



BUFFALO FIELD CAMPAIGN

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RE: Yellowstone bison 12 month status review (FWS/R6/080098)

Yellowstone bison population structure

Dear Regional Director Matthew Hogan,

On behalf of Buffalo Field Campaign, I am attaching the following project summary and report for your consideration, excerpted below.

The Yellowstone bison population is thought to exist in at least two separate breeding herds that use northern and central areas of Yellowstone National Park. Recent and dramatic increases in bison using northern areas and decreases in bison using central areas has raised concern that management removals have targeted the central breeding herd. Bison are managed under an Interagency Management Plan that limits population abundance and distribution. Under this plan, limited numbers of bison are allowed to migrate out of the park during winter with the remainder lethally removed when migrating beyond park boundaries. Based on counts during 2017, numbers of bison using central areas of the park may no longer be sufficient for long-term genetic conservation. However, there is some indication that the historic herd structure has broken down over time. If this is the case, with bison conforming to a single, intermixing population, then the current bison population is likely sufficiently large for long-term genetic conservation – although there are substantially fewer bison observed in central areas of the park.

The goals of this project are twofold. First, we aim to determine the number of breeding herds in the Yellowstone bison population and characterize their genetic makeup. Second, we aim to evaluate whether management removals that occur when bison migrate out of the park differentially affect breeding herd units. This project will identify minimum numbers of bison necessary to maintain the current genetic and herd structure of the population. In turn, this project will provide managers with new information to advise culling animals from the population in a manner that promotes long-term conservation.

"Protecting the Last Wild Bison"

The end result of the project is to prepare a paper suitable to a peer reviewable journal identifying breeding area spatial associations and genetic characterizations of Yellowstone bison and evaluate potential effects of management removals. The specific steps are to: 1) complete a network analysis of the spatial distribution of radio-collared bison; 2) determine the connectedness of breeding groups between years; 3) describe the genetic composition of breeding groups using mitochondrial markers; and 4) evaluate the risk of management removal to each breeding group.

National Park Service and University of Wyoming, *Identifying Structure of the Yellowstone Bison Population*, Rocky Mountains Cooperative Ecosystem Studies Unit (June 1, 2018–December 31, 2022).

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1. Complete a network analysis of the spatial distribution of radio-collared bison.

Figure 1. Social network of all bison collared from 2006 to 2020. Circles represent each collared animal (colored by the amount of time spent on the northern range) and lines represent whether a pair of individual ever spent any time together (i.e., were less than 100m from each other). The network demonstrates that there is some separation between animals that mainly live on the northern range from animals that mainly live in the interior. However, the network also shows that around 11 collared individuals spend significant amount of time on both the northern range and the interior and that those individuals interacted with many other individuals in those ranges. In other words, those individuals acted as network hubs, connecting bison from the northern range to bison in the interior.

2. Determine the connectedness of breeding groups between years.

Figure 2. Social network of bison collared during the core and extended breeding seasons of 2015. Circles represent each collared animal (colored by the amount of time spent in different areas of Yellowstone) and lines represent whether a pair of individual ever spent any time together (i.e., were less than 100m from each other) and widths of the line represents the number of days spent together. The networks demonstrate that during the breeding season, there was clear separation of animals on the northern range and the interior. However, within those areas, and particularly on the northern range, there was significant mixing of animals across different areas. This analysis also suggests that the mixing of individuals from Figure 1 generally occurs outside of the breeding season and once breeding season starts, animals tend to stay either on the northern range or in the interior.

3. Describe the genetic composition of breeding groups using mitochondrial markers.

The mitochondrial analysis is the responsibility of NPS, and those results only recently were secured. Dr. Merkle has developed a workflow and code to calculate social networks and resulting social metrics for each individual that has genetic samples. This analysis has not been fully completed yet because there were some individuals with genetics data that had older collar data that has not been organized. Dr. Merkle and Dr. Geremia agreed that we would wait to complete this objective until the older collar data were organized and cleaned up.

4. Evaluate the risk of management removal to each breeding group.

Dr. Merkle has developed social networks during the removal season (see Figure 4). However, Dr. Geremia and Dr. Merkle discussed this and agreed that this analysis must wait until all the genetics analyses have been completed.

Figure 4. Social network of bison collared during the entire year, the breeding season, and during the removal season of 2013. Circles represent each collared animal (colored by the amount of time spent on the northern range versus the interior of the park) and lines represent whether a pair of individual ever spent any time together (i.e., were less than 100m from each other) and widths of the line represents the number of days spent together. These networks denote that much of the connections of individuals across the northern range and the interior of the park occur during the removal season, not during the breeding season.

Jerod A. Merkle and Chris Geremia, *Identifying Structure of the Yellowstone Bison Population*, Final Federal Performance Report (March 20, 2023).



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