

Wolverine Survey Plan for Upper Turnagain Arm and Kenai Mountains, Alaska

Interagency Collaborative Project

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Need:

Wolverines (*Gulo gulo*) function as scavengers and predators in the ecosystem of southcentral Alaska. They are generally not present at high densities anywhere within their range but are important as a furbearer for human use and as a potential indicator of ecosystem health. The Alaska Department of Fish and Game (ADF&G) is responsible for management of furbearer populations throughout southcentral Alaska. The U. S. Forest Service, U. S. Fish and Wildlife Service, and the National Park Service are responsible for subsistence harvest management on federal lands and for management of other human uses that could affect wildlife resources. Because wolverine population density and reproductive potential is low relative to other furbearers, it is important for management agencies to closely monitor wolverine populations and those human activities that could adversely affect them. Wolverines seem to prefer foothills and mountainous areas (Magoun 1996), which usually are lightly developed by humans but are often favored areas for hunting, trapping, snowmachining, and other outdoor activities. In the Upper Turnagain Arm and Kenai Mountains, wolverines can be harvested under hunting and trapping regulations. This area also is used heavily for recreational snowmachining and skiing, which have both increased rapidly in popularity in recent years. In particular, operators who drop off skiers by helicopter, known as heli-skiing, have expanded their areas of use and increased their permit requests to include much of the ski-able terrain within the Chugach National Forest (CNF). The potential effect of winter recreational activities on wolverine populations is unknown. To obtain baseline data on wolverine population density in the affected areas, ADF&G, CNF, Kenai National Wildlife Refuge (KNWR), and Kenai Fjords National Park (KFNP) propose to conduct a density estimate using the sample

unit probability estimation (SUPE) technique, which is based on wolverine track counts in winter (Becker et al. 1998). Beyond providing a statistically reliable estimate of wolverine density in the areas of concern, results of this survey effort will give an indication of wolverine distribution.

Background:

Previous population surveys for wolverines in southcentral Alaska have derived density estimates of 4.6–5.2 wolverines/1000 km² (Becker and Gardner 1992, Golden 1996, unpublished ADF&G data). These densities are similar to the estimated 5 wolverines/1000 km² reported for wolverines across their circumboreal range (assessment of Wolverine Workshop participants at the Carnivores 2002 Conference, Monterey, California, 17–20 November 2002). The transect-intercept probability sampling (TIPS) technique (Becker 1991) was first used to estimate wolverine density. The TIPS relied on the use of randomly selected linear transects to detect tracks and provided statistically reliable density estimates. While the TIPS may actually be a more efficient estimation technique for wolverines (Becker et al. *In review*), it has 2 important deficiencies. First, it is difficult to detect tracks of a sparsely distributed species along a linear transect where the forest canopy is more dense than open woodland. Second, it is not possible to fly the transect in rugged terrain without breaking off the flight line to gain or lose altitude. This can lead to errors in observing tracks and in reacquiring the flight line. The SUPE technique overcomes these deficiencies because aircraft are not restricted to a particular flight line and thus can fly more easily over rugged terrain. It also allows for greater precision in the survey of large areas (greater than 5000 km²; Becker et al. 1998).

The SUPE technique was originally developed to estimate wolf (*Canis lupus*) density. However, it was used to estimate wolverine density in 1995 in the Kenai Mountains (Golden 1996) and in the western Chugach Range (unpublished ADF&G data). The SUPE for wolverines uses a stratified network of quadrats or sample units (SU; Becker et al. 1998) that are square to rectangular and are approximately 25 km². SUs are partitioned into 2–3 strata based on the likelihood (through experience or observation) of locating wolverine tracks in a particular stratum. SUs within strata are randomly selected using the approximate percentages of 65, 40, and 20 for high, medium, and low strata, respectively, thus putting more emphasis on areas where tracks are most likely to be found. Previous wolverine SUPE surveys have used 2 strata and sampled 65% of high SUs and 30% of medium-low SUs. Teams of a pilot and observer per aircraft (Super Cub) survey each randomly selected SU within 24–36 hours after a fresh snowfall (5–10 cm) or the cessation of strong winds following a fresh snowfall. Once a track is found, it is followed until the wolverine is found. The wolverine may not be seen if it is in a den hole, but this should be considered the end of the track. An effort should also be made to determine if 2 or more wolverines might have been running together. The track should then be followed back to its starting point. The entire route of the track should be recorded carefully on a map and all SUs the track lies in should be recorded on a data sheet.

On 23–24 February 1995, a wolverine density estimate using the SUPE technique was conducted in the Kenai Mountains by personnel of the KNWR, CNF, KFNP, and ADF&G. We sampled an area of 2,050 km² at the north end of the Kenai Mountains between Turnagain Arm and the Kenai River and between Quartz Creek/Six-Mile Creek valley and the foothills to the west. The area contained 198 SUs that were each 10.4 km², with 180 located in the high strata and 18 in the medium-low strata. We selected 45 (24%) SUs from the high strata and 2 (11%) from the medium-low strata. This sample was based on a hypergeometric distribution with an expected population of 10–12 wolverines and was a smaller sample of SUs than we use now. We counted the tracks of 5

individual wolverines in the area. This resulted in a calculated population size of 10.7 wolverines (SE = 4.2; 90% C.I. = 5.0–17.5) for an estimated density of 5.2 wolverines/1000 km². The high variance is an indication that our sampling effort may have been inadequate to precisely estimate wolverine density.

Procedures:

The total survey area in upper Turnagain Arm and the Kenai Mountains is 9,900 km². Because of the similarity of the habitat, we have divided the entire area into high and medium-low strata among 5 smaller areas that can each be surveyed within 2–3 days with one observation team or in 1 day by 3 teams (Figure 1). The areas have been prioritized to meet agency needs and for orderly progression of the survey. We will attempt to follow the priority of the survey areas but we may need to survey the areas out of order due to weather or snow conditions. Because of the variability of those conditions, we also will attempt to survey each area within as short a time as possible. The sampling intensity and sample units to be surveyed are shown in Figures 2–6 and itemized in Table 1. We will begin surveys as early as late January 2004 whenever snow and light conditions become suitable. Survey teams of a pilot and an observer will include at least one OAS contract pilot skilled in wolverine track identification and a pilot from the KNWR. Observers will be staff biologists also skilled at wolverine track identification. We will follow the survey instructions detailed in Appendix A and use the data sheet shown in Appendix B. Results of the survey for each priority area will be calculated by ADF&G using the program SUPEPOP. Output will consist of the estimated number of individual wolverines and their density within the survey area. Precision of the estimates will be determined through 80% and 90% confidence intervals. All wolverine tracks found will be recorded electronically through digitizing for use in GIS applications.

To estimate potential denning habitat, we also will record the locations of all den or resting sites (holes) actively used by wolverines that we observe in the selected sample units and along wolverine trails. We will not be able to determine during the surveys if these sites are natal dens or simply resting sites or if they are short- or long-term sites, but documentation of them should provide an indication of their extent and relative abundance. We will use these results to determine the feasibility of estimating den-site density and distribution across large areas.

Following the completion of density estimates in each area, we will prepare a manuscript for publication of the results in a scientific journal such as the Journal of Wildlife Management.

Estimated Costs:

The estimate for the cost of conducting this SUPE on the Kenai Peninsula is:

Fixed wing charter —

3 planes for 5 days @ 7 hours/day @ \$160/hour = \$16,800

18 hours ferry time @ \$160/hour = \$2,880

Travel (per diem and hotel) f or pilots —

2 pilots for 5 days @ \$150/day = \$1,500

Total = \$21,180

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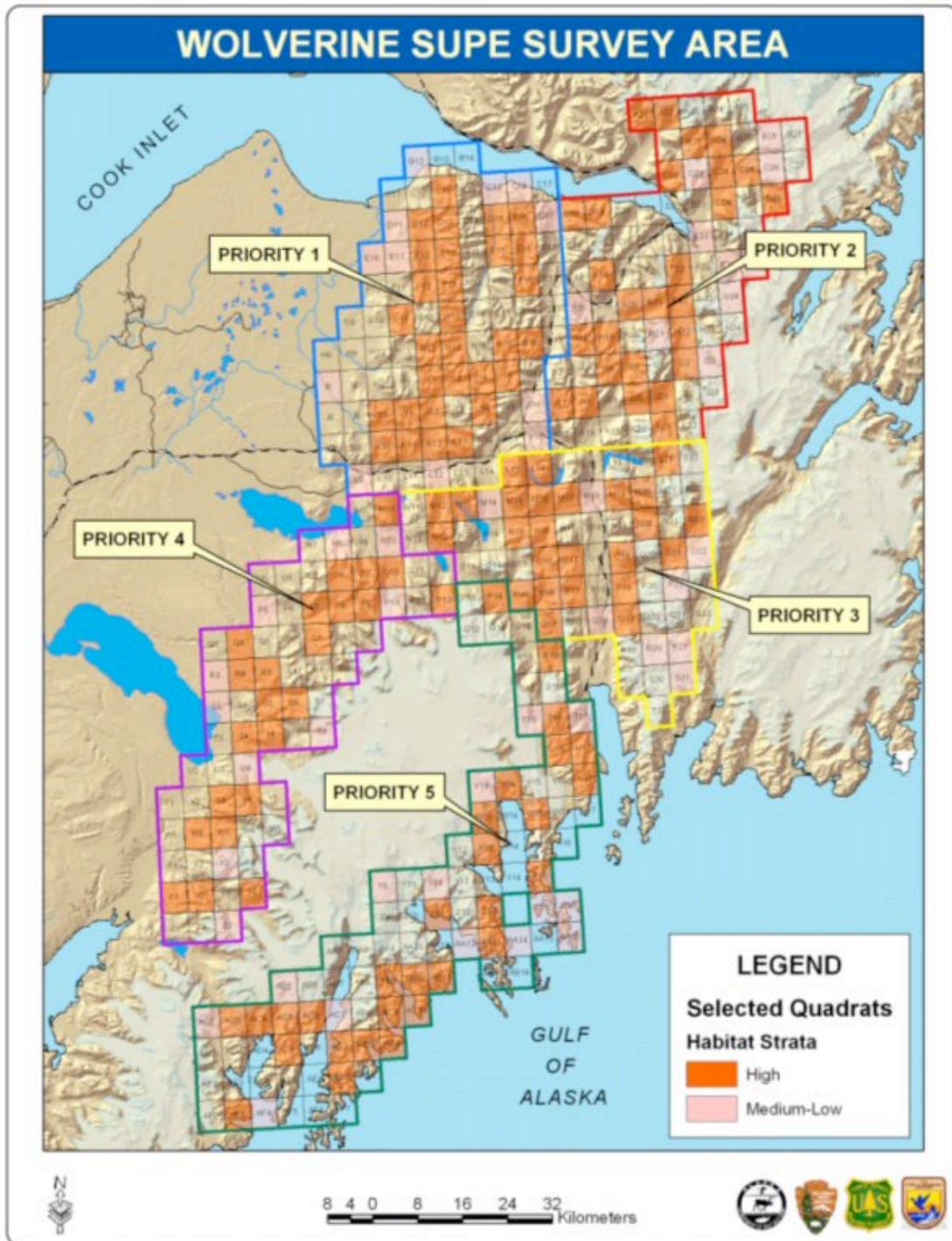


Figure 1. Sample unit quadrats for the wolverine SUPE survey area in the upper Turnagain Arm and Kenai Mountains, indicating priority survey areas.

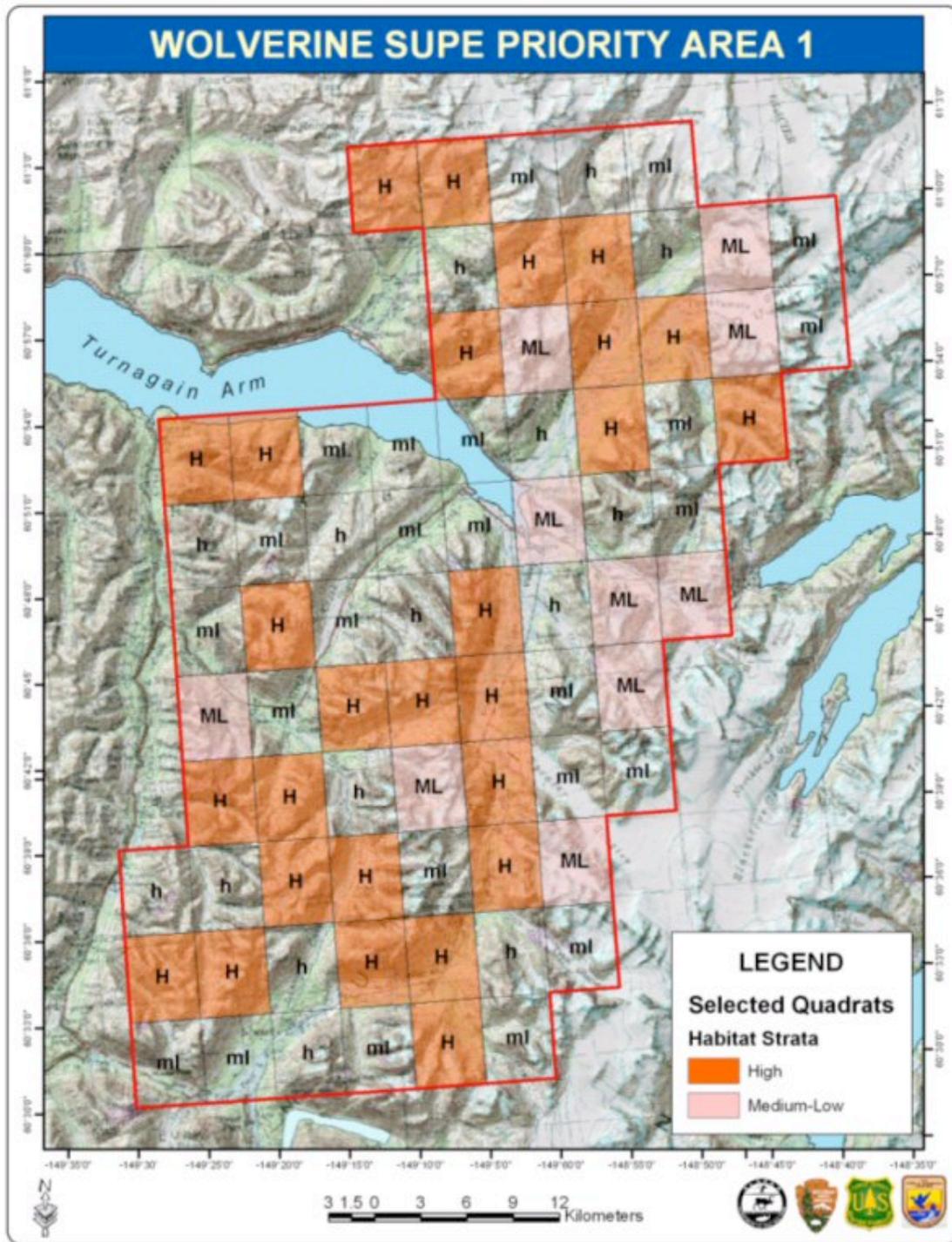


Figure 2. Sampling effort for the wolverine SUPE survey in the upper Turnagain Arm and northeast Kenai Mountains (Priority Area #1). Orange sample units (SUs) designated by H are in the high strata and pink SUs designated by ML are in the medium-low strata. SUs designated by h or ml were not selected for survey.

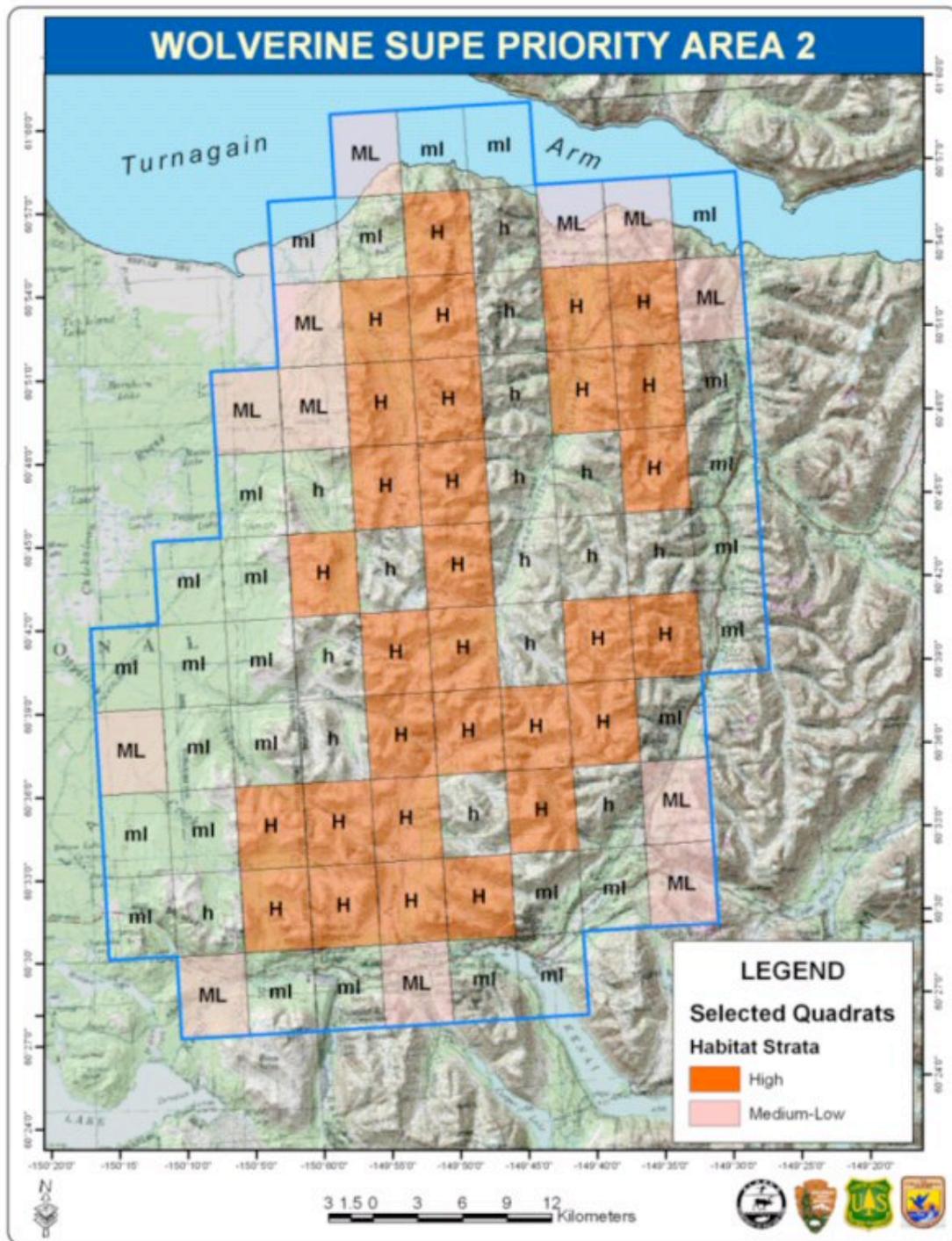


Figure 3. Sampling effort for the wolverine SUPE survey in the northwest Kenai Mountains (Priority Area #2). Orange sample units (SUs) designated by H are in the high strata and pink SUs designated by ML are in the medium-low strata. SUs designated by h or ml were not selected for survey.

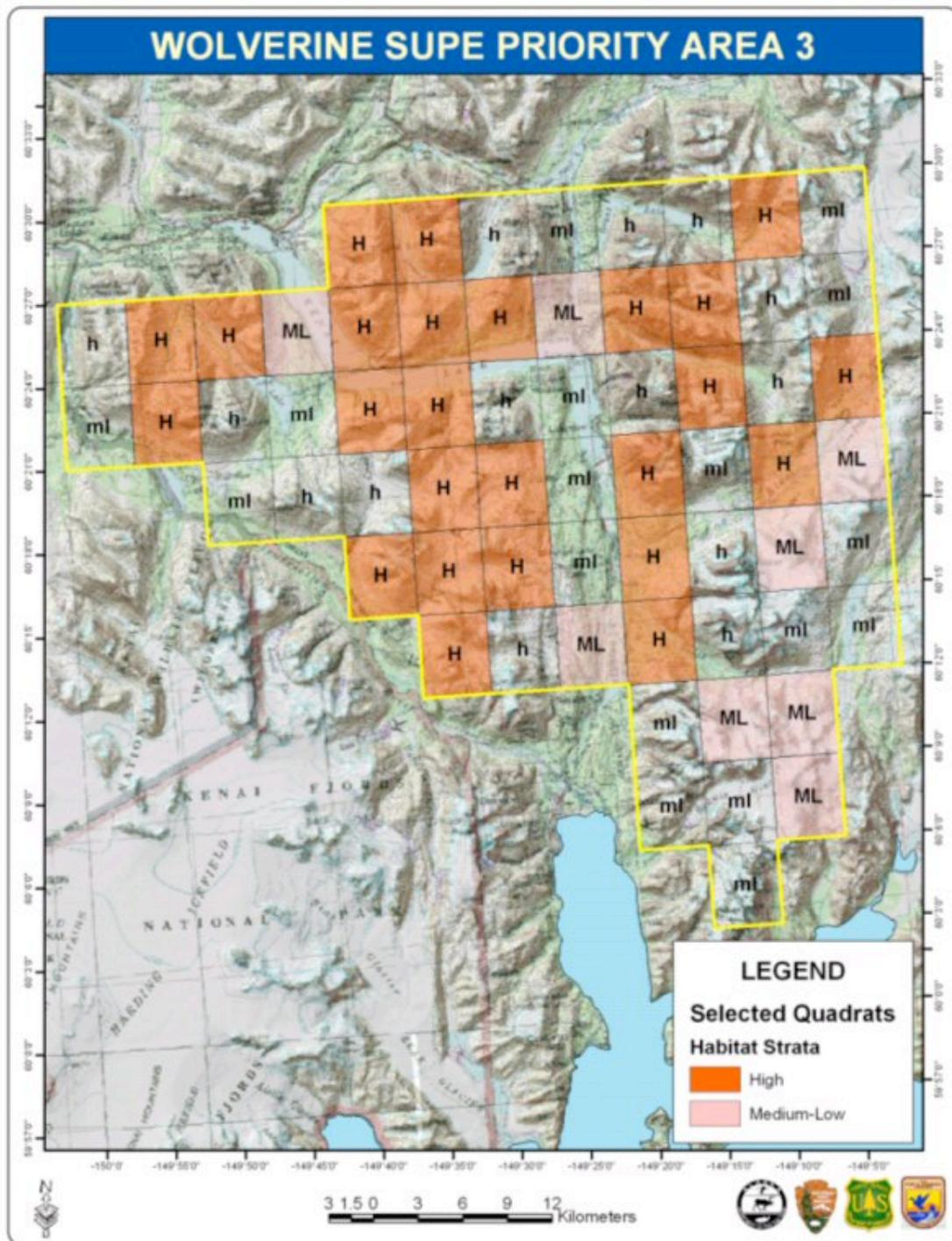


Figure 4. Sampling effort for the wolverine SUPE survey in the central Kenai Mountains (Priority Area #3). Orange sample units (SUs) designated by H are in the high strata and pink SUs designated by ML are in the medium-low strata. SUs designated by h or ml were not selected for survey.

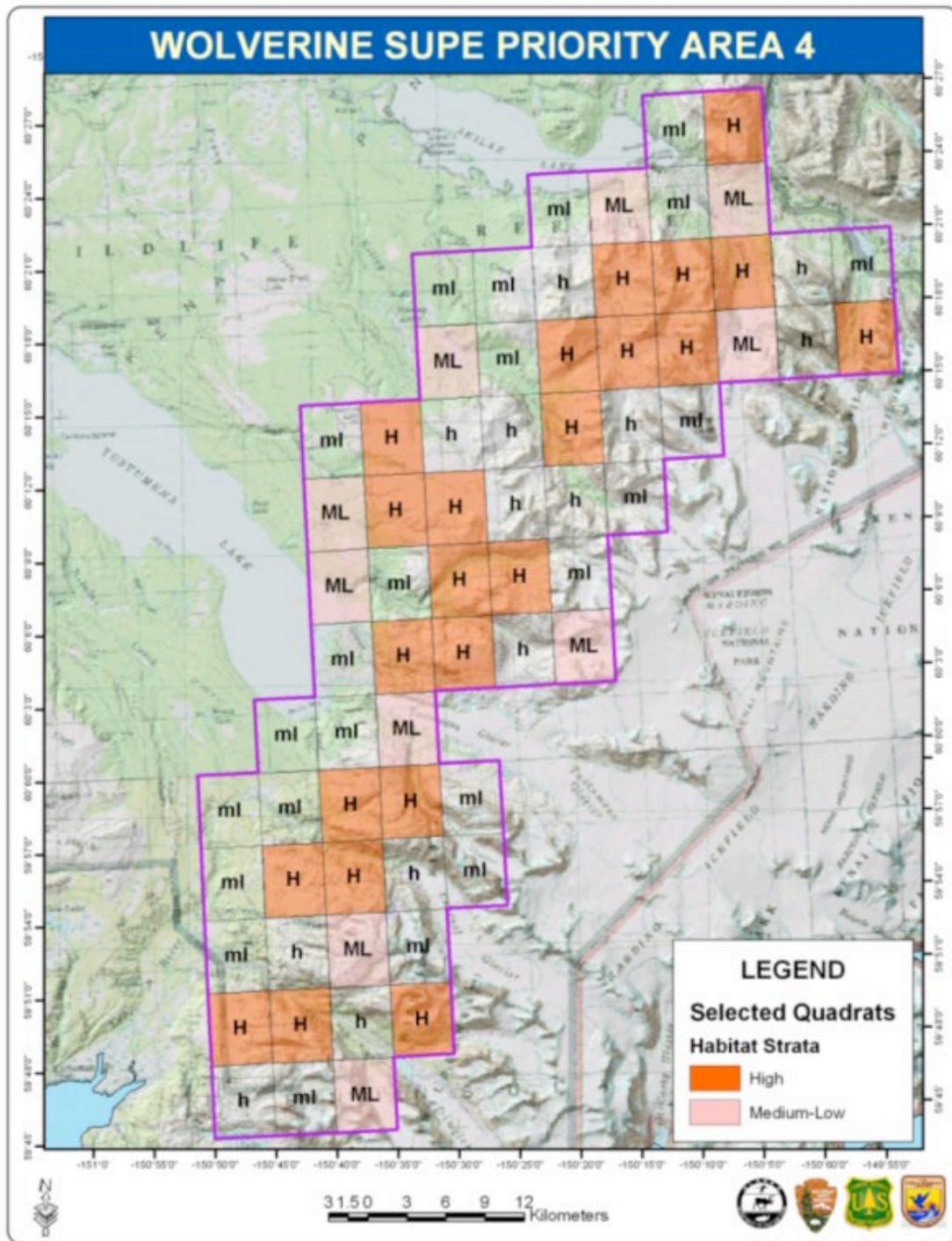


Figure 5. Sampling effort for the wolverine SUPE survey in the southwest Kenai Mountains (Priority Area #4). Orange sample units (SUs) designated by H are in the high strata and pink SUs designated by ML are in the medium-low strata. SUs designated by h or ml were not selected for survey.

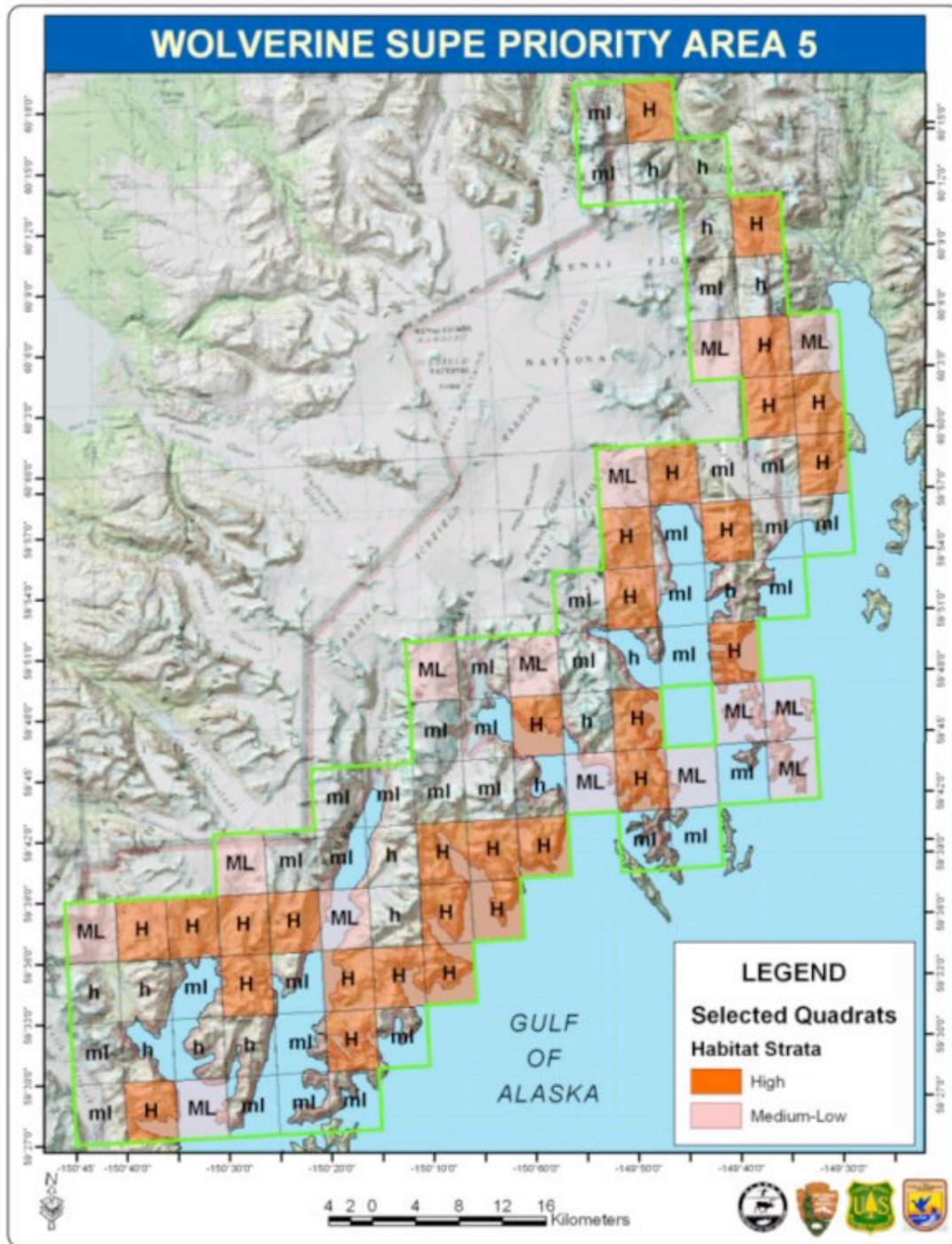


Figure 6. Sampling effort for the wolverine SUPE survey in Kenai Fjords (Priority Area #5). Orange sample units (SUs) designated by H are in the high strata and pink SUs designated by ML are in the medium-low strata. SUs designated by h or ml were not selected for survey.

Table 1. Sample units selected for survey in high and medium-low strata among 5 priority areas on the Kenai Peninsula using the sample-unit probability estimator (SUPE) to determine wolverine density in 2004. Sample unit (SU) size was based on a 3-x 5-minute latitude-longitude grid where

each sample unit was ~25 km². Sampling intensity of SUs was 65% in the high stratum and 30% in the medium-low stratum.

Number	Priority Area 1: Upper Turnagain Arm & NE Kenai Mountains ^a		Priority Area 2: NW Kenai Mountains ^b		Priority Area 3: Central Kenai Mountains ^c		Priority Area 4: SW Kenai Mountains ^d		Priority Area 5: Kenai Fjords ^e	
	High	Medium-Low	High	Medium-Low	High	Medium-Low	High	Medium-Low	High	Medium-Low
	1	A21	B26	C13	B12	L15	M14	M10	N8	P14
2	A22	C23	D12	C15	L16	M18	O8	N10	R16	T17
3	B23	C26	D13	C16	L21	O22	O9	P5	T16	V13
4	B24	E23	D15	D11	M12	P21	O10	P10	U16	Y11
5	C22	F24	D16	D17	M13	Q18	P7	R3	U17	Y9
6	C24	F25	E12	E10	M15	R20	P8	S3	V14	Z15
7	C25	G18	E13	E11	M16	R21	P9	T7	V17	Z16
8	D18	G24	E15	I8	M17	S21	P12	U4	W13	AA12
9	D19	H21	E16	J16	M19		Q4	X3	W15	AA14
10	D24	I23	F12	K16	M20		Q7	Z3	X13	AA16
11	D26		F13	L9	N12		R4		Y15	AB5
12	F19		F16	L12	N15		R5		Z11	AC2
13	F22		G11		N16		S5		Z13	AC7
14	G20		G13		N20		S6		AA13	AF4
15	G21		H12		N22		T4		AB10	
16	G22		H13		O16		T5		AB11	
17	H18		H15		O17		V3		AB9	
18	H19		H16		O19		V4		AC10	
19	H22		I12		O21		W2		AC3	
20	I19		I13		P15		W3		AC4	
21	I20		I14		P16		Y1		AC5	
22	I22		I15		P17		Y2		AC6	
23	J17		J10		P19		Y4		AC9	
24	J18		J11		Q16				AD5	
25	J20		J12		Q19				AD7	
26	J21		J14						AD8	
27	K21		K10						AD9	
28			K11						AE7	
29			K12						AF3	
30			K13							

^a Upper Turnagain Arm and NE Kenai Mountains: Total SUs = 76; high = 42; medium-low = 34.

^b NW Kenai Mountains: Total SUs = 85; high = 46; medium-low = 39.

^c Central Kenai Mountains: Total SUs = 64; high = 39; medium-low = 25.

^d SW Kenai Mountains: Total SUs = 69; high = 36; medium-low = 33.

^e Kenai Fjords: Total SUs = 92; high = 44; medium-low = 48.

Appendix A.

WOLVERINE SUPE INSTRUCTIONS

OBJECTIVE - For every selected sample unit (5 km x 5 km squares) we must determine if a wolverine made FRESH TRACKS in the sample unit (SU). Once FRESH TRACKS are found in a selected SU, they are followed (forward and backwards) to determine which other sample units they entered, and the number of wolverines. In order to obtain a good population estimate, it must be assumed that: no FRESH TRACKS in a selected SU are completely missed, all SUs containing FRESH TRACKS enumerate the number of wolverines.

FRESH TRACKS - Tracks made since the last snow fall and new enough to track (usually less than 2 days old).

OLD TRACKS - Tracks that are not 'FRESH TRACKS'.

SURVEY PROCEDURE

1. Spend 12-13 minutes per selected SU, use more time if necessary to meet the above objective.
2. In selected SUs, spend more time surveying travel routes, such as rivers, streams, ridges, etc., compared with other areas.
3. If practical, survey the travel routes first.
4. Once a FRESH wolverine track is observed in the selected SU, back-track it to the location where the track would be considered too old to follow if first observed at that point, and forward-track it to the location of the wolverine. Record the track location on the map, and note the time the track was found, and the SUs containing the track on the survey form. Also record the track with a gps using the unit's tracking mode set to update the signal every second.
5. SAFETY — Broadcast your flight path to other pilots while following tracks.
6. For all wolverine observations, note the location (SU), direction of travel, number of wolverines, and time the animal was observed on the survey form. Mark the location of the wolverine on the map.
7. When backtracking, if localized environmental conditions have caused the track to be classified as OLD, quickly search for undetected FRESH track segments (tracks greater than 1/2 mile) to ensure that there are no unrecorded SUs with FRESH segments from this animal. Use dotted lines to connect the FRESH segments on the map, and only record SUs on the survey form for FRESH track locations.
8. Once tracking has been completed, quickly survey the remainder of the unit to determine if additional wolverines were in the selected SUs. If any are found, treat as above (#4, #5 & #6), and note that the tracks did NOT connect. Animals that do connect will be treated as 1 animal for survey purposes, unless they can be separated temporally.
9. If the tracks go outside the study area, then follow to determine if more than half of the tracks are outside of the study area; if so stop tracking the animal and record it as 'out'.
10. If daily replicate surveys of the same SUs are being conducted, take care to record only tracks that are new since the previous day's survey.

Appendix B.

WOLVERINE CENSUS FORM

Sheet ____ of ____

Date _____ GMU _____ Aircraft Hours _____
 Pilot _____ Observer _____

Snow Age	Snow Cover	Light Type	Light Intensity	Predominant Habitat in SU	Survey Rating
1. 1-2 days	1. Complete	1. Bright	1. High	1. OPEN lower elev shrubs/wetland	A. Excellent
2. 3-4 days	2. Some low	2. Flat	2. Medium	2. DECIDUOUS FOREST birch, aspen	B. Good
3. 5-6 days	veg showing		3. Low	3. MIXED FOREST	C. Fair
4. 7+ days	3. Bare ground showing			4. OPEN CONIFEROUS FOREST	D. Poor
				5. DENSE CONIFEROUS FOREST	
				6. SUB-ALPINE SHRUB	
				7. BURN	

SAMPLING ORDER	1	2	3	4	5	6	7	8	9	10
SU ID										
SNOW AGE										
SNOW COVER										
LIGHT TYPE										
LIGHT DENSITY										
HABITAT TYPE										
SURVEY RATINGS										
START TIME										
STOP TIME										
COMMENTS										

OBSERVATION INFORMATION

Ref. No.	SU track 1st spotted	Time 1st spotted	SUs containing tracks	SU w/ wolverines	Time tracking ended	In/ Out	Comments
1							
2							
3							
4							

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