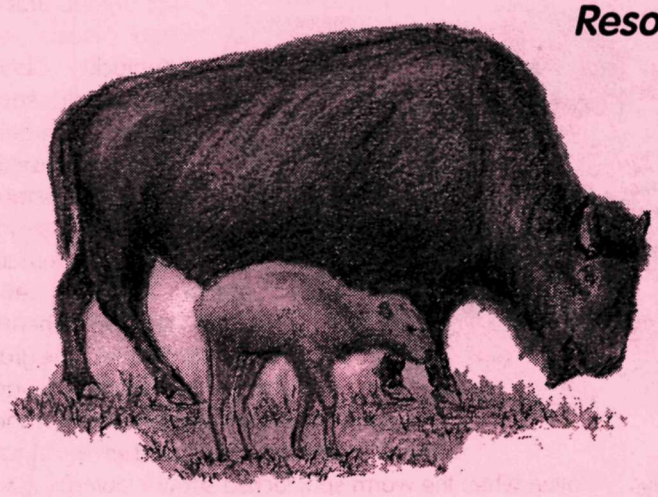
The Buffalo Chip

Resource Management Newsletter
Yellowstone National Park
Midwinter 2003



What's inside

But Did He See His Shadow?

by MacNeil Lyons and Keri Thorpe

As MacNeil sat behind the desk of the Albright Visitor Center one morning back in November, something caught his attention outside on the parade ground. A small, brown object was moving around on a bare spot on the otherwise snow-covered lawn. He initially thought it was a magpie or a weasel, but after grabbing a pair of binoculars discovered it was a Uinta ground squirrel! This was an unusual sight, as these animals are typically hibernating at this time of year. The squirrel appeared to be munching on some of the exposed, now-brown Kentucky bluegrass, and was occasionally spooked by a nearby raven, at which point it would immediately dart back down the nearest hole. MacNeil pointed the squirrel out to Keri, who wondered about its early emergence from its underground den.

The bare spot in the snow was itself a source of interest among the Mammoth Interpretive staff. For the last three years, employees have been noticing that an area of about 9x12 meters seemed warmer than the surrounding area (hence the lack of snow accumulation). Park geologist Hank Heasler and GIS specialist Steve Miller conducted an electromagnetic survey of the area in mid-January. Hank believes that a new sinkhole may be forming, but another survey needs to be done to be sure. At the time of his initial investigation (January 3), Hank found that the ground temperature was 5.4°C higher in the maximum part of the depression than that of the surrounding soil, which may have encouraged the Uinta to emerge, finding little snow and something to eat. This may not be the only explanation, however, as a Uinta was also seen to emerge from a burrow across the street under the cottonwoods, south of the courthouse during the last week of December. On December 30, Greg Gordon of the Yellowstone Association Institute watched this Uinta meet its end when a raven successfully pummeled it to death with its beak. The raven tossed it around a bit and then ate it.

Curious about these sightings, Keri contacted both park management biologist Roy Renkin and Don Streubel, author of *Small Mammals of the Yellowstone Ecosystem.* Renkin recalled visitor reports of Uinta ground squirrels emerging during winter in the early 1980s, and told us that although midwinter emergence among hibernating

mammals is not common, it does happen on occasion; bears, of course, also occasionally emerge during warmer periods in winter. (We'll let you know if we see a bear emerge from the parade ground's warm spot!)

Of course, hibernation is more a continuum of circumstance and species than a simple "yes-or-no." Mammals can range from being "true hibernators," such as bears, to "non-hibernators," such as elk. In between, we find ground squirrels, which are closer to the "true hibernators" end of the spectrum, and tree squirrels, which are closer to the "non-hibernators." Chipmunks are right about in the middle. Within the spectrum, a species's hibernation experience can vary depending on a number of factors, including specific weather conditions and geographic location. Most hibernators experience a sliding scale of winter activity coupled with states of torpor and/or semi-torpor.

On January 6, we alerted park photographer Jim Peaco to the Uinta's presence. Excited by this unusual sight, he set up his new camera and took these pictures.

In other words, although many small mammal species remain active in the wintertime on the subnivean level (beneath the snow), ground squirrels, including the Uinta, experience a suite of physiological changes that result in reduced energy requirements, allowing them to utilize fat reserves to survive winter. These changes include a drastic drop in metabolic rates, which includes reduced respiration, heart rate, kidney and brain function. Whereas tree squirrels, for instance, go through periods of rest but will frequently become active and seek out food that they cached prior to winter, Uinta ground squirrels may rouse periodically in their dens, but usually do not eat.

Whether the warmer ground confused this Uinta's internal clock or he actually got hungry we really don't know, but he emerged and began feeding on the grass. According to Renkin, males typically emerge first in order to establish territories, but usually not until late March or early April at Mammoth. Root crowns of Kentucky bluegrass hold some sugars through winter, because the ground temperature beneath the snow pack typically remains above freezing even without the help of thermal activity. That in mind, the grass over the parade ground's warm spot may be more productive than normal. The Uinta we observed emerged most often when the warm spot lacked snow. However, it was also observed on January 21 sitting on snow-covered ground and digging through a 1/4 inch of freshly fallen snow. Part of the reason these small mammals hibernate is to avoid predation, and we noticed that against the snow, the squirrel stood out like a road flare for a passing raven.

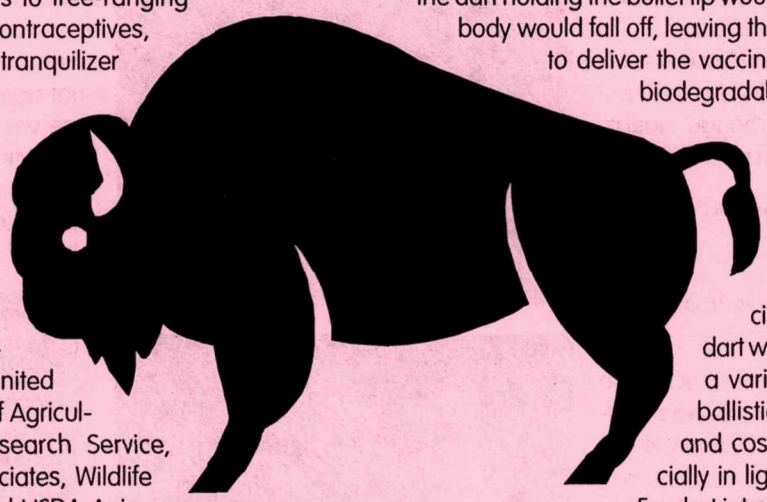
Don Streubel confirmed that the warmth of the ground surrounding the Uinta's den is probably affecting his daily habits, and indicated that it seems logical that in the warmer environment of Mammoth's underground it may rise, detect little to no snow over its burrow opening, and then emerge. He said that during these periods the Uinta would be lethargic and slow-moving—a state that could account for the raven's success across the street. He also suspects that the unusually warm and dry weather in December and January could account for our observations.

MINI-CHIP: BEMO NEWS!

by Mark J. Biel and Rick Wallen

2nd Annual Meeting of the Remote Ballistic Vaccination Delivery Consortium

On January 23, 2003, members of the Remote Ballistic Vaccination Delivery Consortium met in Fort Collins, Colorado. The consortium is an informal, interdisciplinary group of science experts and wildlife managers working together to improve current methodology and develop new technological approaches for remote ballistic delivery of biologics (vaccines) and pharmaceuticals to free-ranging wildlife. The group's short-term goal is to address the delivery of brucellosis vaccine to free-ranging bison at Yellowstone National Park. In the long-term, we will address other application needs for remote delivery of pharmaceuticals or biologics to free-ranging wildlife, such as contraceptives, other vaccines, and tranquilizer drugs.



Personnel from the National Park Service, Wyoming Game & Fish Department, Colorado State University, Turner Enterprises, Ballistic Technologies, Inc. (BTI), United States Department of Agriculture-Agricultural Research Service, Wildlife Health Associates, Wildlife Pharmaceuticals, and USDA-Animal and Plant Health Inspection Service attended this meeting. YNP Bison Ecology and Management Office (BEMO) staff gave presentations addressing what the park is doing to prepare for eventual vaccination of bison; research updates on mock vaccination approach trials; accuracy studies of the BTI delivery system (see next section); and "biobullet" delivery of vaccination to live bison.

Other topics included reports on various kinds of dart delivery systems. A new long-range dart system was introduced by "Ecodart," a company from the U.K. that has designed and tested the system in Europe. On the outside, the dart resembles a 12-gauge shotgun shell. The inside, however, is comprised of a needle surrounded by an air bladder. The air bladder compresses upon impact with the target animal and absorbs the shock to the muscle and skin. Then, the needle injects the payload into the skin and muscle, simulating a hand injection. Afterward, the needle retracts into the dart barrel, and the Ecodart falls to the ground. This system would not be an option for use in Yellowstone because it has not been sufficiently tested, would be expensive to bring on line ($20/empty dart), and could potentially litter the backcountry with spent Ecodarts. The purpose of the interagency consortium, however, is to explore as many avenues as possible; what may not work for one agency may work for another.

A group representative had previously approached Pneu-Dart about the idea of molding a dart from biodegradable material. A prototype was made with a tip that would accept a biodegradable bullet, with the thought that depth of penetration could be controlled, with the biobullet-type tip just penetrating the muscle. The neck of the dart holding the bullet tip would degrade, and the dart body would fall off, leaving the bullet tip in the muscle to deliver the vaccine. It is possible that the biodegradable dart could fly like any other dart, but no tests have been conducted to determine accuracy and effective range. The presenter noted that this was an exercise in theory and that this dart was not worth pursuing for a variety of reasons such as ballistics, delivery of payload, and cost of manufacture, especially in light of the less-expensive Ecodart introduction.

A presentation summarizing the effectiveness of the *brucella* vaccine noted a significant difference in demonstrated immunity from brucellosis between vaccinated and non-vaccinated calves. The results have been consistent over the course of five different studies. Researchers tested hand injection, ballistic vaccination, and subdermal surgical insertion of the biobullet, as well as control groups. Initial studies demonstrate an inconsistent difference in titre response (antibody concentration) to vaccine when comparing ballistic to surgical delivery of a biobullet, with rate of effectiveness favoring surgical delivery. Questions linger about what effects the healing response might have on vaccine delivery, and ultimately, against *brucella* challenges. It was concluded that while the immune system of bison is similar to that of cattle, its manner of function is not exactly the same. There is still a lot we do not know about

the bison immune response to *brucella* vaccines.

Polymer chemists from Colorado State University gave a presentation on packaging the *brucella* vaccine using photo-reactive hydrogel technology. Hydrogels are inexpensive and safer than the more common option of compressing powdered vaccine into a small biobullet projectile. It may also be possible to load hydrogel solutions directly into the chamber of empty biobullets and fix them in the field using visible light. This, however, has never been attempted, and research would have to be done to determine whether the load would remain in the bullet or could pop out the back upon firing. Hydrogel technology is currently used in Norplant (a 5-year birth control device) and other human medical needs such as joint replacement.

Finally, it was proposed that a model be developed to determine the gun barrel rifiling and bullet mass necessary for delivering a vaccine payload out to 100 yards. Another research presentation addressed BTI's production of a prototype air pressure regulator that can be switched between various pressures, enabling a single weapon to fire biodegradable bullets from various distances.

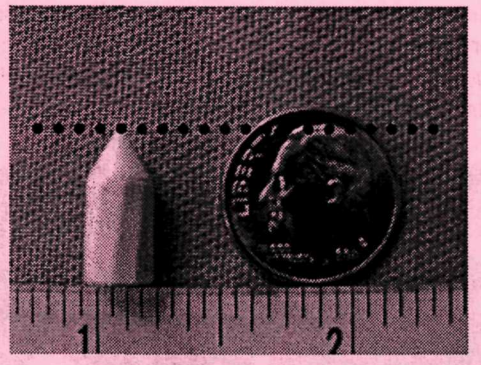
The remote Ballistic Vaccination Delivery Consortium will continue to meet at least annually to exchange ideas, thoughts, and updates on research.

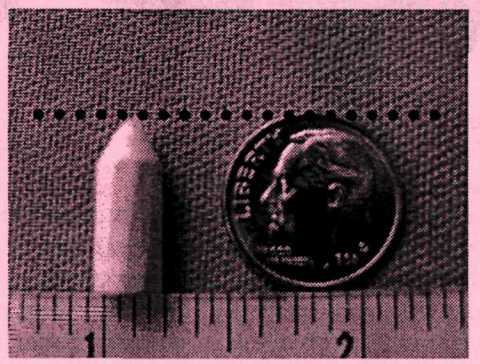
Accuracy Study of BTI Vaccination Delivery System
—OR—
Who can hit the broad side of a bison calf with a biobullet?

This is exactly the question that we in the Bison Ecology and Management Office (BEMO) want to know in order to implement the bison remote vaccination program in the park in 2004-2005, as is called for in the Record of Decision for the recent bison EIS and interagency management plan. Actually, we will be aiming at target zones much smaller than the broad side of a bison calf, using air guns loaded with "biobullets" (fully biodegradable bullets each loaded with a dose of vaccine). The muscle mass on the shoulder of a bison calf presents a target zone of about 6 inches in diameter, and the hip presents a target zone of about 10 inches in diameter.

To determine which combination of biobullets and air pressure will most effectively enable us to hit our targets, we have been working with a company called Ballistic Technologies, Inc. (BTI) out of Oklahoma that produces a vaccine delivery system powered by compressed air at different pressures. BEMO has initiated an accuracy study to evaluate whether or not the BTI equipment could accurately hit a bison calf's target zones. So far, we have shot two types of biodegradable bullets: short (figure 1), and 0.08 longer (figure 2), from air guns hooked up to two air pressure regulators (1200 psi and 1500 psi), at targets 20 meters away. In the future, we will also be testing another biobullet that is 0.08 longer than the short version and whose shell also contains Tungsten particles (figure 3). This biobullet is twice as heavy as the other longer bullet, with the idea being that the added weight of the metal may improve the tungsten biobullet's accuracy at longer distances.

We are comparing the various combinations of bullets and air pressures at a variety of distances to determine which combination works best, and testing to see which members of the BEMO crew are the best sharpshooters. As a control to gauge the delivery system's highest performance level, we are also shooting from a shooting vise and comparing our shooters to that standard. In the near future we will be shooting at distances of 10, 30, and 40 meters and comparing the same variables.





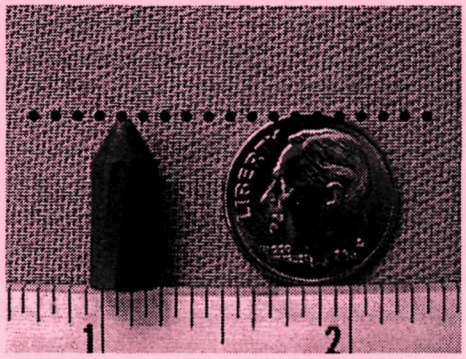


Figure 1 (top). Standard (short) biobullet.
Figure 2 (middle). Longer biobullet
Figure 3 (bottom). Tungsten polymer biobullet.

Biobullets are fully-biodegradable delivery systems used for remote introduction of pharmaceuticals and biologics, including the brucella *vaccine. The outer shell is composed of cellulose, and the vaccine is loaded inside in either powdered or, potentially, hydrogel form. After penetration, muscle enzymes dissolve the outer shell, allowing the payload (in this case, the vaccine) to enter the animal's bloodstream. In tests performed on cattle, no remnants of the biobullet were detectable after one day, indicating that the dissolution and dissemination process had been completed within that time.*

Air pressure Biobullet type	1200 psi short bullet	1200 psi longer bullet	1500 psi short bullet	1500 psi longer bullet
Target zone				
Shoulder	56%	85%	28%	65%
Hip	92%	100%	59%	97%

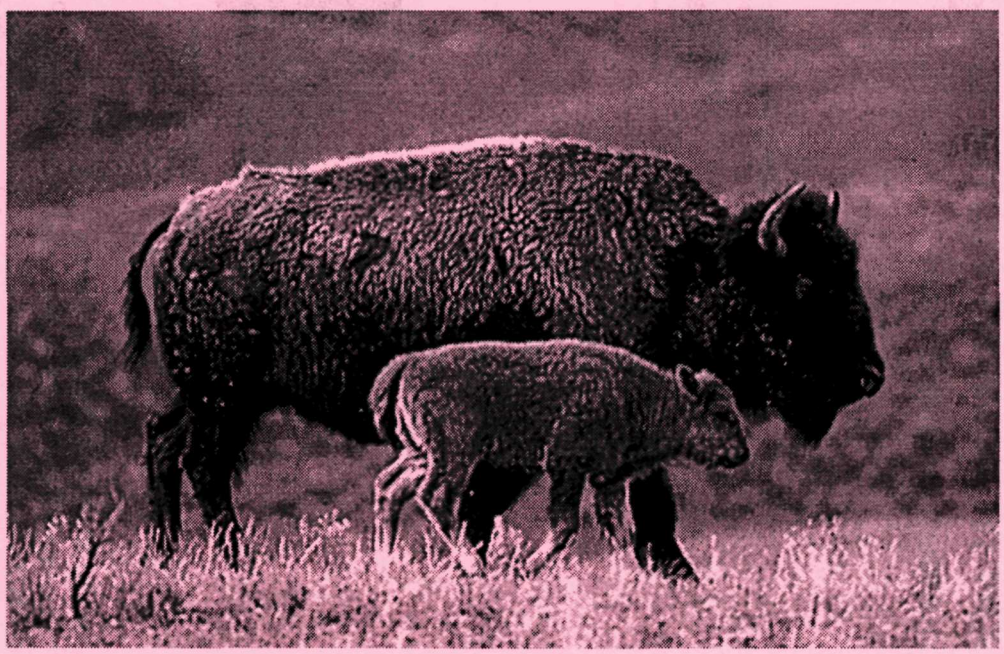
Table 1. Percentage of shots hitting within target zones based on delivery system and bullet type from 20 meters.

Results so far indicate that there is no significant difference among shooters, meaning that everyone was as accurate as the vise. So far, the best shooters are Mark Biel and Chris Geremia, with Rachael Gray a close third—but again, there was no statistical significance between the three.

There was a significant difference in bullet types, with the shorter bullet being much less accurate than the longer bullet. There was also a significant difference between delivery systems, with the 1200 psi being more accurate than the 1500 psi delivery system. There was, however, no interaction between bullet type and delivery system used, indicating that any variation in accuracy was due to either the bullet or the delivery system alone. We also looked at potential interactions between shooters and bullet type, shooters and delivery system, and shooter/bullet/delivery system interactions, and none showed any statistical significance, meaning that there was no interaction for each of these parameters.

These preliminary results indicate that a longer bullet delivered at lower pressure is what we should consider if we want to successfully hit the broad side of a bison calf. So far, it looks promising that we will be able to accurately hit the bison calf target zones from 20 meters. Based on the ideal target zone being either 6 or 10 inches in diameter, we would at this point select the 1200 psi delivery system and the long bullet in order to deliver vaccine at 20 meters (Table 1). Based on other ongoing research, we also know that the 1200 psi delivery system and long bullet combination can penetrate the hide of an 8-to-10 month-old bison calf. In other words, we can hit the broad side of a bison calf, but depending on the delivery system used, we may not hit it all the time. After we determine the accuracy of the delivery systems, we can then decide how feasible a remote delivery vaccination program at Yellowstone National Park may be.

In a related study, we have been monitoring bison movement patterns and the feasibility of approaching bison safely to a distance close enough to deliver a vaccine but far enough to maximize the safety of both the bison and BEMO crew members. Research will continue on the development of a safe and effective delivery system and biodegradable bullet formulation and configuration, as well as on the packaging of the vaccine into the bullets to ensure consistently accurate delivery of the vaccine. We will also continue our research on how best to approach a bison herd containing animals eligible for vaccination, and on how bison utilize the landscape at different times of the year so that we will have known areas or locations where vaccination could take place. Keep an eye out for future issues of the Buffalo Chip as we update everyone on our progress.



Adult female bison with calf.

Bison Movement Patterns Toward the Lower Madison River Area

by Rick Wallen and Chris Geremia

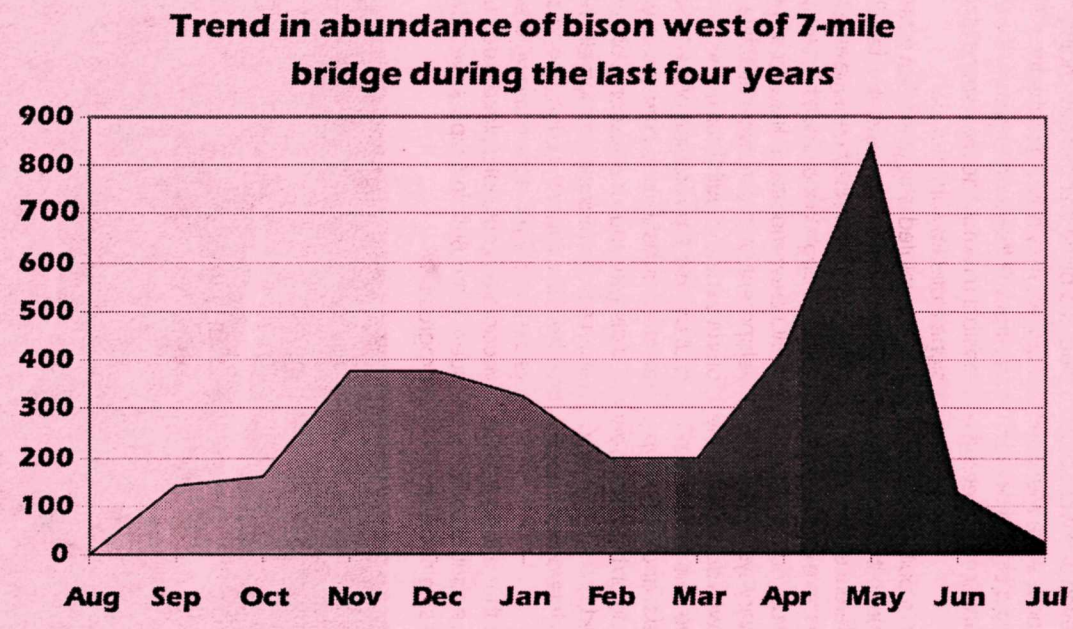


Figure 1. Trend in the annual movement patterns of bison in the 7-mile Bridge area over the past four years.

Bison are often on the move across the landscape, and sometimes their patterns of movement can be predictable from year to year. Beginning in about 1982, Dr. Mary Meagher noted that Yellowstone-area bison show regular annual movements to lower-elevation feeding areas in the vicinity of West Yellowstone, Montana. We have compiled information from aerial surveys conducted during the last four winters and determined that a pattern exists relative to how many bison move into the lower Madison River Valley during the different times of the year (figure 1).

The abundance of bison west of 7-mile bridge in the late autumn is most likely a response to available forage that is either still growing because of the lower elevation or has not completely senesced (died) for the winter. The pattern of animals moving back toward the interior of the park during the shortest days of the year (midwinter) has been very pronounced in recent years. However, by early spring some bison usually leave the park for lower-elevation range, following established routes near the Madison River and along Duck Creek. These locations are part of the population's historic range but include both private and non-NPS public lands. They are also the areas where the spring greening of the landscape begins earliest. Bison moving into these lands seek the new growth that the grasses produce.

3,000? How Do You Figure?

by Mark J. Biel and Rick Wallen

The Record of Decision for the Interagency Bison Management Plan (IBMP) states, "the population target for the whole herd is 3,000 bison. If the late winter/early spring bison population is above the 3,000 target, specific management actions may be undertaken at the Stephens Creek capture facility or outside the park in the western boundary area to reduce its size."

Many people have been asking, why 3,000? Here are some answers.

In 1998, the National Academy of Sciences published a report entitled Brucellosis in the Greater Yellowstone Area. This report was an attempt to provide a non-biased look at a topic that has been controversial in the Greater Yellowstone Area for decades. The report examines such topics as Disease Transmission, Transmission Among and Between Species, Vaccines, and Reducing the Risk of Transmission from Wildlife to Cattle. It is under the topic of Transmission Among and Between Species that the number 3,000 first appears. In this section, researchers examined potential causes of bison movement out of Yellowstone National Park, including snow water equivalent in inches (amount of water contained in fallen snow), temperature, and summer rainfall. Because the idea was to look at what causes animals to leave the park in winter, the summer rainfall category was discarded.

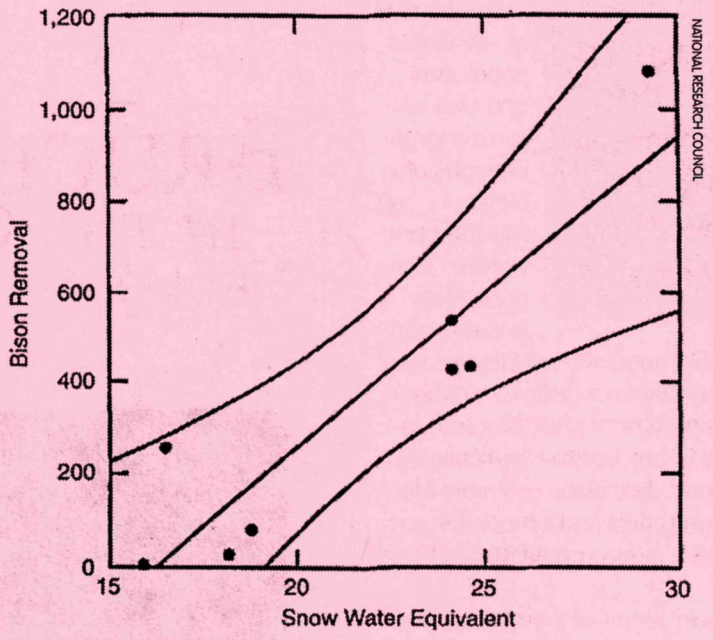


Figure 1. Plot of bison removals on snow water equivalent for bison populations greater than 3,000.

After examining almost five decades of weather data, the researchers determined that none of the weather variables showed a significant correlation with bison leaving the park. Only the estimated bison population size was found to be significantly related to the number of bison leaving the park. The probability of large numbers of bison leaving the park increases sharply when their population exceeds 3,000. The effects of weather on populations above and below this threshold of 3,000 animals was examined, and for a population size below 3,000 animals, there was no weather variable that was significantly related to bison leaving the park. When a population threshold above 3,000 was examined, the only factor strongly related to bison moving out of the park was snow water equivalent in inches (see Figure 1). An estimate of 17 inches of snow water equivalent was determined to be a useful benchmark for increased probability that bison will move out of the park and, if not controlled, could potentially come into contact with cattle.

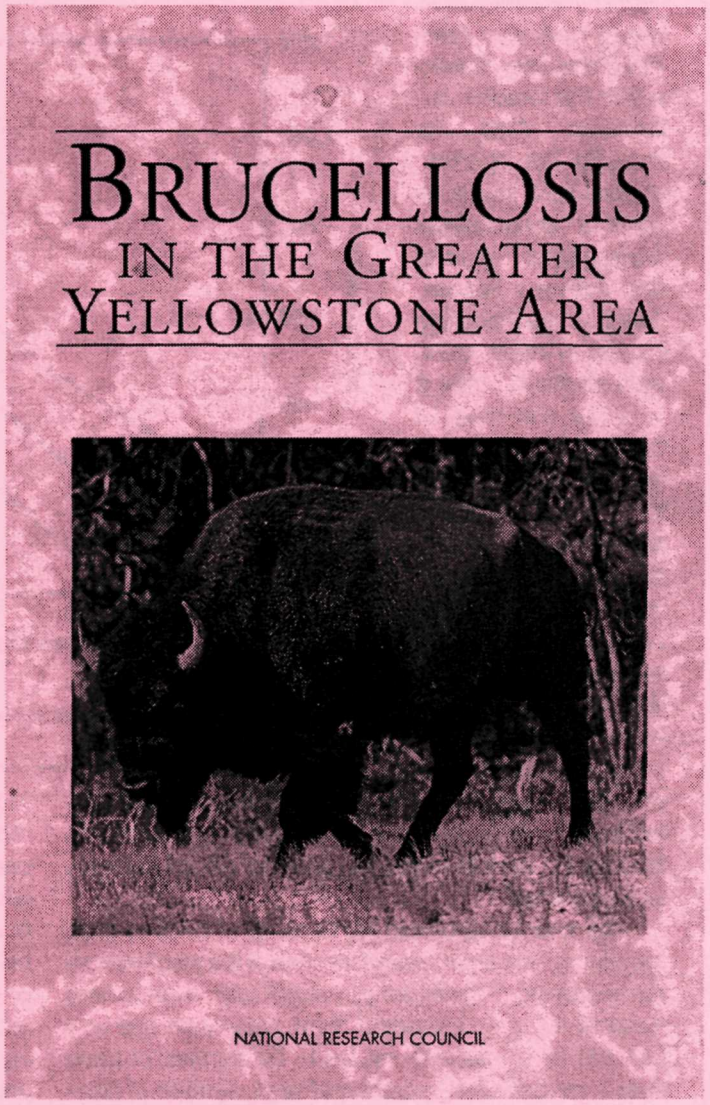
So in essence, 3,000 is the winter carrying capacity for YNP, meaning that above this population size, bison will move out of the park in all but the mildest of winters. Does this mean that 3,000 is the overall carrying capacity for the park? **NO!!** According to the same NAS report in 1998, bison removed from the park in winter 1991-92 and 1996-97 (some of the most severe winters on record) were found to be in good-to-excellent body condition. This, according to the report, indicates that even at a population size of more than 3,500 bison, little or no evidence exists to indicate that forage quantity or quality is inadequate. Rather, winter severity is the driving force behind bison leaving the park. The report continues by saying that although the bison population has adequate forage to maintain itself above 3,000 animals when winters are mild-to-normal, other factors, such as the inaccessibility of that forage during harsh winters, drive a large number of bison out of the park to lower elevations if the population exceeds 3,000.

In short, the 3,000 number is not a carrying capacity of the park, or a "desired" cap, but a management number at which certain management options are available to the cooperating agencies. In order to minimize the probability of large numbers of bison leaving YNP, the IBMP has established an objective for maintaining a population target of 3,000 animals as a risk management measure. This provides the NPS with a large enough population of bison to ensure genetic integrity of a viable population, and also ensures a large enough population to provide park visitors an opportunity to view bison throughout the park. With a population of this size, we can also reasonably expect that our disease management actions can accomplish or at least progress toward our long-term goal of brucellosis elimination. Finally, a population of about 3,000 bison can more feasibly be managed (through spatial and temporal separation from domestic cattle) than a population size of greater numbers.

> Bison leave the park in search of food. During years of heavy snowfall, or rain, snow, or freezing events, food for bison becomes very difficult to find. Thus, the search is extended to a larger area. The older animals are experienced enough to know that snow depths decrease at lower elevations, and group leaders know how to find those areas.

So, what this means in terms of the IBMP is that when the late winter bison population count (usually conducted in March or April) shows that the herd is over 3,000 animals, bison leaving the park may be shipped to slaughter without being tested. This is to bring the population down closer to 3,000 animals in an attempt to prevent a mass migration out of the park should severe winter weather drive animals to lower elevations. This does not mean that the NPS will conduct herd reductions inside the park until the herd size is down to 3,000 bison. In fact, until the late winter bison population flight is conducted, the agencies should test all animals leaving the park and ship only those that test seropositive for exposure to brucellosis unless the animal is deemed a threat to human safety or private property. In this manner, the cooperating agencies hope to maintain a bison population of between 2,300 and 3,000 animals, hopefully keeping the number of bison migrating out of the park to a minimum. There will always be some animals that will leave the park regardless of winter severity and/or population size, and those will need to be managed according to the ROD. The population of bison in the park may be above 3,000 animals, as it is now, but if the winter weather is not severe enough to force movements out of the park, then the population will remain at that level and more than likely grow with the new crop of calves.

For more information on the brucellosis issue and the science associated with it, check out Brucellosis in the Greater Yellowstone Area, published by the National Research Council, www.nap.edu.



Cover, Brucellosis in the Greater Yellowstone Area.

Summary of Bison Management Operations, Summer 2002 through January 2003

by Rick Wallen

Total number of hazing operations conducted	Average number of animals moved each time (range in group size noted in parentheses)	Number of times 3 or fewer bison were hazed	Number of times that only male bison were hazed
West of park: 32 North of park: 0	West: 3 (1-23) North: n/a	West: 27 North: n/a	West: 31 North: n/a

Ten adult male bison have been captured at the Duck Creek facility near West Yellowstone. Four animals have tested negative for brucellosis and released. In addition, two animals have tested positive and sent to slaughter based on test results. Four adult bulls have been sent to slaughter without testing for brucellosis. These animals were removed from our population based on the state's responsibilities to respond to private property damage complaints. One additional bull was shot in November in response to property damage.

Archeological Bits & Pieces

by Ann Johnson

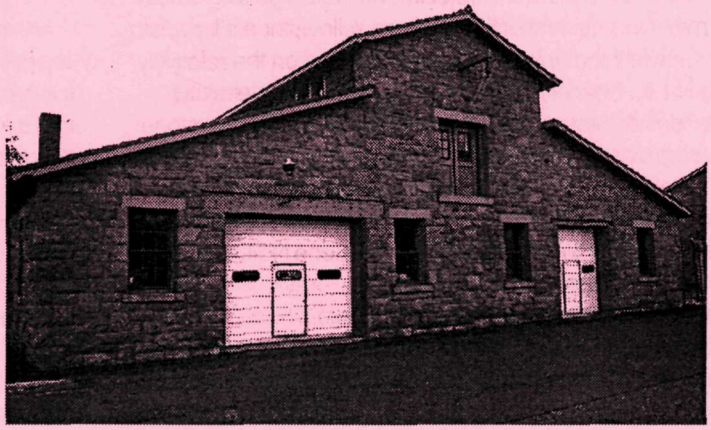
Building 38

Carpenters working in Building 38 have found two more boards with old signatures. One says: "Arthur Grant bult this stair, Scotland, 7/12/1908." The second says: "Thos. Sayers, Milwaukee Wis. Oct. 1st, 1908, Payday." Lee Whittlesey believes Sayers would have been a private in the cavalry, and terms the first signature "way cool" because it identifies a specific date for the construction of the staircase.

Archeological Fish Bone

Evidence for prehistoric fishing in the park is rare and generally limited to a few net weights along the Yellowstone River and a few bones from site 24YE353. Now, there is another fish bone find at another site along the Yellowstone River. A few years ago, an archeological campsite (24YE26) in the Black Canyon was tested. As it turned out, this site contains four camps one on top of another. The one of interest here was made by people of the Pelican Lake culture, dating from ca. 1000 B.C. to A.D. 200. There is little evidence of precontact use of the fish resources though time, but Pelican Lake people were also fishing in Glacier National Park at this general time.

As soil was being screened, two samples of bone were identified as probably belonging to fish. The larger of these is about 2.5 x 1 x .3 cm, and might be considered to be



Interesting discoveries are being made in Building 38, a former cavalry stable currently under renovation.

scrap, except that the bone is largely whole with two obviously exterior surfaces. YNP fisheries biologist Dan Mahony recently identified this bone as a cutthroat opercle or gill cover. The second bone is also fish, but too fragmented for further identification.

The recognition of these bones as fish, and of the first as being cutthroat, add to a small but growing database on precontact fishing in the park. This is also the first time an archeological fish bone was identified as to species. Perhaps most exciting is the discovery of these bones in a quarter-inch mesh screen. We had previously thought that archeological fish bone would only be recovered when using finer mesh (1/8 or 1/16 inch) or during specialized recovery techniques such as flotation and water screening.

Site 24YE356

In late summer, Jim Sweaney (retired NPS resource manager) reported eroding precontact hearths along the Yellowstone River. In September, a 1 x 3 m trench was excavated parallel with and back 0.3 m from the eroding bank. The southern portions of the reported hearths were included within this area. Bulk feature contents have been submitted for macrofloral analysis, which will identify the charcoal as to species.

Two radiocarbon dates were obtained. Feature 1 had a date of 1310+60 Before Present (Beta-171262), and Feature 2 had a date of 1620+60 Before Present. For radiocarbon dating, "present" is A.D. 1950. Use of 1950 relates to the development of the radiocarbon technology in the early 1950s.

As the tops of the features were encountered within six cm (five inches) of the modern surface, we were surprised at the antiquity of the hearths. We believe the dates are accurate because they fall within the period that contains 70% of the radiocarbon dates from the park. The shallowness of the cultural deposits suggests there has been either little deposition in this area or that erosion is removing the topsoil and exposing these cultural deposits. The latter is most likely, given the scatter of lithic debris (flakes) in the general vicinity. The site will need repetitive monitoring to identify and salvage other portions of the site as they begin to be exposed by erosion.

Annual Winter Trend Count of Northern Yellowstone Elk, 2002-2003

by P.J. White

Introduction

Annual winter counts of northern Yellowstone elk from fixed-wing aircraft have been conducted on the northern range since 1967. The objective of these flights is to obtain a minimum count of the northern Yellowstone elk population while the animals are concentrated on the relatively open (i.e., non-forested), snow-covered, low-elevation, portions of their winter range. The Northern Yellowstone Cooperative Wildlife Working Group has conducted these counts since 1986. This group is comprised of resource managers and biologists from Montana Fish, Wildlife and Parks, National Park Service (Yellowstone National Park), U.S. Forest Service (Gallatin National Forest), and U.S. Geological Survey–Northern Rocky Mountain Science Center, Bozeman. The group, formerly known as the Northern Yellowstone Elk Working Group, was formed in 1983 to cooperatively preserve and protect the long-term integrity of the northern Yellowstone winter range for wildlife species by increasing our scientific knowledge of the species and their habitats, promoting prudent land management activities, and encouraging an interagency approach to answering questions and solving problems.

Methods

Annual winter counts are conducted using four fixed-wing aircraft, each covering a segment of the northern range. For survey purposes, the northern range is divided into a total of 68 count units located both inside and outside Yellowstone National Park. Ideally, the entire northern range is surveyed during a single morning. In many years, however, flying conditions and logistical constraints have resulted in the surveys' being conducted over several days.

The 2002–2003 annual winter count of northern Yellowstone elk was conducted on December 24, 2002. Pilot Justin Ferguson and YNP ungulate biologist P.J. White surveyed count units west of the Yellowstone River, from the park boundary north to Yankee Jim Canyon. They also surveyed count units east of the Yellowstone River from the Bear Creek area north to Dome Mountain. Pilot Doug

Chapman and USGS biologist Peter Gogan surveyed count units within Yellowstone National Park from Reese Creek to Geode Creek, south of the Yellowstone River (including the Stephens Creek, Mammoth, Blacktail Deer Plateau, Swan Lake Flat, Gardner's Hole, and Quadrant Mountain areas. Pilot Roger Stradley and YNP wolf biologist Doug Smith surveyed count units within and outside Yellowstone National Park from Bear Creek to Soda Butte Creek (including the Jardine, Hellroaring, Little Buffalo, Slough Creek, Lamar Valley, and Little America areas). Pilots Steve Ard and Doug Stradley surveyed count units within Yellowstone National Park from Geode Creek to the upper Lamar River and Cache Creek (including the Blacktail Deer Plateau, Antelope Basin, Tower, Specimen Ridge, Mirror Plateau, and Calfee Creek areas.

Both the pilot and observer in each plane searched for elk during the survey. However, only the observer counted elk in observed groups (i.e., >1 elk). Group locations were recorded as UTM coordinates using on-board GPS units. All groups were classified as to whether they were comprised of exclusively bulls, a mixture of cows, calves, and spikes (but no adult bulls), or a mixture of cows, calves, and adult bulls. Data were entered into a spreadsheet referenced by each observer team.

We analyzed the trend of counts during the winters of 1987–88 to 2002–03 to estimate the rate of change in the abundance of northern Yellowstone elk. No counts were conducted during the winters of 1995–96 and 1996–97. Also, we did not include data from three winters (i.e., 1988–89, 1990–91, and 2002–03) in these analyses because survey conditions during these flights were considered poor and likely resulted in inaccurate counts. For more information on methods and statistical calculations, contact P.J. White in the Yellowstone Center for Resources.

Little America Flats.

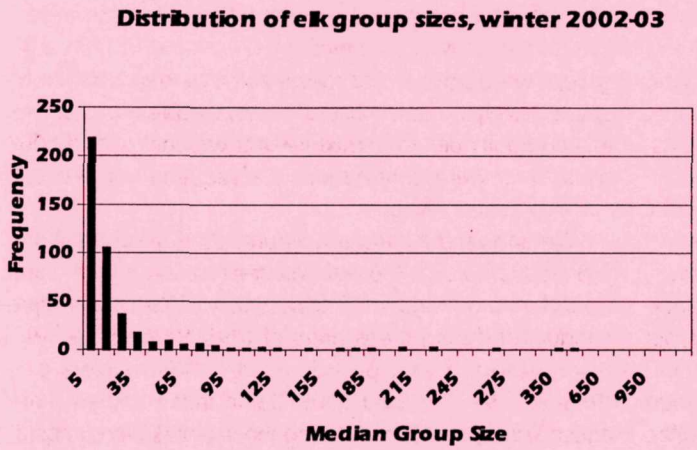


Figure 1. Distribution of group sizes for northern Yellowstone elk observed during the 2002–03 winter count.

Results

Ambient temperatures at the Gardiner airport during the flights ranged between approximately 8-20° Fahrenheit. Skies were partly cloudy and there was no precipitation. Winds were approximately 10-15 miles per hour from the northeast. There were generally fewer than eight inches of snow on north-facing slopes at higher elevations (e.g., vicinity of Lamar Valley) and bare-to-patchy snow conditions on south-facing slopes and at lower elevations. This lack of complete snow cover created a brown or mottled background on the landscape that made elk difficult to detect.

A total of 9,215 elk were counted in 423 groups during the 2002–2003 annual winter count of northern Yellowstone elk (Figure 1). A total of 2,318 elk (25 percent) were counted north of the boundary of Yellowstone National Park, and 6,897 elk (75 percent) were counted inside the park. Elk groups were widely dispersed at relatively higher elevations than typically observed during a survey count in December; this was likely due to the extremely mild winter conditions. The distribution of group sizes for observed elk were qualitatively similar to those observed during the winter of 2001–02 (Figure 2). However, during the 2002–03 count we did not observe any relatively large groups of elk (i.e., >700 elk), which are often observed during survey counts at this time of year.

Survey effort was inconsistent among the different pilot/observer teams. For example, the mean amount of time each team spent surveying their assigned unit areas varied between 0.46 and 1.21 minutes per square kilometer. Likewise, the mean amount of time required by each team to locate each observed elk varied between 0.08 and 0.20 minutes per elk. Both survey effort and time required to locate elk depend on several factors, including the amount of open terrain versus timbered habitat in each count unit, the number of elk in each count unit, and group sizes. There is always likely to be considerable variation between pilot/observer teams depending on which areas are being surveyed.

Discussion

This year's count of 9,215 elk was relatively low compared to the 11,969 elk counted during December 2001. Despite poor counting conditions this year, the long-term trend in counts of northern Yellowstone elk suggests that the population has decreased at a rate of approximately three percent per year since 1988. Statistical calculations show that there is a 95 percent likelihood that the actual overall growth rate of the population during 1988–2003 was between zero (i.e., no change) and a decrease of five percent per year.

These estimates of population growth rate relate to the overall trend in counts since 1988. In reality, elk counts have not consistently decreased at approximately 3 percent per year during this time period. Rather, there has been substantial variability in elk counts from year to year owing to apparent changes in elk abundance (both increases and decreases) and variations in detectability of elk (i.e., the extent of unobserved elk) among counts. For example, the trend in counts during 1991-1994 was increasing, suggesting that the population had a positive rate of growth. Also, there were substantial decreases in counts (i.e., >4,000 elk) following high winter-kills of elk during 1988–89 and 1996–97. The rate of decrease during these winters apparently exceeded six percent.

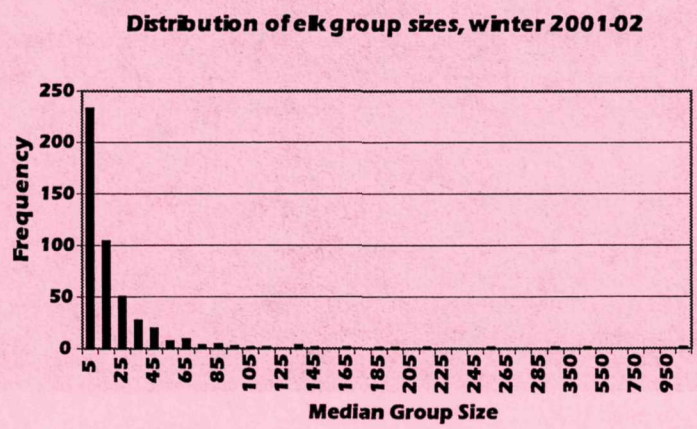


Figure 2. Distribution of group sizes for northern Yellowstone elk observed during the 2001–02 winter count.

Patchy snow conditions, such as those experienced during this year's count, can make elk hard to differentiate from their surroundings, decreasing the reliability of the count numbers.

Factors that contributed to the overall decreasing trend in counts of northern Yellowstone elk during 1988–2003 likely include predation, drought-related effects on pregnancy and calf survival, periodic substantial winter-kill owing to severe snow pack (e.g., winters of 1988–89 and 1996–97), and human harvest during the Gardiner area late hunt, which was designed to reduce elk abundance outside YNP so that elk numbers do not cause long-term changes in plant communities or decrease the quality of the winter range. As total elk numbers and migrations outside the park have decreased from the mid-1990s, Montana Fish, Wildlife and Parks has reduced the total number of elk permits for the Gardiner area late hunt from approximately 3,000 in 1997 to 2,200 this winter.

Elk population projection models developed prior to wolf restoration forecast a 5–30% reduction in the northern Yellowstone elk population following wolf restoration. It is feasible that the abundance of northern Yellowstone elk will continue to decrease to some unknown extent in future years if the limiting factors described above persist at current levels. Monitoring indices suggested that recruitment of calves into the northern Yellowstone elk population was relatively low (i.e., 14 calves per 100 cows) last year, and will likely be low again this year. The continuing effects of drought on maternal condition and calf survival are likely at least partially responsible for this low recruitment because indices of recruitment are low throughout the region (including areas where there are few or no wolves).

Poor counting conditions this year likely contributed to the relatively low trend count of 9,215 elk. Lack of snow cover created a brown background on the landscape and made elk difficult to detect. Also, elk were widely dispersed at higher elevations because of the mild winter and lack of snow pack. We do not have an estimate of the extent of the under-count of elk because the current survey methodology does not enable us to adjust for differences in factors (snow cover, habitat type, group size, elk behavior) that influence our ability to detect elk within and among surveys. Methods that enable sightability corrections have not been implemented during any flights over the past decade. However, a similar low count of 9,456 elk was obtained in 1991, while 14,829 elk were counted during good counting conditions in the previous year (1990) and 12,859 elk were counted during the following year (1992).

Winter Use FSEIS Released

The Final Supplemental Environmental Impact Statement (FSEIS) for Winter Use in Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr., Memorial Parkway was made available to the public on February 20, 2003. National Park Service and National Environmental Policy Act (NEPA) regulations call for a 30-day waiting period following the release, but public comment is not customary on a final environmental impact statement, and there will not be a comment period. A Record of Decision will be signed around March 24, 2003.

Five alternatives for winter visitor use in the three park units are evaluated in the FSEIS. Three of these, including the preferred alternative, are limited specifically to actions that allow snowmobile recreation to continue in the parks. The other alternatives include a no action alternative that would implement the November 2000 Record of Decision to ban snowmobiles from the parks beginning the 2003-2004 winter use season, and a second that would delay implementation of the November 2000 Record of Decision until the 2004-2005 winter use season.

The preferred alternative strikes a balance between phasing out all snowmobile use—as required under the November 2000 Record of Decision—and allowing for the unlimited snowmobile use of the past. Critical elements of the preferred alternative include: reduced numbers of snowmobiles through daily limits; implementing best available technology requirements for snowmobiles; implementation of an adaptive management program; guided access for both snowmobiles and snowcoaches; a reasonable phase-in period; a new generation of snowcoaches; and funding to effectively manage the winter use program. Implementation of all the critical elements will address the adverse impacts identified in the November 2000 Record of Decision.

The Department of the Interior agreed to do the Supplemental Environmental Impact Statement (SEIS) under the terms of a Settlement Agreement to a lawsuit brought by the International Snowmobile Manufacturers Association, the State of Wyoming, and others, asking that the November 2000 Record of Decision be set aside.

In the Settlement Agreement, the preparation of the SEIS was deemed necessary to further the purposes of the National Environmental Policy Act (NEPA) by soliciting more public comment on the earlier decision and alternatives that would maintain protection of park resources. Additional snowmobile technology was considered, as well as other new or updated substantive information not available at the time of the earlier decision.

Three of the five alternatives, including the preferred alternative, are limited specifically to actions that allow snowmobile recreation to continue in the parks.

Hard copies and CDs of the document are available by writing: FSEIS, Planning Office, P.O. Box 168, Yellowstone National Park, Wyoming 82190. The document can also be found by accessing www.nps.gov/grte/winteruse/winteruse.htm. The FSEIS is loaded in two volumes. Volume 1 is the main document and the appendices. Volume 2 is the public comments and their responses. Both volumes have clearly marked chapters, appendices and related sections to download separately. This will make it easier and more manageable for users, especially for those with slower dial-up connections.

CALL FOR PAPERS

7th Biennial Scientific Conference on the Greater Yellowstone Ecosystem

BEYOND THE ARCH

COMMUNITY AND CONSERVATION IN GREATER YELLOWSTONE AND EAST AFRICA

OCTOBER 6–8, 2003

MAMMOTH HOT SPRINGS, WYOMING

The goal of the conference is to generate, in non-technical language, a publicly-oriented discussion of issues that draw together national parks in the Greater Yellowstone and East Africa. We will make comparisons and foster dialogue across boundaries marking the intersections of global and local, private and public, natural and cultural, and scientific and social.

Managers, scientists, policymakers, and the public will come together to discuss and consider the interdependence of both nature-society relations and natural and cultural history in local and global contexts. The conference will promote understanding of the ecological and social challenges facing parks in the Greater Yellowstone and East Africa, and initiate the development of useful strategies for sustaining the national park idea at the dawn of the 21st century.

A limited number of program slots will be devoted to submitted papers. The program committee invites abstracts for papers, panels, and posters on the following topics:

Valuing Landscapes: ecology, culture, & economy Human-Predator Conflicts • Wildfire & Landscape Management • Growth, Development & Sprawl • Indigenous Ecological Knowledge • Ecological Economics

Boundaries and Borders: geographic, political, & biological Reciprocal Effects of Ungulates and Agriculture • Neighbors: parks & gateway communities

Globalization and Vulnerability Exotics, Invasives, and Global Connectivity • Internationalization of Scientific Knowledge

Learning from the Land Different Ways of Knowing: creating sustainable agendas in cross-cultural context • Communicating Science and Park Values to the Public • Parks and Cultural Identity • Comparative Tourism: the visitor experience • Land Use & Property Rights • Sacred & Experiential Values • Revisiting Comparative Grazing Ecosystems • Co-existence of Mixed-Mission Institutions

ABSTRACT SUBMISSION & REGISTRATION INFORMATION

Please visit www.nps.gov/yell/technical/conference.htm for information about registration and how to propose a paper, panel, or poster on one of the topics listed above. Abstracts must be received by May 1, 2003. Authors of selected papers and panelists will be notified by June 1, 2003.

...News Briefs...

NEW LANDIS FILM PREMIERES MARCH 13 AT ALBRIGHT VC

Wolf Pack, Bob Landis's sequel to the National Geographic special, *Return of a Legend,* will be premiered on Thursday, March 13 at noon in the theatre of the Albright Visitor Center. The showing is free and open to the public. Employees with prior supervisory approval are encouraged to attend!

YELLOWSTONE RECRUITS FOR 2003 YCC PROGRAM

Recruiting for the park's 2003 Youth Conservation Corps (YCC) program has begun. The YCC is a summer employment program for young men and women ages 15 through 18. Through work projects done in the park, the YCC provides enrollees with a better understanding of their environment and management of our natural resources.

The 2003 YCC program will run for eight weeks from June 14 through August 11, and participants will be required to live on location. Room and board will be provided at a minimal cost to enrollees. Wages will be set at the federal minimum wage of $5.15 per hour. The program will consist of a 30-member camp with enrollees selected nationwide. Participants must be at least 15 years of age by June 14, but must not turn 19 until after August 11. Applications must be postmarked by March 15, 2003. Selections will be made randomly from all qualifying applicants.

Crews will focus their efforts on projects dealing with rehabilitation of trails and backcountry areas, campground restoration, and a wide variety of resource management, maintenance, and research projects. A wide spectrum of environmental education programs will be offered as part of this year's program, as well as an extensive recreation program.

For further information and/or an application, please contact the YCC Program Manager at Yellowstone National Park headquarters by calling (307) 344-2148 or by writing the park, Attention: YCC Program, P.O. Box 168, Yellowstone National Park, Wyoming 82190. The application is also available on the park's web site at www.nps.gov/yell/technical/jobs/ycc.htm. Completed applications should be sent to the address noted above.

The Buffalo Chip is the resource management newsletter of Yellowstone National Park.
It is published periodically by the Yellowstone Center for Resources.
We welcome submissions of articles or drawings relating to natural and cultural resource management and research in the park. They can be sent to:

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