and grouped into five classes (Collister and Kansas 2003). Higher values represented areas with more and denser layers of vegetation. This was only done for the South FMA but as per plant species diversity information can ultimately be extrapolated to habitat types in the North FMA.

Only 8.3% of the South FMA was assigned very high structural diversity. WHUs in this class included Pine and Spruce dominated Mixedwood Forest and Aspen and Balsam Poplar Forest. Upper Subalpine Spruce and Engelmann Spruce Forest on gentle and SW-facing slopes (UFC2/3, UFC2/6) also received high ratings for structural diversity. Other highly structurally diverse habitat types were Treed Clearcuts on SW- and NE-facing slopes (A3.3/2, A3.3/3); and Treed Wetland at elevations < 1600 m (W1.1/1).

Areas with very low structural diversity encompassed 10.7% of the South FMA. Habitat types with very low structural diversity included Reclaimed/cleared lands (A2.1, A1.1, A1.2, and A2.3), Wet Graminoid Meadow (W1.3/2), eight grasslands habitat types and Recent Clearcuts (A3.1/3, A3.1/1).

2.8 Native Plant Integrity

Invasion of native habitats by non-indigenous or “introduced” species of plants can result in losses of native plant species, changes in community structure and function, and alterations in the physical structure of the system (Drake *et al*. 1989). Human land use and associated interruption of native ecological processes is normally the cause of plant species invasions (Mooney and Drake 1986).

Analysis of the comprehensive vegetation sampling plot database from Kananaskis Country facilitated objective measurement of native plant integrity for habitats in the South FMA. This information can be extrapolated to the North FMA at the vegetation cover type level.

Native plant species integrity was measured by calculating the ratio of native to introduced plants for the sampling plots conducted within each of 113 WHUs in the South FMA. The ratios were then rank-ordered and divided into five equal-sized classes. Introduced plants comprised an average of 4.3% of total species found in sampling plots within Kananaskis Country. Areas with low and very low native plant integrity in the South FMA were generally located at lower (foothills) elevations, on gentle slopes and in relatively accessible sites. The eastern portion of the FMA, characterized by low elevations, relatively subdued terrain and extensive cattle grazing, supports the lowest levels of native plant species integrity. Gently sloping and SW-facing deciduous forest, clear cuts on flat/gentle SW-facing slopes and low elevation grasslands were WHUs with low and very low native plant species integrity. High and very high native plant integrity was found within WHUs that were located at high elevations and on steep slopes where cattle grazing was less intensive.

2.9 Rare Plants

According to the Alberta Native Plant Council (2000), any vascular or non-vascular plant species that exists in low numbers or in very restricted areas in Alberta can be considered rare. In Alberta, most vascular-rare plants are ‘peripherals’ which means that they live at the edge of their geographic range. Some are ‘disjuncts’ or live separated from main range populations by 500-km or more. A few have widespread distribution within North America but are uncommon where they are found or are ‘endemic’ which means that they are restricted to a particular area (Kershaw et al. 2001).

Plant species can be rare due to natural and/or anthropogenic factors such as:

- introduction of aggressive non-native species that out-compete local native plants, alterations of drainage pattern;
- reproductive inefficiency or low reproductive output;
- climate change, and loss of habitat due to agricultural; and
- urban expansion.

2.9.1 Levels of Rarity

The Nature Conservancy (1982) established a method to determine the level of rarity for rare and endangered plant species. A rank is assigned to each plant based on the status codes described below after taking into consideration a specific geographic scale:

global (G) when looking at the status of a plant throughout its entire range
national (N) when interested in the plant species status in a country (e.g. Canada);
and sub-national (S) when the area of interest is a province (e.g. Alberta).

Status Codes

1: critically imperiled due to extreme rarity (5 or fewer occurrences)
2: imperiled because of rarity (6 to 20 occurrences)
3: rare or uncommon (21 to 100 occurrences)
4: apparently secure (> 100 occurrences)
5: abundant and demonstrably secure (> 100 occurrences)
F: falsely reported
H: known historically, may be rediscover
P: potentially present, expected in the province but not yet discovered
Q: questionable taxonomic rank
R: reported but without persuasive documentation to either accepting or rejecting the report
U: uncertain status, more information is needed
X: apparently extinct or extirpated, not expected to be rediscovered
?: no information is available, or the number of occurrences estimated

2.9.2 Rare Plants in the FMA

Appendix 2.6a and Appendix 2.6b presents vascular and non-vascular plant elements found in the South and North FMAs, respectively, as provided by Alberta Natural Heritage Information Center (20 February 2004). Records include survey site, UTM coordinates, site description and elevation (maximum and minimum).

South FMA

Ninety-one rare species are reported for the South FMA with 1-5 occurrences per species (total number of occurrences = 123). The number of species in each rank are: S1 - 22 species; S2 – 49 species; S3 – 1 species; S1S2 – 2 species; S2S3 – 10 species; SU – 5 species; S1? – 1 species; S? – 1 species.

Homalothecium nevadence (S1) and *Coscinodon calyptratus* (S2) had the highest number of occurrences in the South FMA (5 times each). Other frequently recorded species were *Bryum algovicum* and *Cirriphylum cirrosum* occurring 5 times each and both with an S1 rank.

Campylium polygamum (S3); *Limprichtia cossonii* (SU), and *Carex petricosa* (S2S3) occurred 3 times each.

North FMA

Ten species are reported for the North FMA. *L. cossonii* was the only one having two occurrences. Species by rank are: S1 (*Drepanocladus brevifolius* and *Cladonia ramulosa*); S2 (*Bryum pallens, Leptogium tenuissimum, Primula egaliksensism*, and *Parmassia parviflora)*; S3 (*Campylium polygamum*); and SU (*Orthotrichum affine* and *L. cossonii*).

Survey sites where rare plants were reported included Waiparous Creek, Red Deer River, and Meadow Creek. Surveyed site refers to the closest officially named geographic feature and is not necessarily the precise location of rare plants. The descriptions of the precise locations where the rare plants were found and the elevation are presented in Appendix 2.6b.

There is a considerable difference between the number of reported occurrences of rare plants in the South FMA (91 rare species reported) versus the North FMA (10 rare species reported). This difference does not necessarily mean that the South FMA contains a higher number of rare species than North FMA but rather that more intensive surveys have been conducted in the South. The South FMA is embedded within Kananaskis Country, which is an area that is highly utilized and researched.

The majority of rare plants in the Rocky Mountains and Foothills occur on dry ridges, talus, gravelly slopes, strongly calcareous rock outcrops and wetlands - especially calcareous types (Achuff et al. 1986, Fairbarns et al. 1987).

2.10 Wildlife

A list (Appendix 2.7), including status and abundance, of vertebrate wildlife species known, or expected, to occur in the SLS FMA was developed using local, regional and provincial references (Semenchuk 1992; Russell and Bauer 2000; Smith 1993; Pattie and Fisher 1999) and the authors' experience. Status and abundance codes are listed below. A total of 325 species of vertebrate wildlife have potential to occur in the Spray Lake FMA. Of these 257 are birds, 59 are mammals, 7 are amphibians and 2 are reptiles.

Status

- S summer resident, migrates out of study area for the winter
- W winter resident, present only during late fall, winter and early spring
- R permanent resident, present year-round although not necessarily active during winter
- M migrant, passes through area during spring and/or fall, not normally resident at any time of the year

Abundance

- C common, detected whenever suitable habitat is investigated during an appropriate season
- U uncommon, detected often, but not always, whenever suitable habitat is investigated during an appropriate season
- S scarce, detected occasionally, but not usually, even when suitable habitat is investigated during an appropriate season
- R rare, unexpected but could occur in any given year, would not generally be considered a regular component of the study area fauna

2.10.1 Species at Risk and Featured Species

A list of species at risk (SAR) was compiled from the comprehensive list of vertebrate species of the SLS FMA in Appendix 2.7. For purposes of this assessment SAR were considered to be any species designated by COSEWIC or ASRD. At risk definitions are presented below. In addition to SAR a small number of additional (featured) species were selected for assessment based on their importance as species of regional management concern. The combined list of SAR and featured species is presented in Table 2.7.

A total of 54 species at risk are likely to occur within the boundaries of the FMA. Of these 39 are birds, 9 are mammals, 4 are amphibians and 2 are reptiles. All but one (Yellow Rail) of the species at risk are listed in Alberta and of these 53 species three (Trumpeter Swan, Peregrine Falcon and Leopard Frog) are listed as "At Risk – Threatened"), and five as "May be at Risk" (Short-eared Owl, Northern Bat, Grizzly Bear, Long-tailed Weasel, Wolverine). The remainder are listed as "Sensitive" (Table 2.7). Seven species are listed by COSEWIC and including two as "Threatened" (Peregrine Falcon, Sprague's Pipit) and three as "Special Concern" (Yellow Rail, Short-eared Owl, Grizzly Bear, Wolverine, Northern Leopard Frog).

At Risk Definitions (AEP 2000, 2001; COSEWIC 2003)
Alberta Environmental Protection (AEP) At Risk – any species known to be "At Risk" after formal detailed status assessment and designation as "Endangered" or "Threatened" in Alberta May Be At Risk – any species that "May Be At Risk" of extirpation or extinction, and is therefore a candidate for detailed risk assessment. Sensitive – any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk. Endangered – a species facing imminent extirpation or extinction. Threatened – a species likely to become endangered if limiting factors are not reversed. Special Concern – a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. Data Deficient – a species for which there is insufficient scientific information to support status designation. *Committee on the Status of Endangered Wildlife in Canada (COSEWIC)* Endangered - a species facing imminent extirpation or extinction. Threatened - a species likely to become endangered if limiting factors are not reversed. Special Concern - a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. Not at Risk - a species that has been evaluated and found to be not at risk. Indeterminate - a species for which there is insufficient scientific information to support status designation.

Three "featured" species are included in Table 2.7 because of their recreational and economic importance in the region – American Marten, Elk, and Moose.

2.10.2 Management Indicator Species (MIS)

It is neither feasible nor practical for wildlife managers to monitor habitat and populations for all vertebrate species in an extensive management area. As such it is common for managers to focus on a list of species or species group priorities that best reflect the perceived needs of society (Harcombe 1984). Management indicator species (MIS) are defined as "plant or animal species whose population parameters can be used to show the effects of land and resource management practices" (Salwasser and Unkel 1981). Frequently, the goal of a manager is to select a group of species "... that will act as sensors at critical spots in the planning process if the goals of both diversity and population viability of species is to be achieved..." (Harcombe 1984).

A total of 18 management indicator species were selected for the Spray Lake FMA. These species are highlighted in Table 2.7. The species selected for assessment and potential monitoring are those that have significant potential to be affected by forestry operations and for whom the SLS FMA could be considered core range. Species not included in this subset are:

- species associated with wetlands and therefore substantially protected by ground rules buffering requirements;
- species associated with non-forest habitat types (grasslands and other open habitats, bare rock, alpine etc);
- rare species that, although potentially occurring in the SLS FMA from year to year, are not expected to occur regularly or in more than very small numbers; and/or migrants.

Current habitat suitability and supply was modeled for each of these species with the exception of grizzly bear – at the request of ASRD staff. Grizzly Bear modeling is being conducted through the Foothills Model Forest. This will provide an ability to project the habitat of these species over time given different management scenarios.

Table 2.7 Species at Risk and Featured Species

Common Name	Scientific Name	Status	Abundance	At Risk Designation	
				Alberta	COSEWIC
Trumpeter Swan	*Cygnus buccinator*	M	U	At Risk Threatened	Not at Risk
Harlequin Duck	*Histrionicus histrionicus*	S	U	Sensitive	
White-winged Scoter	*Melanitta fusca*	M	U	Sensitive Special Concern	
Sharp-tailed Grouse	*Tympanuchus phasianellus*	R	U	Sensitive	
Pied-billed Grebe	*Podilymbus podiceps*	S	U	Sensitive	
Horned Grebe	*Podiceps auritus*	S	S	Sensitive	
Western Grebe	*Aechmophorus occidentalis*	M	S	Sensitive	
American White Pelican	*Pelecanus erythrorhynchos*	M	S	Sensitive	Not at Risk
American Bittern	*Botaurus lentigenosis*	S	S	Sensitive	
Great Blue Heron	*Ardea herodias*	S	U	Sensitive	
Osprey	*Pandion haliaetus*	S	U	Sensitive	
Bald Eagle	*Haliaeetus leucocephalus*	S	S	Sensitive	Not at Risk
Northern Goshawk	*Accipiter gentilis*	R	U	Sensitive	Not at Risk
Broad-winged Hawk	*Buteo platypterus*	M	S	Sensitive	
Swainson's Hawk	*Buteo swainsoni*	S	S	Sensitive	
Golden Eagle	*Aquila chrysaetos*	R	U	Sensitive	Not at Risk
Peregrine Falcon	*Falco peregrinus*	M	S	At Risk Threatened	Threatened
Prairie Falcon	*Falco mexicanus*	S	S	Sensitive	Not at Risk

Common Name	Scientific Name	Status	Abundance	At Risk Designation	
				Alberta	COSEWIC
Yellow Rail	*Coturnicops noveboracensis*	S	R		Special Concern
Sandhill Crane	*Grus canadensis*	S	S	Sensitive	
Upland Sandpiper	*Bartramia longicauda*	S	S	Sensitive	
Caspian Tern	*Sterna caspia*	M	S	Sensitive	Not at Risk
Forster's Tern	*Sterna forsteri*	M	U	Sensitive	Data Deficient
Black Tern	*Chlidonias niger*	S	U	Sensitive	Not at Risk
Northern Pygmy-Owl	*Glaucidium gnoma*	R	U	Sensitive	
Barred Owl	*Strix varia*	R	U	Sensitive	
Great Gray Owl	*Strix nebulosa*	R	U	Sensitive	Not at Risk
Short-eared Owl	*Asio flammeus*	S	S	May Be At Risk	Special Concern
Common Nighthawk	*Chordeiles minor*	S	U	Sensitive	
Black-backed Woodpecker	*Picoides arcticus*	R	S	Sensitive	
Pileated Woodpecker	*Dryocopus pileatus*	R	U	Sensitive	
Sprague's Pipit	*Anthus spragueii*	S	S	Sensitive	Threatened
Cape May Warbler	*Dendroica carulescens*	S	R	Sensitive Special Concern	
Black-throated Green Warbler	*Dendroica virens*	S	S	Sensitive	
Bay-breasted Warbler	*Dendroica castanea*	S	R	Sensitive Special Concern	
Canada Warbler	*Wilsonia canadensis*	S	R	Sensitive	
Western Tanager	*Piranga ludoviciana*	S	U	Sensitive	
Brewer's Sparrow	*Spizella breweri*	S	S	Sensitive	
Bobolink	*Dolichonyx oryzivorus*	S	S	Sensitive	
Northern Bat	*Myotis septentrionalis*	R	U	May Be At Risk	
Water Vole	*Microtus richardsoni*	R	U	Sensitive	
Grizzly Bear	*Ursus arctos*	R	U	May Be At Risk	Special Concern
American Marten	*Martes americana*	R	C	featured species	
Long-tailed Weasel	*Mustela frenata*	R	U	May Be At Risk	Not at Risk
Wolverine	*Gulo gulo*	R	S	May Be At Risk	Special Concern
American Badger	*Taxidea taxus*	R	S	Sensitive	Not at Risk
Cougar	*Felis concolor*	R	U	Sensitive	
Canada Lynx	*Lynx canadensis*	R	U	Sensitive	Not at Risk
Bobcat	*Lynx rufus*	R	S	Sensitive	
Elk	*Cervus elaphus*	R	C	featured species	
Moose	*Alces alces*	R	C	featured species	
Long-toed Salamander	*Ambystoma macrodactylum*	R	C	Sensitive	
Western Toad	*Bufo boreas*	R	C	Sensitive	
Columbia Spotted Frog	*Rana luteiventris*	R	U	Sensitive	Not at Risk
Northern Leopard Frog	*Rana pipiens*	R	R	At Risk Threatened	Special Concern
Wandering Garter Snake	*Thamnophis elegans*	R	S	Sensitive	
Red-sided Garter Snake	*Thamnophis sirtalis*	R	S	Sensitive	

2.10.3 Habitat Suitability

The relatively low number (n=200) of habitat types in the South FMA allowed for individual rating of Wildlife Habitat Units by species. Therefore, with reference to literature and the authors' knowledge of wildlife-habitat relationships, the suitability of Wildlife Habitat Units in the

South FMA was rated for all vertebrate species at risk and featured species. The following 5-class rating system was used.

0 (Very Low)	The habitat type provides neither food nor cover for the species but may be used for travel/dispersal. The habitat type does not contribute to population viability of the species.
1 (Low)	The habitat type may be used by the wildlife species in question, however, use is limited to travel, resting, loafing or opportunistic feeding and/or breeding. The habitat type contributes minimally to population viability of the species.
2 (Moderate)	The habitat type is used by the species for feeding and/or breeding, but is of sub-optimal quality relative to other habitats. The habitat type may contribute significantly to population viability of the species but only during periods of low environmental stress.
3 (High)	The habitat type is an important habitat of the species for feeding and/or breeding. The habitat type contributes significantly to population viability.
4 (Very High)	The habitat type is essential to the species for feeding and/or breeding. Few, if any, other habitat types are important to the species. The habitat type is critical to population viability of the species.

The relative complexity of the Wildlife Habitat Unit classification in the North FMA resulted in a large number (n=934) WHUs and required a different assessment approach. Habitat suitability was assessed based on ratings applied to individual attributes within the classification system. The set of attribute ratings developed for the Northern Pygmy-Owl is presented in Appendix 2.8. The ratings delineate high (H) and moderate (M) quality habitat with everything else being assigned a low (L) rating. For a type to be considered highly suitable all attributes must receive an H rating. For a type to receive a moderate rating all criteria must receive at least an M rating. Appendix 2.9 provides current habitat suitability maps for the 18 MIS in the South and North portions of the FMA, respectively. The two garter snake species were grouped together for suitability mapping purposes.

2.10.4 Habitat Supply

Habitat supply was calculated for the 18 Management Indicator Species and a summary is presented in Appendix 2.10. Hectares of high (H), moderate (M) and low (L) suitability habitat were calculated for each of the 18 species and for each of the 10 compartments in the FMA. Model projections of habitat supply for these species (fine filter approach) coupled with assessment of landscape units (coarse filter approach) will serve to safeguard against land use options that deteriorate suitable levels of high quality habitat supply.

2.10.5 Habitat Fragmentation

Fragmentation occurs when extensive, continuous tracts of habitat are reduced by habitat loss to dispersed and usually smaller patches of habitat. Not only does fragmentation reduce the total amount of available habitat, it reduces the remaining habitat into smaller, more isolated patches (Meffe and Carroll 1994). Fragmentation increases the amount of edge habitat, decreases the amount of interior habitat, and increases the distance between habitat patches.

Fragmentation has a negative effect on species that require extensive tracts of habitat such as interior-nesting birds and some meso-carnivores.

Fragmentation was quantified using the habitat suitability mapping described in Section 2.10.3. Contiguous high and very high suitability habitat polygons were coalesced within a GIS to produce high suitability habitat patches. This was done for species known or suspected to be impacted by habitat fragmentation (Northern Goshawk, Sandhill Crane, Barred Owl, Black-backed Woodpecker, Pileated Woodpecker, Northern Pygmy-Owl, Western Tanager). Due to inexact knowledge of threshold patch size for most species the number of patches and mean patch size are presented for five cases; patches >50 ha, patches between 50 and 100 ha; patches between 100 and 150 ha; patches between 150 and 200 ha; and, number of patches >200-ha. Minimum, maximum and mean patch sizes were also calculated for each species. Note that seismic lines and recreational trails were not allowed to separate patches within the GIS for this analysis. A summary of this analysis is presented in Table 2.8.

Table 2.8 Availability of High Quality Habitat Patches of Varying Sizes for Fragmentation – Sensitive Species (Part A)

Bird Species	Barred Owl		Black-backed Woodpecker		Great Gray Owl	
	South FMA	North FMA	South FMA	North FMA	South FMA	North FMA
Total >50 Ha	2	4	84	9	9	6
>50 <100 Ha	1	3	50	7	8	3
>100 <150 Ha	0	0	12	0	1	3
>150 <200 Ha	0	0	6	0	0	0
>200 Ha	1	1	16	2	0	0
Min	75.8	50.1	50.2	50.1	51.1	70.9
Max	208.4	340.2	8806.5	361.6	128.5	129.8
Mean Size	142.1	133.4	259.0	129.6	67.9	98.1

Table 2.8 Availability of High Quality Habitat Patches of Varying Sizes for Fragmentation – Sensitive Species (Part B)

Bird Species	Northern Goshawk		Northen Pygmy Owl		Piliated Woodpecker		Western Tanager	
	South FMA	North FMA	South FMA	North FMA	South FMA	North FMA	South FMA	North FMA
Total >50 Ha	87	11	12	29	10	15	15	33
>50 <100 Ha	54	7	7	23	7	11	11	24
>100 <150 Ha	17	2	3	3	3	3	2	2
>150 <200 Ha	7	1		0		0		3
>200 Ha	9	1	2	3		1	2	4
Min	50.1	52.8	51.1	50.1	54.0	53.2	51.7	52.9
Max	943.9	228.9	297.2	361.6	119.2	249.6	238.0	312.1
Mean Size	117.0	101.6	11.5	99.0	82.4	92.9	91.4	105.9

2.11 Significant Biological Features

The significance of a biological feature is typically measured by criteria such as rarity, representativeness, exclusive characteristics, scientific/educative importance, ecological

importance, quality and established recognition (Alberta Recreation and Parks 1988). Based on these criteria and regional literature on environmentally significant areas and features (Bentz et al. 1995; Timoney 1999; Kansas 2003) we list some candidate of significance.

- *Mixedwood forests in riparian settings*, particularly those with balsam poplar and white spruce. These are rare vegetation cover types that are diverse botanically and structurally and are productive as habitat for birds and rare plants.

- *Shallow marshes and beaver pond complexes*, are rare in the FMA and are high quality habitat for a number of bird and herpetile species at risk.

- *Deciduous mixedwood and pure deciduous forest cover types >110 years old,* are of limited supply in the FMA and are subject to loss due to natural succession in a fire suppressed system. These are highly diverse and productive wildlife habitat sources.

- *Late seral and old growth conifer forests* are high quality habitat for a number of listed wildlife species including Marten, Northern Goshawk, Pileated Woodpecker, Northern Pygmy Owl, Barred Owl, Bay-breasted Warbler, Black-throated Green Warbler, Cape May Warbler, and Lynx.

- *Upland Grasslands* are essential habitat for elk and mule deer, which are key species for large carnivores. This habitat is of limited and diminishing supply due to fire suppression.

- *Grizzly Bear population viability* as affected by enhanced mortality risk associated with open roads, motorized vehicles and firearms. This is a problem that needs to be addressed by regional and cooperative access management measures.

2.12 Linear Feature [Road] Density Analysis

Methods

The objective of this task was to document the current densities of roads in the Spray Lake FMA. The following steps were taken to calculate open and total motorized road densities for the FMA and 10 timber harvest compartments (6 in North and 4 in South) in the FMA.

1) Baseline linear features mapping from the Alberta Government was updated by adding designated and non-designated trails from Alberta SRD and timber harvest operations roads from Spray Lake Sawmills.

2) Segments of open motorized and closed motorized roads were marked on hard-copy linear features maps at a half-day workshop on 25 August 2004. The following mapped linear features were considered at the workshop, which was attended by SLS representatives and Alberta SRD personnel familiar with road networks in the north and south portions of the FMA.
    a) Highways
    b) Paved two-lane roads
    c) Gravel roads
    d) Timber harvest operations roads
    e) Improved truck trail
    f) SRD designated/non-designated mapped trails

3) Roads considered impassable to vehicle traffic because of reclamation or gates were classified as closed motorized roads. Those features available for public access and deemed passable by motorized vehicles were classified as open motorized roads. Linear features classified as "trail/cutline" in the mapping database were not rated following agreement at the workshop that the use status of the majority of these roads was unknown (i.e. overgrown, impassable due to rugged terrain). The open and closed motorized road line coverages were exported to workstation ArcInfo, and converted to grids with a cell size of 50 meters in order to determine the total area of various road density classes in each unit. To arrive at the total areas for each of these density classes in each compartment grids were reclassed and the "focalsum" command in GRID was applied running the analysis with a circular search for an area of 1 square kilometer. The following seven classes of road density were summarized (0.0 - 0.3; 0.3 - 0.6; 0.6 - 1.2, 1.2 – 1.8, 1.8 – 2.4; 2.4 – 3.0; and, >3.0 km/km^2).

4) The area and relative percentage of each class (open, closed and total) of road density was calculated for each compartment and for the north and south portions of the FMA as a whole.

5) "Linear" open, closed and total road densities were also calculated for each compartment by dividing the linear kilometers of each road class by the land area (km) of a compartment.

6) The linear density of "trail/cutline" features was calculated separately for each compartment and for the north and south portions of the FMA as a whole.

7) The lengths of linear feature classes (i.e. paved-two lane road; gravel road; operations road; Trail/Cutline; Non-designated trail; designated trail; OHV trail; trail-truck unimproved) in each compartment were also calculated.

Results

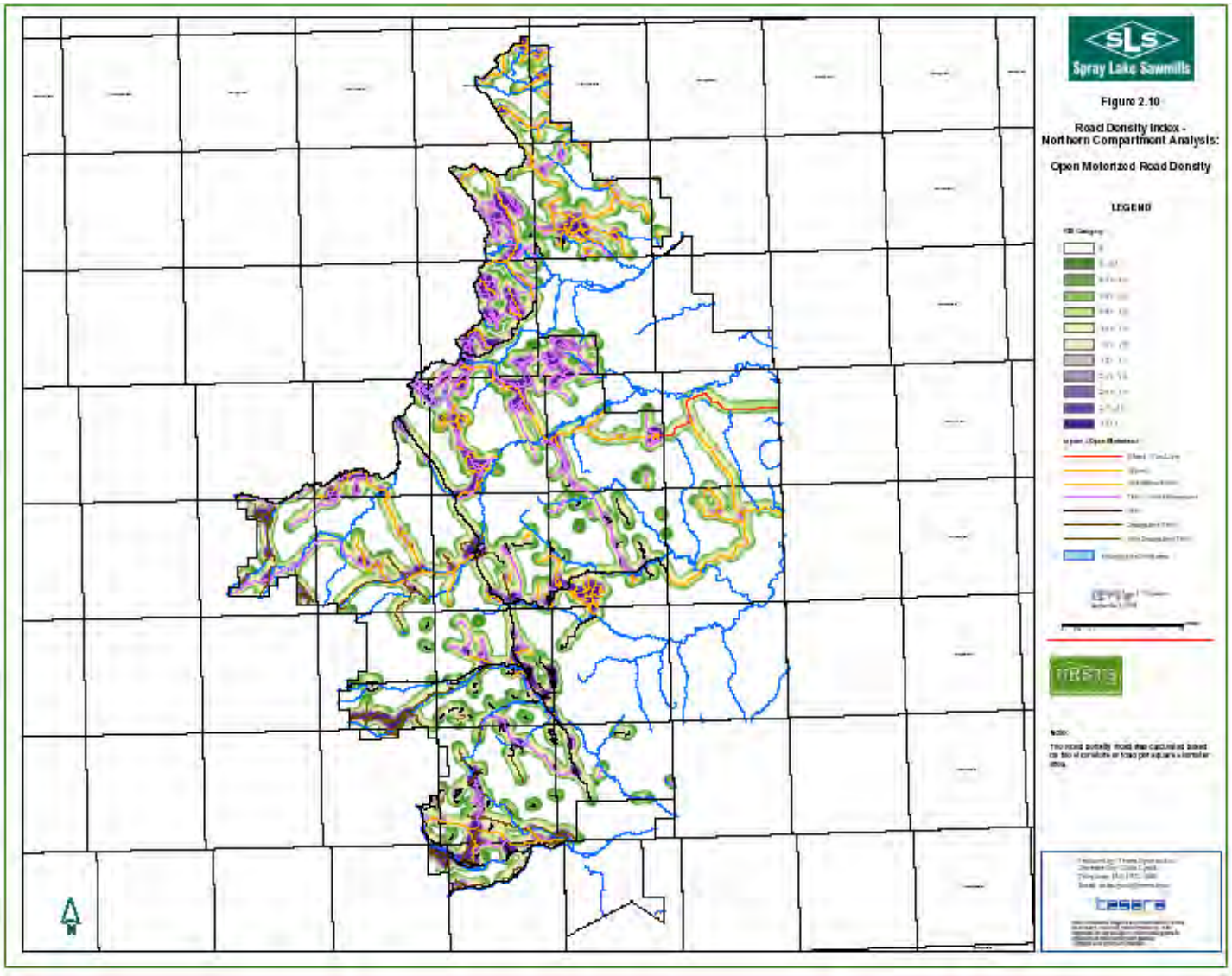
Tables 2.9, 2.10 and 2.11 provide the results of the "moving window" road density analysis for open motorized roads, total motorized roads (open + closed roads), and cutlines/trails, respectively. These data present the percentage of land area of each compartment that occurs within pre-established ranges of road/trail density. These ranges are expressed as the number of kilometers of linear feature per square kilometer of land area (km/km^2). Open motorized road density is generally lower in compartments in the South FMA than in the North. From 80.3% (Jumpingpound Creeek) to 97% (Sullivan Creek) of southern compartments support areas with no roads, taking into account only open motorized roads. This value ranges from a low of 26.1% (Coal Camp) to a high of 87.9% (B9 Quota) in the North FMA. The average percentage of compartments with no open roads in the North FMA is slightly greater than 50

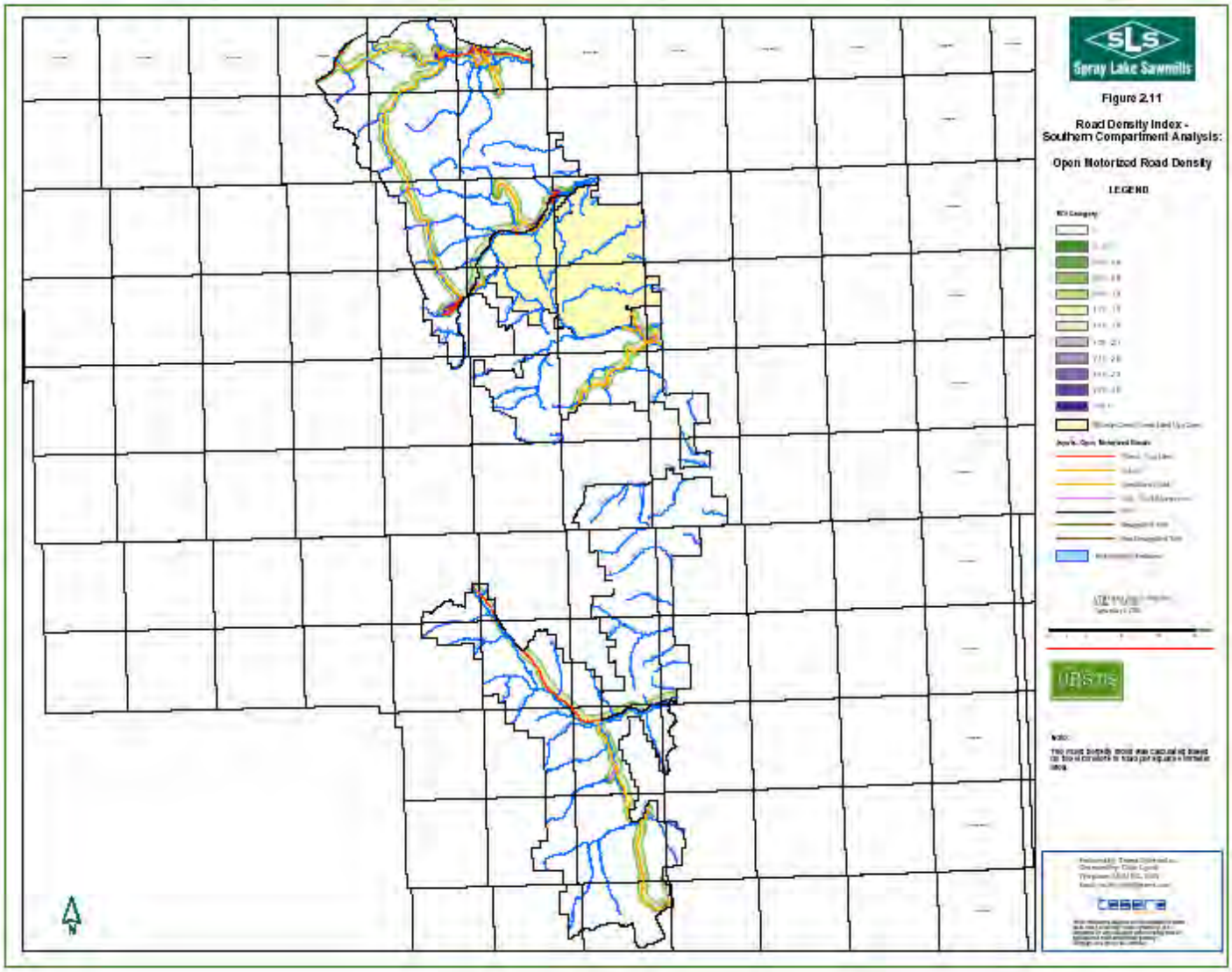
The amount of unroaded land within compartments drops significantly when both open and closed motorized roads are accounted for. For example, the percent unroaded land drops from 87.9% to 33.9% in the B9 Quota compartment when closed roads are enumerated. Percent area without roads drops an average of 17.8% across all compartments. Road closures exert their largest effect on road density in the B9 Quota, Highwood River, Sullivan Creek, Jumpingpound Creek and McLean Creek. Road closure effects on road density were least in the Coal Camp Creek, Burnt Timber and Ghost River compartments. Figures 2.10 and 2.11 illustrate the spatial distribution of classes of <u>open</u> motorized road density in the North and South portions of the FMA, respectively. Figures 2.12 and 2.13 illustrate the spatial distribution of classes of <u>total</u> (open + closed) motorized road density in the North and South portions of the FMA, respectively.

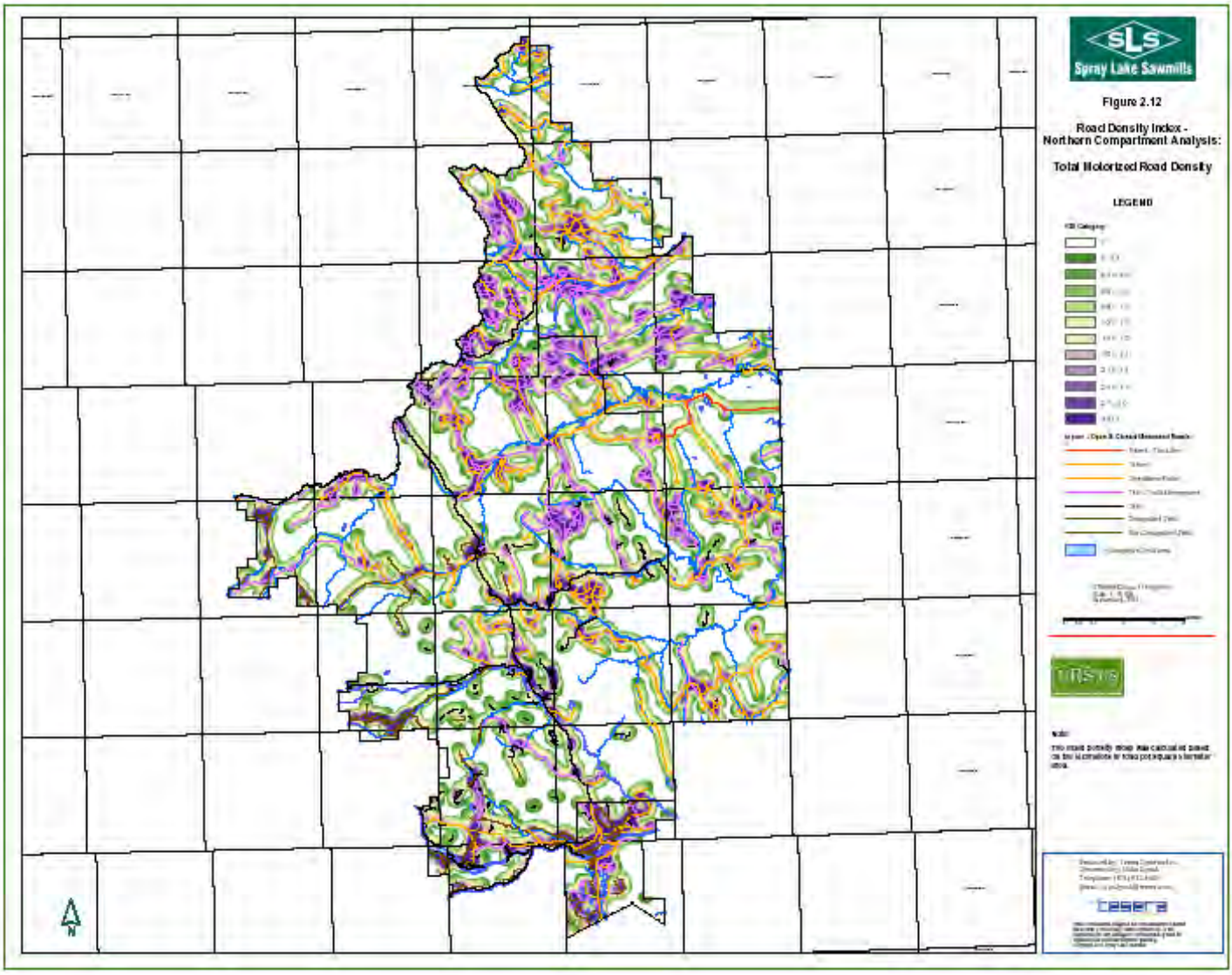
Total motorized road density was calculated separately for the McLean Creek Forest Land Use Zone (FLUZ) because of its unique status as a dedicated off-highway vehicle area. Only 4.0% of land in the Mclean Creek FLUZ is unroaded. Figure 2.14 illustrates the spatial distribution of classes of road total motorized road density in the McLean Creek FLUZ.

The moving window analysis was also completed for trails and cutlines. The percent of area not covered by trails and cutlines ranges from 1.6% (B9 Quota) to 10.1% (Ghost River) in the North FMA and from 22.6% (McLean Creek) to 30.0% (Highwood River) in the South FMA. The status of these features with respect to use by motorized vehicles is currently unknown in many cases.

Table 2.12 summarizes "linear density" values for the 10 compartments based on open motorized, total motorized and cutline/trail features. This calculation gives an average road density value for each compartment. Open motorized road densities range from a low of 0.01 km/km^2 in the Sullivan Creek compartment to a high of 1.1 km/km^2 for the Coal Camp Creek compartment. The average open motorized road density for compartments in the North FMA is 0.62 km/km^2 and for the South FMA 0.12 km/km^2. Total (open + closed) motorized road densities range from a low of 0.26 km/km^2 in the Sullivan Creek compartment to a high of 1.1 km/km^2 for the Coal Camp Creek compartment. The average total motorized road density for compartments in the North FMA is 0.85 km/km^2 and for the South FMA 0.40 km/km^2. Linear densities for cutline/trail features were considerably higher than for roads, ranging from a low of 1.32 km/km^2 for the Sullivan Creek compartment to a high of 3.16 km/km^2 for the B9 Quota compartment (Table 2.12). The average density of cutlines/trails was 2.56 km/km^2 in the North FMA and 1.89 km/km^2 in the South FMA. For comparison, total linear feature densities in the McLean Creek FLUZ was 3.98 km/km^2. Table 2.13 presents lengths of linear feature classes by compartment.


Spray Lake Sawmills
Figure 2.10
Road Density Index -
Northern Compartment Analysis:
Open Motorized Road Density
LEGEND


Spray Lake Sawmills
Figure 2.11
Road Density Index -
Southern Compartment Analysis:
Open Motorized Road Density
LEGEND


SLS
Spray Lake Sawmills
Figure 2.12
Road Density Index -
Northern Compartment Analysis:
Total Motorized Road Density
LEGEND
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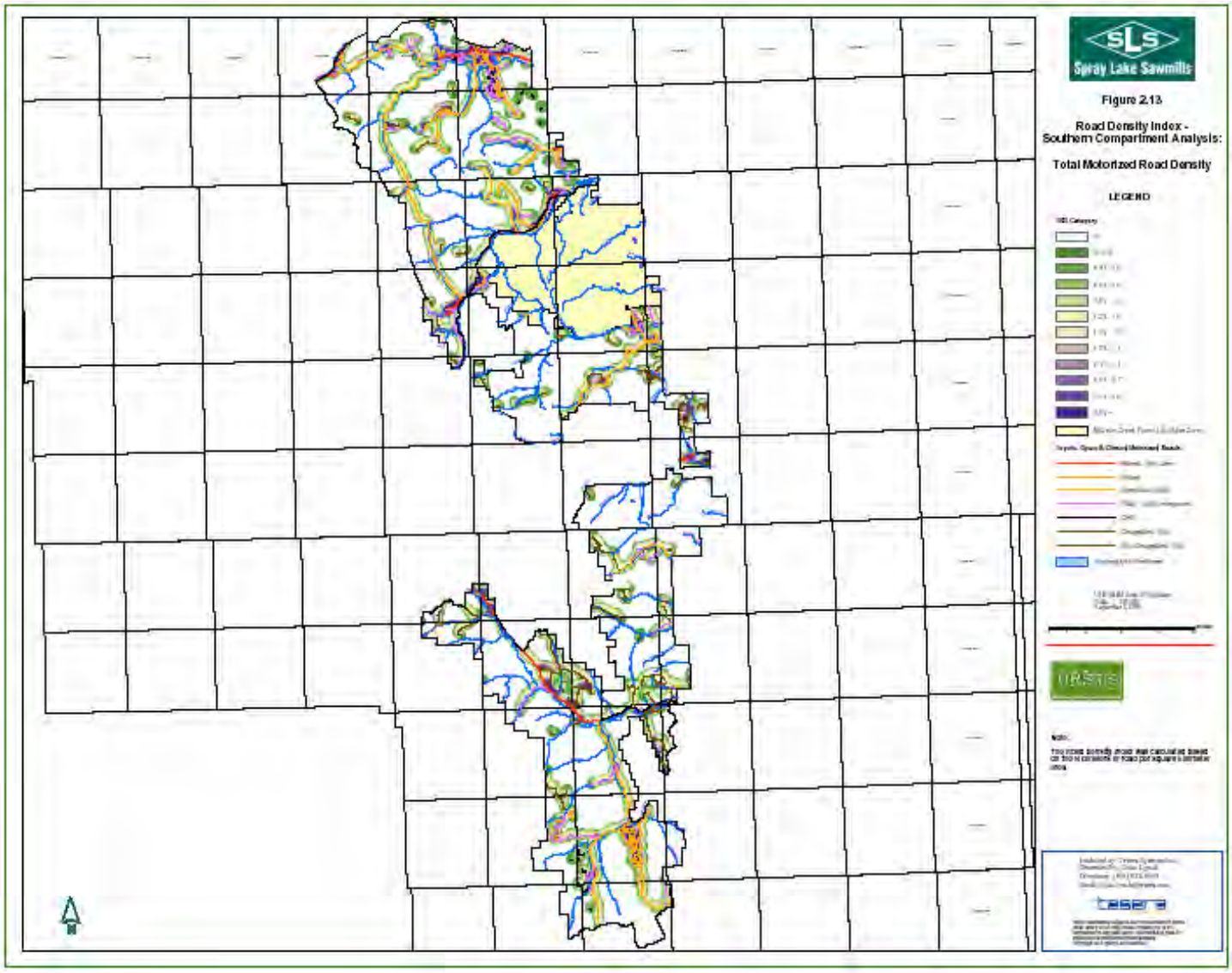

Spray Lake Sawmills
Figure 2.13
Road Density Index -
Southern Compartment Analysis:
Total Motorized Road Density
LEGEND

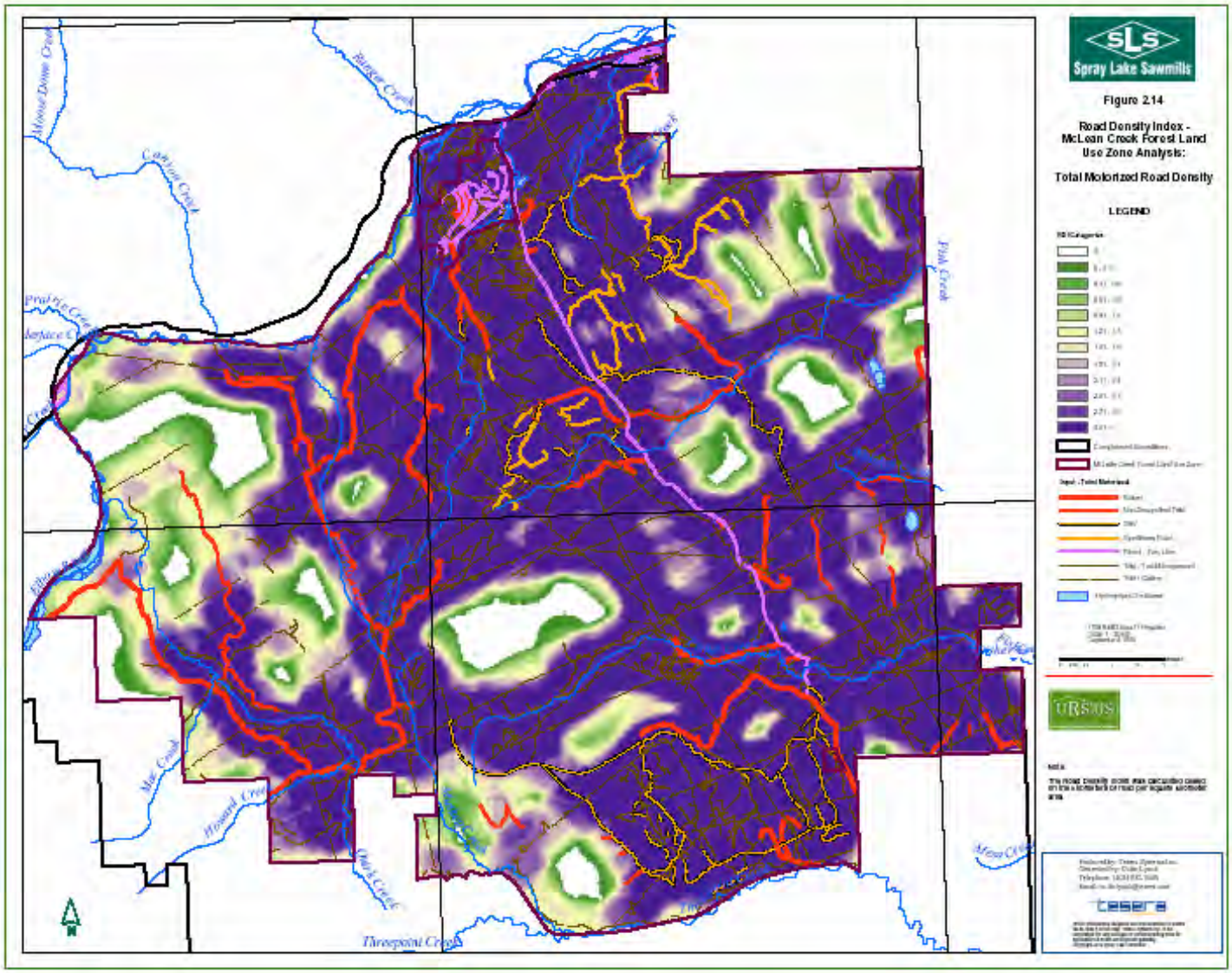


Table 2.9 Percentage of FMA Compartments within Open Road Density Classes

Portion of FMA	Compartment	Open Motorized Road Density (%)							
		0	0 to 0.3	0.3 to 0.6	0.6 to 1.2	1.2 to 1.8	1.8 to 2.4	2.4 to 3.0	>3.0
North	Ghost River	34.1	8.1	8.1	14.6	15.6	8.4	4.9	6.3
	Atkinson	73.1	3.2	2.7	5.9	6.2	3.5	2.6	2.7
	Burnt Timber	51.2	5.6	4.5	12.1	14.9	5.8	3.5	2.2
	Grease Creek	44	6.7	5.4	12.4	13.6	8	4.9	4.9
	B9 Quota	87.9	1.8	1.5	4.5	3.8	0.6	0	0
South	Coal Camp Creek	26.1	6.5	6.3	15.1	19	12.7	7.3	7.2
	McLean Creek	85.2	1.3	1.2	5	5.4	1.5	0.8	0.5
	Jumpingpound Creek	80.3	1.9	1.8	5.8	7.6	1.2	0.5	0.9
	Highwood River	85.8	1.2	1.1	6.2	5.9	0.6	0.2	0
	Sullivan Creek	97	0.7	0.2	1	1	0	0	0

Table 2.10 Percentage of FMA Compartments within Total Road Density Classes

Portion of FMA	Compartment	Total Motorized Road Density (%)							
		0	0 to 0.3	0.3 to 0.6	0.6 to 1.2	1.2 to 1.8	1.8 to 2.4	2.4 to 3.0	>3.0
North	Ghost River	33.7	8.2	8.2	14.8	15.4	8.4	4.80	6.5
	Atkinson	53.2	5.2	4.5	10.8	12.1	6.3	4.3	3.6
	Burnt Timber	49.8	5.3	4.7	12.5	15.6	6.3	3.6	2.2
	Grease Creek	34	5.8	5.1	13.4	16.7	10.8	5	7.2
	B9 Quota	33.9	6.1	5.9	14.9	16	10	6.2	6.9
	Coal Camp Creek	25.7	6.5	6.1	15	19.2	12.8	7.4	7.3
South	McLean Creek	64.3	4.5	3.9	9.1	8.9	4.1	2.4	2.9
	Jumpingpound Creek	57.6	5.4	4.8	10.1	12.2	4	2.1	3.7
	Highwood River	61.1	4.1	4	10.2	11.6	4.1	2.3	2.5
	Sullivan Creek	73.4	3.8	3.2	7.6	6.7	2.8	1.4	1

Table 2.11 Percentage of FMA Compartments with Trail/Cutline Density Classes

Portion of FMA	Compartment	[Total] Trail & Cutline Density Classes (km/km2)							
		0	0 to 0.3	0.3 to 0.6	0.6 to 1.2	1.2 to 1.8	1.8 to 2.4	2.4 to 3.0	>3.0
North	Ghost River	10.1	3.8	3.7	11.2	19	14.3	13.80	24
	Atkinson	7.9	3.8	3.9	11.5	16.4	13.4	11.1	31.9
	Burnt Timber	8.9	2.8	2.6	9.4	17.3	13.4	13.5	32.1
	Grease Creek	2.3	1.7	1.9	6.1	11.4	13.4	14.2	48.5
	B9 Quota	1.6	1.4	2	6.7	9.9	11.3	12.8	54.3
	Coal Camp Creek	3.3	2.3	2.6	7.8	14.1	13	13.5	43.3
South	McLean Creek	22.6	4.9	5	12.6	13.5	9.9	9.8	21.7
	Jumpingpound Creek	28.2	4.5	4.1	11.3	14.4	8.3	7.9	21.2
	Highwood River	30	5.3	4.5	11.2	11.1	7.7	6.1	24.2
	Sullivan Creek	25.3	5.4	4.9	14.9	18	10.7	8.6	12.3

Table 2.12 Linear Road Densities for open Motorized, Total Motorized and Cutline/Trails

Portion of FMA	Compartment	Linear Feature Density (km/km2)		
		Open Motorized Roads	Total Motorized Roads	Cutlines and Trails
North	Coal Camp	1.1	1.1	2.68
	B9 Quota	0.73	0.98	3.16
	Grease Creek	0.6	0.95	2.67
	Burnt Timber Creek	0.09	0.62	2.48
	Atkinson Creek	0.36	0.6	2.52
	Ghost River	0.85	0.85	1.86
South	Jumpingpound Creek	0.22	0.56	1.55
	McLean Creek	0.1	0.27	2.21
	Sullivan Creek	0.01	0.26	1.32
	Highwood River	0.15	0.49	2.48

Table 2.13 Lengths of Linear Feature Classes by Compartment

Portion of FMA	Compartment	Total Length of Linear Feature Class (km)							
		Paved - Two Lane Road	Gravel Road	Operations Road	Trail-Truck Improved	OHV	Designated Trail	Non-Designated Trail	Trail/Cutline
North	Coal Camp	0	122	8.6	84.7	3	0	0	531.3
	B9 Quota	12.9	199.8	0.9	227.7	14.8	0	41	1607.9
	Grease Creek	0.5	83.7	38	183.7	15.8	5.8	0	923.5
	Burnt Timber Creek	0	55.1	7.3	52.4	7.7	6.1	42.4	679.2
	Atkinson Creek	0	74.6	15.9	5.8	21.9	0	1.1	499.4
	Ghost River	0	24.7	0	24.8	516	82.1	0	399.4
South	Jumpingpound Creek	45.4	142.7	0	84	5.2	0	22.5	824.5
	McLean Creek	46.7	106.2	25.1	81.9	50	0	62.5	957.8
	Sullivan Creek	1.6	11.9	0	8.1	0	0	42.5	328.8
	Highwood River	31.5	48.8	28.8	29.8	5.1	0	67.3	1066.7

2.13 Fire Regime Study (Rogeau, 2004)

The natural vegetation mosaic of the boreal, sub-boreal and mountainous forest of Canada has largely been shaped by wildfires for thousands of years. In fire regulated ecosystems the patterns and physical effects of fire are needed to maintain the biodiversity and ecological integrity of these systems. It is widely believed that fire exclusion and suppression policies have considerably reduced the number and size of fires over the past 50 years. It is also believed that forest management practices are shifting the natural seral stage of forest communities. In recent years, a better understanding of the ecological effects of natural disturbances has prompted governments and the forest industry to initiate a form of forest management that would attempt to replace the effect of wildfire by creating a sustainable forest mosaic reminiscent of that created by wildfire.

An understanding of fire regimes is necessary to facilitate attempts at this replication and will also help managers to implement innovative and adaptive harvesting strategies. The fire regime is defined by the frequency, type, intensity and size of fires occurring on the landscape. The natural fire cycle(s) can be estimated by assessing the natural range of variability of fire size, frequency and return intervals. In turn, a yearly disturbance rate of the forested land can be estimated and harvesting designs adapted in an attempt to emulate natural disturbance patterns.

SLS and Alberta Community Development initiated a study for the District of Kananaskis, which includes the SLS FMA. Part 1 of the study was finalized fall 2004. (Rogeau, 2004) Field work (Part 2) was conducted in the summers of 2004 and 2005. The study was completed in February 2006.

Initial findings include:

- Each subregion appears to have distinct fire regime characteristics.
- Modeling produces large extents of young forests (<40 years), which is what the landscape is projected to look like if no fire suppression actions were to take place.
- Field data collection is needed to provide stand ages and to validate inventory ages.
- Harvest patch size distribution, as dictated by the Alberta Timber Harvest Planning and Operating Ground Rules, falls within the natural range of variation of fire size but is not representative of the natural range of variation because all harvest blocks are found at the bottom end of the spectrum.
- Natural range of variation for fire cycle and annual rate of disturbance vary by subregion.
- Recommend using FMF findings on fire refugia and island remnants.
- Recommend monitoring the annual rate of disturbance for both harvesting and fire.

The study (Fire Regime Study, Kananaskis district, Alberta) is available for viewing at the SLS office.

2.14 Visual Resources

SLS has a history of planning for visual resources at the harvest design phase. For the purposes of the DFMP it was determined a broader FMA wide assessment was needed.

The first step was to develop a broad level Visual Sensitivity Assessment for the planning area. The following process was used.

ACD and SLS met to establish the first stratification of the DFMP planning area into high, medium and low visual sensitivity. The stratification was based on the Government's Visual Sensitivity Rating criteria and Visual Sensitivity Factors, found in the document Forest Landscape Management Strategies for Alberta, and on professional judgment. This was done at a 1:250 000 scale.

The initial stratification was transferred to orthophoto-based maps (1:40 000). These maps were reviewed by the SLS Public Advisory Group and the rating boundaries adjusted based on the knowledge and preferences of the group.

SRD and ACD reviewed the 1:40 000 maps and made further adjustments to the rating boundaries. One final adjustment to the ratings was made by SLS based on input from the open houses held in May 2004.

The final stratification was transferred into the GIS environment and a map was produced for the Planning/Review team and for insertion into the DFMP (Figure 2.15). This map will form the basis for future SLS planning initiatives.

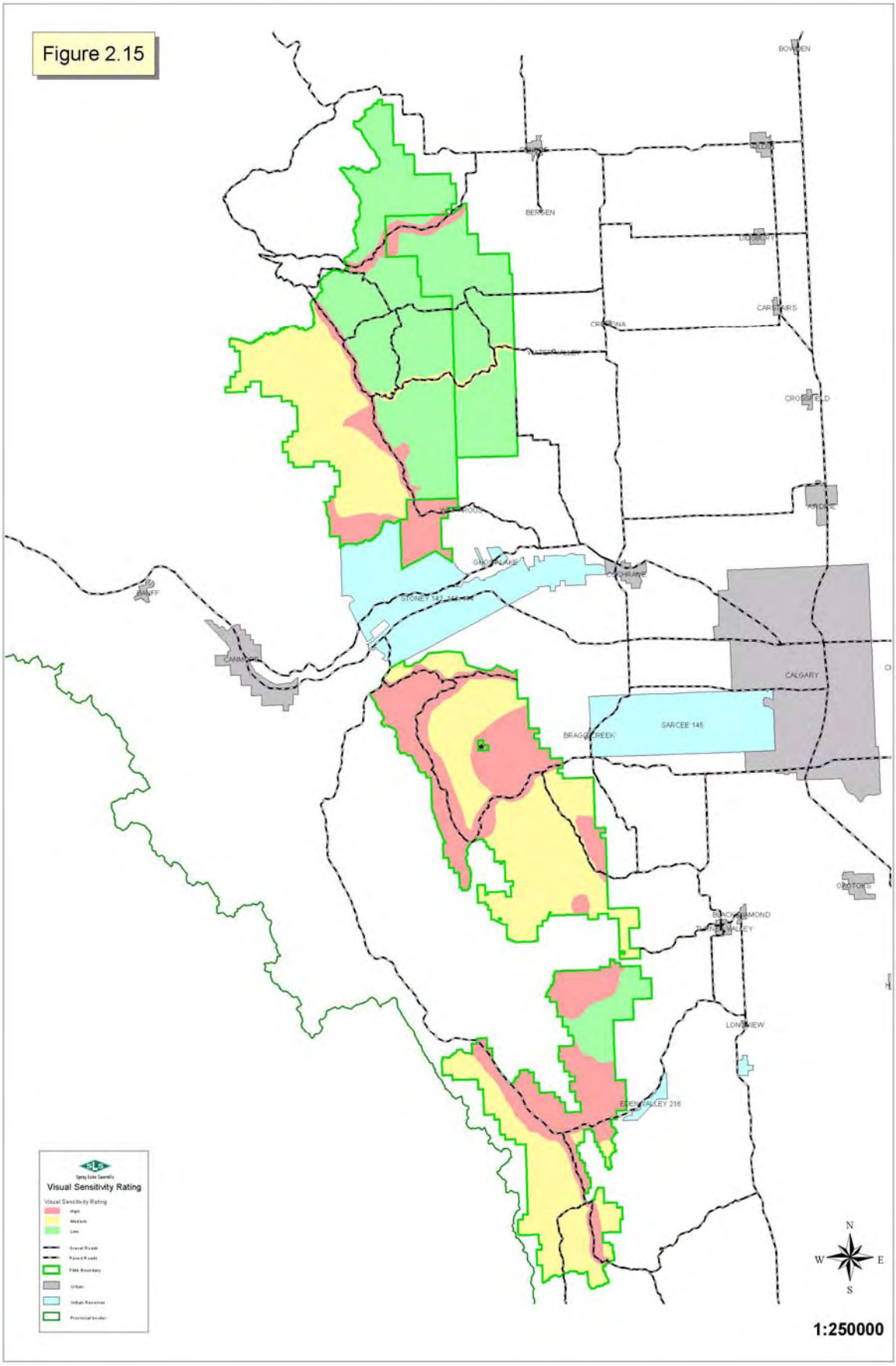


Figure 2.15
BERGEN
CROSSFIELD
CALGARY
SARCEE 145
BRAGG CREEK
CANMORE
BANFF
LONGVIEW
Visual Sensitivity Rating
N
W
E
S
1:250000

Visual Sensitivity Rating[2]

High

- Directly seen in near view
- Dominant in more distant view
- High quality landscape
- Unique or high feature interest
- Viewers stay long, have high concern, are many in number

Medium

- In clear view or close
- Less interest or dominance than high
- Viewing opportunity creates less concern
- Quality landscape, but common to area

Low

- Viewed from distance low prominence in the view
- Low concern
- Viewed obliquely and/or briefly while traveling
- Low quality or monotonous landscape

Visual Sensitivity Factors

1. Landscape Scene – viewable area – sensitivity takes into account its location, surroundings and existing condition.

2. Visual Perception – physical and mental interpretation of how much the eye can see including distance between the viewer and the feature, the angle of view and visual screening.

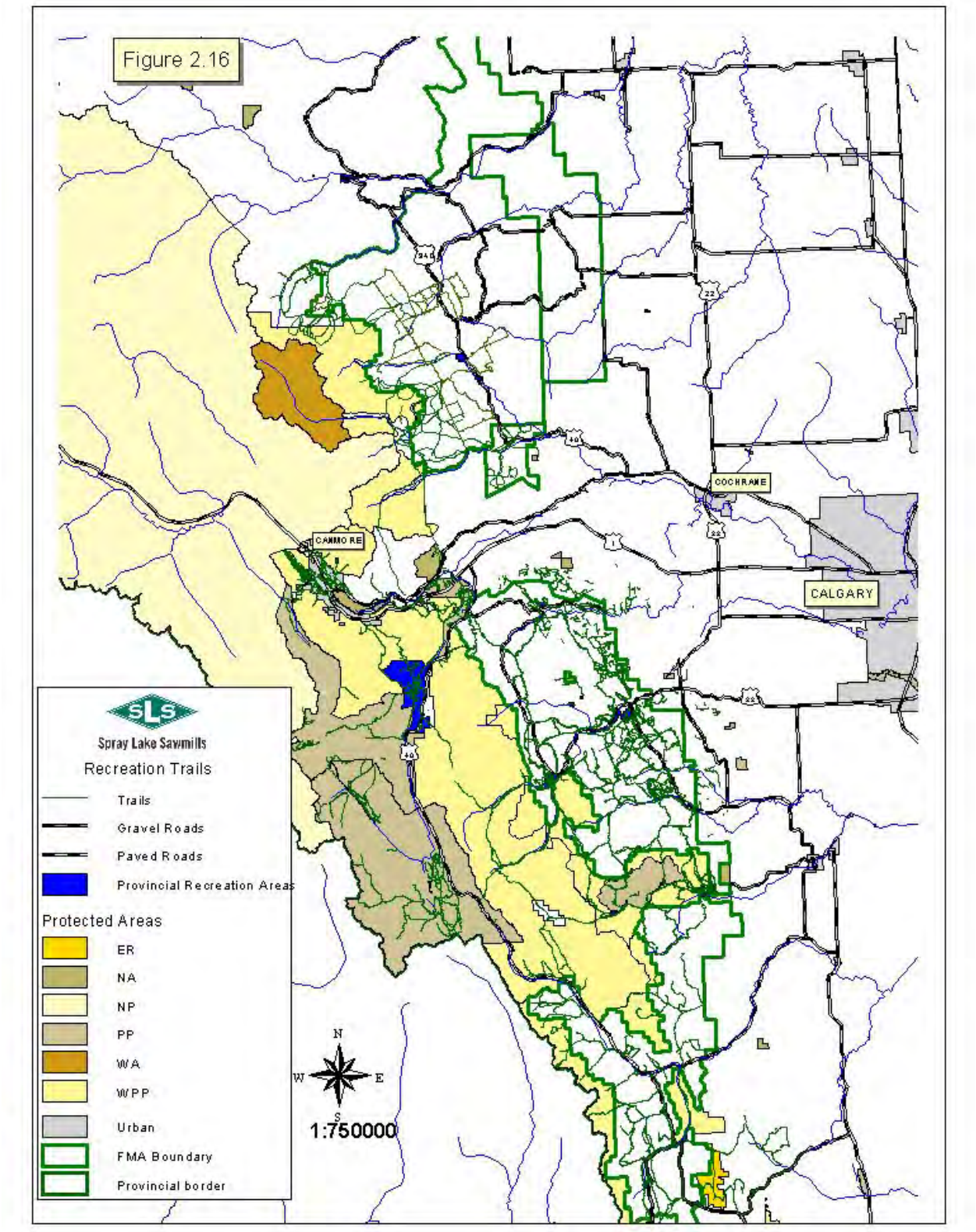
3. Social Sensitivity – number of visitors, length of stay, level of concern and knowledge of the area.

2.15 Recreation and Tourism

Recreation and tourism uses are important within the FMA throughout the year. The FMA is recognized for its diversity of recreational uses in part resulting from its high scenic and natural values as well as proximity to Calgary and many smaller communities located along the eastern boundary. Kananaskis Country is recognized as a major outdoor recreation area in the province. The wide variety of recreation and tourism activities occurring within or near the FMA includes camping, auto touring, hiking, mountain biking, skiing, fishing, hunting, snowmobiling, horseback riding and ATV riding. There are also several leases for youth camps or commercial outfitting facilities. The Kananaskis Country, Ghost River and Nordegg-Red Deer River Integrated Resource Plans currently guide recreation management. In general, the objective of the Provincial Government is to continue to provide for a wide range of year-round recreational opportunities, both motorized and non-motorized.

[2] Alberta Forestry, Lands and Wildlife. 1986 – "The ratings serve as "red flags" to identify visual resources for which further consideration is needed."

Figure 2.16 shows the Provincial recreation areas and extensive trail system within the FMA. In addition to the formal trails are many unofficial trails and seismic lines.



2.15.1 North FMA

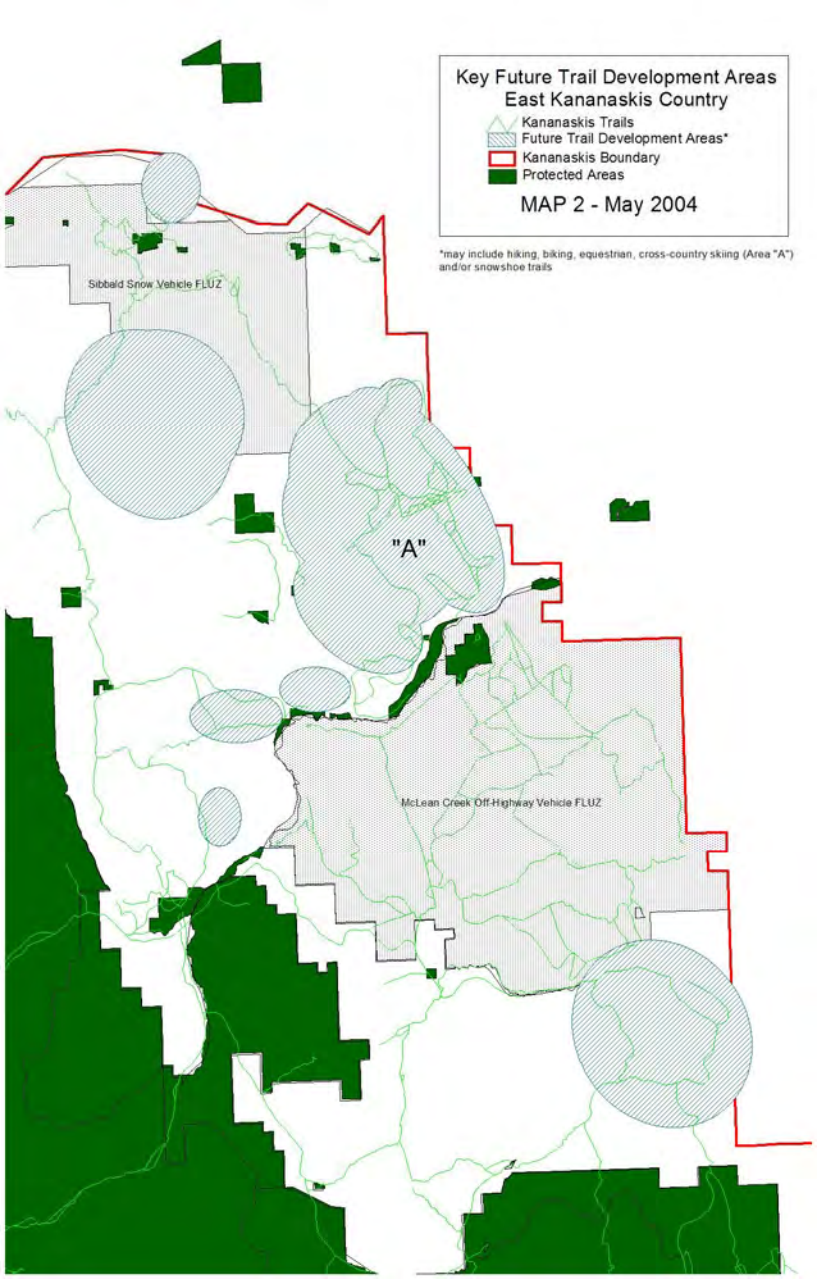
The northern portion of the FMA includes the Ghost-Waiparous area. There are six developed campgrounds and approximately 170km of recognized trails in the Ghost area for summer and winter OHV uses. Within the Ghost area are approximately 341 camping units (Waiporous 56; North Ghost 173; Fallen Timber 62; Burnt Timber 30; North Ghost Group Camp 20) plus extensive random camping in the area. The Provincial Government is concerned with random use levels in the area and is in the process of developing the Ghost-Waiparous Access Management Plan. The purpose of the plan is to provide direction for recreational OHV use and random camping.

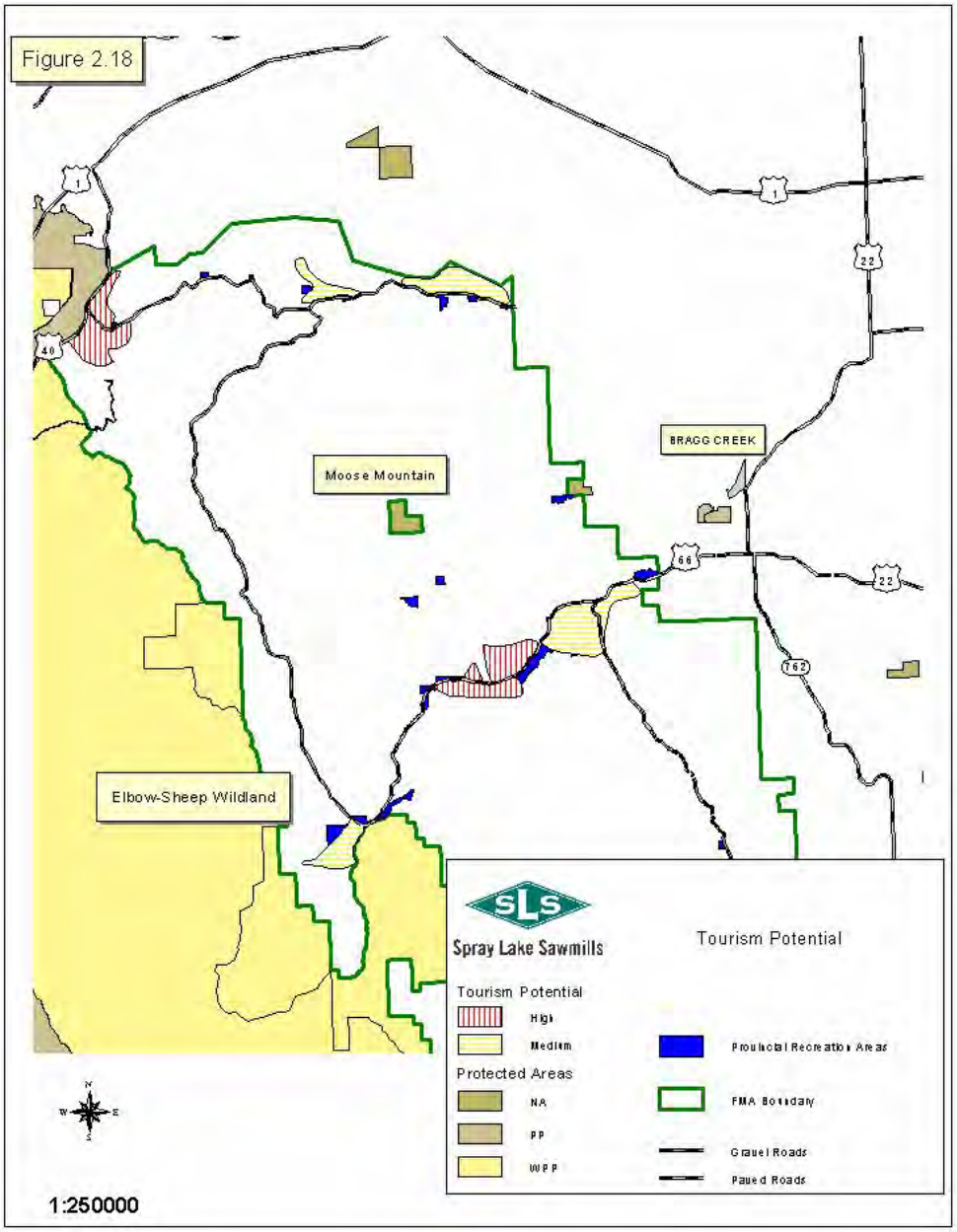
2.15.2 South FMA

The southern portion of the FMA is located within Kananaskis Country. Specifically it includes the eastern portion of K-Country outside of the Provincial protected areas. There are approximately 1035 camping units in the South (Jumpingpound 154; Elbow 660; Highwood 221) and 1070 day use sites (Jumpingpound 95; Elbow 490; Highwood 485). Alberta Community Development recently completed the East Kananaskis Country Trails Review. As stated in the review, “there are approximately 650 kilometers of designated trails for motorized and non-motorized use.” As well, there are hundreds of kilometers of unofficial motorized and non-motorized trails. The review has identified current management strategies for ACD and others as well as future opportunities for motorized and non-motorized trail development. Figure 2.17 shows areas with future potential.

The existing roads, visitor facilities, and trails in east Kananaskis Country are important tourism resources. The Provincial Government has also provided information on long-term tourism potential for areas in close proximity to the main road corridors in east Kananaskis Country. Figure 2.18 shows the approximate location of nodes identified as having medium to high potential.

Figure 2.17


Key Future Trail Development Areas
East Kananaskis Country
Kananaskis Trails
Future Trail Development Areas*
Kananaskis Boundary
Protected Areas
MAP 2 - May 2004
*may include hiking, biking, equestrian, cross-country skiing (Area "A") and/or snowshoe trails
Sibbald Snow Vehicle FLUZ
"A"
McLean Creek Off-Highway Vehicle FLUZ



2.16 Historical Resources

SLS had a Historical Resource Predictive Model developed for the FMA to assist in harvest planning and the management of historical resources that might be located within the FMA. The model highlights the location of all previously recorded archaeological sites within the FMA and stratifies the landbase into high, moderate and low potential for unidentified archaeological sites to exist. (Figure 2.19)

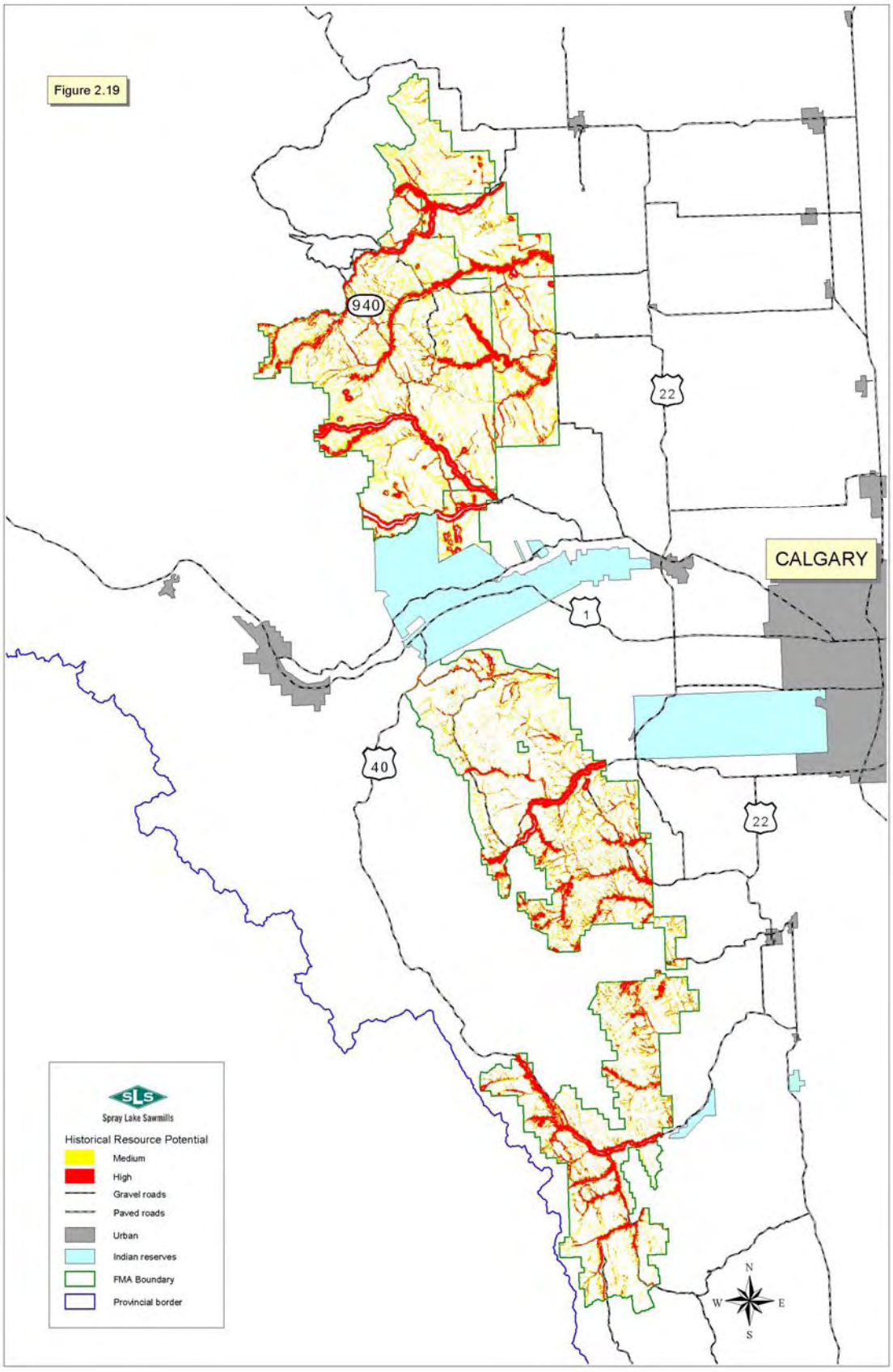


Figure 2.19
940
22
CALGARY
1
40
22
Spray Lake Sawmills
Historical Resource Potential
Medium
High
Gravel roads
Paved roads
Urban
Indian reserves
FMA Boundary
Provincial border
N
W
E
S

Incorporated into the model are 217 precontact archaeological sites that now exist in the Alberta Community Development historical resource database. These sites include precontact campsites dating to over 10,000 years old and bison kill and processing areas. As well, there are a significant number of culturally significant special nature sites such as medicine wheels and graves.

In developing a model to predict the potential locations of historical resources where professional archaeological assessment has not been conducted, a number of independent environmental and cultural parameters were examined. Environmental criteria incorporated into the model included slope, aspect, proximity to permanent and seasonal streams, mountain tops, mountain passes, ridge shadow, and modern vegetation. Cultural variables included the location of known historical trails and passes. The predictive value of these criteria and the variations within each were given weights and ranks based on established archaeological principals.

The resulting stratification is a Geographical Information System product. The full report, A Historical Resources Predictive Model for Spray Lake Sawmills (1980) Ltd. Forest Management Agreement Area, is available for viewing at the SLS office. (Golder Associates, 2003)

2.17 Protected Areas

This was a historical issue dealt with in the establishment of the FMA. The designation of wilderness areas, including buffers (in the case of the Blue Rock/Sheep River sites), was dealt with through the FMA negotiation process. Don Getty Wildland Park, Blue Rock Wildland Park and the Sheep River Provincial Park were added to the extensive system of East Slopes protected areas as a result. (Figure 2.20).

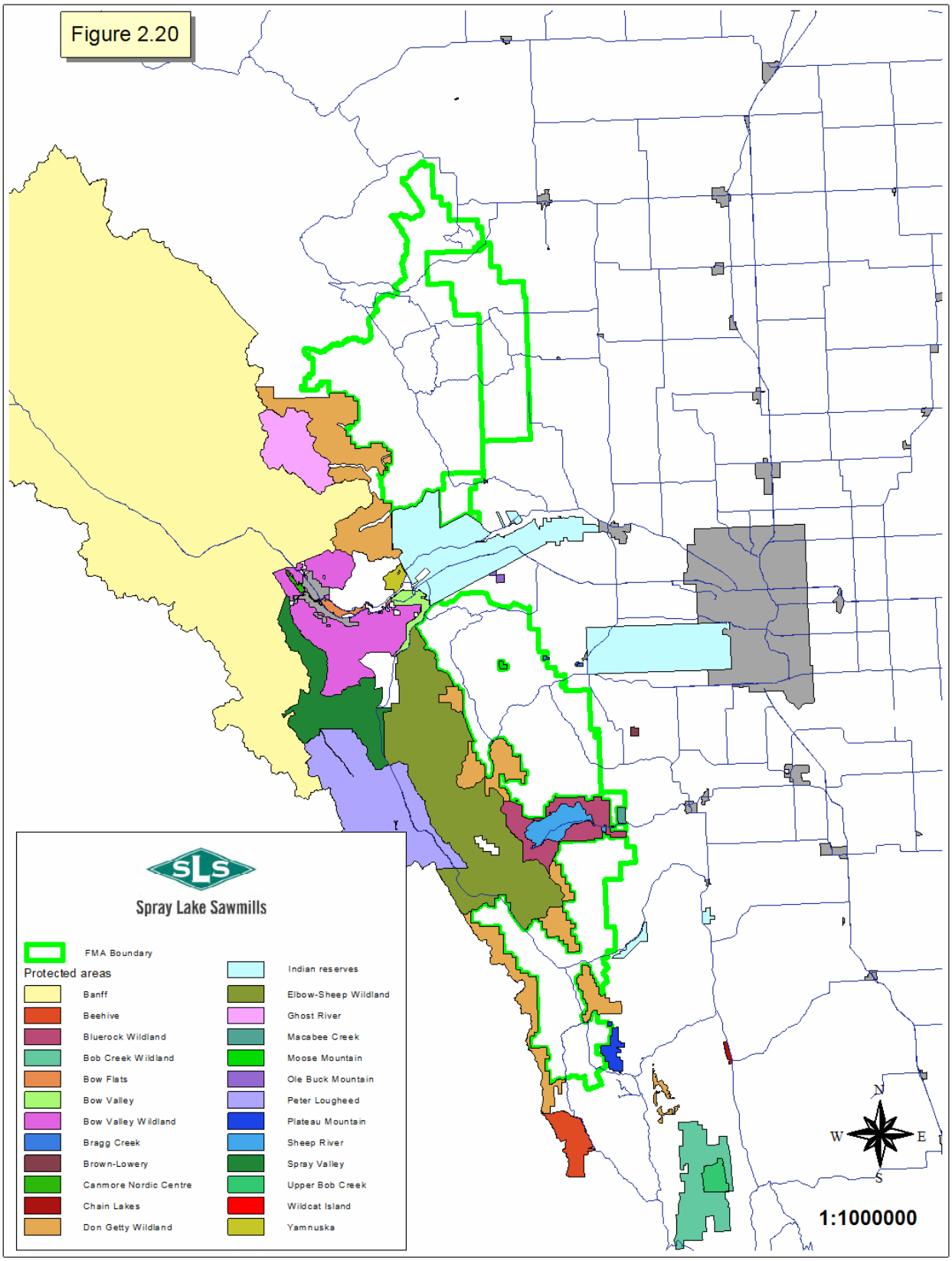


Figure 2.20
Spray Lake Sawmills
FMA Boundary
Protected areas
Banff
Beehive
Bluerock Wildland
Bob Creek Wildland
Bow Flats
Bow Valley
Bow Valley Wildland
Bragg Creek
Brown-Lowery
Canmore Nordic Centre
Chain Lakes
Don Getty Wildland
Indian reserves
Elbow-Sheep Wildland
Ghost River
Macabee Creek
Moose Mountain
Ole Buck Mountain
Peter Lougheed
Plateau Mountain
Sheep River
Spray Valley
Upper Bob Creek
Wildcat Island
Yamnuska
N
W
E
S
1:1000000

2.18 Water and Fisheries Resources

Water Yield

SLS is committed to completing a run of the Equivalent Clearcut Area (ECA) Model for the FMA. The model predicts hydrological recovery within areas where harvesting or other disturbances have occurred by estimating changes in water yield over time in relation to the regrowth of vegetation. ECA has been favorably tested in comparison to WRENSS model results.

The model provides two sampling options. The potential effect of disturbance on water yield may be measured using either the “equivalent clearcut area”, or the “equivalent clearcut area and projected change in annual water yield”. The options available with the model use either average forest stand information or a combination of average forest stand and stream flow information. Alberta stream flow averages are based on 30 years of annual sampling. SLS will determine watersheds within the FMA based on the distribution of third order streams.

SLS has opted to complete the run for the FMA based on “equivalent clearcut area” only. The modeling can be accomplished in-house. It does not require ongoing stream flow measurements, yet provides a good representation of expected hydrologic change. This is supported by results in other locations where the model has been implemented. Interpretation of the information may require assistance from a hydrologist where resultant levels cause concern. It is important to note the implications of increased water yield are also interpreted differently in the boreal region as opposed to the foothills. The foothills watersheds may be less sensitive to change than boreal forest watersheds due to steepness of terrain. (Refer to Chapter 8 for the results of the analysis.)

Water/Rivers

The Spray Lake Sawmills harvest planning areas are located along the eastern slopes of the Rocky Mountains from approximately Sundre, south to Chain Lakes Provincial Park. Generally, many stakeholders influence this portion of the eastern slopes. These stakeholders can consist of trappers, oil and gas development, first nation members, agriculture, timber harvest, hydroelectricity, mining, recreation, and tourism.

There are four main rivers associated with the Spray Lake Sawmills planning area: the upper Red Deer River, Ghost River, Elbow River and the Highwood River. The Red Deer River is a tributary to the South Saskatchewan River, whereas the Ghost, Elbow, and Highwood Rivers are tributaries to the Bow River. (Figure 2.21)

Physiochemical characteristics of water can vary significantly from stream to stream due, in part, to factors such as substrate composition, overhead cover, riparian vegetation, discharge levels and land use. However, streams originating along the eastern slopes of the Rocky Mountains tend to have reduced temperature, a high dissolved oxygen content, and a pH close to neutral. As the stream/river moves further from the Rocky Mountains water temperature tends to increase, dissolved oxygen levels decrease, and the pH moves away from neutral.

Spray Lake Sawmills has conducted detailed aquatic habitat studies on 12 streams (Fish Creek, Fisher Creek, McLean Creek, Quirk Creek, Silvester Creek, Prairie Creek, Etherington Creek, Lost Creek, Wilkinson Creek, Cataract Creek, McPhail Creek, and Baril Creek) within their harvest planning area (Wicklum and Scrimgeour 1997; and Townsend 2000a, 2000b, 2001a, 2001b, 2002a, 2002b, 2003a, 2003b, 2004a, and 2004b). The overall objectives of these studies were to collect data to assist in the development of a regionally specific ecosystem based timber harvest plan, to develop a framework that allows the identification and evaluation