# Natural Grizzly Bear Repopulation in the Greater Bitterroot Ecosystem


**Mike Bader**
**Wildlife Consultant**

**Paul Sieracki**
**Geospatial Analyst/Wildlife Biologist**


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Flathead-Lolo-Bitterroot Citizen Task Force

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For comprehensive information on grizzly bears and the Selway-Bitterroot Ecosystem please refer to:

Dr. David J. Mattson, 2021. The Grizzly Bear Promised Land: Past, Present & Future of Grizzly Bears in the Bitterroot, Salmon & Selway Country. Grizzly Bear Recovery Project Technical Report GBRP-2021-1. https://www.grizzlytimes.org/grizzly-times-reports

WildEarth Guardians
P.O. Box 7516
Missoula, MT 59807
https://wildearthguardians.org/

Flathead-Lolo-Bitterroot Citizen Task Force
P.O. Box 9254
Missoula, MT 59807
https:/www.montanaforestplan.org

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**Mike Bader**
**Wildlife Consultant**
**Missoula, MT**
**mbader7@charter.net**

**Paul Sieracki**
**Geospatial Analyst/Wildlife Biologist**

## Introduction

The U.S. Fish & Wildlife Service (FWS) has begun an Environmental Impact Statement (EIS) process to assess options for restoring grizzly bears (*Ursus arctos*) to the Bitterroot Ecosystem (BE) in Idaho and Western Montana. The FWS will publish a Notice of Intent initiating the public comment scoping process in early 2024 that will include a range of alternatives (Cooley 2023). A legal agreement requires that a final Environmental Impact Statement be completed by October, 2026.

The grizzly bear population in the Northern Continental Divide Ecosystem (NCDE) is the largest population in the lower 48 states and it has been described as a "source population" providing immigrants to supplement other existing populations. The NCDE is most likely to be the primary source of immigrants to the Bitterroot ecosystem (Grizzly Bear Conservation Strategy, U.S. Fish & Wildlife Service 2018) although it is possible that grizzly bears will also move from the Greater Yellowstone towards the BE. Trends in distribution and dispersal movements are related to these prospects.

In order to have long term grizzly bear population viability in the Northern Rockies, the Bitterroot Ecosystem must be reoccupied and linked through protected habitats with the other Grizzly Bear Recovery Areas (Allendorf, et al. 2019).

Once grizzly bears arrive within the BE there are millions of acres of contiguous productive wildlands in which to explore and thrive (Carroll et al. 2001, Mattson 2021). This region could support many hundreds of grizzly bears (Boyce and Waller 2003; Mowat et al. 2013, Mattson 2021, Bader and Sieracki 2022).

Grizzly bear dispersal into the BE has already occurred (U.S. Fish & Wildlife Service 2023). Some have been documented to be males and others have been presumed to be males. The Webster's Dictionary ecological definition of a population (5.b.) is: "all the individuals of one species in a given area." In reality a reproductive population of grizzly bears is the area of overlapping ranges of reproductive age males and females. A collection of males is not a breeding population and we therefore focus on female grizzly bears who are needed to produce offspring. This report explains and shows on maps how and where female grizzly bears may expand from the NCDE and occupy the BE, and how much time that might take measured in years.

We do not present a statistical model with scores and confidence intervals. However, all of the data sets used are from peer-reviewed papers published in scientific journals and from official sources.

The scientific literature suggests we consider two types of dispersal movements.

•Within population natal dispersal, where after being weaned young bears begin to move away from the maternal home range with males initially establishing home ranges outside the maternal range and with females largely overlapping the maternal range. Males have annual and life ranges 3-6 times that of females (Blanchard and Knight 1991, Mace and Waller 1997). Male dispersals are also generally greater than those of females (Proctor et al. 2004, McLellan and Hovey 2001). It should be noted that within population movements may be limited by the presence of more dominant bears in adjacent home range areas (Graves et al. 2014). This represents natural resistance to dispersal. There are relatively few papers on dispersal in the scientific literature and many studies have occurred in core population areas with higher bear density and results often come from limited samples. Resistance can also take the form of high road density and logged landscapes, areas of urban development, agricultural lands, major highways and areas with high social intolerance for grizzly bears.

***"Natal dispersal is difficult to quantify, and long-distance events are often undetected, leading to biased estimates." —Proctor et al. (2004).***

• Beyond or between population movements. These have included lengthy movements over one or two seasons. Examples include a female that moved 90 km from the Cabinet-Yaak to the NCDE (see Figure 1), a male that moved from the CYE to the BE and back, a male and female that moved from the NCDE-BE and back (140 km each way). Several males have moved to the Sapphires, Flint Range, Big Hole, Pioneer Mountains and other areas.

Lengthier movements outside of and between Recovery Areas may be a result of less natural resistance to dispersal. These areas are low grizzly bear density and generally may not be occupied by more dominant bears as young males tend to dominate beyond core area dispersals. Areas with low human population density and large amounts of secure core habitat also pose less resistance to dispersal movements.

We use a temporal-spatial approach and assess dispersal in the context of beyond core movements. Our intent is to show what is possible and perhaps even likely given proper habitat and sanitation management.

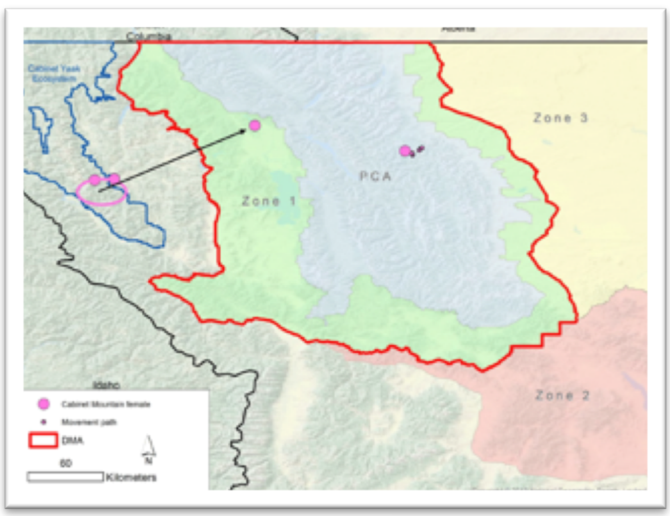


***Figure 1. Female Grizzly Bear Movement from Cabinet-Yaak to NCDE. Costello, et al. (2023).***

There are four key pieces to this analysis:

- •Bader (2000) and Costello et al. (2023) were used to project expansion of the contiguous NCDE occupied habitat area into the Bitterroot Ecosystem. The U.S. Fish & Wildlife Service (2023) has mapped the same information as in Costello, et al.

- •Projected female dispersal applying verified observations of females with cubs, grizzly bear dispersal data from scientific sources and the high value connectivity routes from Sells, et al. (2023). Routes at the beginning (NCDE population) and the end (Bitterroot Ecosystem as defined in Bader and Sieracki 2022) were measured in terms of a range of time to arrival using dispersal distances.


*Figure 2. Male Grizzly Bear in the Northern Sapphire Mountains. Florence, Montana, the Bitterroot River and Bitterroot Mountains in the background.*

- • Overlap analysis of the denning results from Bader and Sieracki (2022) and the connectivity routes for female grizzly bears from Sells, et al. (2023).

## Methods

### NCDE and NCDE-Bitterroot Population Expansion

Two data sets were used for comparison and calculations of increase. These are Bader (2000) and Costello, et al. (2022) and U.S. Fish & Wildlife Service (2023) which present the same information. These efforts used different but somewhat similar methods in that smoothing methods were applied.

There have been several changes in the methodology the Montana Fish, Wildlife & Parks has used to estimate the occupied habitat area in the NCDE. First, Mace and Roberts (2012) used a 10 x 10 km grid system where verified observations would light up individual cells. Then, "kriging" as described in Bjornlie, et al. (2014) was added as a smoothing factor with a reduced 7 x 7 km grid. Then, the FWPs changed the method (Costello, et al. 2023) by reducing the 7 x 7 km grid to a 3 x 3 km grid system which reduced the estimated distribution area by 12,000 km$^2$.

Finally, FWPs changed the method by reducing the number of observations used. Previously, all recorded observations (n = 377,000) of all kinds between 2003-2021 were used, including multiple fixes from the same bear, sometimes every 15 minutes. Now, more recent (ten years) and far fewer observations are used including limiting the number of fixes per bear (Costello 2023, 11/28/23).

It should also be noted that the method described by Costello "does not include occasional forays outside the estimated range or low-density peripheral areas and therefore does not represent the total known extent of occurrences." Due to these changes we used the 2022 results for measurement over the 22-year period and reported the figures below in the Results section.


*Figure 3. Grizzly Bear in the Big Hole. Source: Jonkel (2022)*

To assess expansion towards the BE, we identified the portions of the NCDE closest to the BE. We plotted points (n = 35) every 10 km on the 2022 distribution polygon (see Figure 4). Using the nearest to obtain function in ArcGIS, the shortest distances were measured between the 2000 and 2022 polygons and an average annual rate of potential expansion in km/year was derived. The estimated time in which the contiguous distribution area may cover significant portions of the BE was measured.

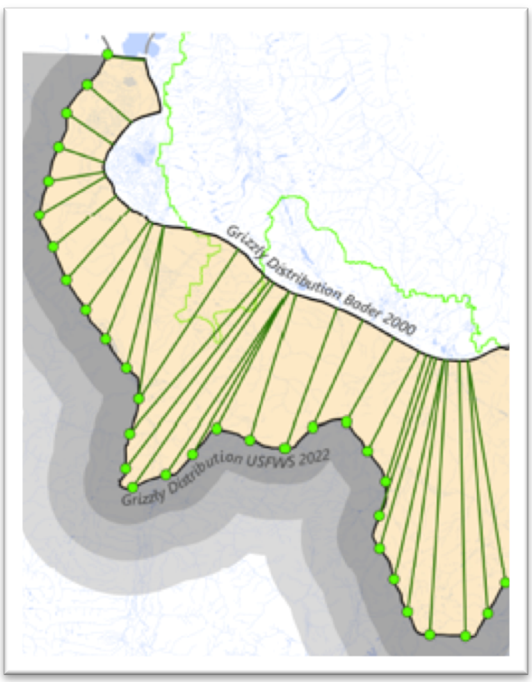


*Figure 4. Nearest Point Analysis Based on Points Spaced 10km Apart on the 2022 distribution boundary.*

**Female Dispersal and Connectivity Route Analysis**

We selected eight recent verified observations of female grizzly bears with cubs on the periphery of the portion of the NCDE population (Jonkel 2022; Montana Fish, Wildlife & Parks 2023) that is closest to the BE. These include the Ninemile Demographic Connectivity Area, part of Zone 1 of the NCDE Demographic Monitoring Area; the Flathead Indian Reservation, Mission Mountains and Rattlesnake Bear Management Units, the North Hills near Missoula and the Garnet Mountains both in Zone 1, and the John Long Mountains in Zone 2. The recent observations of females with offspring represent a source of recruitment into the dispersing cohort of the population. Ten females could potentially produce 15-20 cubs over 6-7 years. After weaning the survivors will join the pool of dispersers.

All of the areas listed above except the Ninemile DCA had verified observation of females with cubs each year from 2017- 2022. The Ninemile DCA had verified observations in 2018, 2019, and 2020. The Rattlesnake Bear Management Unit had a verified observation in 2021, but areas just outside within the Rattlesnake National Recreation Area and the North Hills area near Missoula had verified observations of females with cubs in 2021 and 2022. After digitizing and plotting these locations, we plotted pathways starting from these points through habitats identified by Sells, et al. (2023) as high probability directed connectivity pathways for female grizzly bears. We then applied dispersal distance per year to these routes and measured the time in years until reaching the Bitterroot Ecosystem.

**Female Grizzly Bear Dispersal Distance**

Dispersal data on female grizzly bears in North America come from relatively small samples and do not capture the full natural range of movements. Reported dispersal distances mostly come from within core population areas. For populations adjacent to western Montana and northern Idaho, these are 9.8 km (McLellan and Hovey 2001); 14.3 km (Proctor, et al. 2004); 4.0 km (Graves et al. 2018); 14.0 km (Lamb et al. 2020). Proctor et al. (2004) found the longest female dispersal was 78 km while Lamb et al. found the longest female dispersal was 53 km.

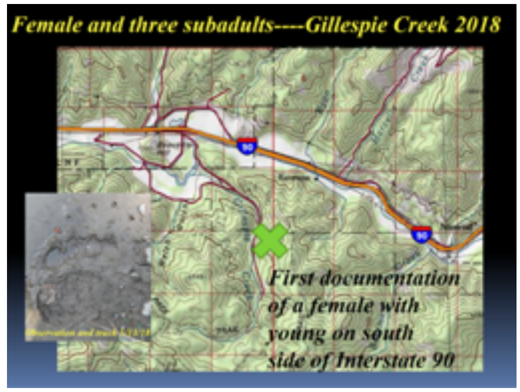


*Figure 5. Example of Female with Cubs Locations Used for Analysis. From: Jonkel (2022).*

Maximum female dispersal distances of 78-119 km have been reported in North America (Sells, et al. 2023). In Europe, long-distance dispersal of female brown bears (*Ursus arctos*) has been documented in expanding populations pre-saturation (before reaching carrying capacity) and these longer dispersals have been detected at the periphery of expanding populations. Swenson et al. (1998) found females dispersed up to 80-90 km away from core and Jerina and Adamič (2008) found female dispersals > 80 km from core area.

Over the past two years, female grizzly bear dispersals within Montana include one-way, one-season movements of 90 km and 140 km (Costello, et al. 2023). Between 2012-2014 one female moved approximately 4506 km and crossed I-90 and US 93 several times. Her movements are considered unrepresentative yet can't be totally discounted.

Given this information we assumed dispersal distance would be greater at the periphery of the NCDE population where bears can move into favorable and largely unoccupied habitats. We therefore applied the Proctor, et al. (2004) and Lamb et al. (2020) mean distances (14.3, 14.0 km) as an approximation while recognizing that short term long distance movements have been documented. Lamb et al. found grizzly bears dispersing from Wilderness were subsidizing populations in higher mortality landscapes which presumably matches the situation between the NCDE and BE. The Proctor et al. and Lamb et al. study areas are partially within and adjacent to the U.S. and with habitats similar to western Montana and northern Idaho. The Proctor et al. dispersals occurred over a period of 1-4 years (2.5 median) or approximately 6 km/year. Kasworm et al. (2023) report that the mean home range size of adult female grizzly bears in northwest Montana is 403 $km^2$. Expressed as a circle, the diameter is 22.65 km. To be conservative, we assumed that on average dispersing subadult females would establish an initial home range overlapping the maternal range by three quarters. This would result in initial movement of approximately 5.7 km. Based on these data, as a rough approximation we plotted points at 6 km intervals on the routes we placed over the Sells et al. directed pathways to represent movements by weaned but pre-reproductive females. Some females will set up home ranges mostly within the maternal home range and stay there representing very low dispersal distance while others have dispersed up to 78 km or more. Time to arrival in the Bitterroot Ecosystem was estimated for each route.

**Assumptions**

•some females will cross Interstate 90 and U.S. Highway 93 because some already have;

•females will move along the best routes identified by Sells, et al. (2023) when in fact some may not and may instead travel through less productive and secure areas;

•we plotted movements from the NCDE towards the BE while some bears may disperse back towards core areas. However, these are not the only adult females on the periphery of the NCDE;

•dispersals outside core areas at the periphery will be lengthier than those reported from within core population areas;

•the most likely source of female grizzlies is the NCDE although male grizzly bears from the Selkirk Mountains and Cabinet-Yaak areas have been documented within the BE and it is possible dispersers would come from the Greater Yellowstone Ecosystem;

•our directed female routes are only ten of many possible points and combinations. We assume they are representative of what is possible. For example, even assuming a lower survival rate of 80% in these areas, ten females could produce about 5 cubs per year of which the survivors are recruited into the pool of dispersers;

•the longer routes including through the Sapphire Mountains may be occupied by successive resident female grizzly bears who produce female dispersers that reach the BE.

**Analysis of Denning Habitat and Female Connectivity Habitats**

Bader and Sieracki (2022) wrote: *"How grizzly bears might best move between and within secure core awaits a future analysis based on habitat quality, least-cost path analysis, and circuit theory."* Sells, et al. (2023) completed this analysis. Layers for moderate-high probability grizzly bear denning habitats from Bader and Sieracki and moderate-high probability (layers 6-10) for female grizzly bear connectivity from Sells, et al. were combined. For measurement purposes, the extents of both analysis areas were intersected to conform to the area of overlap between the two data sets. The amount of overlap in km$^2$ was calculated and reported as a percentage of the connectivity layer. Areas with concentrations of high probability denning and connectivity areas were identified as high value grizzly bear habitat conservation areas.


*Figure 6. Two Grizzly Bears in the East Fork of the Bitterroot. Source: Jonkel (2022).*

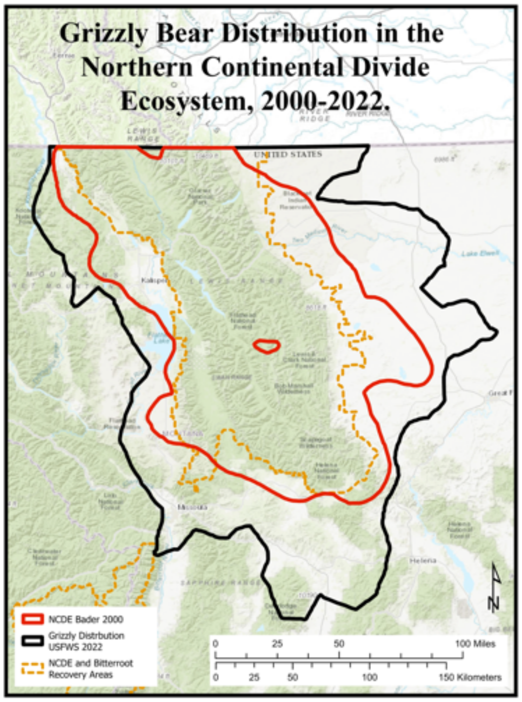


*Figure 7. Grizzly Bear Expansion in the NCDE, 2000-2022.*

# Results

## NCDE Population Expansion

The estimated NCDE distribution area (occupied habitat) increased by approximately 23,000 km$^2$ from 2000-2022 including areas identified as connectivity routes for grizzly bears (Peck et al. 2017; Sells, et al. 2023). Distribution expanded significantly on five major axes to the east, south and southwest (see Figure 7).

Much of the expansion to the east has occurred along two major riparian corridors. In October 2023, a grizzly bear was photographed in the Missouri River Breaks near the Judith and Missouri Rivers, the furthest east a grizzly bear has been documented in about 100 years and in 2021 tracks of a female with cubs were documented in the Missouri River Breaks.

Less significant expansion occurred west of the NCDE Recovery Area. Expansion in this direction is limited by a heavy density of logging roads and cleared areas in which security cover and social tolerance are low, and mortality risk is high.

The most significant movements for connecting isolated populations are occurring towards the Greater Yellowstone Ecosystem and the BE areas, with the occupied habitat area now touching the BE.

The overall expansion rate from 2000-2022 was 1,581.8 km$^2$ per year. Interstate 15 appears to be a barrier to movements by female grizzly bears but as noted above, a female with cubs were documented east of I-15.

## Population Expansion Towards the Bitterroot Ecosystem

Our nearest to obtain analysis of points spaced at 10 km intervals (n = 35) revealed a mean distance of 44.59 km between the external boundaries of the 2000 and 2022 distributions. The standard deviation was 20.05 km and the range (+- 1 standard deviation) was 24.54-64.54 km. Dividing the mean by 22 years equals 2.03 km/year expansion towards the BE (see Figure 8). At this rate, within 5 years the contiguous occupied grizzly bear range could move 10 km into the BE and after 15 years move 30 km to include more of the BE and areas further south in the Sapphire Complex including portions of the Pintlar Range along the Continental Divide.

It is important to note that the prong of expansion on the edge of the BE moved 69 km (3.1/year or projected 31 km over 10 years and 46.5 km in 15 years) and in the Flint Range moved 77 km (3.5/year). If continued at that pace a larger area of the BE and the Sapphire Complex would become occupied habitat sooner than shown.

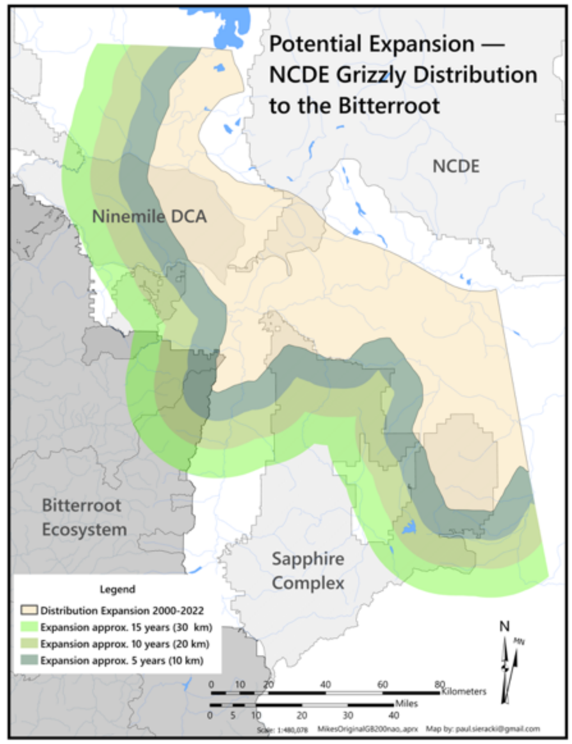


*Figure 8. Average Grizzly Bear Population Expansion Towards the Bitterroot Ecosystem in Five Year Increments.*

## Potential Female Dispersal Routes

Based on the routes we selected, female grizzly bears could reach the BE in as few as 3.7 to as many as 18.9 years with an overall average of 10.6, and 8.7 without the Sapphire routes (see Table 1, Figure 9). If one uses the BE analysis area (U.S. Fish & Wildlife Service 2000) which includes areas west of Missoula, south of the Clark Fork River and the Sapphire Mountains, female grizzly bears could reach that portion of the BE in from 1-4 years.

**Table 1. Distance and Time for Potential Female Routes to the Bitterroot Ecosystem.**

| Route | Description | Distance (km) | Time (yrs) |
|---|---|---|---|
| 1 | Ninemile DCA - Northern Bitterroot | 22.49 | 3.7 |
| 2 | Ninemile DCA - Northern Bitterroot | 32.33 | 5.4 |
| 3 | Flathead Reservation - Northern Bitterroot | 53.46 | 8.9 |
| 4 | Mission Mtns - Central Bitterroot | 86.85 | 14.5 |
| 5 | North Hills - Central Bitterroot | 62.85 | 10.5 |
| 6 | Rattlesnake Wilderness - Central Bitterroot | 49.92 | 8.3 |
| 7 | Garnet Mtns - Central Bitterroot | 56.33 | 9.4 |
| 8 | Garnet Mtns - Southern Bitterroot | 113.26 | 18.9 |
| 9 | John Long/Sapphire Mtns - Central Bitterroot | 46.74 | 7.8 |
| 10 | John Long/Sapphire Mtns-Southern Bitterroot | 113.67 | 18.9 |

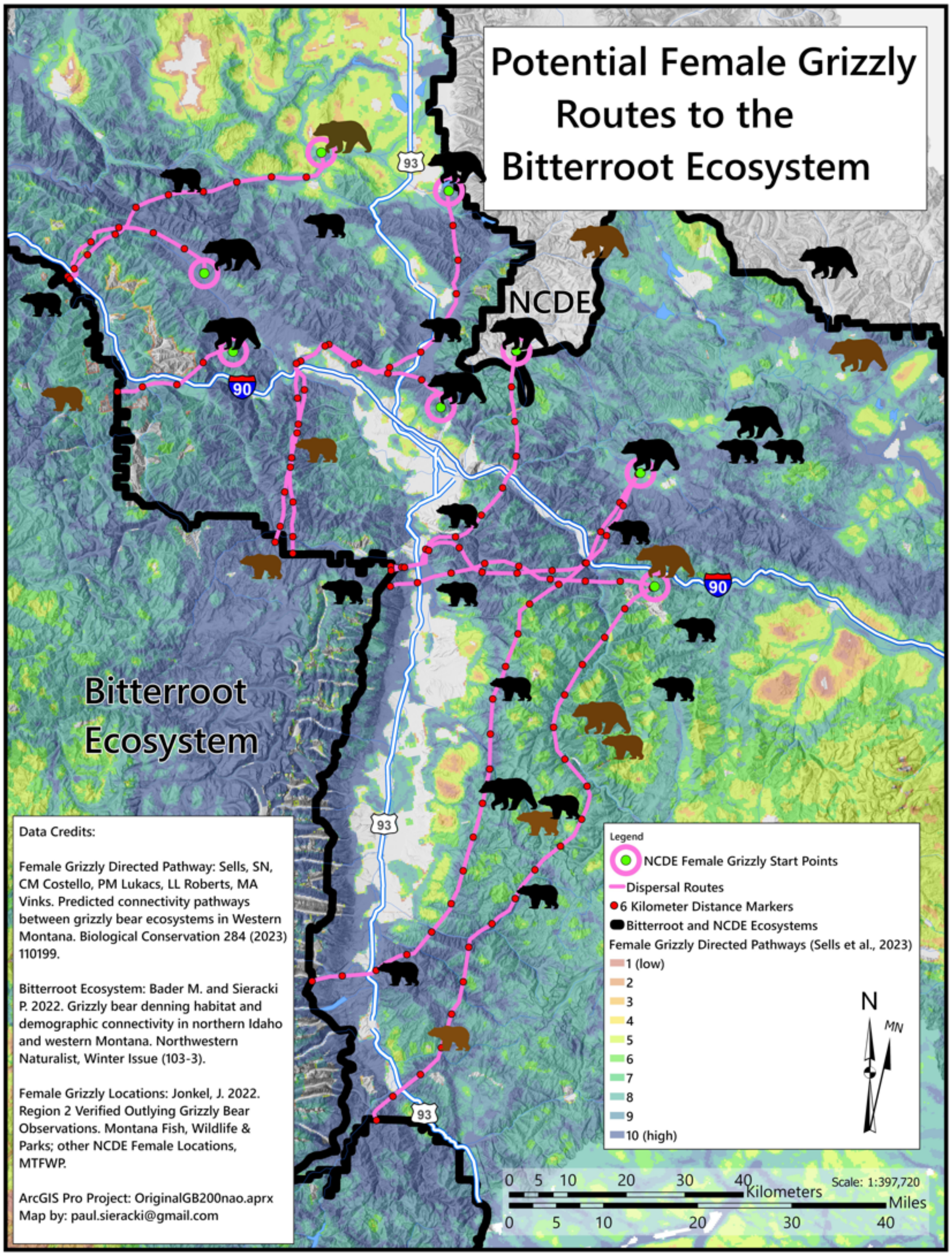


*Figure 9. Female Grizzly Bear Routes to the Bitterroot Ecosystem Plotted Over the Sells, et al. (2023) Highest Probability Directed Pathways for Female Grizzly Bears.*

**Denning Habitat and Female Dispersal Routes**

There is considerable overlap between the moderate-high probability grizzly bear denning habitats in Bader and Sieracki and the moderate-high connectivity routes for female grizzly bears from Sells, et al. There are 8,481 $km^2$ of denning habitats within the 48,506 $km^2$ of moderate-high connectivity habitat or 17.5%. This overlap lends additional support to the concept of demographic connectivity based on residential occupancy as a mean towards natural repopulation of the BE. The overlap areas represent high value landscapes for conservation and in particular, demographic connectivity and BE population establishment as shown in Figure 11.

*Figure 10. Denning Habitat is Key to the Demographic Connectivity Model for Female Occupancy in the Bitterroot Ecosystem. Photo courtesy of Timothy Manley.*

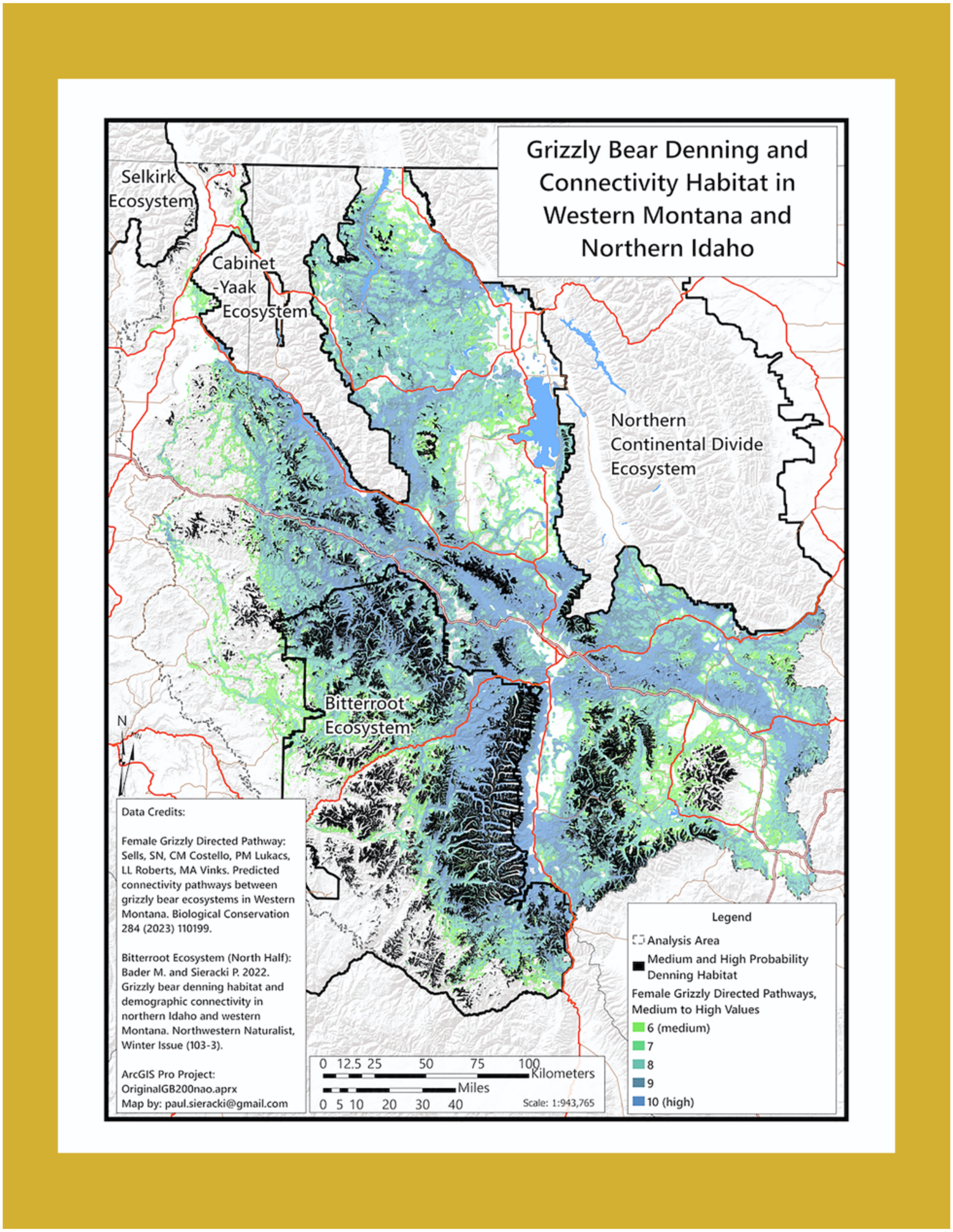


***Figure 11. Moderate-High Probability Grizzly Bear Denning and Female Directed Pathways Shows Several High Value Areas for Demographic Connectivity and Bitterroot Ecosystem Population Restoration.***

High value areas for demographic connectivity include the Ninemile, Petty Creek, Rattlesnake, Northern Bitterroot Ecosystem including the Bitterroot Front and areas north of US 12, West Fork of the Bitterroot, north and south Sapphire Mountains, Pintlar Mountains, Cherry Peak roadless area south of the Cabinet-Yaak Recovery Area, Coeur d'Alene Mountains (where a female grizzly dear denned south of I-90), and the Garnet Range.

Other areas with medium-high denning habitat are directly adjacent to the high connectivity habitat in the Northern Bitterroot Divide to the Cabinet Mountains area, the Baldy Mountain and Thompson River headwaters area.

Since part of the Sells, et al. routes were based upon the shortest path between defined points, some areas outside the shortest path, such as the Sapphire and Flint Mountains, may have fallen out of the highest values even though many recent verified observations of grizzly bears come from these areas. The western edge of the Sapphires is within the highest connectivity category and directly adjacent to abundant denning habitat. The Sapphire Mountains were also found to have extensive ground cover by berry-producing species favored by grizzly bears (Hogg et al. 2001) and also has the highest amount of secure core habitat of any connectivity area between the NCDE, Bitterroot and Cabinet-Yaak Recovery Areas (Bader and Sieracki 2022). Similarly, there is dispersal from the Cabinet-Yaak through Idaho east of Lake Pend Oreille that may reach the BE but this area was not analyzed by Sells, et al.

The western portion of the Bitterroot Ecosystem may have lower estimated connectivity values due to distance as areas north of the Salmon River have been found to have highly productive grizzly bears habitats (Merrill et al. 1999; Hogg et al. 2001, Carroll et al. 2001, Boyce and Waller 2003, Mattson 2020). Future directed dispersal modeling would likely show these areas having higher value when they are closer to occupied habitat areas.

## Discussion

What we have shown is not necessarily what will happen, but it is a reasonable illustration of what might happen and on what time scale. All of the information we used comes from peer-reviewed published papers and official reports.

The NCDE expansion illustration is an average across a wide front. Some prongs of expansion have occurred at greater than 2 km/year. Such directional expansion could penetrate deeper into the BE sooner than shown. Moreover, once there, the BE is wide open to grizzly bears.

*Figure 12. Grizzly Bear in the Flint Mountains. Source: Jonkel (2022).*

On average, about 3-5% of the NCDE population are monitored via radio-tracking (E Wenum, pers. comm.) and just 2.7% in 2023 based on information from Costello (2023) with very few radio-monitored bears on the south end of the NCDE. Thus, dispersals towards the BE may be underreported or documented.

Many dispersal studies come from bears residing within core population areas with relatively high densities. Theoretically, in high density habitats with more dominant bears, young female dispersals may be limited because they are pushing against that form of resistance (Graves et al. 2014). Proctor et al. (2004), in a lower density landscape, reported dispersal distance 40-50% higher than McLellan and Hovey (2001).

In contrast, in areas outside of high density cores, there may be less resistance because of low bear density where many of the grizzly bears are subadult and subdominant males. Large secure core areas outside of Recovery Zones such as the Sapphire Mountains region present less resistance to movements (less roads, human activity, etc.) in another form of dispersal release.

Støen, et al. (2006) wrote: *"The high proportion of dispersing female brown bears in Scandinavian compared with North American studies might be due to lower densities in Scandinavia and recent population expansion, with unoccupied areas available at the edges of the population."* Expansion into unoccupied areas is similar to the current situation in the NCDE and surrounding areas.

Grizzly bears have dietary plasticity (U.S. Fish & Wildlife Service, fws.gov) which allows them to exploit new habitats and may favor dispersal. However, many of these areas between the BE, NCDE and CYE are extensions of the core areas and are not unfamiliar habitats. For example, the U.S. Forest Service (2020) described the Northern Bitterroot Divide as having habitat productivity equal to that within the core Recovery Areas.

Founding population size should ideally be $N_e > 50$ (Allendorf, pers. comm.) where $N_e$ is the breeding age females and males. Initially, the founding population may be male-dominated. An initial founding population of $N_e > 50$ is very unlikely for the BE. However, any founding population would come from adjacent populations so genetic diversity should not be an immediate issue. Moreover, one possible method of population reestablishment in the BE is continued expansion of the core NCDE population so that the founding population would be an extension of an existing larger population.

In terms of recolonizing vacant habitats McLellan and Hovey (2001) wrote: "*...managers wishing to promote recolonization of an area by grizzly bears may need to maintain source populations with a high rate of increase by reducing all sources of human-caused mortality.*"

This will require maintaining Endangered Species Act protections of grizzly bears and minimizing all forms of human-caused mortality to continue population expansion and promote recolonization of the BE.

The initial phase of BE reoccupation is already under way. Numerous verified observations including a den site have come from within and directly adjacent to the BE. These are presumed to be males but the possibility that one or more females have reached the BE cannot be ruled out


*Figure 12. Grizzly Bear in the Bitterroot Ecosystem. Source: Jonkel (2022).*

although that has not yet been verified. Sighting grizzly bears in this remote, heavily forested landscape is difficult, even with game cameras and many people do not report bear sightings.

While our report focuses on female grizzly bears, McLellan and Hovey (2001) wrote: *"Understanding the dispersal behaviour of grizzly bears is essential for developing conservation strategies. Our results suggest that meta-population reserve designs must provide corridors wide enough for male grizzly bears to live in with little risk of being killed."*

The question is, will the core contiguous population area expand into the BE first? It is on the edge of it now. Or will dispersers mate and start pockets of demographic activity ahead of the main core in areas like the Ninemile Demographic Connectivity Area and the Sapphire Mountains? It can be said that both are essentially the same thing and are occurring within many areas adjacent to the Bitterroot Ecosystem.

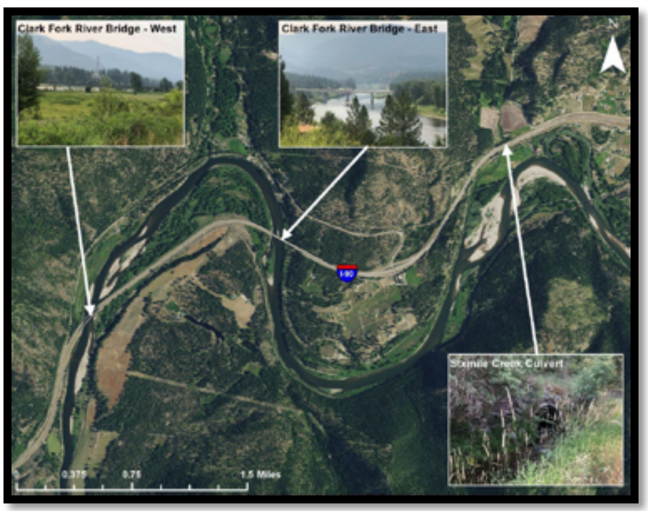


*Figure 13. Proposed Passage Ways for Grizzly Bears and Other Wildlife Across I-90 Between the Ninemile Demographic Connectivity Area and the Bitterroot Ecosystem. Source: Missoula Regional Connectivity Group.*

**The I-90 and US 93 Barriers**

Interstate 90 and US 93 are significant barriers to movements by female grizzly bears. However, at least two reproductive age females have crossed I-90 including a female with 3 subadults in the John Long Mountains, part of the Sapphire Mountains complex. Another subadult female crossed at least twice. What we don't know is how many females have attempted a crossing and how many successfully did so. Similarly, female grizzly bears have been documented crossing back and forth across US 93.

Wildlife passage infrastructure has been proposed to facilitate movements by grizzly bears including where the Six Mile and Ninemile Creeks enter the Clark Fork River (see Figure 13). This is a documented grizzly bear crossing site and when on the south side of the river grizzly bears are effectively within the BE.

**Population Cohesion During Breeding Season**

Expansion in the distribution of an established population and dispersals are driven by male bears (Itoh et al. 2012; Eriksen et al. 2018). Male brown bears have been documented to move well away from core populations including for denning but return to core areas during breeding season (Eriksen et al. 2018). To "hold" males outside of core areas may require the presence of breeding age females. This phenomenon may favor the BE being repopulated by the contiguous occupied habitat area of overlapping reproductive age males and females expanding into the BE.

**Trends in Landscape Resistance and Permeability**

Some gains have been made in areas where land purchases and conservation easements have been secured maintaining connectivity opportunities for grizzly bears. These include tens of thousands of acres in the Thompson River area and smaller purchases in the Ninemile area. Highway passage structures have been proposed for several areas. The President's White House Council on Environmental Quality issued Guidance for Federal Departments and Agencies on Ecological Connectivity and Wildlife Corridors (3/21/23). One goal is: *"Designing infrastructure to facilitate wildlife movement, ecosystem processes, and ecosystem services."* and *"Removing, modifying, or avoiding the installation of barriers to wildlife movement along migratory routes."*

Losses continue to occur as a result of long term forest management plans that authorize massive increases in logging and roadbuilding. The new roads and large forest openings impact grizzly bear connectivity and habitat security. These projects are targeting identified connectivity areas for grizzly bears. Urban sprawl and rural homesite construction is another impediment. Unsecured garbage, food and domestic chickens have become a major source of grizzly bear mortality. Major transportation corridors are fragmenting the landscape.

***Figure 14. Two Grizzly Bears in the Northern Flint Range. Source: Jonkel (2022).***

Another barrier to successful dispersions are the hunting and trapping regulations adopted by the States of Montana and Idaho. Grizzly bears are subject to takings including death and at least two grizzly bears have been killed by snares in north Idaho.

**The Case Against Assisted Translocations**

Miller et al. (1999) wrote: *"The technical considerations of translocation are closely related to the biological questions. They include legal framework, fiscal and intellectual resources, monitoring capacity, goals of the translocation, logistic challenges, and organizational structure of decision making."*

Key considerations include:

• *What are the prospects of new immigrants via unassisted movements?*

In this case we believe the prospects are quite high. The NCDE occupied habitat area now touches the BE and we show projected expansion deeper into the BE.

• *Are the reintroduction and source areas far enough apart to overcome the homing instinct of grizzly bears?*

In the case of human-assisted mechanical translocations they are far too close to overcome the return instinct which is very powerful in grizzly bears. *"Excessive movement from the release site is a major reason for low survival and poor reproductive rates of translocated carnivores."* (Miller et al. 1999). To overcome this, minimum translocation distances for grizzly bears should be > 241 km (H Reynolds, pers. comm. in Bader 2000b).

*How would it affect the legal status of the animals?*

A previous effort in 2000 would have designated the bears as "experimental, non-essential." That would have effectively delisted individual source bears taken from the NCDE by removing their legal protections under the ESA. A federal court in *Alliance for the Wild Rockies v. Cooley* found grizzly bears are now present in the BE and experimental, non-essential status no longer applies.

•*Has it been tried before?*

An augmentation program in the Cabinet Mountains has largely been a failure. Several translocated bears to the returned to the NCDE or were killed. Notably, of the 22 translocated bears, only three contributed genetically to the Cabinet Mountains population, and of these three, just one contributed 87% of documented offspring and there was just a 13% success rate per bear (Mattson pers. comm.). A 13% success rate would not result in Bitterroot repopulation.

*Are there long-term political and financial commitments?*

Management of wildlife and fish is vulnerable to frequent changes in political administrations and therefore policies and priorities. A previous plan to recover grizzly bears in the BE was politically defunded and essentially abandoned until the USFWS was sued to comply with federal laws and ordered to prepare a new EIS. If the plug on assisted translocations were pulled mid-stream, this would be proven to be an ineffective approach that results in mortality for the source population.

*What is the organizational structure of decision-making?*

Decision-making would likely be concentrated within state and federal agencies rather than spread out over a scientific committee that includes non-agency scientists and consultants. This may bias the goals, process and the methods used.

*Have the Underlying Causes of Population Decline or Extirpation Been Remediated?*

In the case of the BE, both yes and no. The grizzly bear is now protected under the ESA which has limited illegal killings. The issues of habitat loss have not been addressed and in fact, long range National Forest management plans authorize many-fold increases in logging and roadbuilding, including within roadless areas. Storage regulations for attractants on public lands are lacking and very tardy in implementation.

The NCDE is a source population for natural emigrations to the BE because the bears work it out on their own without unnatural interventions that require capturing, drugging and transporting bears long distances, which increases the risk of accidental mortality. Public attitude surveys (Shaw and Whalen 2021) suggest local residents have less resistance to grizzly bears coming to the BE on their own as opposed to having grizzly bears actively moved in by the government.

## Recommendations

We believe that continued NCDE population expansion and female dispersals can result in female grizzly bears arriving within the BE within a few years, not decades, with reproductive activity to follow. The data on long-range, short time span movements by female grizzly bears provide evidence that one season dispersals into the BE are possible in which the time to arrival would be significantly reduced. The key is maintaining and expanding populations of breeding age adults on the NCDE core population periphery.

Natural immigration is a viable strategy which must be considered and fully analyzed in the upcoming EIS. We believe that the law and the science direct that the Bitterroot Ecosystem grizzly bear recovery strategy be based on natural immigration facilitated by protected habitat connectivity areas and with the full protection of the Endangered Species Act.

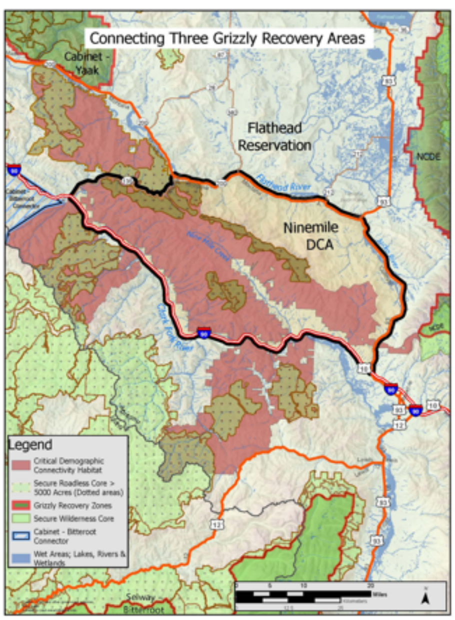


*Figure 15. Connecting the Ninemile Demographic Connectivity to the Bitterroot and Cabinet-Yaak Ecosystems. Map: Bader and Sieracki.*

•All sources of human-related mortality in the NCDE and Western Montana must be reduced to the minimum possible to promote continued population growth stimulating emigration of female grizzly bears towards the BE. As such, delisting of the NCDE and GYE populations from Endangered Species Act protections is incompatible with demographic connectivity and reestablishment of a breeding population of grizzly bears within the BE.

•Several highway and rail line passage structures must be constructed across the I-90 and US 93 transportation corridors including the northern Bitterroot Valley, the Six Mile/Ninemile and the Bonner-Clinton areas. A passage project at Six Mile Creek and Ninemile Creek has been proposed. There is a proposed wildlife crossing at Osborn, Idaho over an abandoned bridge and there are as yet undetermined sites across I-90 in North Idaho.

•The Ninemile Demographic Connectivity Area must be extended to include the Petty Creek, Northern Bitterroot and Cherry Peak areas and connect the DCA to the Bitterroot and Cabinet-Yaak Ecosystems as shown in Figure 15.

•The core Bitterroot Recovery Area must be expanded as suggested by Mattson (2021) and Bader and Sieracki (2022) to include biophysically suitable grizzly bear habitats. A proposed recovery area is shown in Figure 16. While the area generally south of the Salmon River is drier and less productive in vegetative food sources for grizzly bears including huckleberries (Hogg, et al. 2001) there are large ungulate populations and the landscape is remote, rugged and contains moist micro-sites. The existing Recovery Area, restricted to the Selway-Bitterroot and River of No Return Wilderness was drawn for political expediency and is not scientifically based.

•As per the recommendations of Proctor, et al. (2019) road densities must be reduced within and adjacent to key connectivity routes.

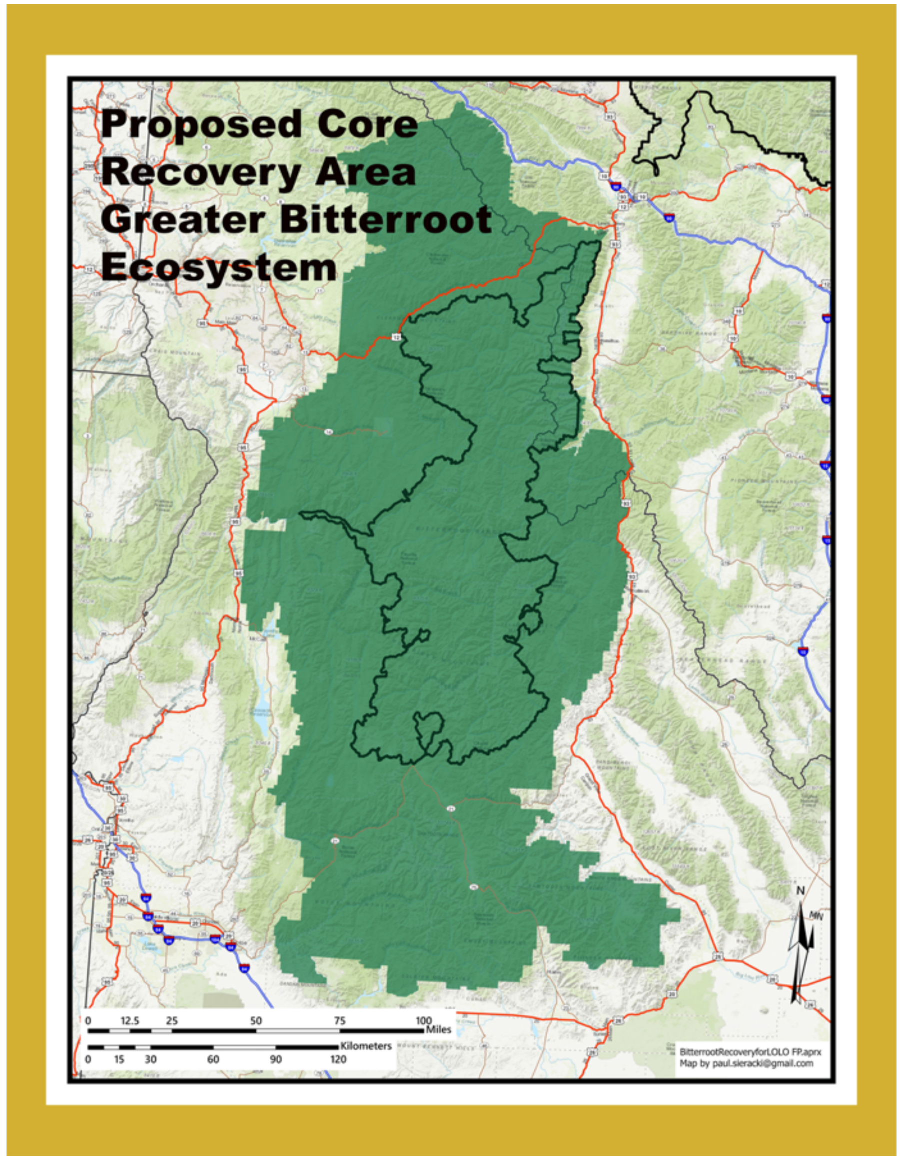


*Figure 16. Proposed Core Greater Bitterroot Recovery Area in green and the former Recovery Area in black.*

•A systematic hair trap DNA study should be conducted throughout the Bitterroot Ecosystem on a grid basis as described in Kendall, et al. (2009). Monitor and evaluate for 15-20 years before considering human assisted translocation into the BE.

•The number and distribution of adult male grizzly bears in the BE should be monitored during breeding seasons. Male presence during this time period could be an indicator of female presence.

•Food and attractant storage regulations including garbage must be expanded. Just one discovery of unsecured attractants can put an end to a dispersing grizzly bear and prevent it from immigrating to the BE.

## Literature Cited

Allendorf, FW, LH Metzgar, BL Horejsi, DJ Mattson, FL Craighead. 2019. The Status of the Grizzly Bear and Biological Diversity in the Northern Rocky Mountains. A Compendium of Expert Statements. Flathead-Lolo-Bitterroot Citizen Task Force. Missoula, MT. 21p.

Bader, M. 2000. Distribution of Grizzly Bears in the U.S. Northern Rockies. Northwest Science 74(4):325-334.

Bader, M, P Sieracki. 2022. Grizzly Bear Denning Habitat and Demographic Connectivity in Northern Idaho and Western Montana. Northwestern Naturalist 103(3):209-225.

Bjornlie, DD, DJ Thompson, MA Haroldson, CC Schwartz, KA Gunther, SL Cain, DB Tyers, KL Frey, and BC Aber. 2014. Methods to estimate distribution and range extent of grizzly bears in the Greater Yellowstone Ecosystem. Wildlife Society Bulletin 38: 182–187.

Blanchard, BM, RR Knight. 1991. Movements of Yellowstone grizzly bears. Biological Conservation 58(1991):41-67.

Boyce, M, J Waller. 2003. Grizzly Bears for the Bitterroot: predicting potential distribution and abundance. Wildlife Society Bulletin 31(3):670-683.

Carroll, C, RF Noss, PC Paquet. 2001. Carnivores as focal species for conservation planning in the Rocky Mountain region. Ecological Applications 11(4):961-980.

Costello, C, J Dellinger, JK Fortin-Noreus, MA Haroldson, WF Kasworm, LL Roberts, JE Teisberg, FT van Manen. 2022. A Summary of Grizzly Bear Distribution in Montana: Application of Consistent Methods in 2022. 8p.

Costello, C, L Roberts, M Vinks, P Adams, J Jonkel, E Hampson, J Horn, W Sarmento, J Vallieres, J Waller, E Wenum, C White. 2023. Northern Continental Divide Ecosystem 2022 Annual Results. Montana Fish, Wildlife & Parks. 36p.

Eriksen, A, P Wabakken, E Maartman, B Zimmermann. 2018. Den-site selection by male Brown Bears at the population's expansion front. PLoS ONE 13(8):e0202653.

Graves, T, RB Chandler, JA Royle, P Beier, KC Kendall. 2014. Estimating landscape resistance to dispersal. Landscape Ecology 29:1201-1211.

Hogg, JT, NS Weaver, JJ Craighead, BM Steele, ML Pokorny, MH Mahr, RL Redmond, FB Fisher. 2021. Vegetation patterns in the Salmon-Selway ecosystem: an improved land cover classification using Landsat TM imagery and wilderness botanical surveys. Craighead Wildlife-Wildlands Institute Monograph Number 2. Missoula, MT. 98p.

Itoh, T, Y Sayo, K Kobayashi, T Mano, R Iwata. 2012. Effective dispersal of brown bears (*Ursus arctos*) in eastern Hokkaido, inferred from analyses of mitochondrial DNA and microsatellites. Mammal Study 37:29-41.

Jerina K, M Adamič. 2008. Fifty Years of Brown Bear Population Expansion: Effects of Sex-Biased Dispersal on Rate of Expansion and Population Structure. Journal of Mammalogy. 89(6):1491-1501.

Jonkel, J. 2022. Region 2 Outlying Grizzly Bear Observations. Montana Department of Fish, Wildlife & Parks. Missoula.

Kasworm, WF, TG Radant, JE Teisberg, T Vent, M Proctor, H Cooley, JK Fortin-Noreus. 2023. Cabinet-Yaak Grizzly Bear Recovery Area. 2022 Research and Monitoring Progress Report. U.S. Fish & Wildlife Service. Missoula, MT. 118p.

Kendall, KC, JB Stetz, J Boulanger, AC Macleod, D Paetkau, GC White. 2009. Demography and Genetic Structure of a Recovering Grizzly Bear Population. Journal of Wildlife Management 73(1):3-17.

Lamb, CT, AT Ford, BN McLellan, MF Proctor, G Mowat, L Ciarniello, S Boutin. 2020. The ecology of human–carnivore coexistence. Proceedings of the National Academy of Sciences, 117(30), 17876-17883.

Mace, RD, JS Waller. 1997. Spatial and temporal interaction of male and female grizzly bears in northwestern Montana. Journal of Wildlife Management 61:39-52.

Mace, R and L. Roberts. 2012. Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2012. Montana Fish, Wildlife & Parks, 490 N. Meridian Road, Kalispell, MT 59901. Unpublished data.

Mattson, DJ. 2021. The Grizzly Bear Promised Land: Past, Present & Future of Grizzly Bears in the Bitterroot, Salmon & Selway Country. Grizzly Bear Recovery Project Technical Report GBRP-2021-1.

McLellan, BN, FW Hovey. 2001. Natal dispersal of Grizzly Bears. Canadian Journal of Zoology 79:838-844.

Merrill, T, DJ Mattson, RG Wright, HB Quigley. 1999. Defining landscapes suitable for restoration of Grizzly Bears *Ursus arctos* in Idaho. Biological Conservation 87(1999):231-248.

Miller, B, K Ralls, RP Reading, JM Scott, J Estes. Biological and technical considerations of carnivore translocation: a review. Animal Conservation (1999) 2, 59-68.

Mowat, G, DC Heard, CJ Schwarz. 2013. Predicting grizzly bear density in western North America. PLoS One 8(12).

Peck, CP, FT van Manen, CM Costello, MA Haroldson, LA Landenburger, LL Roberts, DD Bjornlie, RD Mace. 2017. Potential paths for male-mediated gene flow to and from an isolated Grizzly Bear population. Ecosphere 8(10):1-17.

Proctor, MF, BN McLellan, C Strobeck, RMR Barclay. 2004. Gender-specific dispersal distances of grizzly bears estimated by genetic analysis. Canadian Journal of Zoology 82:1108-1118.

Proctor, MF, BN McLellan, GB Stenhouse, G Mowat, CT Lamb, MS Boyce. 2019. Effects of roads and motorized human access on Grizzly Bear populations in British Columbia and Alberta, Canada. Ursus (30e2):16-39.

Sells, SN, CM Costello, PM Lukacs, LL Roberts, MA Vinks. 2023. Predicted connectivity pathways between grizzly bear ecosystems in Western Montana. Biological Conservation 284 (2023):110199. 14p.

Sells, SN, CM Costello, PM Lukacs, LL Roberts, MA Vinks. 2022. Grizzly bear habitat selection across the Northern Continental Divide Ecosystem. Biological Conservation 276.

Servheen, C. 2012. Email from Chris Servheen to Idaho Fish & Game. 10/12/12.

Shaw, K, K Whalen. 2021. Exploring the Human Dimension Equation in Grizzly Bear Conservation in Idaho. How to Effectively Outreach to Our Publics. University of Idaho. Presented to Bitterroot Subcommittee, Interagency Grizzly Bear Committee. 10/27/21.

Støen, O-G, A Zedrosser, Solve Sæbø, J Swenson. 2006. Inversely density-dependent natal dispersal in brown bears *Ursus arctos*. Behavioral Ecology 148:356-364.

Swenson, JE, F Sandegren, A Söderberg. 1998. Geographic expansion of an increasing brown bear population: evidence for presaturation dispersal. Journal of Animal Ecology 67:819-826.

U.S. Fish & Wildlife Service. NCDE Subcommittee. 2018. Conservation strategy for the Grizzly Bear in the Northern Continental Divide Ecosystem. 170p. + appendices.

U.S. Fish & Wildlife Service. 2000. Grizzly Bear Recovery in the Bitterroot Ecosystem. Final EIS. 292p.

U.S. Forest Service. 2022. Redd-Bull Environmental Assessment. Lolo National Forest.

White House Council on Environmental Quality. 2023. Guidance for Federal Departments and Agencies on Ecological Connectivity and Wildlife Corridors (3/21/23).