Analysis of Road Density and Grizzly Bears

in the Ninemile Demographic Connectivity Area Montana

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Female grizzly bear with cubs. Photo: Interagency Grizzly Bear Committee

Cover photo: Ninemile DCA, Mike Bader.

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Introduction

The grizzly bear (*Ursus arctos*) is a federally listed species under the Endangered Species Act. The Conservation Strategy (CS) for Grizzly Bears in the Northern Continental Divide Ecosystem (NCDE; USFWS 2018) established the Ninemile Demographic Connectivity Area (DCA) as part of Zone 1, which is within the Demographic Monitoring Area (DMA). The DMA is the Primary Conservation Area (Recovery Zone) plus Zone 1. The DCA is occupied grizzly bear habitat (USFWS 2018).

The purpose of the DCA is to provide for continual occupancy by female/cub groups to facilitate movement and connectivity between the NCDE, Cabinet-Yaak and Bitterroot Ecosystem Recovery Areas as part of a meta-population recovery strategy. Linkage is a key recovery goal in the Grizzly Bear Recovery Plan (USFWS 1993). The Plan at pages 24-26 recommends that, until the Service analyzes linkages, *"land management agencies take precautions not to degrade the potential linkage areas."*

The CS and Forest Plan Amendments for Grizzly Bear Habitat Management (USFS 2017) set standards for the Primary Conservation Area and Zone 1 habitats including standards for open and total road density and secure core based upon the Forest Service interpretation of Boulanger and Stenhouse (2014). These documents replaced the Amendment 19 strategy developed by the Flathead National Forest (1995). The management standard for Zone 1 is "continual occupancy." The survival rate for females/cubs must be at least 90%. The survival rate for independent males must be at least 85%.

The CS at page 67 states:

> *This Conservation Strategy incorporates some modifications to the previous definitions and changed the term "core habitat area" to "secure core" to avoid confusion. Secure core is different by no longer deducting a buffered area around high-intensity-use non-motorized trails. In addition, Plum Creek Timber Company (now Weyerhaeuser Company) lands and routes are now considered private. Using a computerized GIS analysis process, Federal, State, Tribal, and private roads are considered by buffering them 0.31 miles (500 meters) when identifying secure core, but only Federal lands are included when calculating the percent secure core in the BMU subunit. Additionally, private roads are not included in calculation of OMRD and TMRD. Appendix 4 documents the baseline values using the Conservation Strategy's definitions for the percent secure core, OMRD greater than 1 mi/mi^2 and TMRD greater than 2 mi/mi^2 in each BMU subunit.*

Standards for Flathead Indian Reservation lands are described on page 72:

> *…habitat management is directed by the Forest Management Plan, as authorized by the Tribal Council and the BIA. On these lands, the following motorized access management direction applies: Open road densities shall not exceed 4 mi/mi^2; Total road miles shall remain at or below what existed in 1999; Total road densities will be reduced by removing 15% of road spurs in currently roaded areas over the life of the plan (2000–2030); Designated roads in timber sale areas will be closed after the harvest is complete.*

Proctor, et al. (2019) provide a comprehensive review of road impacts on grizzly bears and summarize their findings and recommendations:

Our review of the scientific literature suggests that industrial road management would be a useful tool if (a) roads exist in high-quality grizzly bear habitats with population-energy-rich food resources; (b) open road densities exceed 0.6 km/km^2; (c) less than at least 60% of the unit's area is >500 m from an open road in patch sizes of 10 km^2. Motorized access management would be most beneficial in threatened populations, in areas where roads occur in the highest quality habitats, within and adjacent to identified linkage areas between population units, and in areas that are expected to exceed motorized route thresholds as a result of resource extraction activities. Evidence suggests benefits of motorized access management are more likely to be realized if habitat quality is integrated and is best if managed at scales that optimize the benefit of distribution, survival, reproduction, and density of female grizzly bears.

Soldier-Butler Project

The Lolo National Forest (2020) approved the Soldier-Butler Project in the center of the Ninemile DCA. This project includes construction of permanent and temporary roads and reconstruction of others. The Soldier-Butler Environmental Assessment (2019) analyzed potential effects on grizzly bears that included an analysis of road density increases and secure core decreases over the span of the project.

Photo: U.S. Forest Service

Methods

Study Area

The study area consists of the Ninemile DCA located on the Lolo National Forest and Flathead Indian Reservation and the Soldier-Butler Project Area on the Ninemile District of the Lolo National Forest. There are also private lands within the DCA. The DCA is bounded by highways US 93, MT 200 and 26 and Interstate 90. Elevations range from 750m (2461') along the Clark Fork River to 2437m (7,996') along the Reservation Divide. It is within the Maritime Climate Zone west of the Continental Divide with productive habitats. Key features include the Reservation and Ninemile Divides, the Ninemile Creek watershed and the Clark Fork River.

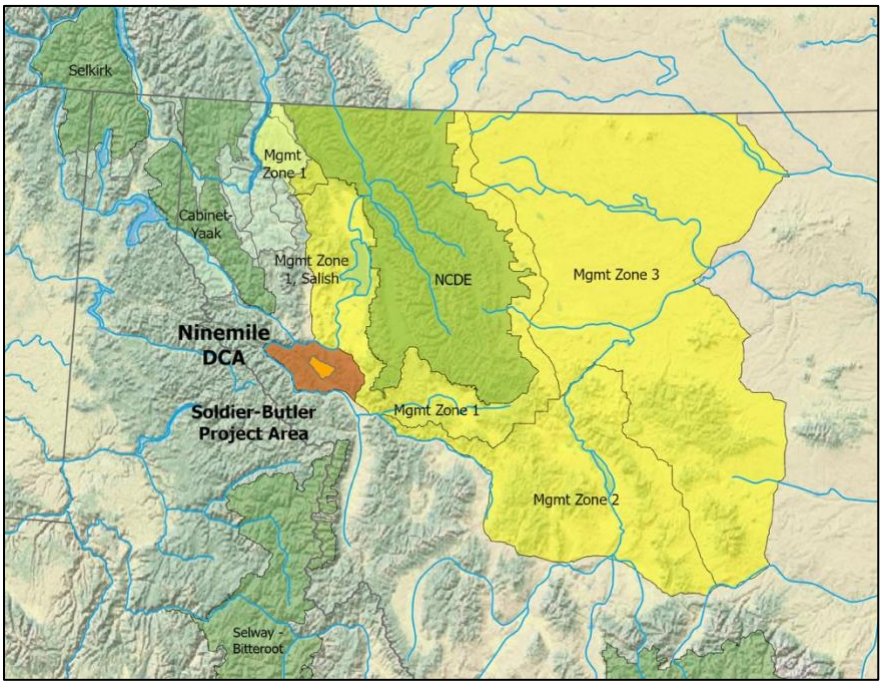

Figure 1. The Nine Mile Demographic Connectivity Area, Soldier-Butler Project Area and Grizzly Bear Recovery Areas.

Roads Data, Parameters and Model

GIS roads data came from Region 1, US Forest Service and the Confederated Salish and Kootenai Tribes. We used the parameters from the CS, Proctor, et al. (2019) and Boulanger and Stenhouse (2014) as measurements of the current situation. These include open road density ≤ 0.6mkm/km^2 (1mi/mi^2); open road density ≤ 1.2 km/km^2 (2mi/mi^2); secure core areas ≥ 10km^2 (2500 acres) comprising at least 60% of a unit's area. Analysis software used was ArcMap 10.1 (ESRI 2020). TMRD, OMRD and Core habitat were calculated using the procedures in the Conservation Strategy (USFWS 2018, Appendix 6:267) and we included roads on private and tribal lands. Road feature classes for private lands, the Flathead Reservation and Forest Service lands were merged after being edited and viewed in Google Earth to reflect TMRD, OMRD and

Core road classifications. A 30m raster of a digital elevation model provided the extent, snap raster and cell size for the focalsum tool (moving window). For TMRD and OMRD, the road feature classes, converted to a 30m raster, provided the raster for the focalsum tool. For Core habitat, a 500m buffer of the road feature class was used. Modelbuilder provided process automation and documentation of analysis steps for TMRD and OMRD as shown in Figure 2.

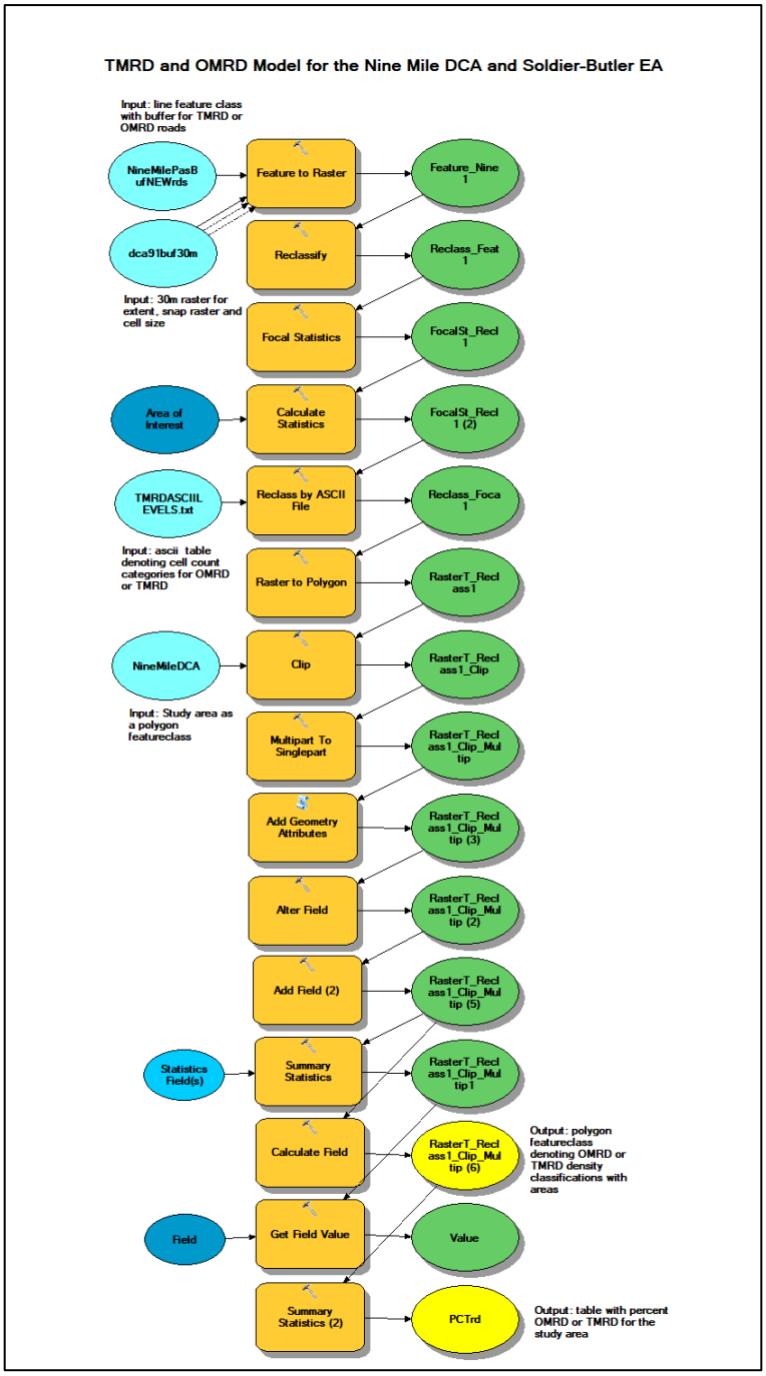

Figure 2. Model builder for TMRD and OMRD.

Results

Table 1. Numerical results for the DCA and Project Area.

Summary	Ninemile DCA	Soldier-Butler Project Area
Area, Acres	517,248	45,158.4
Area, km^2 (mi^2)	2093 (808.2)	182 (70.6)
Total Road km (Core + TMRD)(miles)	5443.8 (3382.6)	486.3 (302.2)
Total Road Density with Motorized Trails km/km^2 (mi/mi^2)	2.6 (4.2)	2.7 (4.3)
Open Roads km (miles)	5126.4 (3185.4)	251.5 (156.3)
Open Road Density including Motorized Trails km/km^2 (mi/mi^2)	2.4 (3.9)	1.4 (2.2)
Motorized Trails km (miles)	66 (41)	0 (0)
TMRD ≤ 1.2 km/km^2 (2 mi/mi^2)	21.9%	32.3%
TMRD ≥ 1.2 km/km^2 (2 mi/mi^2)	78.1%	67.7%
OMRD ≤ 0.6km/km^2 (1mi/mi^2)	15.4%	36.1%
OMRD ≥ 0.6km/km^2 (1mi/mi^2)	84.6%	63.8%
Secure Core ≥ 10km^2 (2500ac)	12.8%	30.5%
Secure Core all sizes	19.1%	31.4%
Not Core	80.1%	68.6%

Female/Cub Survival and Secure Core

The current OMRD in the Project Area is 1.4km/km^2 (2.2mi/mi^2) and at this level mean female/cubs survival is approximately 70%, well below the standard of 90%. At the DCA open road density of 2.4km/km^2 (3.9 mi/mi^2) the female/cubs survival rate drops well below 50%. OMRD ≥ 0.6km/km^2 (1mi/mi^2) in the DCA and Project Area are 3-4 times the level prescribed in Amendment 19. Secure core areas ≥ 10km^2 (2500 acres) in the Project Area are just half the 60% recommended by Proctor, et al. (2019) and only then by the Forest Service adjusting the Project Area boundary to include the 101km^2 (25,000ac) Reservation Divide Inventoried Roadless Area. For the DCA, secure core is approximately 20% of the minimum. Core < 10km^2 (2500ac) consists of isolated fragments too small to function as secure core as shown in Figure 3.

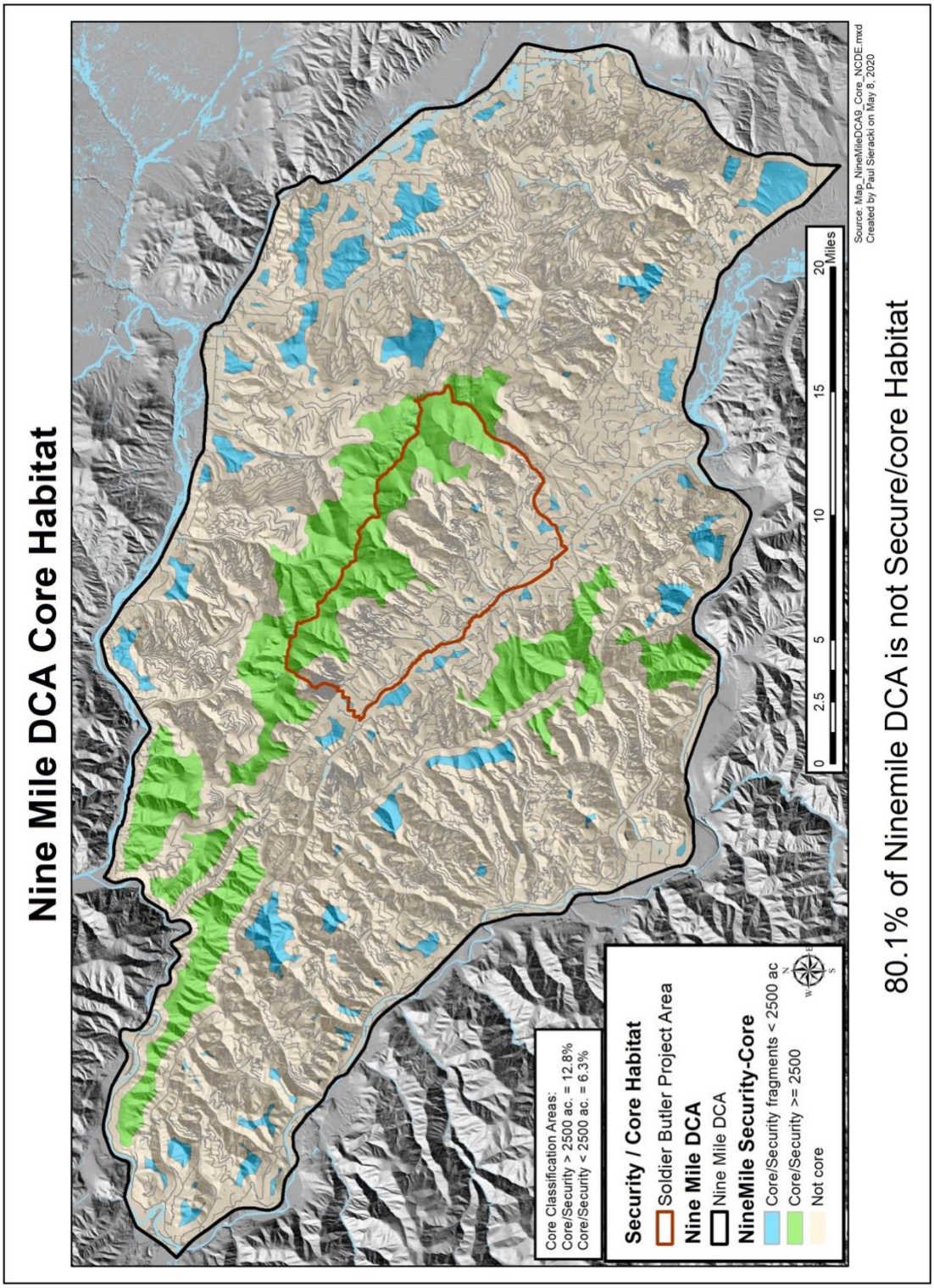

Figure 3. Core Areas >2500 acres and <2500 acres, Ninemile DCA.

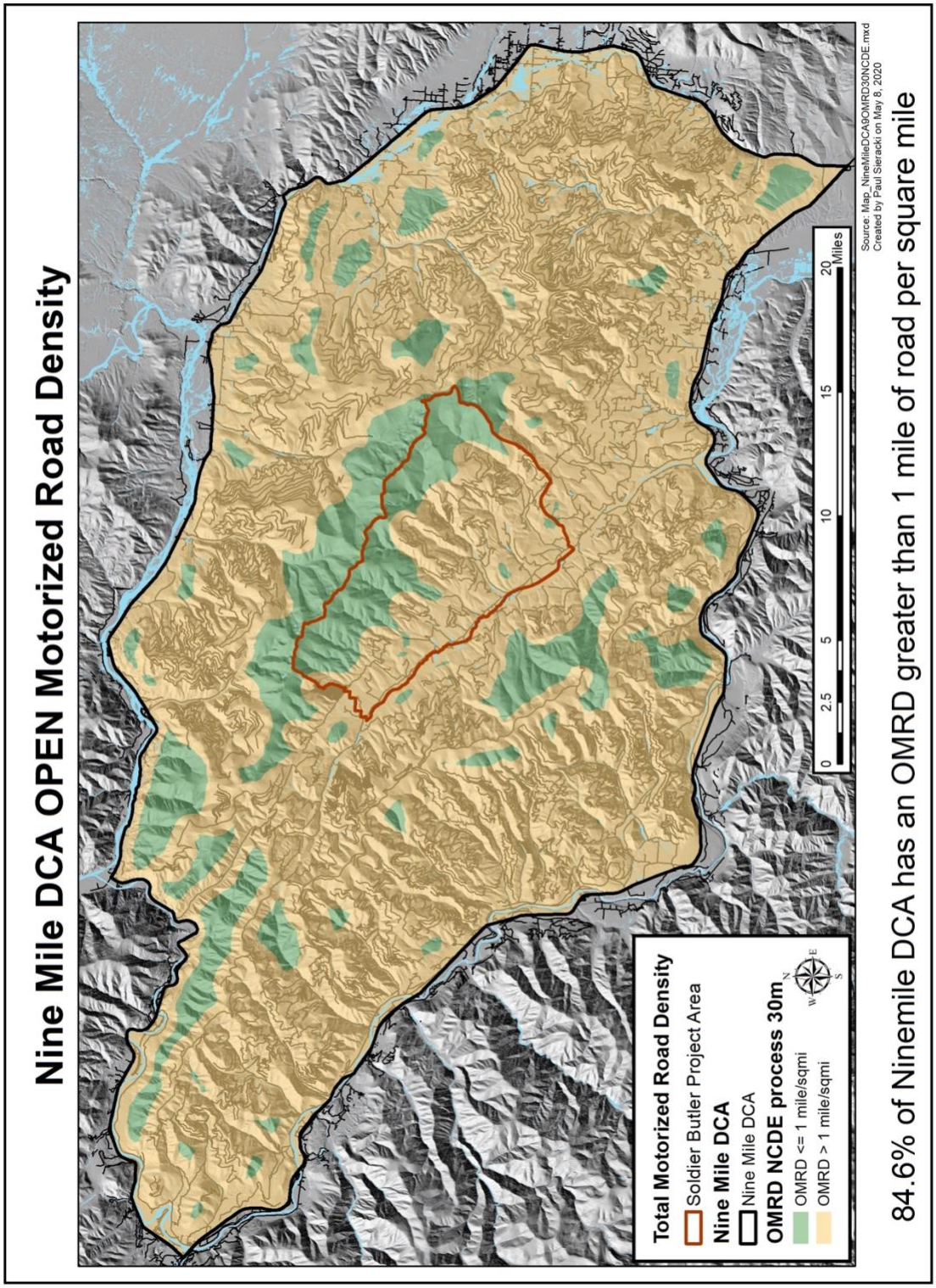

Figure 4. Open road density, Ninemile DCA.

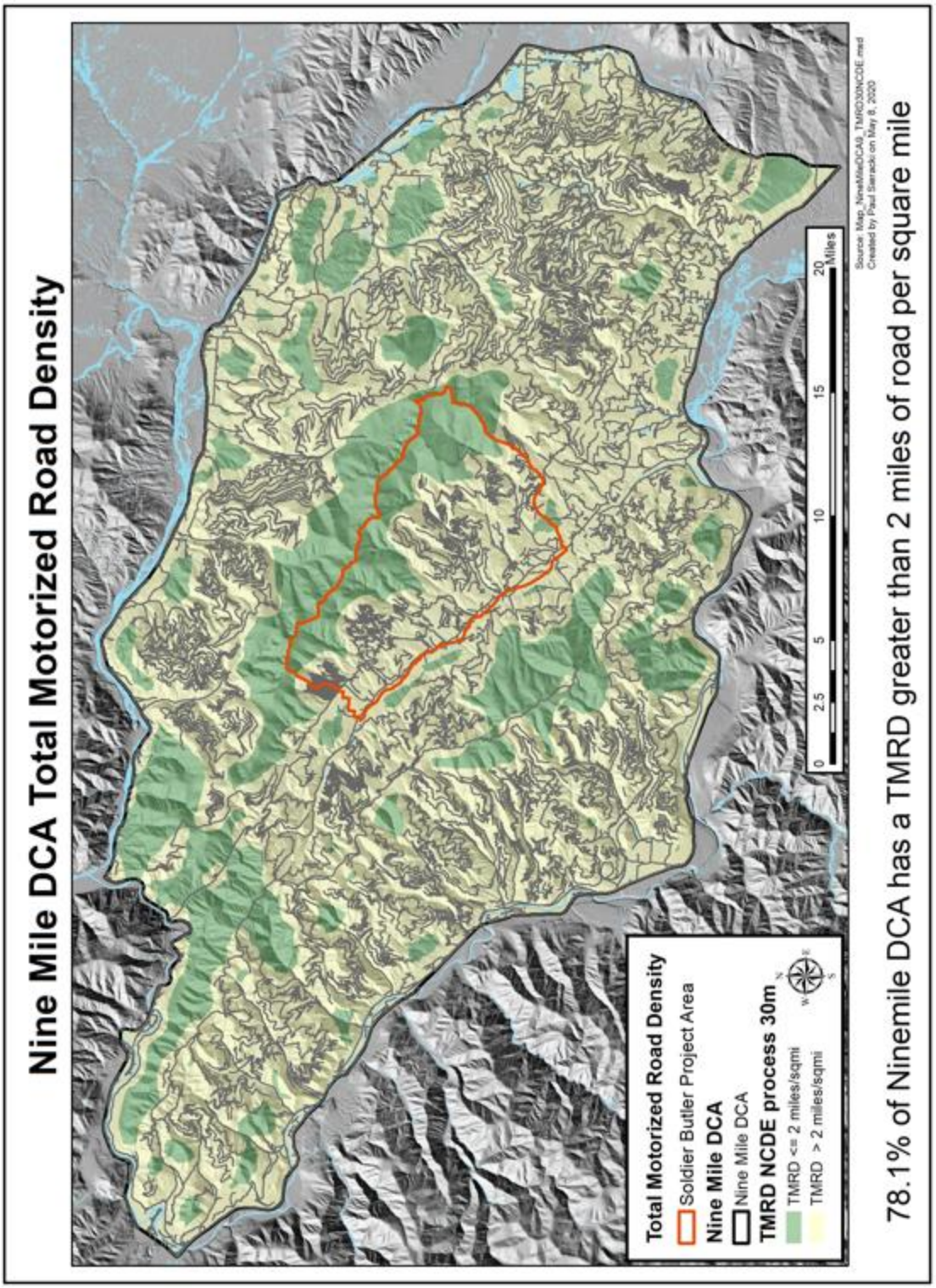

Figure 5. Total road density, Ninemile DCA.

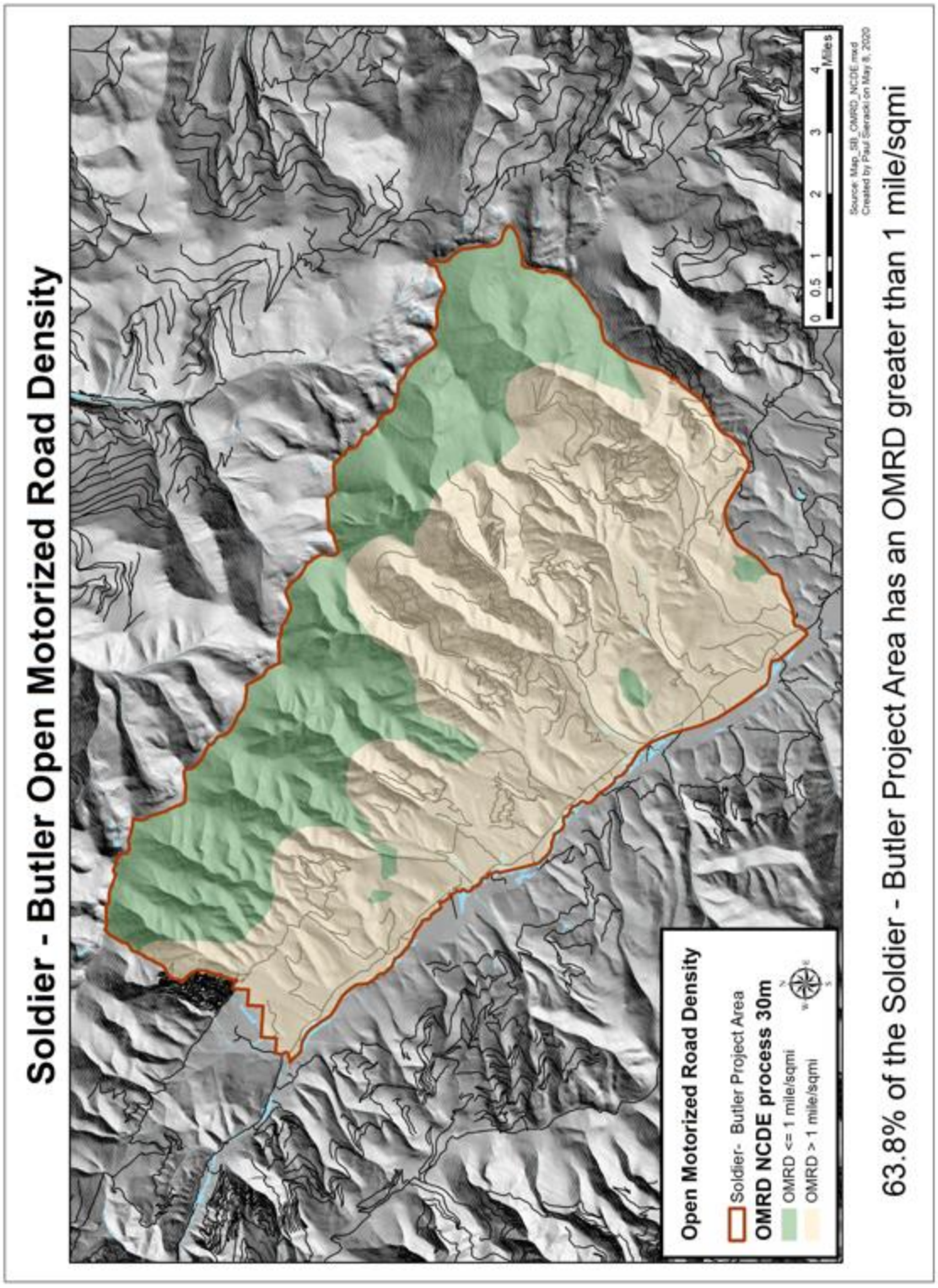

Figure 6. Open road density, Soldier-Butler Project Area

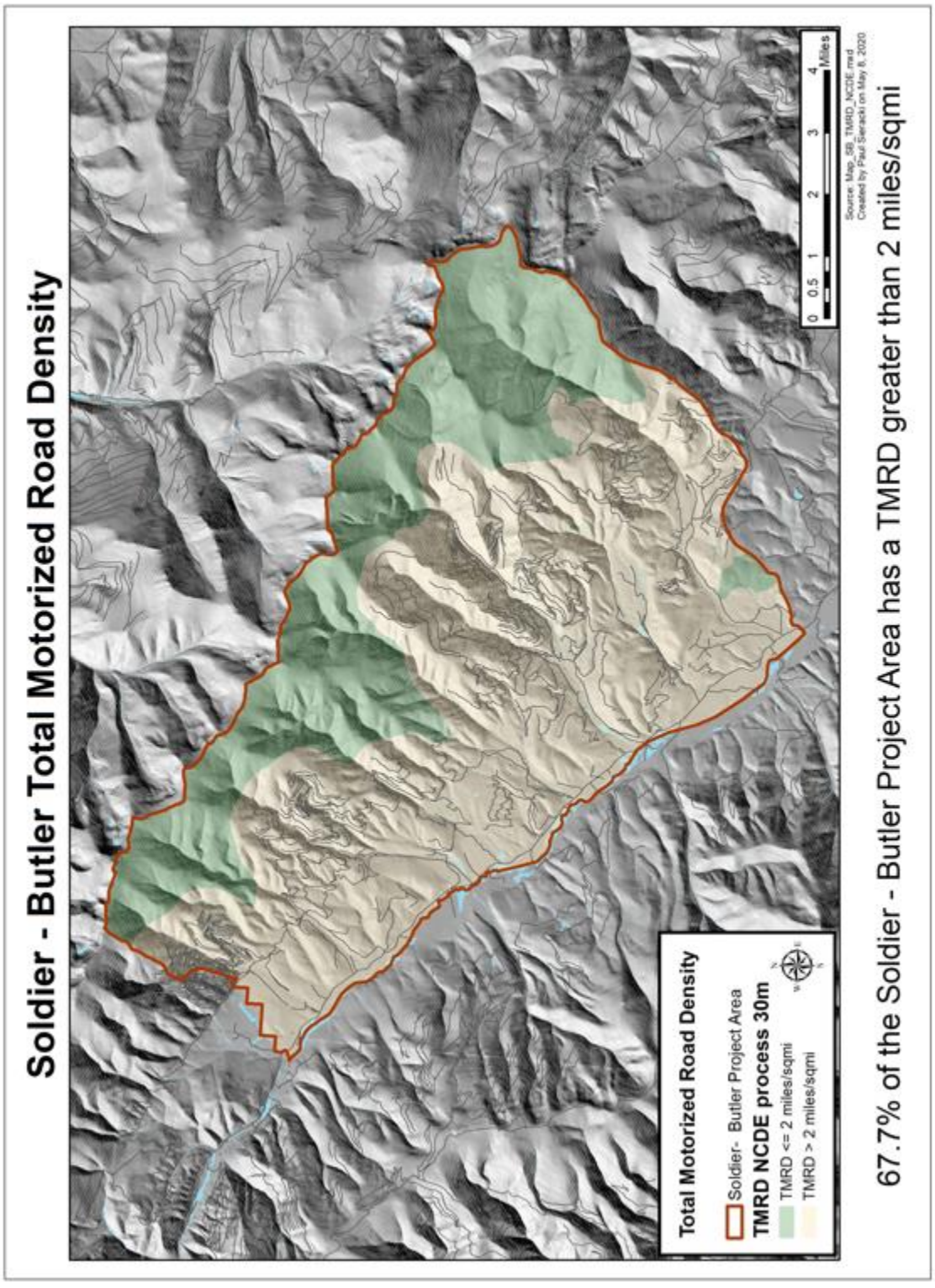

Figure 7. Total road density, Soldier-Butler Project Area.

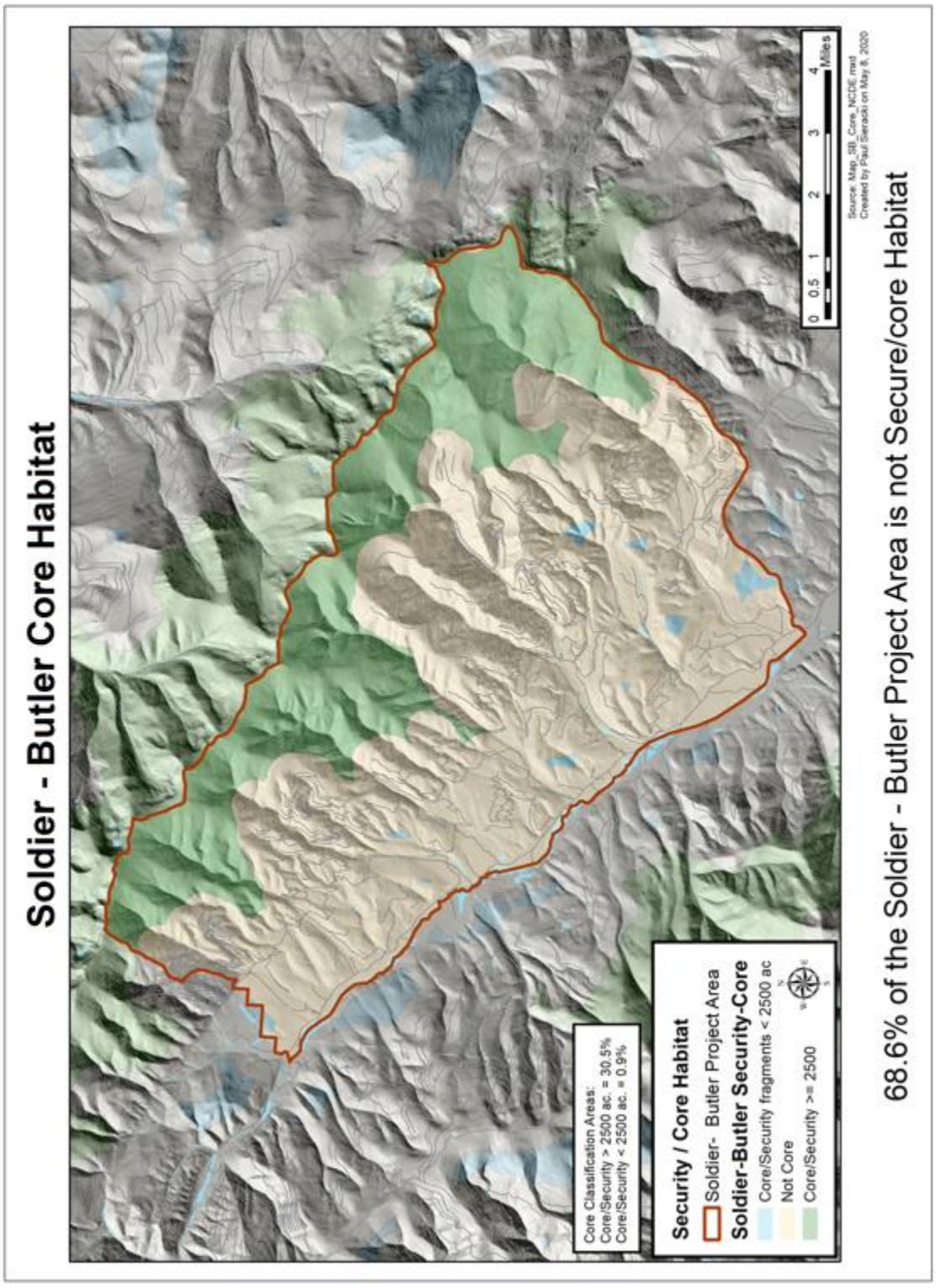

Figure 8. Core areas, Soldier-Butler Project Area.

Discussion

For more than thirty years scientists have established a relationship between open roads and grizzly bear mortality risk and displacement from productive habitats. Archibald, et al. (1987); Mattson, et al. (1987); McLellan and Shackleton (1988); Kasworm and Manley (1990); Mattson (1993); Craighead, et al. (1995); Mace, et al. (1996); Wakkinen and Kasworm (1997); Mace and Waller (1998); Metzgar (1998); Boulanger and Stenhouse (2014); McLellan (2015); Auditor General of British Columbia (2017); Proctor, et al. (2019). Grizzly bears use areas within 500m (1640') of roads less than expected and this zone of avoidance extends to > 2km (6562'). Over a thirty-year period McClellan (2015) found 84% of grizzly bear mortalities occurred < 120m (394') from a road.

These findings suggest that female/cubs survival is reduced below 100% at open road density ≥ 0.4 km/km^2 (0.64 mi/mi^2). At ≥ 0.6 km/km^2 (0.95 mi/mi^2) grizzly bears exist at lower density and face significant displacement effects. At ≥ 1.2 km/km^2 (1.95 mi/mi^2) female/cubs survival declines to < 90% as shown in Figure 9.

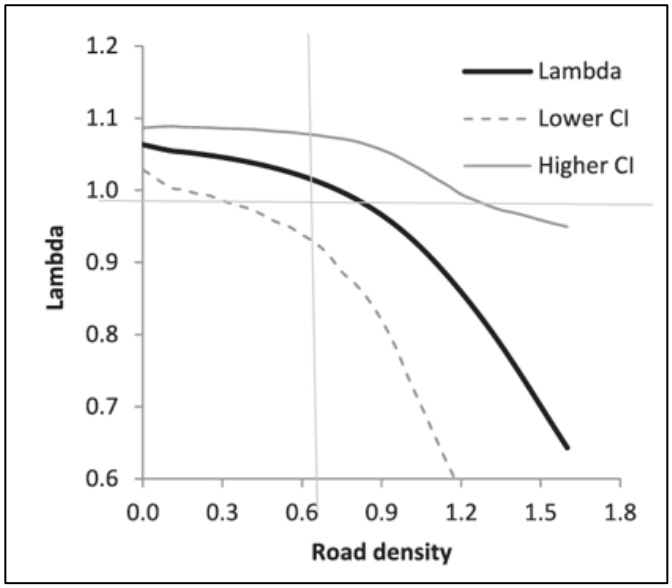

Figure 9. Road density and female/cubs survival. Source: Proctor, et al. (2019), adapted from Boulanger and Stenhouse (2014).

Both the DCA and the Project Area fall far short of the thresholds set by Proctor, et al. (2019) and even the less stringent standards in the CS and Forest Plan Amendments. The Amendment 19 strategy was replaced with these relaxed standards. For example, Amendment 19 stated no more than 19% of a unit could have open road density ≥ 0.6km/km^2 (1mi/mi^2) within 5 years or road density ≥ 1.2km/km^2 (2mi/mi^2) within ten years. This was accompanied by an ambitious schedule of road decommissioning and reclamation to bring bear management units up to standards, which also benefitted bull trout (*Salvelinus confluentus*) and elk (*Cervus canadensis*).

Omission of private roads and private lands from OMRD and TMRD calculations is arbitrary and not based on any scientific findings and artificially results in lower OMRD and TMRD and lower estimated impacts to grizzly bears. For example, the main Ninemile Road is a high-use road with numerous spurs that runs the length of the DCA. It is likely traffic on this road displaces grizzly bears from use of the Ninemile Creek riparian area but these impacts are not accounted for.

Moreover, the Soldier-Butler Project Files and minutes of the Interdisciplinary Team meetings show the Forest Service further manipulated their analysis by adding the Reservation Divide Inventoried Roadless Area to the Project Area, by again counting all roads on private lands as closed and by adding 35 miles of overgrown impassible roads to the Road System so they could then be "closed" to further bias the results. The net effect is that the Forest Service analysis has yielded inaccurate and overly optimistic results.

The Soldier-Butler EA also excluded Flathead Indian Reservation lands from its reported open road density for the DCA, incorrectly stating the DCA-wide OMRD is 2mi/mi^2. In reality, the DCA OMRD is 3.9mi/mi^2, approximately double what the EA says it is.

These are not trivial distinctions since the Project would result in site-specific open road densities as high as 4.8km/km^2 (7.7mi/mi^2) with grizzlies 100% displaced from much of the Project Area (Soldier-Butler EA 2019). The Effects Summary from the Biological Opinion (USFWS 2020:15) states:

> *The effects of access management under the existing baseline condition in the action area may be affecting grizzly bears. These effects may be insignificant in some situations or adverse in others. Adverse effects may significantly impact adult female grizzly bears' ability to find food resources, breed and raise young, and find adequate shelter at some time. The other effects related to access management, which includes using restricted/closed roads and temporary roads, may result in additional adverse effects to female grizzly bears that may be using the action area. These effects would be temporary as access conditions would return to pre-project conditions post-implementation. However, because adverse effects may already be occurring as a result of the existing baseline condition, allowing additional temporary impacts may result in additional adverse effects to grizzly bears that may be using the action area. In other words, some grizzly bears using the action area may already be experiencing displacement affects in some areas due to the under-use of suitable habitat as a result of the existing condition and may experience further avoidance as a result of the use of the temporary and/or closed roads. The short-term, temporary increases may result in additional under-use of suitable habitat by female grizzly bears, potentially disrupting normal breeding (or more specifically, cub rearing) or feeding patterns in the short-term.*

Moreover, failure to buffer high-use non-motorized trails overestimates secure core. Mountain biking presents unique challenges in grizzly bear habitat that include increased safety risks and displacement of bears from productive habitats (Servheen, et al. 2017; Servheen, public comments 2019). We do not know what the current and projected levels of mountain biking are within the DCA but it merits investigation as part of roads and trails management in

occupied grizzly bear habitat. Recreational use by horseback riders and foot hikers also displace grizzly bears from productive habitats (Gunther 1990).

The CS standard for secure core is insufficient. Mattson (1993), Mattson, et al. (1996) suggest minimum core size for females/cubs in the roaded matrix is 28.3km^2 (10.93mi^2), nearly three times the CS standard. Annual home range for females is 120km^2 (46 mi^2) Mace and Waller (1987), ten times minimum core and in the Cabinet-Yaak area, adult female life ranges average 637km^2 (246mi^2) Kasworm, et al. (2017). In demographic connectivity areas secure core areas must be located within known dispersal distances and should be permanent, unshifting core.

Conclusions and Recommendations

This analysis corrects deficiencies in the Forest Service methodology and provides a more realistic assessment of the current situation pre-project implementation. The current road density and secure core situation is significantly less favorable than what is portrayed in the Soldier-Butler EA. The best available scientific information is that grizzly bears in the Project Area and the DCA are currently being displaced from prime habitats and subjected to elevated risk of mortality (USFWS Biological Opinion 2020). Adding the projected effects as described in the EA, the DCA may be damaged to the point it cannot serve its purpose of continual occupancy by females with cubs.

We suggest that:

- The Forest Service return to the Amendment 19 strategy and implement more comprehensive and intensive road management throughout the Ninemile DCA including road decommissioning designed to bring the DCA within the parameters established by the best available scientific information.

- The linear road miles approach used by the Forest Service is a departure from the long-accepted standard of using the moving windows methodology.

- Secure core should be permanent, rather than shifting every ten years. The CS standard may result in female grizzly bears being displaced from their home ranges multiple times in their lifetimes. Sudden shifts from secure core to roadbuilding and industrial activity are disruptive and expose grizzly bears to constant displacement from productive habitats and crowd bears into smaller areas which increases competition for resources and reduces overall bear density.

- High intensity use non-motorized trails should be buffered by 500m for calculation of secure core area.

- Future assessments of open and total road density should include all roads whether public or private.

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