Sept. 9, 2008
581 Antelope Ridge Rd.
Belgrade, MT 59714

To: Interagency Bison Management Partners

Re: Genetic Diversity of Yellowstone Bison

In wildlife populations, genetic diversity is correlated with reproductive success, survival and resistance to disease. It is the basis for continuing adaptation of a population to its environment, and is important to the long-term survival of a species, especially where there may be substantial environmental changes, range expansions or reintroductions to new sites. Retaining genetic diversity of the Yellowstone bison herd is especially important because the Yellowstone herd is the only large herd of wild bison that is uncontaminated by cattle genes. Maintaining the genetic integrity of Yellowstone bison is one of the most important wildlife issues in North America.

This issue is important to Montana because wild bison have been extirpated from the state and because Yellowstone bison are, by far, the best possible source of +animals for reestablishing wild bison in appropriate Montana habitats such as areas within the Greater Yellowstone Ecosystem and the Charles M. Russell National Wildlife Refuge.

Genetic diversity is lost through random variations of reproduction and survival in small populations, and through misguided management practices such as non-random culling of animals. As indicated below, the number of bison estimated as necessary to retain 95% of the genetic diversity of Yellowstone bison over 200 years is between 2000 and 4000 animals, but probably is closer to 4000 bison than to 2000. The current population is under 3000 bison. However, under the Interagency Bison Management Plan, the herd can and probably will be reduced to 2300 or fewer. Indeed, Montana Fish, Wildlife and Parks expects to harvest animals in 2008 and Native Americans will probably take more. Under the Interagency Bison Management Plan, additional bison will probably be culled this winter, as they leave the Park.

With a “limit” of 2300 bison, we are intentionally managing Yellowstone bison near the brink of genetic extinction; whereas population geneticists and other scholars (cited below) have urged a cautious, conservative approach for this unique herd. With 2300 bison, the slightest deviation of reality from assumptions in population/genetics models will assure loss of rare alleles. Such deviations are already apparent.

* * * * * *

I base numbers given in the above paragraphs on the following research, scholarly review and field studies.

Gross et al. (2006), using population/genetic modeling, estimated that 1000 bison are needed to provide a 90% probability of retaining 90% of allelic diversity for 200 years. However, assumptions of their models do not fit what has occurred in Yellowstone National Park. Deviations from model assumptions, addressed below, provide greater jeopardy to the genetic diversity of Yellowstone bison than indicated in the models. Gross et al. recognized some of these deviations and urged a cautious approach in applying their results to management of Yellowstone bison.

Freese et al. (2006) reviewed Gross et al. (2006) and concluded that, considering the importance of the Yellowstone herd to conservation of bison in North America, a more prudent goal would be retention of 95% of the existing genetic diversity over 200 years. This will require maintaining about 2000 bison, according to the models of Gross et al. (2006).

Deviations of reality from assumptions in the Gross et al. (2006) models are:

1. Uncertain knowledge of lifetime male breeding success. Genetic diversity would be jeopardized if a greater proportion of breeding were being accomplished by fewer males.
2. Shorter generation times. Emphasis on removing older bison in Yellowstone control programs has reduced lifetime breeding success of individual bison and jeopardizes the retention of genetic diversity. (At the August 2008 meeting of the IBMP, Rick Wallen, Park biologist noted that, whereas 12-13 year-old bison were once fairly common, it is now hard to find an animal older than 8 years.) In contrast, in modeling the effects of control programs, Gross et al. limited the taking of bison in the oldest age classes.
3. Non-random culling of bison. Other than cow-calf pairs, Gross et al. modeled a random selection of animals for slaughter. In reality, many bison have been captured in groups of probably related animals and there has been emphasis on taking of cows and calves. Removal of extended matrilineal groups of bison increases jeopardy to retention of genetic diversity.
4. Population substructure. There are at least two major subpopulations of bison in Yellowstone, the Central breeding herd and the Northern breeding herd (and genetic studies suggest the possibility of 3 subpopulations). Gross et al. (2006) stated that a more complex modeling analysis would be needed to deal with this substructure. Assuming 2 Yellowstone subpopulations, if there were no interchange of breeding bison between them, the Gross et al. estimate of needing 1000 bison to preserve 90% of genetic diversity, and the Freese et al. estimate of needing 2000 bison to preserve 95% of genetic diversity, would apply to each herd.

5. Herd interchange is unknown. Gross et al. (2006) estimate that "transfer of about 10 bison per generation should be adequate to maintain genetic similarity in subpopulations." Note this implies a need for 20 emigrants per generation, 10 each way between the two subpopulations. Note also, that generation times have been shortened by culling practices in Yellowstone, so that more frequent transfer of animals is needed to maintain genetic similarity. The Park biologist has found 6 emigrants from the Central to the Northern herd, and recent growth of the Northern herd suggests augmentation by animals from the Central herd. Trapping operations at Stevens Creek may be encouraging this transfer of animals. Apparently, there is no evidence of movement of breeding animals from the Northern to the Central herd.
6. Model predictions uncertain. Gross et al. (2006) note that their models show rather high variation of results during the 2nd century of simulation. Precision of their predictions is therefore not great, and they suggested caution in their application.

* * * * * *

In a May 18, 2008 letter to the Animal Welfare Institute, the Denver Regional Director of the National Park Service stated that the Park Service would present AWI's Yellowstone bison genetics analysis at the next (August 6-7) meeting of the IBMP partners. The Director also stated that NPS would recommend an assessment of how recent science should be incorporated through the IBMP adaptive management framework. I find no public evidence that NPS presented the AWI argument at this meeting. Instead, NPS summarized the recent genetics information without providing an interpretation. Further, there is no public evidence that NPS recommended a reassessment of current IBMP bison control procedures. Instead, in a briefing statement dated August 7, 2008 NPS accepted that FWP and the tribes may harvest 200 bison in 2008 and noted that fewer than 200 more bison could be removed in 2008-09 for brucellosis risk management, before reaching the IBMP threshold of 2300 bison in the Park herds.

Thus, no adaptive changes were recommended by NPS for 2008-09. New limits on the numbers of animals to be removed were not offered. Nor were there recommendations to control the sexes, ages or sources (Central vs. Northern herd) of animals to be removed.

NPS is advertising that new genetics research and analysis has been funded, to be completed in 2009. This is an admission that we do not have all the answers and should justify new cautious procedures, if not a complete cessation of bison culling, until we have the new information.

To my knowledge, FWP has been silent on this issue of conserving genetic diversity of Yellowstone bison. As a sportsman and retired wildlife biologist, I find

this terribly disappointing and unprofessional. Moreover, in a summary of the August 6 IBM Partners meeting, FWP is quoted as needing to increase opportunities to harvest prime-age females. This strategy will maximize harvest impact on reducing the herds and will further reduce average generation time in the herds. Both results will further jeopardize retention of genetic diversity.

A prudent and conservative approach, already recommended by geneticists and conservationists, would be to cancel the harvest of bison in 2008 and to minimize the number of bison removed in any 2008-2009 control efforts. This policy can then be reviewed once the results and recommendations of research funded by NPS become available in 2009.

Sincerely,

James A. Bailey
406-599-1343
jabailey34@aol.com

Gross, J. E., G. Wang, N. D. Halbert, P. A. Gogan, J. N. Derr and J. W. Templeton. 2006. Effects of population control strategies on retention of genetic diversity in National Park Service bison (*Bison bison*) herds. Revised Final Rpt., Yellowstone Research Group, Dept. of Biology, Montana St. Univ. Bozeman.

Freese, C. H., K. E. Aune, D. P. Boyd, J. N. Derr, S. C. Forrest, C. C. Gates, P. J. P. Gogan, S. M. Grassel, N. D. Halbert, K. Kunkel and K. H. Redford. 2006. Second chance for the plains bison. Biological Conservation.