Peer Review of the Motorized Access Management Strategies for Grizzly Bear Habitat in the Northern Continental Divide Ecosystem

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By

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INTRODUCTION

In October 1999, Dr. Christopher Servheen, Grizzly Bear Recovery Coordinator for the United States Fish and Wildlife Service (USFWS), asked The Wildlife Society, the Society for Conservation Biology, and the International Association for Bear Research and Management to work together and organize a peer review of motorized access management strategies on public lands in grizzly bear habitat, developed by USFWS for the Northern Continental Divide Ecosystem (NCDE). In response, each organization nominated the following individuals to participate in the workshop:

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We, the peer review group, was specifically asked to:

1. Study the two approaches to motorized access management in western Montana – the current approach hereafter referred to as A19 (Amendment 19) and the newly proposed approach.

2. Comment on the adequacy of the correct use of the available scientific information on the impacts of motorized access on grizzly bears used to develop these approaches.

3. Comment on the rationale and acceptability of the assumptions made to develop these access approaches given the available scientific information.

We were instructed, however, not to critique the adequacy or scientific basis for the existing information on grizzly bears nor were we to create a new design for motorized access management.

The NCDE Data Base Manager provided us with a set of documents. Broadly, these documents described the current A19 approach, the proposed approach, background South Fork grizzly bear studies, in-depth analysis of methods, and a set of maps delineating access under A19 and under the proposed guidelines. A full list of the documents is attached. In addition, we were given a copy of a report produced by Lee H. Metzgar (1998) for The Alliance for the Wild Rockies, that critiqued the rational and choices made during the development of the proposed access guidelines. We met for two days in Kalispell, Montana to review the material, discuss the proposals, and most importantly, meet with agency scientists who developed the access management approaches. We also were given the opportunity to talk to interested non-agency parties, including those publicly critical of the access guidelines. However, we have not exercised this option thus far and have only engaged agency staff made available to us during the workshop for substantial dialogue.

ASSUMPTIONS COMMON TO BOTH AMENDMENT 19 AND THE PROPOSED APPROACH.

Both A19 and the Proposed Approach are based mainly on research conducted by the South Fork Study Team (SFST) between 1987 and 1996, with additional information form the East Front Study Area (EFSA). Using primarily data from the South Fork of the Flathead (SFSA) involves some assumptions common to both A19 and the Proposed Approach and these include:

1. Do Bear Management Unit (BMU) sub-units represent grizzly bear biological units?

   We assume BMU sub-units were delineated to ensure guidelines were distributed more or less evenly across the landscape. The sub-units, however, were not explicitly based on grizzly bear ecology, and thus may or may not be suitable units for bear use. The assumption being made is that each unit contains all the necessary requisites to support at least one grizzly bear. It appears that it is assumed that bears will be free to move among sub-units and features lacking in one sub-unit are assumed to be available in adjacent BMUs.

2. Is the South Fork Study Area representative of the NCDE west of the Rocky Mountains and in the Proposed Approach, is the East Fork Study Area representative of the NCDE east of the Rocky Mountains?

   Comparisons of topographic (elevation, ruggedness), ecological (average temperature, forest cover, habitat type), or human created features and activities (road densities, human settlement densities, hunter-days) were not made even thought GIS basemaps of some of these factors are likely available. Thus, it is difficult to

determine if study areas are indeed representative. Features of the SFSA such as the Hungry Horse Reservoir and a lack of small tract public holdings and associated access routes suggest that there may be important differences. In addition, grizzly bear telemetry data are available in other parts of the NCDE (USA) such as in the North Fork of the Flathead and Blackfeet Reservation that could eventually be used to test the models.

3. Are data from the radio-tagged female bears in the South Fork study representative of all bears in the South Fork area?

   Because only a small sample of adult female bears was used to develop A19 and the Proposed Approach, the conclusions are unlikely representative of all bears. Although adult females are the most critical segment of the population for population growth, they can't meet conservation requirements alone. Subadult females are needed to replace adults and adult males are also needed. Recent publications suggest that the death of a resident adult male may have significant consequences to the population as young, immigrant males may have a higher propensity to kill cubs that cannot be their own (Wielgus and Bunnell 1994, 1995). Based on these proposed methods, it may be difficult to develop a rational strategy for the conservation of male bears.

4. Can bears used in the study form the basis of a conservation strategy?

   Both management strategies were developed primarily from data collected on adult female bears in the SFSA, and after, the EFSA. Although the females used were those that survived and reproduced successfully (as these were the only ones that provided enough telemetry data for the analyses), the best estimate of the population trend from all bears monitored in the SFSA was negative. If the "successful" females had home range and areas of use different from "unsuccessful" females, then the characteristics of the successful females' ranges may be considered sufficient as the basis for conservation planning. However, if the home ranges and habitat use patterns of successful and unsuccessful females were similar, but some were just luckier or more skilled at avoiding people within their range, then the "lucky to be successful" females may not be suitable as the basis for conservation planning. If the successful females lived in more secure areas than unsuccessful females, then it would be assumed they needed that level of security to be successful; perhaps they could have done fine with less security. Without comparing the range locations and habitat use of bears with varying levels of success (probability of being killed appears to be the currency of success) then this question remains unanswered. There were too few locations of females that were unsuccessful to make this analysis, however, the logic and potential errors of using only one study area to identify needed habitat features for conservation, should be thought through.

5. Are areas of >10.12 km^2 (2,500 acres) preferred by adult females?

This value appears to be a personal communication from Tim Manley well before the study was completed. There may not be any better scientific information on this topic as it does not appear to have been based on any analyses, however, a 3.9 square mile area may not be adequate for animals that move a great deal like grizzly bears.

6. Are the mean values of open and total road densities for female SFSA grizzly bears sufficient for conservation?

   The average proportion of each adult females home range that included < 1 km/km^2 of open roads and of total road densities of <2 km/km^2 were 11 and 14%, respectively. One bear, No. 94, lived in an area with high road density and her extreme values may have forced the mean value to higher levels than most bears. The median values of 10.145 and 13.875, however, were not very different.

THE CURRENT APPROACH: AMENDMENT 19

On 22 January 1986, the United States Forest Service adopted the Land and Resources Management Plan for the Flathead National Forest. The Forest Plan provided management direction for multiple uses of the Flathead National Forest. The Biological Opinion for the Flathead Forest Plan (15 May 1985 and amended 18 July 1989) concluded that implementation of the Plan was not likely to jeopardize the continued existence of threatened and endangered species. No incidental take was authorized. Eighteen previous amendments have been proposed to the Forest Plan dealing with a variety of resource management issues. Amendment 19 (approved 31 July 1989) added the Interagency Grizzly Bear Guideline (IGBG) to the Forest Plan. The Forest Service consulted with the USFWS on this and other amendments to the Forest Plan. The USFWS consistently found that the Forest Plan and proposed amendments did not jeopardize the continued existence of threatened and endangered species.

On 22 February 1989, conservation groups filed a lawsuit challenging the Flathead Forest Plan and accompanying Environmental Impact Statement (EIS). Although the U.S. District Court ruled in favor of the Forest Service, plaintiffs appealed to the Ninth Circuit Court of Appeals. On 3 November 1993, the Circuit Court issued an opinion and an order amending the opinion and denying rehearing on 5 July 1994. This opinion affirmed the District Court's ruling on 11 of the 12 claims but reversed the District Court ruling on one claim. The 5 July 1994 order held that "...the Forest Service acted arbitrarily and capriciously in concluding, on the record as a whole, that the Plan would not jeopardize listed species even at timber harvest levels of 100 mmbf/year." The Court noted the Forest Service could reinitiate formal consultation with the USFWS and after the USFWS issued an amended opinion based on its assessment of all the relevant information, the Forest Service must reevaluate its determination the Plan would not be likely to jeopardize listed species. To comply with this order, the Forest Service proposed Amendment 19 and formally consulted with the USFWS. Early in this consultation, the USFWS recommended the proposed amendment include objectives for open and total

road densities and security core areas. Amendment 19 (Decision Notice March 1995) is the culmination of the Forest Service's efforts to comply with the Court order. The principal changes to the Plan were:

A. Forest-wide Standards for Grizzly Bear

In all BMU sub-units, there would be no net increase in total motorized access density greater than 2 miles per square mile, no net increase in open motorized access density greater than 1 mile per square mile, and no net decrease in the amount or size of security core area.

B. Forest-wide Objectives for Grizzly Bear

On all BMU sub-units that were greater than 75% in the National Forest System land the Forest Service would:

1. limit high-density (> 1 mile/square mile) open motorized access to no more than 19% of a BMU Sub-unit within 5 years.

2. limit high-density (> 2 miles/square mile) total motorized access to no more the 24% of a BMU Sub-unit in 5 years and no more than 19% in 10 years

3. provide security core areas that equal or exceed 60% of each BMU sub-unit in 5 years, and 68% in 10 years

On all BMU sub-units that were less than 75% National Forest System land the Forest Service would:

1. assure that Forest Service activities would not result in an increase in motorized access density or reduction in security core areas on the National Forest System lands

2. improve habitat effectiveness through cooperative management with other landowners, land adjustments, or other means.

A. Forest-wide Objectives for Timber Management

The Forest's allowable sale quantity was amended to 270 million board feet (mmbf) for the period 1995-99, or an annual average of 54 mmbf.

B. Forest Plan monitoring

The Forest Plan monitoring decisions were amended to increase efforts to monitor the use of open and restricted roads and trails. In addition, this Decision required an annual report on implementation of grizzly bear habitat objectives.

The Flathead National Forest currently operates under the Forest Plan that includes Amendment 19. Grizzly bear/road use information incorporated into Amendment 19 was obtained primarily from research ongoing in the South Fork Flathead River grizzly bears (Mace and Manley 1993). Preliminary results indicated adult grizzly bears used habitat with open road densities greater than one mile/square mile less than expected. All sex and age classes used habitat with total road densities greater than 2 miles/square mile less than expected, and adult female bears maintained home ranges with substantial amounts of habitat greater than 0.5 miles from roads. In addition, areas larger than approximately 2,260 acres (3.53 square miles) were used more than expected by adult females (Manley, unpublished data). Along with the South Fork study, other supportive studies concerning the effects of motorized access on grizzly bear habitat use were Mace and Jonkel (1980), Mattson et al. (1987), McLellan and Shackleton (1988), and Kasworm and Manley (1990).

Assumptions of Amendment 19: Weaknesses and Strength

Assumptions used in the development of A 19 include include:

1. Will all areas with low road densities be of value to bears or are other factors, such as habitat quality, also important in delineating the road-free core areas?

   This assumption is a major weakness of A19 as habitat quality was not considered. It may be possible that the potentially the best bear habitat may be in heavily roaded areas while poor habitat is included in core areas. It is also possible that roads may be closed at great expense in areas of poor habitat that will only have marginal value to bears. By not incorporating habitat value, it is not possible to make optimal trade-offs between costs of road closures to people and value to bears.

2. Is the use of a composite home range for all female bears appropriate for defining a core area?

   It may be misleading to describe a core area by defining a composite home range using all telemetry locations for all female bears. If some female bears have more locations than others then the composite home range will be biased towards those females and could, in turn, affect the results of core size and the amount of roads a "average" bear will tolerate. A median core size and median amount of roads tolerant to bears may be a better metric.

1. Is the shape or juxtaposition of the 68% of road-free core areas considered?

   The only requirement is that areas to be included be at least 2,500 acres in size. However, the shape and number of separate included areas, and juxtaposition of pieces comprising the core area could have considerable bearing on use on non-use by grizzly bears. Also, known non-bear areas are not excluded from the 68% core area.

Amendment 19 also has several strengths including:

1. The major advantage of A19 is that it is a relatively simple method and thus easier to implement and more easily understood by the public,

2. A19 has demonstrably secure areas for the grizzly bears, year round.

3. A third strength of A19 is there is no net loss of habitat to new roads and roads can be closed to meet the 68% rule.

THE PROPOSED APPROACH

Once A19 began to be developed, land managers and biologists discovered several serious shortcomings that failed to optimize trade-offs between the needs of bears and the desire of people to access bear habitat. In particular, the quality of habitat for grizzly bears was not incorporated into A19 rules for establishing "core areas" and a substantial amount of expensive road reclamation was planned that may have little value to bears. Because the NCDE did not have an ecological or forest cover base map, the South Fork Study Team (SFST) was unable to extrapolate habitat quality data from their study area until near the end of their research project. At that time, the SFST developed mathematical models to predict the probability that a location would be used by adult female grizzly bears. This was done by simultaneously incorporating information on 3 classes of roads, human activity point sources, 3 elevational categories, and a "pseudo-habitat" variable based on categories of the "greeness" spectral bands of LANDSAT satellite images (Mace et al. 1998). The effect of human features such as roads could be excluded from this model to estimate "habitat potential" or the predicted habitat value in the absence of humans.

Once the SFST developed the ability to predict the multivariate nature of habitat quality, they had to determine how much high quality habitat secure from human disturbance that bears needed and the optimal location for these Seasonally Secure Areas (SSA). Based on the relationship between the size of each female's entire home range (95% adaptive kernel) compared to the size of a series of 9 utilization density contours designed to contain 10, 20, ... to 90% of all radio-locations, core areas of 8 females were determined. Core areas averaged 58 km^2 for 8 females in spring and 74 km^2 for 11 females during summer/fall (Mace and Waller 1997). Because grizzly bears use lower elevations that are more often roaded during spring, SSAs were to be 58 km^2 to accommodate the spring habitat and space requirements of adult females. The 58 km^2 was simplified to 45% of each sub-unit.

To locate SSAs within each sub-unit in a consistent and repeatable way, a computer algorithm was developed that would begin with the pixel (actually, 100 pixels were aggregated into 300 x 300 m cells) with the highest habitat potential. To it, from all adjacent cells, was added the one with the highest habitat potential, provided the growing

SSA did not violate a shape constraint that limited the perimeter to area ratio to ensured some degree of amalgamation. This process of adding the highest ranking cell from the adjacent to the growing SSA continued until it reached 11.6 km^2 or 1/5 of the 58 km^2 needed for a SSA. To ensure other portions of a sub-unit did not contain an area of overall better habitat, this process was continued 5 times, each time beginning with the pixel with the highest habitat potential that was not already in previously located potential SSA. All portions of a SSA had to >10.12 km^2 (2,500 acres) because SFSA females appeared to prefer habitat blocks of this size. The growing of SSAs was continued until 45% of the sub-unit was included in the SSAs. Cells of lower quality habitat that were engulfed within the SSAs were automatically included, and an equal number of cells on the perimeter were excluded from the final SSA with lower quality cells being deleted first.

Once the method of delineating SSAs was developed, it was extrapolated over the multiple use land of the NCDE. By studying the output of the model, it was clear that modifications were needed, particularly for spring SSAs. The was because the best potential spring habitat was a low elevations where most of the roads were and closing roads at low elevations (source of roads) often resulted in closing the entire road network. In addition, due to non-closable roads on private and public lands, public demand for access after July 4, and other exceptional circumstances, several additional modifications of SSA delineation and rules governing access within them were made.

The delineation of SSAs in the proposed method is relatively complex, however, SSAs only cover 45% of each sub-unit; other road density guidelines still needed to be developed for the majority of the land base. Based on the average open and total road densities in the home ranges of 10 adult females in the SFSA, it was determined that 11% of each sub-unit could contain areas with open road densities of 0.0-1.0 km/km^2. This was increased by 1 Standard Deviation or 7% during summer because few bears were killed during summer. Similar calculations on the eastside resulted in recommendations that 7% of each sub-unit could contain areas with open road densities of 0.0-1.0 km/km^2 (increased to 10% during summer). Total road densities of < 2 km/km^2 were acceptable on 14 and 2% of the West and East Side, respectively.

Assumptions of the Proposed Approach: Weaknesses and Strength

The proposed method is much more complex than the A19 and involves many analyses and assumptions. Here we review some of assumptions that may be worthy of consideration.

1. How adequate is the pseudo-habitat "greeness" index?

   Without a habitat base map, the SFST transformed a LANDSAT satellite spectral image into greeness bands. Grizzly bears appeared to show selection for habitats with different categories of greeness as this variable was significant in multivariate models.

Greeness is generally limited to static conditions and it is difficult to forecast because of changes in greeness over time due to ecological events such as fire or timber harvest. It also is a difficult concept to communicate with forest managers or to make prescriptions to increase greeness. However, grizzly bears use has been found to be associated with this pseudo-habitat as far away as Banff National Park (Gibeau, pers. comm.).

2. How accurately does seasonal dates established by the proposed approach reflect bear habitat use?

   Based on diet studies in the SFSA and further south (Craighead et al. 1982, Mace and Jonkel 1986), 15 July was identified as the division between spring and summer (Mace and Waller 1996, Waller and Mace 1997). This break was moved to 30 June because the public believes that summer begins on 4 July. The diet studies of Mace and Jonkel (1986) however, were based on only 140 samples and these were not analyzed weekly or bi-weekly. The division between spring and summer was also not clear from the elevational movement data in the SFSA (Waller and Mace 1997). In the North Fork of the Flathead, shifts in diet, elevation, and habitat use suggested that the spring/summer division was at the end of July (McLellan and Hovey, 1995, in press). If roads closed to protect bears during spring are opened on June 30, then bears in portions of the NCDE will not have security in their spring SSA for 1 month.

3. Is the size of early period (spring) core sufficient for SSAs?

   The core range of the sample of adult female grizzly bears was determined to be 58 km^2 during the early period (spring) and 74 km^2 for the late period (summer and fall). Because most conflicts between grizzly bears and roads are in the spring, a SSA of 58 km^2 was considered sufficient. However, 2.8 times as many (14 versus 5) SFSA bears were killed in the fall as in the spring (none were killed in summer). If a major goal of access management is to decrease the mixing of bears and people to reduce the mortality rates of bears, then perhaps the fall core area may be more appropriate for the fall season.

4. Should lower quality pixels engulfed with SSAs be included at the expense of better quality perimeter habitat?

   This trade-off was accepted in order to ensure that SSAs remained 45% of each sub-unit. Given the nature of mountainous terrain, rock outcrops with little or no value to grizzly bears may be included in the SSAs at the expense of higher quality, lower elevation habitats. In mapping grizzly bear security areas near Banff, Alberta, Gibeau et al. (in press) excluded non-habitat that included rock and ice. If there is a little rock and ice in the multiple-use areas of the NCDE, this may not be a significant issue. Perhaps it may be preferable to trade "relative values" of the engulfed cells with relative values of perimeter cells. For example, if the engulfed cells had, on average, half the value as the perimeter cells, then half as many perimeter cells should be

removed. This will result in slightly >45% of the sub-unit to be in a SSA, but should not jeopardize the bears as much.

5. Will seasonally gated roads provide sufficient security for grizzly bears?

   The SSAs, particularly those for spring, will require seasonal road closure using gates. It is assumed that gated roads will function as closed roads at best or at least as low use roads (< 1 vehicle/day). SFSA female grizzly bear use of areas near low use roads is not clear. When all other measured variables are equal, adult female bears appear to avoid areas with high densities of low-use roads in spring a summer (but not fall) (Mace et al. 1998). But, from within their seasonal ranges, most bears do not avoid low use roads by 500 m (Mace and Waller 1996). It appears that these bears avoid areas with high densities of low use roads but don't avoid these individual roads when they are encountered in their seasonal range. If densities of gated roads are excessive, SSAs may not be as secure as hoped. In addition, it not clear that areas with networks of roads that are only closed seasonally will be regarded by bears the same as permanently closed roads. Once a bear is within a network of closed roads, the roads may have little effect on the bears use, however, bears may not use areas with seasonally closed roads because of previous experience during seasons when the roads are open. There appears to be no data on the effectiveness of seasonally closed roads.

6. Are the multiple standards used for sub-units with private land sufficient for conservation?

   Several add-hoc exception rules were made to road standards for sub-units with private ownership and associated access routes. Private roads were excluded from road density calculations and, if federal land was <75% of the sub-unit, "no net loss" rather than the numerical guideline value was used. These, and other rules that relaxed road density guidelines were established in sub-units with private lands even when it was shown that a bear's level of risk was 30.27 times as great in rural areas as in backcountry areas. It would appear that in sub-units with private holdings that stricter, not reduced, access controls would be necessary to offset higher levels of mortality.

CONCLUSION

A motorized access management strategy for grizzly bear habitat, Amendment 19, is currently in place for NCDE. Several assumptions were made in developing A19. Chief amongst these were that habitat quality was not needed in identifying optimal locations for core areas, the extrapolation of data from the South Fork Study Area to other areas, the use of a composite home range, and the relaxation of shape or juxtaposition requirements for the core areas.

Nevertheless, the simplicity of A19 and its ability to permanently secure areas for grizzly bears makes it a powerful tool in the conservation of the grizzly bear in the NCDE.

However, as A19 began to be implemented, biologists and land managers discovered a potentially serious flaw. A19 failed to optimize the trade-off between bears and human access to bear habitat because grizzly bear habitat quality was not incorporated into the rules for establishing "core areas". In response, to make A19 more biologically realistic, the USFWS has developed a new proposed access management approach that incorporates some topographical and "pseudo-habitat" variables. The proposed approach's added complexity unfortunately necessitated several additional assumptions, some of which are tenuous.

The authors of the proposed approach should be commended for their exhaustive search of the literature and their attempt to incorporate all the scientific information available to them. Apart from a few relatively minor exceptions, available scientific information was correctly used in the development of both A19 and the proposed approach. However, when examining, in totality, the assumptions we have highlighted in the previous section, we must conclude the assumptions made were too bold at this time to fully justify the added risk and uncertainties created for grizzly bears under the proposed approach. While we applaud and encourage the authors to continue their work on incorporate habitat quality indicators into access management guidelines – a clearly necessary step – we caution against any relaxation of establishing permanently secure areas unless the assumptions made meet a higher standard than demonstrated in this proposed approach.

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