BISON AND BRUCELLOSIS IN YELLOWSTONE NATIONAL PARK:

A PROBLEM ANALYSIS

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Research Biologist

July 1968

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Introduction

This report reviews past attitudes and programs relating to brucellosis control in the park, analyzes the present situation, and presents recommendations as to the course of action we should take in the future. The report is not a comprehensive review of the epidemiology of brucellosis, its transmissibility, or the details of Federal and State brucellosis eradication programs.

Information was obtained from park and library files and from information furnished by or developed through discussions with Mary Meagher; Glen Cole; Kenneth Greer, Montana Fish and Game Department; and Dr. Paul Holcomb, Animal Health Division, U. S. Department of Agriculture.

Most of the historical information used in this problem analysis, some "facts" about brucellosis and the brucellosis eradication program, data on bison herd size over the years, the occurrence of brucellosis in park bison and elk, and significant supporting documents are included in the Appendix.

The Past

Brucellosis may or may not be indigenous to the western hemisphere, North America, and Yellowstone National Park. This question will never be answered. Brucellosis was first detected in the park bison herd in 1917. Apparently this was the first time the herd had been tested. No concern was shown about the disease at that time, even though the park was engaged in an intensive program to increase the bison population from near extinction in the early 1900's.

The U. S. Department of Agriculture embarked on a brucellosis eradication program in domestic livestock in the 1930's. The program has increased in scope and effectiveness through the years and has been backed by increasingly restrictive regulations. The stated goal of the Department of Agriculture is to eradicate brucellosis from the entire United States by 1975.

From the beginning, the National Park Service and, more specifically, Yellowstone National Park, have cooperated with the Department of Agriculture in their brucellosis control and eradication program. In the early years, when bison wintering in the Lamar Valley were fed and intensively managed, cooperation involved some testing of bison for brucellosis. Beginning in the 1940's the testing program was expanded, and a trial program was carried out to reduce the incidence of brucellosis in the Lamar bison herd through calf vaccination and

slaughter of reactors. This program was apparently successful, since the incidence of brucellosis in the herd was reduced from 62 percent in 1941 to 15 percent in 1948. Apparently this intensive program was not continued, perhaps partly because large scale handling of the Lamar herd under "ranch" type conditions was deemphasized in the 1940's and was eliminated in about 1952. The control program was not applied to other segements of the park bison herd, such as those in Pelican Valley and Hayden Valley.

Cooperation also consisted of cessation of live bison shipments from the park between 1944 and 1948. Live shipments were again stopped in 1951, and apparently no live bison were shipped between 1952 and 1961.

It was early recognized by Service personnal and consultants from the U. S. Fish and Wildlife Service that (1) any reduction in bison reproductive performance due to brucellosis could not be considered serious in regard to natural perpetuation of the Yellowstone herd, (2) if brucellosis control was initiated the reason would be to avoid public criticism and to facilitate future bison live shipments rather than to safeguard the herd itself, (3) an effective brucellosis eradication program is impractical under conditions that prevail in the park.

It appears that since the 1940's, when the U. S. Department of Agriculture brucellosis control and eradication program began to shape up as a nationwide program with defined goals that seemed attainable, the park's approach has been to incorporate some kind of brucellosis control activities into our routine bison reduction program. Brucellosis control for its own sake has never been practiced nor have we stated that we were interested in carrying on such a program except as it could be accomplished along with other active wildlife management programs. This arrangement was apparently satisfactory to the Department of Agriculture up to the very recent past. Even a "token" program of brucellosis testing or control has not been consistently carried out over the years.

Until the winter of 1962-63 all brucellosis control activities have involved only bison wintering on the Northern Yellowstone winter range. Prior to that time all bison herd reduction operations were by live trapping (Northern Yellowstone winter range only), or by field shooting; therefore no brucellosis testing or control had been carried out on the Pelican Valley or Hayden Valley-Nez Perce herds. Development of helicopter driving techniques permitted live trapping bison from the Hayden Valley-Nez Perce herd in 1962-63 and initiation of testing and control efforts on these herd segments the winter of 1963-64.

The policy of not live shipping bison from the park was broken in the winter of 1961-62 when 143 bison were shipped from the Lamar Valley herd and in 1962-63 when 357 were shipped from the Hayden Valley-Nez Perce herd. Some of the bison shipped from the Lamar Valley were tested for brucellosis by the U. S. Department of Agriculture, but reactors were shipped. None of those shipped from the Hayden Valley-Nez Perce herd were tested for brucellosis. This herd had a brucellosis incidence of about 30 percent in 1964-65; therefore it is certain that some brucellosis reactors were live shipped in 1962-63. Live shipments in both 1961-62 and 1962-63 were to a private ranch near Gillette, Wyoming. The trapping operations both years were carried out by the ranch owner under contract with the National Park Service. The arrangement had political overtones.

In 1964, in order to strengthen the brucellosis eradication program, federal regulations were put into effect that prohibited live shipment (except for slaughter) of bison from herds known to be infected with brucellosis. This put an end to live shipments from the park for transplanting purposes, but we did live ship bison to Livingston, Montana, for slaughter in 1964-65 and 1965-66. No bison herd reduction programs or brucellosis testing and/or control programs have been conducted since the winter of 1965-66.

The Present Situation

In recent years the U. S. Department of Agriculture and State Livestock Sanitary Boards, backed by more strict regulations and new testing and

monitoring techniques, have been intensifying the nationwide brucellosis eradication program. Success in achieving brucellosis-free status or modified brucellosis-free status over increasingly large areas has probably spurred their efforts, as has the fact that the 1975 target date for total brucellosis eradication draws ever closer. The concerned agencies are apparently giving increasing attention to so-called "problem herds" of domestic livestock where brucellosis has not been eradicated for one reason or another. Bison herds on National Park Service areas fall into this "problem herd" category.

As the national brucellosis eradication program has intensified, the National Park Service has been subjected to increasing pressure to "clean up" bison herds in Service areas. Increasing concern has been expressed about Yellowstone bison serving as a reservoir of infection in an area that was otherwise becoming free of the disease. Montana and Wyoming counties adjacent to the park were modified certified areas by 1962; that is, not more than 1 percent of the cattle were affected by brucellosis, and not more than 5 percent of the cattle herds harbor brucellosis. In Montana, 50 of 56 counties (including Park County adjacent to the park) could be certified free of brucellosis now; however the State veterinarian prefers to wait until the entire State can be certified free rather than certify individual counties (Dr. Paul Holcomb, personal communication). Counties adjacent to the park in Idaho were brucellosis free in 1967; that is all herds have been

declared free from brucellosis by both the U. S. Department of Agriculture and the State. Increasing concern about brucellosis in bison culminated in a bison management plan for the Midwest Region in 1964 which accepted brucellosis control and/or eradication as a desirable objective. Since 1964 active programs aimed at brucellosis control and/or eradication have been in effect in all National Park Service areas that contain bison.

Presently, our Long Range Wildlife Management Plan (signed by the Director in October 1964) provides for attempting to minimize brucellosis in all park bison herds in cooperation with the U. S. Department of Agriculture. This includes live trapping, testing, calf vaccination, and disposal of brucellosis reactors. However, brucellosis control was to be accomplished in conjunction with bison population control programs, not as a specific program unto itself.

In order to accomplish the brucellosis control program, it was proposed to build a live trap (for helicopter driving) in Pelican Valley. As a result of experience gained from 1962 through 1965 in trapping bison with helicopters and in handling bison annually, both U. S. Department of Agriculture and Service personnel expressed dissatisfaction with a "token" program that would be never ending and that would be increasingly difficult to carry out as bison become more "conditioned" to helicopters and handling operations.

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Currently we are operating according to directives from the Regional and Washington offices stating that we will cooperate with the U. S. Department of Agriculture in eradicating brucellosis from park bison herds. The program is still a "token" one so far as involvement and effectiveness is concerned. Operational problems are recognized by both U. S. Department of Agriculture and Service personnel. The program is not satisfactory from our standpoint or from the standpoint of the U. S. Department of Agriculture. No control has been accomplished the past two years simply because no bison herd reduction has been necessary.

Recent concern about Yellowstone's "diseased" bison herd may be in response to the fact that we have not carried out any brucellosis control activities since the winter of 1964-65. Renewed pressure to "do something" may also have been in response to our meeting with U. S. Department of Agriculture personnel on November 21, 1967. At this meeting the need for future bison reduction programs was questioned as was the feasibility and desirability of working toward brucellosis control or eradication in park bison. The U. S. Department of Agriculture brucellosis eradicati people may have gotten the impression that we were backing away from our earlier commitments.

So far as physical and biochemical tests can show, an organism of the same type as occurs in domestic livestock (Brucella abortus, Type One) has been isolated from Yellowstone Park bison and elk that have reacted positively to the brucellosis agglutination test. The incidence of

brucellosis in elk since 1960 has averaged 1.32 percent of 5,988 animals tested and has ranged from .10 (945 tested) to 5.31 (621 tested). The incidence in bison in recent years has averaged about 54 percent for animals from Lamar Valley, 42 percent in Pelican Valley, and 26 percent in animals from the Hayden Valley-Nez Perce herd segment.

Bison and Brucellosis from the National Park Service Standpoint

Since the beginning of the U. S. Department of Agriculture's brucellosis eradication program in the 1930's, park personnel and cooperating researchers from the U. S. Fish and Wildlife Service have recognized that brucellosis control and/or eradication is not necessary or desirable to accomplish basic park purposes. More recently, the many serious drawback of being involved in such a program have become more apparent. The park has been involved only because of pressure from another federal agency (and ultimately pressure from state and local interests) and perhaps because of the necessity of maintaining an "image" of interagency cooperation within the federal establishment. Of course, a crusade to "stamp out disease" in humans and in economically valuable domestic livestock receives great support from concerned interest groups and the informed public. Agencies conducting the crusades have a great deal of political and legal power.

Some undesirable aspects of being involved in a brucellosis control program include: (1) brucellosis may be endemic to the bison herd and

therefore an evolutionary factor that may be important and that we should preserve as part of the park ecosystem, (2) the Yellowstone bison herd is the only free-ranging (unfenced) herd in the contiguous 48 states. It has great esthetic and scientific value for that reason and its integrity should be maintained. (3) Though the Yellowstone bison herd has been "contaminated" by breeding with introduced animals, the herd still does contain "blood lines" from bison that originally occupied the park, and these original inhabitants may have been of the "mountain" variety, rather than the "plains" variety. This has significant scientific value. (4) An effective brucellosis control program would seriously affect the distribution and behavior of the herd and would reduce visitor opportunities to view bison.

As has been recognized from the beginning, there is no reason for Yellowstone National Park to be involved in a brucellosis eradication program from the standpoint of best achieving the basic purposes of the park.

Bison and Brucellosis from the U. S. Department of Agriculture Standpoint

The Department of Agriculture and cooperating state agencies firmly expect to eradicate brucellosis from domestic livestock--hopefully by 1975. They will employ all legal and technological methods at their disposal to accomplish this goal on schedule.

With increasing effectiveness of the brucellosis eradication program, the U. S. Department of Agriculture and cooperating state agencies are looking ever more critically at isolated "problem situations"--such as bison herds. Infected bison herds are considered a potential source of reinfection of domestic livestock that have been rid of the disease at great trouble and expense. Whether or not bison can transmit brucellosis to cattle is not clear, but infected bison herds do indefinitely maintain the disease in a high percentage of animals (up to 62 percent in the park) unless the disease is controlled.

Still no answers after 24 yrs!

Presently, the U. S. Department of Agriculture does not consider wildlife (other than bison) such as deer, elk, and moose as sources for reinfection of domestic livestock once the disease has been essentially eliminated from domestic livestock in many states. Apparently the U. S. Department of Agriculture assumes (perhaps rightly) that, even though brucellosis does occur in wildlife, incidence is very low, and the disease disappears from wildlife once the source of reinfection in domestic livestock is eliminated. This assumption needs clarification. However, it may be significant that domestic livestock have been maintained free of brucellosis in many states despite any source of reinfection that may have persisted in wild animals.

Risk has not increased

Our knowledge of bison movements indicates there is little chance that bison will transmit brucellosis to cattle outside the park. This chance

can be further reduced or eliminated through measures recommended in this report. No brucellosis has been detected in cattle herds surrounding the park for the past 10 years. But personnal involved in the brucellosis eradication program have consistently maintained that, even though the statistical probability of Yellowstone bison spreading brucellosis to domestic livestock is very low, the probability does exist, and it should be eliminated.

Another thing that might concern the U. S. Department of Agriculture is that by allowing brucellosis to persist in Yellowstone a "precedent" might be established that could be used by others as an excuse not to cooperate fully in the brucellosis eradication program. Perhaps this is unlikely because the economic sense of eradicating brucellosis from domestic livestock is fairly clearcut.

Problems and Unanswered Questions

The following discussion is based on information available in Yellowstone National Park. A more thorough review of the scientific literature and/or consultation with authorities on brucellosis and brucellosis eradication might provide satisfactory answers to some of the questions.

We know there is very little chance that bison can spread brucellosis to surrounding cattle herds. Chance of spread can be further reduced by initiating recommendations in this report.

We can assume that, without population control (herd reduction), the park bison herd will increase to at least 1,300 and perhaps higher. When this occurs, chances of bison moving out of the park will probably be increased, and we could be faced with a different situation than we have now. Adequate study of changing conditions as they develop should provide the basis for solving any problems as they arise.

We can ask in all seriousness whether it is actually possible to eradicate brucellosis in Yellowstone without eradicating the bison. Will any program other than herd eradication serve any other purpose than to reduce the incidence of brucellosis? If reduction in the incidence of brucellosis is all that can be expected, we would be in a never ending program. Should we mess with the herd if we cannot be assured of completely eradicating brucellosis when we already know that there need be little or no chance of spreading brucellosis to cattle surrounding the park?

if Test + Slaughter the only alternative to eradication + that is unacceptable then what other option available except risk control?

We need to know more about the chances of horses contracting brucellosis in the park, carrying it out, and transmitting the disease to cattle herds outside the park. Summer horse use (both by the Service and visitors) may prove to be one of the greatest potential sources of spreading brucellosis out of the park.

Possible Courses of Action

If the biological, esthetic and scientific interests of Yellowstone National Park were the only considerations, we would do nothing at all towards controlling and/or eradicating brucellosis from the park. Obviously, this is not satisfactory, and we can do more toward preventing the spread of brucellosis from the park without adversely affecting the bison.

The alternative to doing nothing is to cooperate with the U. S. Department of Agriculture in their brucellosis eradication program. Cooperation could take two forms:

1. Participate in a full-fledged eradication program in the park. Three approaches are apparent:

    a. A "token" program consisting of periodic calf vaccination and removal of brucellosis reactors. This program could be carried out either in conjunction with bison population reduction programs as we have done in the past, or specifically to control brucellosis if no general herd reduction programs are needed.

    Is it senseless? Can help reduce risk

    Past experience shows that a "token" program of this kind is senseless because it is essentially unending. Perhaps some reduction in the incidence of brucellosis would be obtained after many years, but the disease would still be present, and

maintenance of the reduced incidence would require a continual control program. A great deal of effort and expense would be expended, the bison herd would be continually harassed and handled (reducing visitor opportunities to view bison), and we would still be little better off than we are now, so far as eradicating brucellosis from the park is concerned.

Why not just calves? See pg. 69-71

The only way this approach could hope to be successful is if most bison in the park could be trapped and handled annually or at least fairly frequently. This is literally impossible with a free-ranging herd under conditions of climate, topography, and accessibility that exist in the park.

In the winter of 1964-65, only about 70 percent of the bison wintering on the Northern Yellowstone winter range and in the Hayden Valley-Nez Perce area were trapped. This is probably the maximum trap efficiency that could be obtained. The winter was a good one for trapping, and bison were not "conditioned" to helicopters. Trapping efficiency would go down in less satisfactory winters and as bison learned to avoid being driven and trapped by helicopter.

b. As recommended by a U. S. Department of Agriculture official, an all-out effort could be made to live trap as many bison as possibl from the Hayden Valley-Nez Perce, Pelican Valley and Lamar Valley

60 days is standard protocol

herds during the winter. These animals would be tested and held under fence until proved brucellosis free. All reactors would be eliminated. In the meantime, an all-out effort would be made to kill off all bison outside the holding pens throughout the park. After accomplishing this, the brucellosis-free animals would be released.

Not these days

If we must undertake brucellosis control in the park, this is the plan that has been favored by park personnel and U. S. Department of Agriculture veterinarians most familiar with conditions in the park. It would be extremely expensive and complete success in eliminating brucellosis the first time around could not be guaranteed. Obviously, even this approach would seriously disrupt the bison herd, but probably less so than the never ending program of calf vaccination and elimination of reactors outlined above.

A consideration/impact of calf vaccination

c. The park bison herd could be killed off and replaced with brucellosis-free bison. Of course, this would be completely unacceptable from the park standpoint, but it probably would stand the best chance of eliminating the threat of bison transmitting brucellosis to cattle--unless the bison were reinfected by other park wildlife. Then the eradication program might have to be repeated.

Same old question

2. Prevent bison from infecting cattle outside the park by preventing contact or transmission between bison and cattle. This seems to be the most rational approach for several reasons:

a. Trapping, handling, testing, vaccinating and elimination of bison reactors from park herds is seriously at odds with preserving the one truly wild bison left in the United States and providing opportunities for visitors to see and photograph them.

b. Recent research has confirmed earlier indications that Yellowstone has essentially one bison herd. Even though herd segments may seasonally concentrate in certain areas, there is free and frequent interchange between the segments. Thus any effective brucellosis control and/or eradication program would have to simultaneously deal with bison throughout the park.

c. Even an intensive program inside the park would not guarantee elimination of the disease.

d. The fact that there has been no evidence of brucellosis in cattle herds surrounding the park for the past 10 years suggests that the chances of bison infecting these herds are very remote.

e. The chances could be further reduced by an intensified program to prevent bison from leaving the park, cattle from entering it, and, an adequate system of monitoring cattle herds surrounding

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NATIONAL PARK
LIBRARY

the park so that brucellosis-infected animals could be quickly detected and the disease prevented from spreading if it did show up in the herds.

f. Since most bison that move out of the park are bulls, the chance of transmitting brucellosis to cattle may be very small.

Not the case but a factor

Recommendations

1. Request that Yellowstone National Park's wild bison herd be excluded from the overall National Park Service program to control and/or eradicate brucellosis from all bison herds on Service areas. The request should be based on recognition of the following facts:

   a. The Yellowstone bison herd is unique from all other herds in the United States.

   b. The herd has great esthetic and scientific value as the only free-ranging herd in the contiguous 48 states.

   c. The herd retains an irreplaceable representation of the genotype that originally occupied the park.

   d. The original bison in the park were likely of the "mountain" rather than the "plains" variety.

   e. The National Park Service has an overriding responsibility for preserving the genetic, biological and behavioral integrity of the herd, and the opportunity for visitors to view bison.

We haven't stressed this too much

f. The presence of brucellosis in the herd is not in conflict with the preservation of the herd, in fact, it may be that brucellosis and bison have evolved together and that brucellosis should be retained in order to more fully maintain the integrity of the herd and the environmental factors that affect it.

Maybe, but we've abandoned this notion haven't we?

g. Bison in Yellowstone range freely over thousands of square miles of rough, inaccessible mountain country and therefore cannot be rid of brucellosis by methods routinely applied to confined cattle and bison herds without unacceptable damage to herd integrity and other park values. Brucellosis eradication from a free-ranging bison herd of about 550 on the Crow Indian Reservation in the early 1960's involved herd eradication because of the rough inaccessible area occupied by the bison.

h. For the foreseeable future, at least, the responsibility of the National Park Service to preserve herd integrity and the responsibility of the U. S. Department of Agriculture and related state agencies to eradicate brucellosis from domestic cattle can be met without an intensive brucellosis eradication program in Yellowstone National Park.

i. There are too many unanswered questions concerning brucellosis in bison, elk, and other wild animals, the transmissibility of the disease between wild animals and cattle, and the effectiveness

of brucellosis control in a wild bison herd to justify the expens and the damage to the herd that would occur if an intensive brucellosis eradication program was initiated at this time.

2. If the above recommendation is approved, we should firmly state our opposition to a brucellosis control program inside the park and prese our alternative proposal to all concerned agencies, groups, and individuals. We should actively strive for support of our position. We should no longer give the impression of supporting eradication of brucellosis in Yellowstone bison as in the best interests of the bison, the park, or the American public. We should no longer participate in "token" control programs to placate brucellosis eradication advocates, and we should no longer use the excuse of inadequate financing as the reason why we have not progressed further with brucellosis eradication. We should not give the impression that we are willing and anxious to do more toward brucellosis eradicat in the park, but our hands are tied by forces beyond our control.

We've stated no interest in preserving Bruce. but we also stress best interest of preservation of park resources

Even for Risk Control?

3. Propose to the U. S. Department of Agriculture a plan for preventing the spread of brucellosis from the park that includes the following points:

Working on it.

a. Preparation of a map showing cattle distribution on private and public lands surrounding the park, the past and present distributi of bison near the perimeter of the park and locations where bison

move out of the park (including historical records).

We're doing it.

b. Ground and air surveillance by the park staff as needed to keep track of bison movements during the winter in areas where they might conceivably move out of the park.

Interim Plan & Park Ops.

c. The National Park Service will prevent bison from moving out of the park during the winter either by herding them back from the boundary, by killing them, or by other methods that may be developed.

Interim plan ops.

d. Cooperative arrangements will be made with surrounding fish and game departments and the U. S. Department of Agriculture to kill any bison that might accidentally get out of the park and to test them for brucellosis.

Hasn't been a problem, could re-emphasize

e. Work with the U. S. Forest Service and surrounding ranchers to prevent domestic livestock trespass into the park.

Work w/ APHIS & D. of L. to initiate mandatory vaccination & testing

f. Work with the U. S. Department of Agriculture and/or Livestock Sanitary Boards in the surrounding states to develop an adequate testing program for quickly detecting brucellosis that may show up in cattle herds surrounding the park and methods for eliminati as quickly as possible any infection that may occur in a manner that will be satisfactory to all parties involved.

4. Obtain answers to the following questions from recognized authorities on brucellosis, along with the documented, scientific data on which the answers are based.

24 yrs. and no answers.

a. Can or have bison transmitted brucellosis to domestic cattle and vice versa?

b. Can or have other wild ungulates such as elk, deer, antelope and moose transmit brucellosis to cattle and vice versa?

c. Can any other animals contract brucellosis from bison and cattle and transmit the disease to bison and cattle?

Doesn't seem to be a concern to APHIS now.

d. Can horses contract brucellosis in an area such as Yellowstone that contains a source of infection from bison and can horses carry the disease out and transmit it to cattle?

e. Can cattle remain brucellosis free in an area where free-ranging wild animals test positive for brucellosis?

f. Can bull bison transmit brucellosis to cattle, and if they can, what is the mechanism of transmissibility and its chances of occurring naturally?

g. Can male bison infect clean females or vice versa and what is the mechanism?

h. Why do male bison have such a high incidence of brucellosis and how does this influence the effectiveness of a control program, particularly since male bison remain widely scattered and male bison calves are not vaccinated?

5. If answers to the above questions cannot be provided, request that t be obtained through research before we embark on any intensive brucellosis eradication program in the park. A research plan designe to answer some questions about bison-elk transmission of brucellosis is included with supporting documents in the Appendix.

How can YNP help? FACILITY?

6. We should request an evaluation of brucellosis eradication programs i other bison herds--problems, effectiveness, methods, time required fo eradication, instances of reinfection, etc.

7. Test the park horses for brucellosis to get some idea of the probability of horses contracting the disease and spreading it outsid the park.

APPENDIX

APPENDIX

BACKGROUND INFORMATION

Management History:

1. It is not known if brucellosis is an introduced or endemic disease in the park or in North America, for that matter. Introduction of the disease, if this did occur, could have been through contact with cattle which were in and near the park in early years or, possibly, from "tame" bison introduced from Montana and Texas in 1902.

2. Park bison were first tested for brucellosis in 1917, and the disease was found. It was recognized then that the disease had no serious effects on reproduction or perpetuation of the herd, and no concern was shown (even though the total bison population in the park was about 330 and an intensive program was in effect to rebuild the herd).

3. About 1941 the U. S. Fish and Wildlife Service recommended that only brucellosis non-reactors be live shipped from the park and that these should be vaccinated. Apparently this was done. It is not clear whether or not all live trapped bison were regularly tested for brucellosis prior to that time, but apparently reactors (known or unknown) were shipped from the park.

4. In 1944 live shipments of bison were suspended as a result of concern shown by the American Veterinary Medical Association that brucellosis might be spread to disease-free areas outside the park.

5. In December 1944, Dr. E. R. Quortrup who was in charge of the Bear River Wildlife Disease Research Station, U. S. Fish and Wildlife Service, studied brucellosis in the park and prepared a comprehensive report. Some conclusions and recommendations follow (Quortrup 1945):

   a. Any reduction in reproductive performance of bison due to brucellosis could not be considered serious in regard to natural perpetuation of the herd.

   b. If brucellosis control was to be initiated, the reason would be to avoid public criticism and to facilitate future live shipments of bison rather than to safeguard the herd itself.

   c. It is probable that brucellosis has existed in the bison a long time and that a natural immunity has been acquired through years of exposure.

   d. That cessation of bison feeding in the Lamar Valley would increase the chance of animals moving out of the park during severe winters. He supported continuing winter feeding of bison in Lamar Valley to prevent this.

e. He stated that an effective brucellosis eradication program is impractical under conditions that prevail in the park.

f. Recommended the following activities that would, over a period of years, reduce the incidence of brucellosis in the herd, though brucellosis would not be completely eliminated. The brucellosis control program would be carried out in association with herd reduction activities.

what impacts would this have?

(1) Vaccinate all calves.

(2) Live ship non-reactors only. — APHIS says they must be neutered since exposed or sent to Class-free state.

(3) Prevent bison from migrating out of the park by a modified feeding program at Lamar and by turning the herd back if it drifts toward Gardiner. — Being done — No! could be market for the anyw

(4) Dispose of waste products from the bison slaughter in a sanitary manner.

6. Apparently (little detailed information was found) a program was initiated in 1946 or 1947 (at the recommendation of the Fish and Wildlife Service) to determine if the incidence of brucellosis infection in the Lamar bison herd could be satisfactorily reduced by a vaccination program and slaughter of infected animals. Very satisfactory progress in the immunization phase of the control program was noted in 1947.

7. As a result of the above, in 1947 the Director removed the restrictic against live shipment of bison.

8. A summary of the bison brucellosis control program cited above showed a lowering of the incidence of infection in the Lamar herd from 62 percent in 1941 to 15 percent in 1948 (143 and 156 bison tested in 1941 and 1948 respectively).

9. Shipment of live bison from the park was again discontinued in 1951 by order of the Director. Apparently no live shipments were made until 1961-62.

10. In 1961 Service personnel and Under Secretary of the Interior Carver met with Mr. Bud Bosolo and associates to discuss the possibili of Mr. Bosolo live trapping and shipping bison from Yellowstone Park to his ranch near Gillette, Wyoming. The Service expressed interest in Mr. Bosolo's proposal, and a contract was made between the Service and Mr. Bosolo to remove live bison from the park. During the winter of 1961-62, 148 bison were removed from the Lamar Valley, and 357 were shipped from the Hayden Valley-Nez Perce area in 1962-63. Brucellosis tests were made in 1961-62 but not in 1962-63. Brucellosi reactors as well as non-reactors were live shipped to Gillette, Wyoming, both years.

11. Records of meetings in 1962 indicate the continued desire of the National Park Service to cooperate with the Department of Agriculture toward control of brucellosis in park bison within limitations provided first by policy and then practicality and cost.

12. In 1964, in response to a proposal by Mr. Bud Bosolo to achieve a brucellosis-free bison herd in exchange for surplus bison, the park staff prepared an analysis of alternative proposals for controlling brucellosis in the park bison herd (see supporting documents). General conclusions were:

a. If it is decided that Yellowstone should work toward achieving a brucellosis-free bison herd, outside help from private citizens would not be needed (as was done under contract with Mr. Bosolo in 1961-62 and 1962-63 when 405 bison were shipped from the park)

b. There is little chance of bison associating with domestic livestock, and steps could be taken to prevent bison from moving out of the park.

c. Possible alternatives listed in order of increasing undesirabilit so far as the park staff was concerned:

(1) Handle bison only as needed to achieve population regulation

calf vaccination?

(2) Incorporate a modified brucellosis control program in conjunction with population control programs (recognizing that this approach would not eliminate brucellosis from park bison herds) to be carried out by Service and U. S. Department of Agriculture personnel.

(3) Same program as above to be carried out with the assistance of private individuals or groups who would get surplus bison for live shipment.

(4) If the Service set brucellosis eradication in bison as an objective, all the bison in Yellowstone would be killed over a period of years and animals from a brucellosis-free herd introduced.

13. In 1964 rules and regulations restricting movement of bison because of brucellosis were published in the Federal Register. This effectively prevented us from shipping live bison from the park except for slaughter. The regulations were a reflection of increasin concern and pressure by the Department of Agriculture about bison serving as a reservoir of infection in otherwise brucellosis-free areas. In 1961-62 and 1962-63, 405 bison were live shipped under contract with Mr. Bud Bosolo to his private ranch near Gillette, Wyoming, with no regard as to whether or not they had brucellosis.

unless neutered or sent to Class A state

Just change the date to reaffirm.

14. In March 1964, the Superintendent of Yellowstone recommended the following approach to the problem of brucellosis in bison.

    a. Bison should be managed in accordance with recommendations by the Advisory Board on Wildlife Management; that is, under full jurisdiction of biologically trained personnel of the Service--not by private citizens or groups as proposed by Mr. Bosolo (who raised bison for profit and who wanted surplus park bison).

    b. Salvaged bison meat should be supplied to Indians as in the past.

    c. Considerable study is needed before undertaking any large scale program to develop a brucellosis-free bison herd. Any serious control effort would involve a program of trap construction, road construction, and personnel expenditures in excess of any previously needed for wildlife management. Even with such a program, the outcome would still seem questionable.

    d. Since bison are unlikely to come in contact with domestic livestock, there appears to be no urgent reason to undertake a program until firm and justifiable plans are laid.

15. This same interpretation was expressed by the Acting Regional Director, Midwest Region to Superintendent, Yellowstone, in a memorandum dated April 30, 1964 (see supporting documents).

16. The following statement was included in a memorandum of April 13, 1964, from the Associate Regional Director, Midwest Region, to Superintendents of Midwest Region Parks and Monuments with bison herds. The statement is quoted from a memorandum dated April 7, 1964, from the Acting Assistant Director of the National Park Service:

> "Our cooperation in achieving overall Animal Disease Eradication program objectives is necessary and activities toward this goal should be accelerated once the Midwest Region bison management plan is finalized."

17. In a memorandum of July 27, 1964, from the Acting Regional Director, Midwest Region, to the Director, the difficulty of managing free-roaming bison, the need for "continuous application" of a well designed management program over an indefinite period of time, and the fact that " . . . brucellosis eradication will be a long-range program" was recognized. However, it was stated that these factors did not preclude an immediate initiation of positive action. (see supporting documents).

18. In 1964 a bison management plan for the Midwest Region was formulated during a three day meeting at Yellowstone. The plan accepts brucellosis control and/or eradication in bison herds in parks and

Basically what we've already stated in correspondence w/ APHIS

monuments as a desirable objective within limitations provided first by policy, and then practicality and cost. The program for Yellowstone was to carry on brucellosis control in conjunction with the bison reduction program as follows:

a. Hayden Valley-Nez Perce herd and Northern Yellowstone herd.

(1) Helicopter live trap as many bison as possible from this herd and

POPULATION LIMITS, controls identified specifically

(a) test all trapped animals for brucellosis.

(b) vaccinate and release all calves.

(c) kill all brucellosis reactors.

(d) kill non-reactors as needed to achieve reduction goal of 335 animals.

b. Pelican Valley herd--kill 124 bison and test all slaughtered animals for brucellosis.

c. Bechler herd.

(1) Check bison distribution through the winter by air.

(2) Work with the Idaho Fish and Game Department and (if necessary) Department of Agriculture to kill and dispose of any bison that leave the park.

Messrs. Bendt, Jacot and Reid believed that this program would satisfy the Department of Agriculture in 1964-65 and in future years.

19. In a memorandum of July 22, 1964, from the Director to the Regional Director, Midwest Region, the immediate development of a coordinated regional bison management program was requested. Generalities were outlined that should be incorporated into existing area management plans. For Yellowstone this included (1) 100 percent sampling for the Hayden Valley-Nez Perce herd; (2) bison herd reductions to be accomplished through selective removal of positive and suspect reactors; (3) vaccination, marking, and release of trapped calves; and (4) recognition that economical and other limiting considerations might require development of rotating bison herd management programs (see supporting documents).

20. In the Park's Long Range Wildlife Management Plan signed in October 1964, attempts to minimize brucellosis in all bison herds in cooperation with the U. S. Department of Agriculture was included as an integral part of the plan. This included trapping, testing, calf vaccination, and disposal of reactors; however, brucellosis control was to be accomplished along with bison population control--not as a specific program unto itself.

21. During the winter of 1964-65 an intensive effort was made to initiat an effective, park-wide brucellosis control program that involved testing, vaccination of female calves, and shipment of reactors to slaughter. As a result of problems encountered and experience gainc during the winter of 1964-65, it was recognized by Service and U. S. Department of Agriculture personnel that such an approach would be never ending so far as eradicating brucellosis, extremely expensive, and less and less effective as bison became more "conditioned" against helicopter trapping. A new approach was proposed that both Service and U. S. Department of Agriculture personnal believed would be more likely to eradicate brucellosis from the park most efficientl and with minimum disruption of the bison. The proposal follows:

A likely program effectively not no longer acceptable

a. Trapping and handling facilities adapted for helicopter herding and large holding pastures would be constructed in the Lamar Vall Pelican Valley, and at the Nez Perce Creek bison trap.

b. When conditions are right, as many bison as possible would be trapped as quickly as possible at the three locations. Pre-feeding may be desirable to concentrate as many animals as possible within herding range of the traps. All these areas would have to be trapped at the same time.

c. When the majority of trappable bison are confined in the holding pastures at all three locations, trapping would be discontinued,

and the trapped animals would be tested for brucellosis. All reactors would be shipped for slaughter. Non-reactors would be returned to the holding pasture where they would be fed.

d. An all out effort would be made to kill all bison in the park not in holding pastures. Much of the job would have to be done from helicopters.

e. After a suitable period of time, all bison in holding pastures would be retested and reactors shipped to slaughter. The retesti is necessary to detect animals that had brucellosis in the incubation stage during the first test. The standard agglutinati test would be supplemented with additional tests to assure that all bison retained in the holding pens were free of brucellosis. Once this was ascertained, and when all bison outside the holding pens had been killed, the brucellosis-free bison would be release

Dr. Paul Holcomb (personal communication) believes that with test techniques now available, all bison in the trapped groups that were infected with brucellosis could be detected and eliminated. Thus there would be a high degree of certainty that all released bison would be brucellosis free. Prevention of the herd becoming reinfected with brucellosis would depend on whether all infected bison outside the holding pastures were killed and whether or not bison could be reinfected from other animals (such as elk) that carry brucellosis.

Some questions

22. At a meeting of Park Service personnel in Yellowstone in April 1965, the Chief, Branch of Wildlife Management stated that our brucellosis control program would be undertaken only in conjunction with our habitat management program. He also seemed to think that the Animal Disease Eradication people and the Agricultural Research Service were not interested in the proposed study of brucellosis in elk.

why not? Are they now?

23. The 1965-66 bison management plan included a " . . . . continued brucellosis control program incident to our habitat management plan." Removal of 100 bison from the Hayden Valley-Nez Perce herd was to be accomplished. All bison trapped were to be tested for brucellosis, calves would be vaccinated and released if with non-reactor cows, and any non-reactors not needed to accomplish the reduction goal would be released. The Bechler herd was to be checked by airplane and any bison about to move out of the park would be killed.

24. In a May 1965 telephone call to the Park Management Biologist, the Chief, Branch of Wildlife Management reported a meeting between the National Park Service, Washington, D. C.; and the Animal Disease Eradication personnel, Washington, D. C. It was apparent that the Animal Disease Eradication Division was not very interested

See Pg. 40-41
This seems contradictory to present contention that vaccination is not enough.

in a "token" brucellosis eradication program in Yellowstone. Animal Disease Eradication personnel wanted to see us in a calf vaccinatio program every year, endeavoring to vaccinate all the calves possible in all herds. This in hopes that over many years, brucellosis incid would be appreciably lowered, or mostly eradicated.

25. Brucellosis control programs proposed, for 1965-66 and 1966-67 by National Park Service personnel in Washington, D. C., were more intensive than the 1964-65 program. These proposed programs did not meet with the approval of the Park Management Biologist.

26. In a letter of May 20, 1965, from the Assistant Director, National Park Service, to Dr. G. K. Mingle, Senior Staff Officer, Animal Disease Eradication Division (see supporting documents), we assured the Animal Disease Eradication Division of our continuing desire to move forward in the cooperative brucellosis control program. We indicated that the extent of our cooperation was dictated by availab funds for construction of necessary trap and holding facilities at Pelican Creek, as well as adequate funds for management purposes. Thus our excuse for lack of "full" cooperation was based on financin problems, rather than basic conflicts with National Park Service philosophy and policy. We had requested funds for construction of a bison trap at Pelican Creek.

27. In April 1965, in a memorandum to the Chief Park Naturalist (in Appendix) Mary Meagher discussed the question of brucellosis control in bison. She stressed the following points and made recommendations:

It really helps having MARY's past perspectives + experiences available!

a. The Yellowstone bison herd is unique, possibly containing blood lines from the "mountain" bison subspecies.

b. Brucellosis may be indigenous in North America.

c. Brucellosis has no adverse effect on park herds.

d. An intensive control program would probably eliminate the isolate or small groups of bulls which are the only bison many visitors see. These cannot be effectively live trapped. ← Not now but w/ big reductions on trapping it could be true again

e. Frequent trapping and handling for brucellosis control would have an adverse effect on bison behavior and would reduce opportunities for visitors to view bison.

f. There is need for more data on the question of bison-elk-cattle transmissibility of brucellosis before a control program in Yellowstone can be justified.

28. In the approved 1965-66 bison management plan, the following was stated:

a. Lamar bison herd--removal of the annual increment and brucellosi testing will be carried out on a two or three year basis, thus minimizing harassment and expense.

b. Pelican Creek bison herd--no reduction or brucellosis control planned. Construction of a live trap in this area will facilitate future management operations and brucellosis control. Management is proposed on a two or three year basis.

c. Hayden Valley-Nez Perce herd--Remove about 125 bison. Brucellos testing and vaccination will be carried on as a part of this program, reactors will be shipped live to a slaughterhouse.

29. In a meeting of Service and Animal Disease Eradication personnel at Yellowstone in September 1965, Dr. O. J. Halvorson, Animal Disease Eradication Division, stated:

a. If we live shipped elk into the Gardiner, Montana, hunting area, they would not have to be tested for brucellosis.

b. He did not believe that we will ever gain a great deal in brucellosis control until some such plan is instituted such as holding brucellosis-free bison and killing all others.

c. He did not think that a calf vaccination program (as outlined in a memorandum from Assistant Director Baker to Dr. Mingle of May 20, 1965,) would be effective, (see supporting documents).

30. The following statements were included in a summary of a meeting on March 23, 1966, in the park between the Park Management Biologist and Dr. J. H. Slack and Dr. Paul Holcomb, Animal Health Division, U. S. Department of Agriculture.

a. The group agreed that a brucellosis control program probably acceptable as regards bison would be to take advantage of severe winters and trap a maximum number of animals in Pelican Creek, Lamar, and Nez Perce; vaccinate and release calves, and ship reactors for slaughter.

Could calves alone be trapped + vaccinated w/ fewer herd impacts?

b. Dr. Slack believed the calf vaccination program would be the bulwark of the overall brucellosis control program, though it would take a number of years to appreciably lower the incidence of brucellosis.

c. The group also agreed that after conducting the above program for 5 to 10 years and building up a nucleus of vaccinated calves to then reevaluate the proposal for holding brucellosis-free animals at Pelican, Lamar and Hayden Valley-Nez Perce Creek and killing all bison outside the holding pens.

31. In a meeting in the park on November 21, 1967, between National Park Service personnel and Dr. J. H. Slack and Dr. Paul Holcomb, Animal Health Division, U. S. Department of Agriculture, the following general conclusions and statements were made (see supporting documen

APHIS agreed 24 yrs ago that more research needed!

a. Our bison reduction program is being reevaluated, and any future reductions would be conducted only when based on specific research findings.

b. Reservations were expressed about the effect of past brucellosis control programs on the opportunity of visitors to view bison.

c. Questions were asked of Dr. Slack and Dr. Holcomb about brucellosis "biology" and chances of bison infecting domestic livestock.

d. We suggested that Yellowstone's free-ranging bison be considered wild animals such as elk and deer and that justifications for brucellosis control be considered in the light of the almost absent statistical probability of transmitting brucellosis to livestock.

32. The Chief, Branch of Wildlife Management in a memorandum to Glen Cole dated December 12, 1967, summarized the results of a meeting between himself and Dr. E. A. Schilf, Animal Health Division, U. S. Department of Agriculture (see supporting documents).

a. The U. S. Department of Agriculture is concerned that Yellowstone is an island of infection within a disease-free area. Dr. Schilf admitted the probability was slight of transmitting brucellosis from park bison to domestic livestock or park visitors--but there is a chance, therefore a problem exists.

b. We indicated that while we are willing to cooperate with the U. S. Department of Agriculture, we do not believe brucellosis eradication should be the overriding or primary objective of our bison management program.

c. Dr. Schilf said the U. S. Department of Agriculture does not intend to apply any pressure which might jeopardize our basic objectives.

DATA ?

d. Dr. Schilf believes that once the herd was rid of infection, reinfection is not possible.

Records of Bison Movements Out of the Park

1. Northern Yellowstone winter range.

a. During the severe winter of 1942-43 about 130 bison out of about 742 on the Northern Yellowstone winter range moved out of the park Most did not travel far outside and returned within 10 days. A few traveled as far as Carbella Flats, and one was reported invading a ranch 8 miles south of Livingston. Some damage to ranchers' haystacks, fences and other facilities resulted and several serious criticisms were received.

b. By late March 1948, at least 106 animals were within the park along the Yellowstone River below Little Cottonwood Creek. At

about the same time 68 were seen between Gardiner and Jardine and scattered bison were reported as far north as Yankee Jim Canyon. About 530 bison were on the Northern Yellowstone winter range when this occurred.

c. In March 1951 when about 380 bison were on the Northern Yellowstone winter range, six bulls had gone down below Crevice Creek but not out of the park, as far as is known.

d. In February 1956 when about 220 bison were on the Northern Yellowstone winter range, many bison went down the Yellowstone River. From March 20 to 22, 67 were seen west of Blacktail Deer and Crevice Creek. At least 8 bison had been a short distance outside the park about March 15.

e. During the winter of 1961-62 when about 135 (post reduction) bison were on the Northern Yellowstone winter range, about 10 old bulls of the Lamar herd moved up Eagle Creek on U. S. Forest Service lands reserved for winter game range. These ranges are not open at any time of the year to domestic livestock grazing. "Such movements occur almost every severe winter (about 5 to 7 years)."

2. A few bull bison move north out of the park during the summer into areas drained by Hellroaring Creek and Slough Creek, Gallatin National Forest. Domestic sheep graze some of this area, but no cattle are permitted to graze anywhere in the drainages. There is essentially no chance of bison contact with cattle unless cattle stray into the Hellroaring and Slough Creek drainages, or unless bison moved north into terrain that drains north into the Yellowstone River east of Livingston. A few bulls also moved into the upper Sunlight Basin in 1966, and probably do so almost every year.

3. Three bull bison that must have come from the park were seen in Jackson Hole in September 1943.

4. In July 1966 two bison were seen in the Henry's Lake area, one of which moved as far as Ennis, Montana.

5. In July and August 1966, domestic cattle strayed from 20 miles outsid the park onto the Madison Plateau at least 15 miles inside the park.

6. Almost every winter one or two bison (bulls usually) can be expected to move out of the park in the Bechler area. With a larger overall bison herd, perhaps six may move out each winter (Mary Meagher, personal communication).

YELLOWSTONE NATIONAL PARK

BISON CENSUS 1936-1967

Year	LAMAR HERD			PELICAN VALLEY HERD			MARY MOUNTAIN HERD			GRAND TOTALS		
	Actual Count	Reduct. or Known Losses	Est. Total	Actual Count	Reduct. or Known Losses	Est. Total	Actual Count	Reduct. or Known Losses	Est. Total	Actual Count	Reduct. or Known Losses	Est. Total
1936	605	180	673	136			71			812	180	880
1937	456	17	488	188		200	30		68	674	17	756
1938	554	25	577	146		160	55		63	755	25	800
1939	582	67		157			72			811	67	850
1940	630	3	675	122		165	116		130	868	3	970
1941	674	212	700	217	1	255	56		165	947	213	1120
1942	528	202		256	2		100			884	202	
1943	742	9		122	2		100			964	11	1064
1944	352	405		222	1		173	1		747	407	
1945	445			324			163			932		
1946	348	200		232			210	38		791	238	
1947	442	7	529			295	101		273	543	7	1097
1948	313	237	375	307		355	340		395	960	237	1125
1/1949	396		396	205		205	525		525	1126		1126
2/1950		228	230	311		311	553		553			1094
3/1951			380			340	640		640			1360
1/1952	143	243	143	251	5	251	582	2	582	976	250	976
4/1953												
1/1954	158			461			858			1477		
1955								288			288	1350
1/1956	207	24		392	118		659	231		1258	373	
1/1957	145	60		88			310	212		543	273	
4/1958								12			12	
4/1959		18						26			44	800
4/1960												800
5/1961	212			169			488			869		
1962		148	135			190			650		148	975
6/1963		8	183			232		362	418		370	819
1964		6	137			274			347		6	821
1965		32	150		238	140		34	172		354	471
1966		0			50						50	
1967		0	89		0	221		0	140			450

1/ Fixed wing plane census. 2/ Plane count of Pelican and Mary Mtn. herd (Lamar estimated).
3/ Plane count of Mary Mtn. herd only (other herds estimated). 4/ No census or estimates made.
5/ Helicopter census.

INFORMATION ABOUT BRUCELLOSIS AND BRUCELLOSIS ERADICATION

The following information has been gleaned from a cursory search of literature in the park. It by no means constitutes a thorough review of the subject. Such a review of brucellosis, its transmissibility between wildlife and domestic livestock, and vice versa, would take considerable time and, if needed, would probably be best accomplished by personnel who are professionally involved with the disease. However, the information presented here is sound, we can stand on it, and it provides a good basis for asking "experts" specific questions.

1992 Current INFO Seems to be unchanged

Brucellosis - The Organism and The Disease

Brucellosis is spread directly from one animal to another. In cattle it is not spread to any extent by actual breeding. It is spread extensive at calving (Lovaas 1967).

Disease organisms do not live long outside an animal's body--up to a coupl of weeks in ideal spots. The organisms should not persist, even in a continuously used feed lot situation for more than 3 to 4 weeks (Lovaas 1967).

Pastures contaminated by infected fetal membranes, urine, and feces remain a source of living organisms for many months (Soule 1950) (This statement is in sharp contrast with the previous one). Apparently

the length of life of B. abortus outside an animal's body depends on exposure to sunlight. If well protected, the organisms remain viable for a longer period.

Research conducted in the park in 1944 (Quortrup 1945) indicated that there was little or no danger of live brucellosis being carried beyond the park by water or by scavengers.

In a recently exposed nonvaccinated herd (cattle) with no earlier history of abortion, nearly all exposed, pregnant heifers will abort during the first and probably second pregnancy. Some may abort a third time. Later generations continue to abort in the first pregnancy, or failing satisfact exposure, in the second. Fewer and fewer abort, and full-term calves are born with or without a diseased placenta. Carriers develop in this herd with infected udders (Elberg and Silverman 1950).

Brucella organisms are maintained from one gestation period to the next in the udder and regional lymph nodes, and animals may become carriers for life (Soule 1950).

The factors which influence the incidence of infection and the course of brucellosis in cattle artificially exposed to Brucella abortus are (1) virulence of the infective agent, (2) amount of exposure, and (3) susceptibility of the individual (Manthei 1950). There is wide variability between species of animals in susceptibility to brucellosis.

Urogenital and blood infections of brucellosis have been shown to persist in some cattle for as long as 101 and 97 weeks respectively (Manthei 1950). But as noted previously, the infection may localize and the animals may be carriers for life. There is no known treatment to prevent the carrier state (Dr. Paul Holcomb, personal communication).

In pregnant animals, whose uterus is infected, almost 100 percent of the cases will probably show an elimination of Brucella in the milk after calving or abortion (Elberg and Silverman 1950).

The responsibility of the bull in disseminating bovine brucellosis has been a controversial question. Many attempts have been made to transmit Brucella infection from the infected bull to susceptible cows by natural service with no success. Further research on the potentialities of the infected bull as a means of disseminating brucellosis in cattle is extremely important and will be continued. (Manthei 1950).

Brucellosis in Animals Other Than Cattle and Swine

Domestic animals other than cattle and swine that may suffer from brucellosis include goats, sheep, horses, and even poultry. Wild animals such as deer, moose, elk, bison, and rabbits are known to be susceptible. Wild rodents such as barnyard rats are apparently highly resistant (Boyd 1950).

Brucellosis in Horses:

In an experiment in Minnesota, horses on farms with and without brucellosis infected cattle showed that the percentage of reactors in cattle was higher on farms where there were infected horses than on farms where horses were free of the disease. An outbreak of brucellosis in a Minnesota dairy herd following purchase of two infected horses that had contact with the cattle was also reported. "Infected horses may serve as reservoir animals . . . . From an epidemiological standpoint, horses must still be considered as a source of brucellosis for both man and cattle." (Boyd 1950).

Brucellosis in Carnivora:

Normal dogs naturally contacted brucellosis when allowed close contac with infected dogs. This suggests that dogs (and coyotes) are possib carriers of brucellosis in animals and man. It is believed, though carnivora are not naturally immune to brucellosis, they do possess a high degree of resistance. (Boyd 1950).

Quortrup (1945) in a report of research conducted in Yellowstone National Park suggested that, since dogs are commonly infected with brucellosis, there was good reason to believe that coyotes in the park might also be infected. Coyotes have ready access to aborted fetuses, placental material, and other remains or discharges from infected bison.

Brucellosis is rare in dogs (Lovaas 1967).

Experience in Montana indicates that dogs do spread brucellosis, but through mechanical transport of infected materials rather than throu discharges from the dogs. The only Brucella of real significance in canine infection is Br. bronchisceptica which is of no importance as far as ungulates are concerned. (Personal communication from Dr. Paul Holcomb).

In experiments where dogs were repeatedly injected with Brucella suis, the course of the clinical disease was progressive only as lon as inoculations continued. The dogs recovered from the most severe infection if inoculations were discontinued, after which the organis could be detected for seven months. Apparently dogs have a significa natural resistance to Brucella and are able to clear themselves of natural infection. (Elberg and Silverman 1950).

The dog discharges Brucella organisms in the urine and thus may spre the germ among other dogs and possibly to man (Soule 1950).

Brucellosis in Domestic Sheep

" . . . there are no reports of infection in sheep in this country although it is common in Europe. This indicates that sheep are highly resistant to American strains of Br. abortus and Br. suis . . (Merchant 1950).

In the national eradication program, domestic sheep have not been a factor. It appears our sheep are highly resistant to Brucella abort (Dr. Paul Holcomb, personal communication).

Brucellosis in Rodents:

" . . . rodents such as rabbits, guinea pigs, mice, and white rats ca be readily infected experimentally; therefore it is reasonably feasib to assume that wild rats may become infected under natural conditions (Boyd 1950).

Rodents have a different kind of brucellosis that is not transmitted to swine or cattle (Lovaas 1967).

Brucellosis in Big Game Animals:

"The literature contains numerous reports of brucellosis in wild animals but the relationship of infection in these animals relative to the spread of the disease in cattle remains unknown. The disease when occurring in big game ruminants exhibits the same characteristic manifested in cattle and goats. Studies in Minnesota have clearly demonstrated that brucellosis of deer and moose is not an important problem as related to the control of the disease in cattle. Even though deer and moose may occasionally contact domestic cattle, they do not do so with sufficient frequency and intimacy to provide for massive exposure." (Boyd 1950).

The only wild, free-ranging animals in which brucellosis is a proble are bison and caribou. Tests have shown that brucellosis is not a problem in deer, antelope, or moose (Lovaas 1967).

Elk? see pg. 54

The brucellosis in caribou is a type of Brucella suis not B. abortus (Dr. Paul Holcomb, personal communication).

Of 58 deer tested for brucellosis in southeastern Saskatchewan, all were negative. Deer herds range almost continuously with cattle her in this area and, from the results of this test it was considered th deer were not likely to be a source of infection for cattle (Gwatkin and Peart 1950).

In a Canada test, of 6 moose and 6 elk that mingled with infected bison, all the moose were negative, but one elk was positive for brucellosis (Gwatkin and Peart 1950).

Results of brucellosis tests of big game animals in Montana are summarized in the following table. They show that brucellosis is essentially absent from big game with only 3 suspect deer and 1 positive black bear. The one positive black bear out of two tested suggests that bears may be more susceptible than most other species. Further testing seems justified. The three suspect deer of 766 teste were from the National Bison Range where association with bison may have been responsible.

Brucellosis incidence in big game animals in Montana, 1932-1968[a]

Area and specie:	Year	No. tested	No. Reactors (incl. suspects)	Pct. Reacti (incl. suspec
National Bison Range				
Bison	1932	87	58	66.6
	1933	86	48	55.81
	1934	75	55	73.33
	1952	13	5	38.46
	1960	54	0	0.
	1961	50	1	2.
	1962	58	0	0.
	1963-64	60	0	0.
	1964-65	75	1	1.3
	1965-66	93	0	0.
	1966-67	42	2	4.77
	1967-68	20	0	0.
Elk	1954	24	0	0.
	1961-64	44	0	0.
	1966-67	11	0	0.
	1967-68	29	1	3.45
Deer, mule	1957-67	520	3	.57
Statewide				
Antelope	1958-65	38	0	0.
Bighorn sheep	1958-64	22	0	0.
Deer, mule	1957-67	246	0	0.
Moose	1962	2	0	0.
Goat, Rocky Mtn.	1963	1	0	0.
Black bear	1960-68	2	1	50
Grizzly bear	1963-68	2	0	0

[a] Records from Montana Livestock Sanitary Board Laboratories.

The absence of brucellosis reactors in elk from the National Bison Range is interesting; however, elk were not tested until brucellosis was essentially eliminated from bison. It would be interesting to know if brucellosis infected elk on the Bison Range prior to elimination of brucellosis in the bison. It may be that elk were not introduced to the Bison Range until after bison were nearly freed of brucellosis.

This has changed! Need to know the whys.

The data from Montana suggest that brucellosis is rare in big game animals in Montana and supports the opinion of U. S. Department of Agriculture personnel that there is little chance of big game reinfecting domestic livestock. It also supports their contention t once brucellosis is eradicated in susceptible animals (cattle and bi the disease disappears from the less susceptible wild animals.

Brucellosis in Bison and Elk:

Bison are apparently more susceptible to brucellosis than cattle. Bison bulls are apparently as susceptible as bison cows, which is in contrast to the case in cattle (Lovaas 1967).

The following information was obtained from a mimeographed informatic sheet (Anonymous, n.d.) and may need confirmation from the scientific literature before it can be accepted as "fact".

1. Brucellosis causes symptoms in bison similar to those in cattle when it first gains entrance into a herd of mature bison. Howeve

bison apparently have the ability to quickly adjust to the disea following initial period of symptoms (abortion), and subsequent symptoms are rare.

2. After the initial period of abortion following introduction of brucellosis into a bison herd, subsequent calf crops are usually good in spite of the infection.

3. Brucellosis may spread until 50 percent or more of the herd is infected, but this seems to be the saturation point.

4. In reference to Yellowstone bison, there is no evidence that brucellosis was not endemic in bison prior to contact with domestic cattle.

5. In studies conducted by Tunnicliff and Marsh (1935) in Yellowstor Park, Brucella abortus, typical of the type commonly found in cat was isolated from testicular lesions. These cultures were examin by Dr. I. F. Huddleson of Michigan State University who found all the characteristics attributed to Brucella of bovine origin.

6. Brucella abortus typical of the organism found in cattle was isol in 1929 from testicles of bison from the National Bison Range.

7. During an extensive survey of brucellosis in bison conducted by the Animal Disease Eradication Division in 1960 and 1961, of 300

animals tested, 147 were infected. Brucella abortus, Type I, similar in all respects to the Brucella commonly recovered from domestic cattle, was isolated from a number of animals. In virulence test, these cultures proved equal to the virulence of field strains of Brucella recovered from diseased domestic cattl

Elk are quite highly resistant to brucellosis. Where elk are suspected they have been in close contact with other animals tha were highly infected (Lovaas 1967).

Biological specimens from organs that normally harbor B. abortus organisms have been examined from several Yellowstone elk that reacted positively to the agglutination test for brucellosis. In only one case have Brucella abortus organisms been isolated, cultured, and identified. In this case Dr. Stiles, Animal Health Division Laboratory, Mission, Texas, isolated an organism from the iliac and supernamary lymph nodes of an elk. The organism's physical and biochemical reactions were identical with those of Brucella abortus, Type I (Dr. Paul Holcomb, personal communication). Thus it is fairly well established that Yellowstone elk do harbor brucellosis, though the incidence is very low.

It is not known if bull bison can transmit brucellosis to cows or vice versa through copulation or other activities associated

with breeding. The high incidence of brucellosis in male bison compared to the very low incident in male cattle suggests that bull bison are much more susceptible to infection or that there is venereal transmission in bison that does not occur in cattle (Dr. Paul Holcomb, personal communcation).

No documented cases of bison transmitting brucellosis to domesti livestock or vice versa were found; however, Dr. Paul Holcomb (personal communication) provided the following circumstantial evidence that suggests transmission between bison and cattle.

Before free-ranging bison (about 550) were eliminated from the Crow Indian Reservation in about 1963 or 1964, brucellosis could not be cleaned up in 3 or 4 cattle herds in the surrounding area. Dr. Holcomb suspects the bison were keeping the cattle herds reinfected. However, the cattle herds were freed of brucellosis before all the bison on the reservation were eliminated. The bison eradication program was carried out over several years, and Dr. Holcomb believes this reduced the chance of reinfecting cattl sufficiently so that the cattle herds could be rid of brucellosis A constant screening progrm has not detected any sign of brucellosis in the cattle herds since the bison were eliminated.

This is evidence?

Cole (1949) presents a thorough analysis of brucellosis in the Wind Cave bison herd. He presents pertinent facts about brucello

particularly relating to transmissibility. He points out that little is known about brucellosis in bison. It has been assumed that bison react to the disease the same as cattle. The lack of information about transmission of brucellosis from other animal carriers to cattle is emphasized and is cited as reason for not basing brucellosis control in Wind Cave bison upon the premise th the bison might infect cattle on adjacent ranges. Cole cites abundant evidence supporting the conclusion that brucellosis pose no threat to the Wind Cave bison herd, and thus there is no reas for the National Park Service to control brucellosis in the herd.

Cole also points out the possibility that brucellosis is a nature condition in bison and for this reason brucellosis control might be contrary to Service policy of maintaining "natural" condition

Cole discusses the feasibility of carrying out a brucellosis eradication program on a free-ranging bison herd. He notes that calf vaccination is recommended for 6 to 8 months of age for maximum effectiveness with minimum complications. Apparently these recommendations still hold. Wind Cave (as well as Yellowstone) bison calve in April, May, and June with a few calves being born at other times of the year. The optimum time for calf vaccination would be in November, but at both Wind Cave and Yellowstone, trapping is not feasible until later in the win

APHIS has questions too.

Just what effect late vaccination has on vaccination effectiveness is a question that should be looked into more closely.

Cole concluded that (1) transmission of brucellosis from bison to cattle, although a possibility, was not probable under condit at Wind Cave National Park, (2) scavengers would not appear to p any appreciable role in spreading the disease, (3) brucellosis i the bison herd did not jeopardize existence of the herd, and (4) Wind Cave bison could not be corralled often enough at the proper time of the year for effective control by test-and-slaugh methods.

A study in Canada reported test results from 186 elk and 37 biso obtained when these animals were slaughtered to reduce the size herds in two national parks. All elk were negative. About 30 percent of the bison were positive or questionable. Later tests showed that of 6 moose and 6 elk that mingled with infected biso all the moose were negative, but one elk was positive. (Gwatkin and Peart 1950).

The incidence of brucellosis in bison from 1917 through 1966 is summarized in the following table. In general, bison wintering the Northern Yellowstone range have a higher incidence of brucell than bison wintering in the Hayden Valley-Nez Perce and Pelican

Brucellosis incidence in bison, Yellowstone National Park, 1917-1966[a]

Year	Herd Segment					
	Northern Yellowstone			Hayden Valley-Nez Perce		
	No. tested	No. reactors[b]	Pct. reactors[b]	No. tested	No. reactors[b]	Pct. reactors[b]
1917	2	2	100			
1920	5	3	60			
1931	106	64	60			
1932	199	107	54			
1933	151	110	73			
1941	329	176	53			
1942	60	20	33			
1944	406	148	36			
1946	296	62	21			
1948	200	32	16			
1950	120	43	36			
1961-62	85	44	52			
1964-65	129	76	59	302	84	28
1965-66[c]	10	4	25	101	19	19

[a] Data from 1917 through 1944 were taken from Quortrop (1945). Data for 1946 is from Rogers (1946), for 1948 from Skinner, et al (1942), and for 1950 from Rogers (1950). Data for 1961 through 1966 were compiled from official "Record of Brucellosis Test" forms filed in the Biologists' Office, Yellowstone National Park.

[b] Includes suspects.

[c] An additional 33 bison from Pelican Valley were tested of which 14 or 42 percent were reactors (including suspects).

Valley areas. The lowered incidence between 1944 and 1948 for the Northern Yellowstone herd segment is apparently in response to the brucellosis control program in effect at the time. When control was stopped, brucellosis incidence apparently returned to pre-control levels of 50 to 60 percent. The drop in 1965-66 may reflect effectiveness of renewed brucellosis control in 1964-65, but the sample of tested animals was small and perhaps not representative. The lowered incidence in the Hayden Valley-Nez Perce herd from 28 percent in 1964-65 to 19 percent in 1965- may also reflect brucellosis control (female calf vaccination an elimination of reactors) in 1964-65.

In a letter of June 11, 1965, to the Acting Superintendent of Yellowstone, Mr. N. C. Ray, Staff Veterinarian, Animal Disease Eradication Division, U. S. Department of Agriculture, stated that brucellosis among elk is associated with their opportunity for contact with infected animals of other species. "We feel (underlining mine) that brucellosis is not a serious problem in elk from the standpoint of transmission from animal to animal." He mentioned that a summary of wildlife testing in the United States through February 1965 showed that of 3,338 elk tested for brucellosis in 8 states, only 20 were reactors (probably a high percentage of the elk tested and the reactors were from

Yellowstone). He said there is no indication that brucellosis has become established within the elk population or that it is spreading within the elk population or that it is spreading wit the herds. Indications are that continued exposure to Brucella through contact with infected animals of susceptible species su as bison will result in an occasional animal showing a response to the exposure by a reaction to the brucellosis test. This do not mean that the affected elk will transmit the infection or remain permanently diseased. The U. S. Department of Agricultu concern is elimination of brucellosis from bison which should correct the problem among the elk.

If it's not a problem w/ elk why the restriction? APHIS is also concerned w/ the current problem of live elk calves being poached + how that might impact brucellosis/T.B. spread to livestock.

However, despite these statements, the U. S. Department of Agriculture did not think we should live ship elk from the park that reacted positively to a brucellosis test, and they asked that all elk for live shipment be tested.

The incidence of brucellosis in elk that winter on the Northern Yellowstone range from 1931 through 1968 is summarized in the following table. The average incidence has been 1.72 percent in 6,178 animals tested.

The high incidence of 17.88 percent in 151 elk tested in 1931-33 seems highly suspect when compared to an incidence that ranged fr

Brucellosis incidence in
Northern Yellowstone Elk Herd, 1931-1968[a]

Year	No. tested	No. Reactors (incl. suspects)	Pct. Reactors (incl. suspects)
1931-33	151	27	17.88
1942	39	0	0
1960-61	64	0	0
1961-62	1,644	11	.67
1962-63	220	5	2.27
1963-64	481	1	.21
1964-65	621	33	5.31
1965-66	1,121	14	1.25
1966-67	892	14	1.57
1967-68	945	1	.10
Total	6,178	106	
Avg. Pct.			1.72

[a] Records from Montana Livestock Sanitary Board Laboratories for 1931-33 and 1942. All other records from National Park Service files in Biologists' Office, Yellowstone National Park.

0.0 to 5.31 percent in 5,938 elk tested since 1960. Perhaps faulty test procedures were used in 1931-33.

These brucellosis test results indicate that elk are not very susceptible to brucellosis and much less so than bison that occup the same winter range area. The data do not show any obvious shifts in the incidence of brucellosis in elk that can be related to changes in the elk population or to bison brucellosis control and herd reduction activities.

Brucellosis Control and Eradication

The Federal and State Eradication Program

Bovine brucellosis is one of the most costly diseases encountered by the cattle industry and is also a definite hazard to public health. The often insidious nature of brucellosis in cattle and other susceptible animals, together with the different cattle husbandry practices employed in this country, has made progress in the development of an acceptable control program extremely difficult. (Manthei 1950).

The Bureau of Animal Industry, U. S. Department of Agriculture's fixed policy is to fight on a nationwide front only those diseases of livestock which can be eradicated. "Established precedent and policy classify brucellosis as a disease which the Bureau believes can be eradicated."

The brucellosis eradication program is one of cooperation between the federal and the different state governments. The Bureau has authority to prevent interstate movement of diseased animals, but it does not set u brucellosis control and eradication programs within states unless agreeme are reached with the state livestock sanitary officials concerned (Simms 1950). Nationwide uniformity in the brucellosis eradication program is assured by the U. S. Livestock Sanitary Association (personal communicati Dr. Paul Holcomb).

Brucellosis Testing

The agglutination test fails to detect infected animals during the incubative stages of the disease (Gilman 1950).

Individuals may react differently to the three kinds of brucellosis tests (tube, plate, and card). The tests cannot differentiate between antibodi of brucellosis and those of a certain respiratory disease. To date disea organisms have not been isolated from cows testing negative to the card test (Lovaas 1967).

CATTLE Vaccination

Where natural infection routes have been examined in bovines the effect of vaccine is to delay the development of brucellosis, modifying its effect b reducing the abortion rates, and to lower the incidence of spreading at calving time. (Elberg and Silverman 1950).

According to a U. S. Department of Agriculture (1959) publication:

1. Vaccination will:

   a. Provide an average of 65 percent protection from infection.

   b. Help limit the spread of infection within a herd if a majority of the herd is vaccinated.

   c. Gradually reduce the percentage of diseased animals in an infecte herd over a period of years as older animals are culled and the number of susceptible animals is reduced.

   d. Reduce animal infection about 80 percent in areas where a majorit of calves are vaccinated.

   e. Reduce herd infection about 20 percent in areas where a majority of calves are vaccinated.

   f. Mask or moderate the symptoms in some animals that contract the disease.

   g. Cause a reaction to the blood test which will disappear in nearly all animals by the time they are 30 months old if they were vaccinated when they were 4 to 8 months old.

2. Vaccination won't:

   a. Eradicate or cure brucellosis.

b. Provide complete disease immunity in all animals, nor will revaccination do so.

c. Prevent all animals from aborting if they become infected.

d. Cause the disease in cattle or other livestock.

e. Cause calves or older animals to become carriers or spreaders of brucellosis.

f. Eliminate the danger of human infection.

3. Vaccination will help eradicate brucellosis if you follow this progra
   a. Blood test your herd and get rid of reactors.

   b. Vaccinate all heifer calves.

   c. Avoid exposing the herd to new sources of infection.

Recommendations for vaccination with Strain 19 are: "For immunization against brucellosis of cattle over 4 months of age, but not after fourth month of pregnancy." Where there is no serious objection to the longer persistence of the agglutination titer, there should be no objection to the vaccination of cattle older than 8 months. The opposition to adult vaccination is gradually diminishing. However, there is no need for it except when cattle herds are experiencing or threatened by an abortion storm or when revaccination is being considered. There is almost univers

agreement that there is no advantage in vaccinating agglutination reacting animals. (Traum 1950).

Currently, adult vaccination is not recommended and in some states it is prohibited because it completely confuses any eradication efforts through persistently high post vaccination titers (personal communication from Dr. Paul Holcomb).

In one test, subcutaneous injection of 5 milliliters of strain 19 vaccine in recently Brucella-infected cattle had little or no effect on the natural course of the disease (Manthei 1950).

In a test of immunity acquired by vaccination, immunity had greatly waned by the third gestation period in animals vaccinated as calves. However, in other tests animals vaccinated as calves and exposed in the fourth and fifth pregnancy still possessed immunity comparable to that present in the first pregnancy period. (Elberg and Silverman 1950).

Any consideration of revaccination should be based on the assumption or evidence that duration of resistance induced by calfhood vaccination has decreased or disappeared and that a booster dose or renewal is indicated. Preliminary results from revaccination of cattle appeared favorable (Traum 1950).

Vaccination can present some problems in reading test results--
(1) some vaccinated animals will test as reactors when they are not really

infected, (2) some may test only as suspects when they actually have the disease, (3) the vaccine may cause some animals to become infected (Lovaas 1967). Recent information indicates that strain 19 may occasiona produce an active infection in vaccinated animals (personal communication Dr. Paul Holcomb).

Currently revaccination is not practiced and not recommended (Dr. Paul Holcomb personal communication).

Brucellosis Control in Bison

Control of brucellosis in bison involves vaccination of calves with strain 19 and selective culling. "In those infected herds in which all animals have been vaccinated through the years, it is now unusual to find animals with blood serum agglutinin titers in the reactor range. Apparent strain 19 has been effective in reducing the incidence of the disease in infected bison herds to very low levels when used over a period of many years." (Anonymous, n.d.).

The reappearance of brucellosis in bison herds such as the Wichita Refuge and Niobrara which were brucellosis free for many years is not fully explained, though cattle may be to blame at Wichita (Lovaas 1967).

Ordinarily a brucellosis eradication program in bison involves calf vaccination plus elimination of all reactors. However, brucellosis in bison on the National Bison Range was eliminated by calf vaccination alone

Would this be a reasonable compromise? Need to evaluate impacts on herds but could probably be done w/ a minimum of handling - Would it help w/ risk? 69

What is effectiveness of Strain 19 in bison. Not much but could be enough to further reduce risk.

According to Dr. Paul Holcomb (personal communication) this was the only case he knew of in any animal species where vaccination alone resulted in brucellosis eradication. However, in this case all calves of both sexes were vaccinated annually under very closely controlled conditions.

Current U. S. Department of Agriculture policy is not to vaccinate male cattle or bison for the following reasons: (1) the possibility of establishing a persistent infection of strain 19 in the genital organs of male calves, (2) the possibility of developing persistent post vaccination blood titers that would confuse future testing. This same problem can occur where 3-6 month old female calves are vaccinated, but it is not as likely as in male calves. (Dr. Paul Holcomb personal communication).

Although this policy may be justified in cattle where infection of males is very low, some have questioned its applicability to bison where infectio in males is as high as in females. Some have advocated vaccination of male bison calves and doubt if a vaccination program alone can be effective if this is not done.

The inefficiency of a female calf vaccination program is shown in the following analysis. The analysis is based on our knowledge of bison population dynamics, and the results of the 1964-65 bison management program. The analysis shows just how inefficient a calf vaccination program would be. Progress toward a brucellosis-free herd would be very slow despite severe harassment of the bison.

If calf vaccination, why would all animals need to be trapped? Just trap + vaccinate calves & you'd increase the efficiency.

	Lamar Herd	Hayden Valley Herd
Estimated population winter 1964-65	187	480
Number live trapped	132	327
Percent of herd that was trapped	70	68
Number of males trapped (including calves)	58	134
Number of females trapped (including calves)	64	193
Number of females that could have calves at their side (3 years or more old)	37	105
Number of calves trapped	25	77
Number of female calves trapped (equal sex ratio in calves)	13	39
Number of calves vaccinated (male calves are not vaccinated)	13	39
Vaccination efficiency	65%	65%
Number of resistant calves obtained	8	25
Resistant calves obtained expressed as a percent of the animals trapped	6%	8%

if only calves trapped these numbers should be same percentage as effectiveness of vaccine

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