

7 April, 1993

AGREEMENT

APR 12 1993

U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

Atten: Jack Whitten

Re: Addition to license renewal application.

Dear Mr. Whitten;

This request is for the use of up to 2 mCi of tritium (^3H) in the form of tritiated water in the study of lactational strategies and constraints of pronghorns (antelope), using tritium as a tracer to:

1. Define the relationships between neonatal growth rate in pronghorns relative to:
 - a) the milk quantity consumed,
 - b) milk quality, and
 - c) the reported values of other North American ungulates.
2. Determine if and for how long adult female pronghorns are required to mobilize tissues to meet lactational demands.
3. Examine the duration of lactation in pronghorns relative to:
 - a) the body weight/fattening cycle in adult females,
 - b) the timing of neonatal weaning, and
 - c) the duration of lactation periods documented for other North American ungulates.
4. Define the relationships between behavioral characteristics and physiological measurements associated with lactation in pronghorns, including:
 - a) suckling frequency,
 - b) suckling bout duration,
 - c) milk transfer,
 - d) milk energy intake,

- e) neonatal growth rate, and
- f) maternal body condition.

Location of temporary site:

The study will be conducted at the Sybille Wildlife Research and Educational Unit, operated by the Wyoming Game and Fish Department. The unit is located on both sides of Sybille Canyon and state highway #34 approximately 45 miles Northeast of Laramie, Wyoming. The research area consist of 5 acres fenced with four foot high woven wire fence. (Pronghorns do not jump fences.) The boundaries of the Research Center, including Wyoming Highway 34, are fenced with 7 1/2 feet of woven wire fence, topped with barbed wire. The area is situated such that there is little run off from neighboring areas. The research area is a 5-acre south-facing, natural sagebrush-grassland fenced enclosure on the Northwest side of the highway. The area is divided into two fenced paddocks to enhance observations. Water from a spring North of the units supervisor residence will provide water for the pronghorns at a rate of < 0.5 gallons/minute. The range vegetation consists primarily of big mountain sage brush and mid-range grasses (with respect to height). Sage brush provides approximately 20 to 30 percent of the cover. Precipitation averages between 15 and 20 inches per year.

The research unit experienced a 100 year flood in the summer of 1991. The area designated for this research was not in the flood plain. A map of the area is attached.

Use of tritium:

Tritiated water with a concentration of 100 $\mu\text{Ci/ml}$ will be injected into six experimental pregnant pronghorns at the rate of 300 $\mu\text{Ci}/50 \text{ kg}$ body weight (average weight of an adult antelope) after parturition. Urine and milk sample will be analyzed for tritium content using liquid scintillation methods.

Discussion of release of tritium to the environment:

The pathway for tritium release is through the water turnover pathway since the tritium is introduced as THO. There is a paucity of data on water turnover rates for pronghorns, however, considering other mammals and the data available pronghorns are expected to behave similar to camels. It is estimated that water turnover will have a 6 to 12 day half-life and that approximately 50% of the water turnover will be as urine and feces. The turnover rate is expected to change due to the lactation state of the mothers and environmental stresses to which the animals are subjected.

Release to the atmosphere:

Based on the release of 2 mCi of tritium of a 120 day period.

Assumption: Free air dispersion and metabolic rates similar to sheep or man would imply an estimated breathing volume of 14,000 liters/day/adult animal.

Which implies 42,000 liters/day for 3 pronghorn.

Total volume of air released to the atmosphere over 120 days is 5.04×10^6 liters of air.

The concentration release limits to the atmosphere for ^3H is $2 \times 10^{-7} \mu\text{Ci/ml}$ (10CFR20 Appendix B, Table II).

$$5.04 \times 10^6 \text{ liters} \times (1000 \text{ ml/liter}) \times (2 \times 10^{-7} \mu\text{Ci/ml}) = 1.008 \times 10^3 \mu\text{Ci}$$

or 1 mCi (over 120 days) yielding 3 mCi

This quantity may be averaged over a period of one year (10CFR20 § 20.106) and or atmospheric dispersion can be considered. In either case release to the atmosphere would fall in the accepted range.

Urine and feces would be distributed over the 5 acres of enclosure. A worst case consideration of release would be to consider that all the tritium (2 mCi) were released to the two springs.

The concentration release limits to water for ^3H is $3 \times 10^{-3} \mu\text{Ci/ml}$ (10CFR20 Appendix B, Table II).

$$2 \text{ mCi} / 3 \times 10^{-3} \mu\text{Ci/ml} \times 1000 \mu\text{Ci} / \text{mCi} = 6.667 \times 10^5 \text{ ml} = 667 \text{ liters}$$

This calculation indicates the tritium would need to be diluted to a volume of 667 liters which would require a spring flow of less than 5 liter per day over 120 days or less than 2 liters per day average over a year.

Security:

The research unit is fenced and access to the facility is obtained by arrangements with Game and Fish personnel responsible for the unit operations. Visitors are escorted. Radioactive material will not be stored at the research unit, rather it will be administered to the pronghorns the day the material is brought on site. Any unused material will be returned to campus.

Transportation:

RAM transported between UW and the research unit will be in accordance with DOT requirements including packaging, labeling, and shipping papers.

Closure:

When the experiment is concluded soil samples will be taken in areas of relatively high occupation by the pronghorns. Any measurable contamination will be addressed on closure.

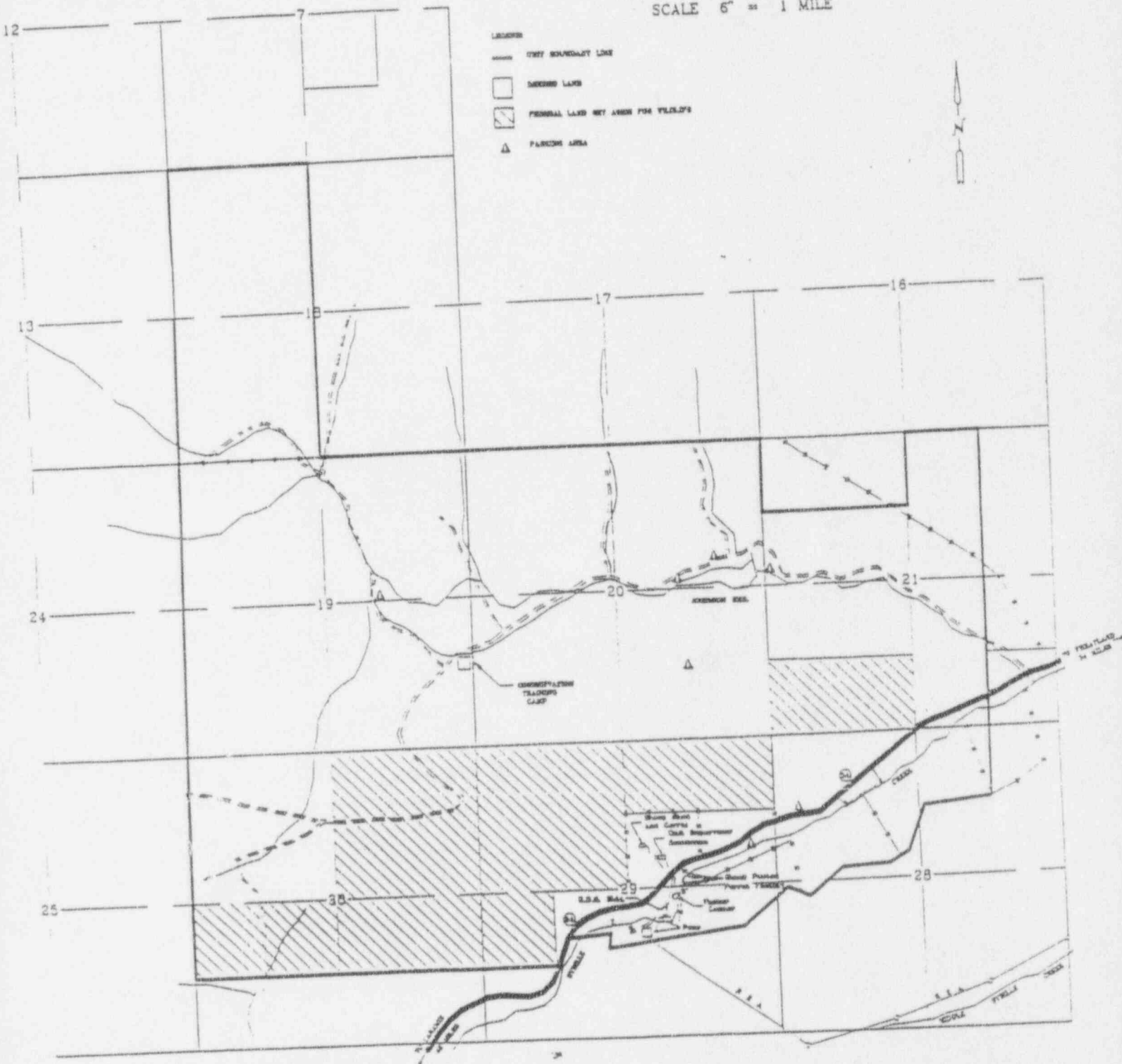
A letter from the Wyoming Game and Fish Department authorizing the proposed use of tritium at the department's "Sybille Wildlife Research and Conservation Educational Unit" is attached.

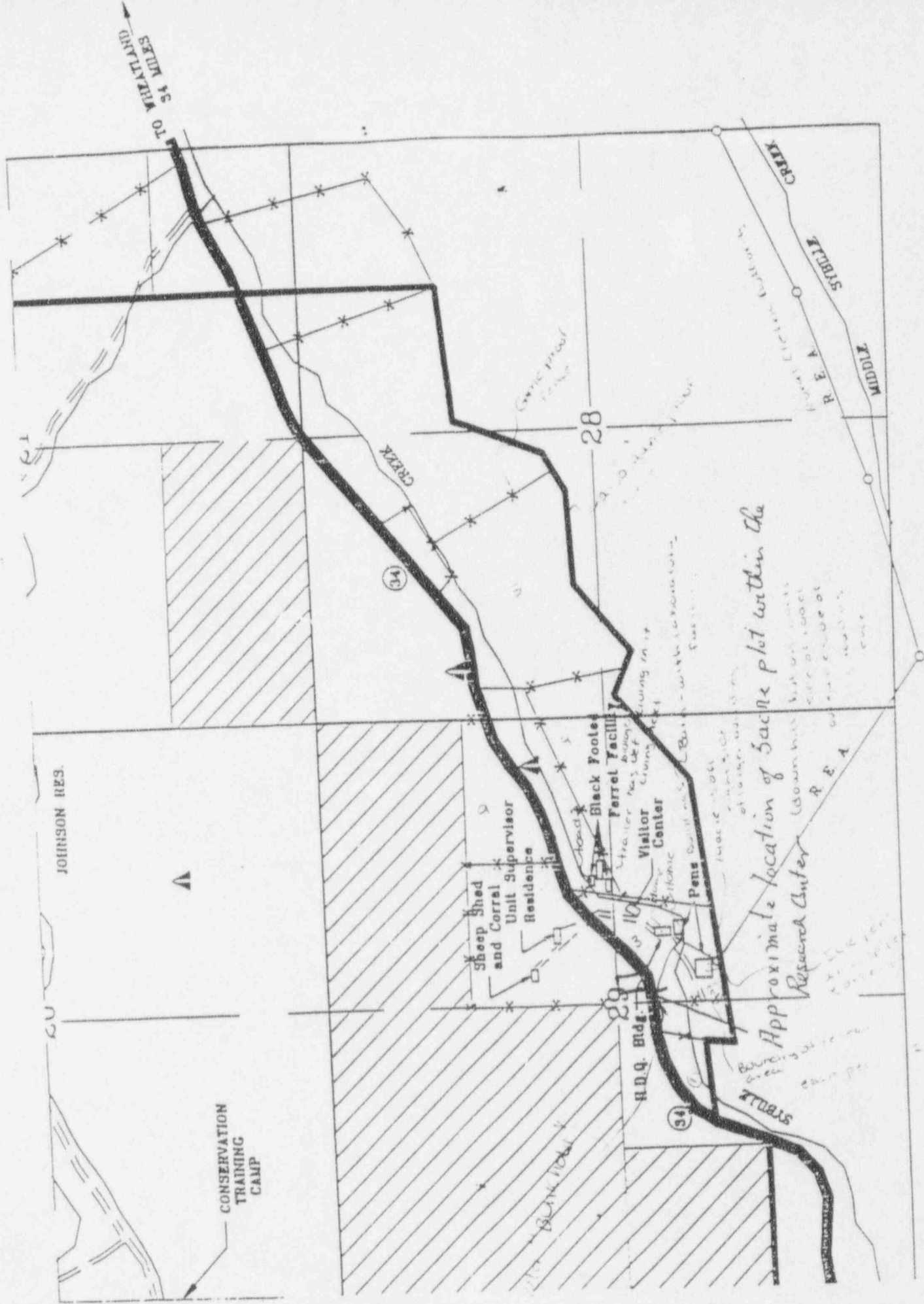
Attachments:

Map of research area

Authorization letter from Wyoming Game and Fish Department

SYBILLE WILDLIFE RESEARCH AND CONSERVATION EDUCATION CENTER
 WYOMING GAME & FISH DEPARTMENT
 FEDERAL AID IN FISH AND WILDLIFE RESTORATION
 ALBANY COUNTY, WYOMING
 SCALE 6" = 1 MILE





JOHNSON RES.

▲

CONSERVATION TRAINING CAMP

Sheep Shed and Corral
Unit Supervisor Residence

Black Footed Ferret Facility
Visitor Center
Pens

H.Q. Bldg.

Approximate location of Saxe plot within the Research Center

Burning site near camp per...

TO WYLAND 34 MILES

CRK

28

29

34

CRK

STUBS

MIDDLE

R. E. A. Forest Creek

R. E. A.

WYOMING
GAME AND FISH DEPARTMENT

Mike Sullivan, Governor



Francis E. Petera, Director

Game and Fish Laboratory
University of Wyoming
P.O. Box 3312
Laramie, Wyoming 82071
(766-6313)

February 1, 1993

Dr. Kathrine L. Parker
Department of Zoology and Physiology
University of Wyoming
P.O. Box 3166
Laramie, WY 82071

Dear Dr. Parker:

This letter is to inform you and others that the Wyoming Game and Fish Department has reviewed your proposal to use tritiated water for milk intake determination on pronghorn fawns. These activities will be necessary for completion of the study "Understanding Recruitment in Pronghorns." The activities will take place at the Department's Sybille Wildlife Research and Conservation Education Unit.

We will expect you to make all further arrangements for the use of the small quantities of tritiated water for this study at Sybille. All activities, including handling of pronghorns, inoculations of tritiated water, milk and blood collection etc. must be coordinated and conducted with the help of Mr. Huey Dawson, Unit Supervisor.

Sincerely,

Tom Thorne, DVM

E. Tom Thorne
Wildlife Research Veterinarian

cc: J. Herrold ✓
H. Dawson

Brad

COPY

OVERVIEW OF THE
SYBILLE WILDLIFE RESEARCH AND CONSERVATION EDUCATION UNIT

September, 1987

Brad Meyer, Education Assistant

Company based out of Chugwater, Wyoming. This ranch was gradually broken up and sold to different people.

C. Size

There are 3100 acres in the Unit; ²⁴¹⁰~~2100~~ are deeded, 680 are Natural Resource Lands which have been withdrawn under Public Law 1080 for permanent wildlife use, and ~~320 are under lease from the State of Wyoming.~~

D. Purpose and Current Management Priorities

The lands comprising the Sybille Unit were originally purchased to provide critical winter deer range in an area where the terrain provides excellent cover, but where food species were gravely overused.

As ground cover and water retention capacity were improved through protection from livestock grazing, the deer range and fisheries have improved.

Because the Unit and surrounding area are well suited to the needs of most of Wyoming's big game animals, and because of its accessibility, strategic location, climate, etc., it became evident at an early time that this would be a logical place for the development of a research facility to supplement and enhance work being done by field personnel and the Game and Fish Research Laboratory in Laramie. Sybille along with the Laboratory offers the vehicle for almost any type of research which might be needed for the management of our wildlife. This includes the capability for research on parasites and disease, nutrition, anatomy, physiology, ecology, management, and research techniques and toxicology.

Location of this research complex is ideal. Sybille comprises game range typical of a large portion of southeastern Wyoming. It has successfully maintained all of the big game species in Wyoming and several species of exotic. The Laboratory is at the University of Wyoming where University laboratories and many technical consultants are available. These factors help make the Laboratory and Sybille into an enviable research facility.

A side benefit of Sybille concerns public recreation. A 6.6 acre reservoir was constructed on Johnson Creek in 1961 and furnishes excellent fishing, along with Johnson Creek, in an area where public fishing is premium because of a general lack of water and also lack of public lands. These waters are stocked several times a year with catchable rainbow trout by the Fish Division. Public use areas along Johnson Creek and Sybille Creek are used by hunters, fishermen and the general public.

The corrals and pens where animals are under close confinement are closed to the public except for prearranged guided tours. This is

so that molestation of the animals and interference with research and maintenance activities can be kept to a minimum. The animals in several of the pastures are plainly visible from the highway. These often comprise most of the hoofed big game species found in Wyoming and they attract a great deal of attention and afford opportunities for people to get better acquainted with these species.

Most of the Johnson Creek portion of the Unit is commonly opened to deer and elk hunting along with the surrounding county. Studies have shown that an average of 13.31 deer per section were taken on this area over a longterm period.

E. Strategic Plan Problems and Strategies Addressed

Attention to several areas of the 1978-1983 plan are addressed by the goals and objectives of the Sybille Unit; these include:

Department Goal Problems and Strategies 1-K; 2-1.e; 3-b; 6-1.b; 7-a, d; 8-a; 9-a; 11-a

Big Game Problems and Strategies 4-1; 7-b; Whitetail Deer 2-a; Mule Deer 1-d; Moose 1-d; Bighorn Sheep 4-b

II. INVENTORY

A. Biological

Much of the following information in paragraphs one through five was taken from a report on the effects of livestock grazing on all season mule deer ranges prepared by Welch (1966).

1. Topography:

The terrain is rugged and rocky, marked by narrow, rock crowned ridges and numerous deep draws. The southwestern and north-central parts of the area contain some fairly level ridge tops and swales. There are also level stretches of bottomland of varying sizes along Johnson Creek and some of its tributaries and Sybille Creek. The elevations range from 6,000 feet to almost 7,000 feet. Virtually any combination of slope and exposure can be found in this rugged terrain.

2. Geology:

A large body of Precambrian rock known as the Laramie Anorthosite Massif makes up the central portion of the Laramie Range. The Unit lies mostly on this substrate with a small area on related igneous and metamorphic rocks. Lenses and dikes of ilmenite-magnetite are common in the anorthosite. Cretaceous sediments were deposited in the Laramie Range during the Laramide Revolution, but were completely eroded from the anorthositic rocks during the Oligocene and Miocene time.

Erosion during Pliocene time exposed the anorthosite rocks again and left them much as they are today (Murray 1961). There is no evidence of glaciation in this region.

3. Soils:

The soils of the research unit are almost entirely azonal lithosols derived from the anorthosite parent material and its associated rocks (Joint Publication by Western Land Grant Universities 1964). The soils are young, shallow, rocky, and well drained. The A horizons vary from about 2 inches thick in some basin big sagebrush (Artemisia tridentata) communities to complete absence on wind-eroded ridge tops. There is little development of other horizons due to the immaturity of the soils.

Colluvial deposits are present along the lower reaches and bases of steep slopes. They are the result of constant gravitational erosion and rock slides.

Alluvial soils are found sparingly along some watercourses. They may reach depths of several feet and in some places have supported small hayfields along Johnson and Sybille creeks.

4. Climate:

The climate of this portion of the Laramie Mountains is classified as semiarid. The summers are generally moderate to cool and the winters moderate to severe (Appendix A). Snowfall is heavy at times, but spatial distribution is very irregular due to the almost constant winter winds which bare much of the surface area of snow and leave it in large drifts in other places. The prevailing winds come from the west and southwest, but gusts and eddies from any direction are common due to the topography of the country. Chinook winds are important in breaking long cold spells and melting snow during the winter.

5. Terrestrial Vegetation and Habitat:

a. Vegetation Types and Composition

The vegetation of the Laramie Range belongs to the Rocky Mountain Floristic Element described by Porter (1962). The vegetation of the Unit can be further classified as a Mountain Shrub Zone (Costello 1954) or its equivalent, a Foothills Shrub Zone (Porter 1962). The elevation also places it within the lower limits of the Ponderosa Pine-Douglas Fir Zone and the upper limits of the Semidesert-Sagebrush Zone (Costello 1954, Porter 1962). Species groupings, representative of the aforementioned zones, can be found in various vegetative types throughout the Unit indicating the area is representative of a transition between the several floristic zones.

The vegetation presents a general pattern which can be related to the topographical features of the Unit: The watercourses support stands of boxelder maple (Acer negundo), narrowleaf cottonwood (Populus angustifolia), quaking aspen (Populus tremuloides), common chokecherry (Prunus virginiana), Rockymountain maple (Acer glabrum), and several species of willow (Salix spp.)

Silver sagebrush (Artemisia cana), giant wildrye (Elymus condensatus), western snowberry (Symphoricarpos occidentalis), and bluegrasses (Poa spp.) characterize the bottomland sites along streams and draws. Smooth brome (Bromus inermis) dominates old hayfields which occupy considerable stretches of the bottomland along Sybille and Johnson creeks.

Most of the slopes are occupied by shrub communities dominated by basin big sagebrush and antelope bitterbrush (Purshia tridentata) or, on some sites, true mountain-mahogany (Cercocarpus montanus). Upper slopes and ridge tops support black sagebrush (Artemisia nova) and grasses or pure grasslands. Some of the important species here are blue grama (Bouteloua gracilis), prairie junegrass (Koeleria cristata), western wheatgrass (Agropyron smithii), and bluebunch wheatgrass (Agropyron spicatum). Common forbs are Hoods phlox (Phlox hoodii) and plains prickly-pear (Opuntia polyacantha).

Remnant, open, conifer stands are made up of ponderosa pine (Pinus ponderosa), Rockymountain juniper (Juniperous scopulorum), limber pine (Pinus flexilis) and an occasional Douglasfir (Pseudotsuga menziesii) is found on the crests of some of the north-facing slopes in the area. A complete list of identified vegetation is given in Appendix B.

b. Vegetative Condition and Trend

The range condition is good to excellent and improving over the long term at present grazing rates. Most of the available information concerning vegetative condition and trend can be gleaned from the reports of Welch (1966) and Muchmore (1969).

c. Average Utilization on Preferred Areas by Wildlife and/or Livestock

Starting as early as 1955 many permanent transect lines, survey points, and exclosures have been established on various parts of the Unit. Range and use information derived from reading these has been incorporated in the reports of Laycock (1956), Wyoming Game and fish Department in cooperation with U. S. Forest Service (1962) (an unpublished administrative report on file at the Unit) Welch (1966).

Muchmore (1969), and FW-3-R Work Plan No. 3. Job No. 1W reports for 1967 through 1975. Copies of these reports are on file in the Sybille office as a part of this document and should also be available in the Wyoming Game and Fish Department files in Cheyenne.

A substantial number of these transect lines, survey points and exclosures were intended to provide information on the flora of the Sybille Unit which would be useful later in determining big game and livestock utilization and preference and various factors influencing both. These were also done to acquire a basis for future vegetational trend studies dealing with the influence of different degrees of use and varying weather conditions.

6. Aquatic Vegetation and Habitat

a. Amount of Lake and Stream Providing Aquatic Habitat

Approximately 2 miles of North Sybille Creek and 3 miles of Johnson Creek normally provide year-round stream habitat on the Unit.

Johnson Creek Reservoir, which contains 95 acre feet of water with a surface area of 6.6 acres (maximum depth is about 35 feet), is situated a little over a mile upstream from the mouth of the creek.

b. Dominant Shoreline Vegetation

The shorelines support stands of boxelder, narrowleaf cottonwood, chokecherry, several species of willow, Rockymountain maple, water birch (Betula occidentalis) and quaking aspen. Such grasses as blue wildrye (Elymus glaucus), smooth brome, Kentucky bluegrass (Poa pratensis), and western wheatgrass are common along the streams.

7. Past and Present Wildlife Use and Estimated Carrying Capacity

One of the prime reasons for choosing the Sybille area as the site for a big game research facility was the fact that it was the historical home of both mule deer (Odocoileus hemionus) and white-tailed deer (O. virginianus), elk (Cervus canadensis), bison (Bison bison), bighorn sheep (Ovis canadensis), and pronghorns (Antilocapra americana). When the property was purchased in 1948, the only game animals remaining were a few pronghorn and an abundant population of mule deer. When the unit was first purchased biologists figured the deer population averaged 160 head. In the early 70's the deer population fell due to a two deer hunting season and a bad winter. Since that time the deer numbers average around 75 to 100 head of deer at different times of the year.

There are 14 miles of fence on the Sybille Unit; of this, eight miles are boundary fences, four miles are highway right-of-way fence, and two miles are intercross fences. The fence types and conditions are as follows:

Boundary fence

Six miles of 39-inch, 11 gauge net wire with one strand of barbed wire below and four above for a total of 54 inches. Posts are pressure-treated pine, 3 to 4 inches in diameter and set 12 to 16 feet apart. The fence is braced with 3 to 4-inch poles at all corners, gates, and where terrain changes occur. This fence forms the boundary of the Johnson Creek area of the Unit and is in fair to good condition.

Two miles of 76-inch, 9 gauge net wire with one to three strands of barbed wire below and two to four above for an average height of 7-8 feet. All posts are pressure-treated pine 10½-12 feet tall, 5-6 inches in diameter, spaced 12 feet apart, and set 3 feet deep. The fence is braced with 3 to 4-inch poles and 2½-inch pipe at all corners, gates, and terrain changes. This fence makes the south and west boundary of the game-proof pastures and is in fair to good condition.

There are approximately 2 miles of intercross fences which separate the six game-proof pastures lying south of State Highway 34. These fences are of the same type and condition as the boundary fence listed immediately above.

Highway 34 right-of-way fences are made up of 2 miles of the previously described game-proof fence on the south side and 2 miles of the 54-inch sheep-proof type on the north side. These fences were constructed at the beginning of the Unit's development, and their condition is good. A chain link and woven wire fence surrounds the Black Footed Ferret facility.

3. Roads

There are 8.5 miles of service roads and vehicle trails on the Unit. Of these, 7 miles provide access to the Johnson Creek area for inspection, research activity, fence repair, fire control, and hunting and fishing. Approximately four miles of this road system have been surfaced with crushed rock, and metal culverts are installed in most of the 16 creek crossings.

The remaining 1½ miles of road are used primarily for animal care, fence repair, and fire control. Nearly all of it has been surfaced with crushed rock or limestone chips.

4. Dams

An earthen fill dam was constructed in the SW ¼, NW ¼ of section 21 on Johnson Creek in 1961. This structure, with con-

crete overflow, trickle tube drain, and rock rip-rap water face, resulted in a reservoir with 6.6 maximum surface acres which contributes greatly to the fisherman days use on the Unit.

5. Irrigation and Flood Control

In 1984, a rock filled gabion dam was constructed between pastures #1 and #2. This structure serves two purposes; one, as a source for irrigation water and two, as an erosion control structure on Sybille Creek as it flows through the Unit.

In 1986, work was begun on a stream bank erosion control project through the Unit on Sybille Creek. The stream was surveyed by the Soil Conservation Service and most of the work is being done by the Game and Fish Department construction crew. Work includes rock rip-rap and gabion rip-rap on heavily eroded bends in the stream. Also, several large drop structures to slow the water during high runoff. Shrubs and grass will be planted in the disturbed areas to help hold the structures in place.

6. Public Use Facilities

Parking areas and sanitary facilities are maintained at one location on Sybille Creek and five on Johnson Creek and include nine toilets. Camping is allowed for limited periods. In addition, there are light roadside parking areas along Highway 34 and garbage barrels at five of the parking areas.

7. Buildings

a. Main Headquarters Building

This cement block structure, with wood shingle roof, is 60' X 30' X 37' and houses a large office area, garage, workshop, utility space, and living quarters for project personnel. It was built in 1952 and is in a good state of repair. In 1981, part of the office space was converted into public restrooms.

b. Project Leader's Residence

This 24' X 48' frame house was built in 1971. It has a full basement and a 24' X 24' attached garage. To ensure better fire control and prevent crowding, this building was located across Highway 34 from the headquarters area. The dwelling is in excellent condition.

c. Bunkhouse

Bachelor quarters are now provided by housing formerly occupied by the project assistant. This 26' X 44' block

veneered house was built in 1958 and is in good condition. The roof was completely reshingled in the summer of 1979.

The 10' X 14' check station building, which formerly housed extra help is being used for storage. It was moved west, across the creek for fire hazard concerns.

d. Feed Room and Storage Barn

This prefabricated 20' X 60' steel building, on a 4-inch concrete slab, was acquired in 1954. It is used for storage of grain, salt, and other animal feeds, and building materials, tractors, vehicles, etc. The building is in good condition.

e. Implement and Material Storage Barn

Constructed in 1961, this wood 26' X 72' barn provides indoor housing for small laboratory animals, a heated shop for equipment repair, and space for the storage of lumber, tractor, snow plow, manure spreader, trailers, and supplies. This barn is in good condition.

f. Veterinary Building

In 1966, the Unit was provided with a 28' X 42' veterinary building of cement block construction. It includes a room for laboratory work, another for animal autopsy and surgery, two for small laboratory animal confinement, a bath, walk-in cooler, furnace room, and provision for six (6' X 7') preparation or recovery stalls for animals. The latter are so constructed that they can be converted into a lesser number of large areas. The condition of the veterinary building is very good.

g. Hay Storage Barns I and II

This building was constructed in 1972 for the storage of part of the Unit's annual hay supply. It is 36' X 63' with 12-foot side walls and a 12-foot wide door in either end. It is a pole frame structure with color-coated, ribbed steel roofing and siding and is floored with 4 to 5-inch thick reinforced concrete.

The summer of 1980 saw the completion of Hay Storage Barn II (30' X 60'). The addition of this building provides adequate space for storing hay under cover. It is of pole frame type construction with 12-foot side walls covered with corrugated galvanized metal. Two 11' X 12' doors are located on the east side and one 10' X 12' door on the south side. The building is in excellent condition.

h. Shop and Storage Building for Assistant's Residence

In 1972, this 18' X 24' metal covered building was constructed to provide additional storage space and a small show area. This building also has an automatic watering device which provides water for animals using the surrounding pasture when natural water is not available. The building is in good condition.

i. Conservation Training Camp Building

This 20' X 29½' building provides for indoor dining and lectures during the annual 2-week conservation training camp held on Johnson Creek and also for other camps scheduled by interested groups. It has an attached 14' X 16' kitchen for preparing meals and storing groceries and other supplies. Cooking, water heating, and refrigeration are done with propane appliances. Electricity for lights and showing lecture movies is provided by a portable generator. The dining area has a concrete floor and the kitchen area has a wood floor. The building is located approximately three miles up Johnson Creek from Highway 34 and is in good condition. Sanitary requirements are met by three toilets, which also serve the needs of hunters and fishermen when they are in the area. Water is pumped from a thirty-six foot well by a hand pump.

The building was damaged by a flood in 1984 and has not been used since the conservation camp was shut down. It needs some work to become usable again.

j. Black Footed Ferret Building

In 1986, a 168' X 48' metal pole barn building was built for the propagation of a captive black footed ferret population. Associated electricity and phone lines were run to it and a new well. The facility is equipped with a propane powered generator in case of power failure.

k. Black Footed Ferret Biologist Residence

A used 72' X 14' trailer from the Yellowtail Unit was set up at the black footed ferret facility in 1986, for the ferret biologist to live in. New plumbing and carpeting were installed, a lawn and trees planted, and the trailer painted.

8. Pens and Corrals

Facilities for the close confinement and handling of research animals are comprised of the following:

- a. Four 50' X 50' pole corrals with connecting lane, scales, and 12' X 21' enclosed elk handling shed. A metal roof and walled shelter, open on the south, runs the full 200-foot length of these corrals and is floored with concrete.
- b. Five 27' X 48' pole corrals with connecting lane, dipping vat, and 15' X 31' Wild sheep handling building. A metal roofed and walled shed 15½' X 140' provides shelter for this bank of corrals. Floors throughout corrals and sheds are concrete.
- c. A 20' X 40' pole corral with attached 12' X 40' shelter and handling shed for domestic animals. This corral and shelter is located across Highway 34.
- d. A 26' X 41' open shed for hay storage and animal shelter is located north of Highway 34.
- e. One 30-foot diameter pole corral (at south boundary between exercise corrals and veterinary paddock) with catch pen and pole lane connecting to bighorn and elk corrals. A 12' X 36' shelter is adjacent to this corral.
- f. Two 30-foot diameter circular pole corrals (on line between pastures 5 and 6) with catch pens between, loading chute, and 12' X 30' closed shed.
- g. A ¼ acre wire pen with attached 11' X 20' closed shed for domestic sheep, bighorn rams and ewes, etc.
- h. Three connected 20' X 60' wire runs with 10 feet at the south end walled and roofed with metal for deer confinement.
- i. An isolation and holding pen complex attached to the veterinary building and consisting of four isolation pens (30' X 36', 30' X 36', 24' X 32', and 22' X 26'), three holding pens (25' X 27', 25' X 27', and 24' X 25'), and a covered feed area (24' X 25'). These facilities are constructed of 9-foot high panels and approximately the north half of each is roofed with sheathing and galvanized metal and walled with metal. All floors are concrete, and drainage to the waste disposal system is provided by concrete gutters. They are served by a central lane which connects them to each other as well as to the veterinary building and to all other pole corrals in the headquarters area. These pens were constructed in 1966.
- j. Five pole panel enclosed paddocks ranging from 100' x 150' to 90' x 205'. These average 8 feet in height and are equipped with automatic waterers and each paddock has a 16' x 24' metal walled and roofed shelter, and hay bunks. They are connected by a 12' wide pole lane which runs along the

south side of them and connects them with other corrals and handling facilities.

- k. Two 30' X 72' antelope pens with adjoining shelter and automatic watering device situated between the hay storage barn on the west and the implement storage barn on the east.
- l. A cattle catch pen in the Johnson Creek area of the Unit is 100' X 150', divided across the unit and has a lane down the south side from center to end for loading purposes. Construction is of treated wood posts, set at 10-foot intervals and topped with continuous bracing of 4-inch pine poles. Forty-seven inch netting with one barbed wire above was used on both exterior and divider lines.
- m. A ramp walkway from the main headquarters yard area to the parking access level adjoining the veterinary building was constructed in 1969. This ramp is 4 feet wide, floored with 2-inch lumber, and supported on treated 6-inch posts by means of two double 2-inch by 6-inch stringers. Height above ground varies from about 4 feet at the point of beginning to just over 16 feet where it crosses Sybille Creek. Total length of the ramp is 226 feet, and the average span is 12 feet. However, the highest span is over 28 feet long and is provided additional support by eight angle braces. Two yard lights are an added convenience for nighttime use. This ramp has both a convenience and safety factor in that it permits almost level, above snow drift and creek access to the veterinary area, and also crosses above animal pens so that visitors to that area are not exposed to sometimes dangerous bucks and bulls.
- n. In 1980, a 71' X 70'5" corral-pasture was constructed along the south side of the isolation corrals for rearing fawns and calves. This area was enclosed with four-foot high solid sides attached to post and poles.

It was seeded with alfalfa, red clover, orchard grass, and smooth brome grass. During the years, trees and browse plants will be added to make it as natural as possible for young animals being raised in it.
- o. Numerous small wire pens and paddocks with various types of small shelters and coops.

9. Pastures

The Sybille Unit has eight game-proof pastures and one fenced with sheep-proof wire. The game-proof pastures are used for holding animals not being used on research jobs, range manage-

ment studies, for public viewing, and confinement of animals on research work that does not require them to be available for frequent handling.

Seven of the game-proof pastures are located south of State Highway 34 and are referred to by number. Numbering of the pastures goes from west to east with the acreage of each as follows:

Pasture No. 1 - 7 acres
Pasture No. 2 - 18 acres
Pasture No. 3 - 7 acres
Pasture No. 4 - 56 acres
Pasture No. 5 - 40 acres
Pasture No. 6 - 65 acres
Pasture No. 7 - 42 acres

Three of the pastures (No. 2, 5, and 6) contain small holding areas that aid in the capture and removal of animals or sometimes in better forage utilization of the area. Creek bottomland in Pasture No. 4 is separated from the steep hillside part by an intercross fence which prevents elk use of the big-horn sheep range. Sybille headquarters and all close handling facilities are located in Pasture No. 3.

One game-proof pasture is located across Highway 34 north of the Unit headquarters. This contains approximately 60 acres and has a well-developed natural spring for water. This pasture has one intercross fence which separates the assistant's residence from the remaining area.

The Johnson Creek part of the Unit contains 2786 acres and is enclosed with sheep-proof fence except for the 320 acres leased to Christinck. This area provides a place for extensive range studies, public fishing and hunting, camping, picnicking, and hiking. The annual Wyoming Game and Fish Department Youth Conservation Training Camp was held in this area. Grazing by domestic livestock is permitted in this pasture during years of adequate precipitation and when it will benefit fire control measures.

All of the above pastures are shown on the base map (Appendix D) which accompanies this Management Plan.

10. Water Systems

Water supplies for the Sybille Unit are provided by four wells located at the Unit headquarters. These wells provide water for domestic, animal, and irrigation needs.

Well No. 1 is in the main headquarters building and was drilled in 1952. It is approximately 26 feet deep and has a 6-inch steel casing.

Well No. 2 is located near the bunkhouse. It was drilled in 1958. This well is also 26 feet deep with a 6-inch casing.

Well No. 3 is located along the north edge of Number 3 elk corral. It is 23 feet deep with an 8-inch steel casing. Ten feet of the casing is perforated. It was drilled in 1961.

Well No. 4 is on the south side of Sybille Creek and about 40 feet north of bighorn sheep corral Number 4. This well was drilled in 1967 and is approximately 32 feet deep with a 6-inch steel casing.

Well No. 5 is located at the black-footed ferret facility. It was drilled in 1985 and is approximately 44 feet deep.

Well No. 6 is located just west of the conservation camp building. It was drilled in 1982 and is 36 feet deep. An old fashioned hand pump is used to draw water.

Well Numbers 1, 2, and 4 supply water for all houses, veterinary building, pens and corrals, and other buildings around headquarters. Pumps on these wells are set up so that, in the event one fails, pumps on the other wells will continue to provide the necessary water supplies.

Number 4 well serves as irrigation water for lawns, trees, and the front meadow area. This well is no longer being used due to the need for a new pump and the inefficiency of pumping with electricity.

Water for the project leader's house across Highway 34 is provided by a natural spring located approximately 150 yards up the draw west of the house. Water from the spring is piped underground to a 1000 gallon capacity concrete cistern. From here it goes into a water pressure system which supplies the house and lawn needs. Overflow water from the cistern is caught in an above-ground tank and used for watering trees and animals. Water from the spring is also piped into a stock tank which furnishes water for the corral and shelter north of Highway 34.

III. Goals and Objectives

A. Goal

The long-range management goal for the Sybille Wildlife Research and Conservation Education Unit is to facilitate wildlife research and education and to provide quality human experience with wildlife.

B. Primary Objective

1. To continue to furnish and maintain facilities for the maintenance of large numbers of elk to be used for research purposes.

2. To continue to maintain additional animals (including bighorn sheep, antelope, moose, deer) as required for other research.
3. To continue to propagation and research of the endangered Black-Footed Ferrets.
4. To continue to use the land, wildlife, and facilities for conservation and education purposed to the extent that they are compatible with the primary objective.

C. Secondary Objectives

1. To continue to maintain wildlife in confinement as necessary to meet law enforcement or quarantine needs.
2. To continue use of Sybille for human experience with wildlife (including hunting) to the extent that it is compatible with the primary objective.
3. To continue to monitor and provide for small game and nongame species.
4. To continue to provide and protect fisheries habitat.
5. To maintain outlets for surplus animals.
6. To conduct research on other native and non-native game animals when it is in the best interests of the Department.
7. To continue to monitor vegetative trends on the Unit.

IV. Operations

A. Cooperative Agreements with Other Agencies and Individuals

1. Bureau of Land Management

In 1950, a Memorandum of Understanding was entered into with the Bureau of Land Management on 680 acres of Natural Resource Land. This land was withdrawn under Public Law 1080 for permanent wildlife use. Under this memorandum, the federal range grazing privileges for livestock use on the S $\frac{1}{2}$ SW $\frac{1}{4}$ of section 21, N $\frac{1}{2}$ NE $\frac{1}{4}$, NW $\frac{1}{4}$, and NW $\frac{1}{4}$ SW $\frac{1}{4}$ of section 29 and NE $\frac{1}{4}$ N $\frac{1}{2}$, SE $\frac{1}{4}$, and N $\frac{1}{2}$ of section 30 in Township 21 North, Range 71 West, 6th P.M. were relinquished and reserved for year-round utilization by mule deer and other wildlife.

2. Garton Ranches, Incorporated

In 1953, a land lease agreement was executed with Plaga and Garton for approximately 20 acres of the NE $\frac{1}{4}$ NE $\frac{1}{4}$ of section 28. This lease expired in 1973 and was executed again in

1974, with Garton Ranches, Incorporated, for a period of 20 years. This agreement makes inspection and maintenance of the Unit's south boundary less time consuming and also helped put the boundary in better alignment with existing fences.

Copies of this lease agreement are on file at the Sybille Unit headquarters and in the Research and Development Division office of the Wyoming Game and Fish Department in Cheyenne, Wyoming.

3. Martens-Christinck Exchange of Use Agreement

In 1953, an Exchange of Use Agreement was executed with Verne and Minnie Martens for a period of 20 years. This agreement involves approximately 90 acres in section 21 and 320 acres in section 18.

This agreement was renegotiated in 1975 with Thomas T. and Valeria F. Christinck for a period of 50 years.

This Exchange of Use Agreement provides the Department with the only feasible access to the Johnson Creek area of the Unit. It also aided in the construction of boundary fences and allows the Christinck Ranch use of Department land which is not vital to the Sybille Unit. The terms of this agreement allow the Christinck Ranch and the Game and Fish Department the right of ingress and egress upon their respective lands.

Copies of this Exchange of Agreement are on file at the Sybille Unit headquarters and in the Research and Development Division offices of the Wyoming Game and Fish Department in Cheyenne, Wyoming.

B. Farming and Grazing Practices

The Sybille Unit was a badly overgrazed cattle and sheep ranch at the time of its purchase in 1948. From then until 1969, no livestock was allowed on the unit although occasional trespass did occur. During the summers of 1969 through 1974 and 1978 through 1981, the Johnson Creek portion of the unit was leased for the grazing of domestic cattle on a controlled and limited bases. Since 1982, the Johnson Creek portion of the unit has not been grazed in order to fulfill an obligation to the Bureau of Land Management and to revegetate the riparian areas which were showing signs of overuse, which will provide more benefits to a larger variety of wildlife.

In the future, grazing may be permitted on a limited basis to maintain plant vigor. By doing this, the vegetative composition of the area should not be hurt.

In order to evaluate the grazing and rest periods on the unit, previously established range transects can be read.

Table 1 contains information concerning the years during which the approximately 2,460-acre portion of the Johnson Creek area was let for cattle grazing.

C. Mineral, Oil and Gas Exploration and Development

It has not been determined that the Department owns any of the coal, oil, gas, or other mineral rights on this Unit. In the event the Department owns or eventually owns any of these rights, the following recommendations are made:

1. No use will be made of the surface of the leased premises for the housing or boarding of employees.
2. No use will be made of the surface of the land premises, without prior written permission of the Department, for the production, storage, or processing of oil and gas or casing-head gasoline.
3. Location of roads, pipelines, and drill sites shall be subject to the prior written approval of the Department.
4. It is agreed that upon completion of a well, the lessee will clean and fill all pits and repair all damages to fences and ditches occasioned by the drilling of such a well.
5. Lessee agrees to fence drilling sites when necessary for protection of game animals, livestock, and the public.
6. In the event a well is completed as a dry hole or otherwise abandoned, and if such a well has possible value as a water well, then the lessee agrees to notify the Department as soon as possible so that the well may be developed for water purposes by the Department. In the event that an underground water supply is indicated by seismograph operations carried on by the lessee on the leased premises, then the lessee shall make such information available to the Department.
7. No activity is to be carried on during the months of October and November except after prior approval by the Department.
8. The lessee shall not pollute any springs, surface water, regulation underground water or unreasonable damage the surface of the leased premises.
9. The lessee shall not deepen an oil or gas well for the purpose of producing oil or gas from a lower stratum until the upper productive stratum is protected in accordance with good oil field practices and to the satisfaction of the Wyoming State Mineral Supervisor.

10. No activity will be permitted in the game-proof pastures south of Highway 34.

D. Fire Control Plan

Reporting

The type of work at Sybille requires the presence of someone at the Unit at all times, and should a fire occur, it will probably be sighted by an employee. A fire may be reported by people driving through the Unit on Highway 34 or by one of the neighboring ranchers. Also, during the period of high fire danger, the Johnson Creek area is used by many fishermen, hunters, and campers, and a fire in that area could be reported by one of them.

Notification and Assistance

In the event of a fire, assistance may be received from neighboring ranchers, permanent Department personnel residing in Laramie and Wheatland, Platte and Albany County rural fire districts, Wyoming State Forestry Division and volunteer fire departments from Wheatland and Laramie. Telephone numbers for fire and enforcement dispatchers in Albany and Platte Counties are posted at each Unit telephone.

The Wildlife Veterinary Research Services Branch Supervisor will be notified as soon as practical after a fire is discovered.

Fire Prevention

A animal research Unit such as Sybille must be maintained in a clean and sanitary condition at all times. To do this, all vegetation around buildings, corrals, pens and driveways is kept in as clean a condition as possible. This greatly reduces the fire danger in these areas and also prevents the rapid spread of fire should it approach closely.

Around flammable installations, such as propane gas tanks, the vegetation is either completely removed or regularly irrigated to keep it green and mowed as necessary.

As part of the design and construction of the black-footed ferret building, a 25 foot graveled vegetation-free zone surrounds the facility. The exterior siding is metal to prevent easy burning. Fire extinguishers are located at strategic places within the building and water hoses at outside hydrants.

During periods of high fire danger the burning of garbage in the barrels provided at each residence will not be done without prior approval from the Unit Supervisor. All new employees at the Unit will be thoroughly acquainted with fire prevention measures, location of extinguishers, water hoses, who to contact and the telephone numbers of local fire fighting units.

The construction of firebreaks is not practical at the Sybille Unit.

Equipment

At headquarters, nearly all buildings are equipped with fire extinguishers located in accessible places. Garden water hoses are kept at all water hydrants or spigots in the corral and pen areas and in buildings with water outlets. Also, a 55 gallon weed sprayer powered by a gasoline engine, is available for filling and use at all times.

Animal Evacuation

Most pens and corrals at Unit Headquarters are connected with a series of lanes for easy movement of research animals. Should it be necessary during a fire, animals can be quickly moved several hundred yards from one end of the corral areas to another, to get them away from immediate danger. If danger from fire approaches too closely, animals can be turned into several adjoining pastures. Small animals, such as the black-footed ferrets, are provided with 1 or 2 closable nest boxes per cage. During a fire threat these animals are immediately locked into their nest boxes and can be moved out of a building in a matter of minutes by one person.

E. Control of Designated Noxious Weeds

When the Sybille lands were acquired, there were considerable infestations of Canada thistle (Cirsium arvense), American licorice (Glycyrrhiza lepidota), and common burdock (Arctium minus) in the bottom areas along the creeks. Annual control measures have reduced the problem, but it has by no means been eliminated. Approximately five acres of Canada thistle and musk thistle (10 percent coverage of an overall area of 50 acres) must be chemically treated each year to prevent eruption of this pest in the future. Treatment is mainly by means of backpack sprayers which permit close control of spray and prevent drift from entering streams of damaging desirable forage. In some isolated situations, cutting and burning are also applied in the control of both thistle and burdock. Recent developments in chemical herbicides have given increased effectiveness to control efforts, but continuing vigilance will be necessary in the years ahead.

Herbicides used will be limited to those registered with the Department of Agriculture and used in conformance with registration requirements.

The most common noxious weeds found on the Sybille Unit are listed in order of importance as follows: Canada thistle, American licorice, houndstongue (Cynoglossum spp.), Douglas waterhemlock (Cicuta douglasi), musk bristlethistle (Cardus nutans), common burdock, poison ivy (Rhus radicans), bull thistle

(Cirsium vulgare), scotch cottonthistle (Onopordum acanthium), stinging nettle (Urtica dioica), pricklypoppy (Argemone spp.), meadow salsify (Tragopogon pratensis), and western stickseed (Lappula occidentalis).

F. Easements, Rights-of-way, and Water Rights

1. Right-of-way Easement

In January of 1977, a right-of-way easement was granted to the Mountain States Telephone and Telegraph Company. This easement is 16 feet wide and goes across the S 1/2 NW 1/4 SE 1/4 of section 29, T. 21 N., R. 71 W., 6th P.M. It is for the construction of underground telephone lines.

2. Highway Right-of-way

State Highway 34 runs through the Unit for a total of two miles. This highway has a 100-foot right-of-way which was acquired from the previous owners on October 11, 1932. It contains 21.048 acres.

3. Water Rights

The following table shows water rights for the Sybille Unit.

Permit No.	Name of Ditch	Priority	Source	Acres
3016	Little Creek	January 29, 1901	Little Creek (Johnson Creek)	69
3015	Moore Ditch No. 1	January 29, 1901	Sybille Creek	--
3014	Moore Ditch No. 2	January 29, 1901	Sybille Creek	3
6398	George Moore Ditch	December 31, 1903	Sybille Creek	3

G. Administration, Maintenance, and Operations

Table shows the estimated annual cost for the Sybille Unit. These costs will be evaluated every three years.

V. MANAGEMENT PROBLEMS

Perhaps the greatest problem faced by Sybille is that of human interference with research activities. A fairly tenable solution in the past has been to impose minor restrictions on public access to various parts of the Unit and to completely deny access to the close confinement and handling areas except for organized groups with prior arrangements. As littering, vandalism, and damage to animals increase, it may be necessary to impose more and more restrictions on public use and enjoyment of the Unit.

A very real problem which arises each spring is that of having to devote many critical man hours to the bottle feeding of numerous fawns, lambs, and calves which have, in most instances, become orphaned due to human ignorance or just plain illegal intent. The solutions to this dilemma would seem to lie chiefly with the Department's enforcement and education personnel. Our contribution at Sybille has been to emphasize at every opportunity (personal conversations, lectures, tours, and training camps) that young animals found in the wild should be left completely alone. In the event there is good evidence that they are really abandoned, they should still be left as is and the local game warden notified of their plight.

While the Unit's ranges and watershed capability are kept in good condition through judicious issuance of grazing leases, there still remains the problem of erosion caused by violent and uncontrollable runoff. It appears that the only feasible solution here is to continue a program of damage repair through bank sloping and reseeding, riprapping and backfilling of eroded banks, the removal of debris jams which may lead to rerouting of stream channels, etc.

The control of noxious weeds has been pursued so diligently and successfully in past years that this problem would be very minor today were it not for reinfestations from neighboring lands. However, since seeds are continually being brought onto the Unit by wind, water, birds, animals, etc., it will be necessary to continue annual control measures far into the future.

VI. Management Direction

Since Sybille was established most of the goods and objectives considered then have been reasonably well met. A new management objective that has surfaced in recent years is that of managing people. This is being met by the addition of a visitor center, and implementation of a new conservation program that will inform the public of the various research activities without too much interference in those activities.

One of the initial objectives was to develop sufficient pens, small pastures, and handling facilities to permit the confinement of 150 head of elk and their use on at least two concurrent studies such as one dealing with a disease problem and another concerned with feeding or nutrition questions. This capability has been achieved. It is not anticipated that this number of elk will be needed annually. However, it can be assumed that several head should be planned for on an annual basis for proposed disease and nutrition work.

It has also always been considered desirable to maintain sufficient numbers of bighorn sheep, pronghorns, and deer for unplanned disease investigations, public display, and education purposes. In addition to this, an adequate research unit should have the capability of confining and handling up to another ten head of any of the above animals in the event the need for research involving them arises.

Facilities should be available, at the same time, to accommodate such animals as beaver, bobcat, coyote, etc. which may be brought in for quarantine to determine if they have rabies or other serious or communicable diseases.

In order to serve the entire needs of our Department, Sybille should also be able to hand-rear orphaned calves, fawns, and lambs and to establish relations with acceptable outlets which will permit the later disposal of any such animals which are surplus to research requirements. In some instances, it may be necessary to capture and hand-raise considerable numbers of young animals for research needs. This means that trained personnel and necessary equipment must be available on a continuing basis. Another task which sometimes falls to a unit such as Sybille is the boarding of all sorts of animals which enforcement personnel need. For example, in recent years, Sybille has held and cared for one African lion, two mountain lions, four javelinas, three leopards, one jaguar, several wolves and wolf-dog crossbreeds, and various birds. This type of activity may become more demanding if the State's population continues to increase.

In May, 1985, the U.S. Fish and Wildlife Service and Wyoming Game and Fish Department jointly agreed to capture and hold black footed ferrets as founder animals for the planned captive propagation facility. The ferrets were captured in September, 1985, and held at the laboratory facility at Sybille until the new captive propagation facility was completed there. A black footed ferret biologist was hired in December, and, in the summer of 1987, eight new ferrets were born with seven surviving.

We believe the Sybille Unit has been quite adequately meeting all of the foregoing objectives and is even capable of taking care of additional problems which have not yet been encountered.

Another increasingly important objective of the Unit is conservation education. Educational endeavors include lectures and tours for numerous groups ranging all the way from pre-school children through rancher and sportsmen's organizations to professional wildlife researchers. In the past, actual weeklong conservation training camps were an annual affair and professional wildlifers from other states and Canada have visited the unit for periods of several days to a week to acquire knowledge concerning the handling of captive wild animals for research purposes.

An important program of Sybille in the past has been the operation of a conservation camp for boy and girl scouts and in later years any interested teenager. The camps were started in 1957 and continued through 1983 when they were terminated due to the need for the funding to be used elsewhere. The young people were taught many aspects of conservation and learned that there are many things involved in conservation efforts.

While public recreational activities often impose an unwanted burden on a research program, the people who finance the operation should still

be able to see how their money is being spent. Therefore, public hunting, fishing, camping, and sight-seeing are permitted whenever and wherever such pursuits do not pose too great a hazard to the primary objective.

No doubt the opportunities which Sybille provides for hunting and fishing do much to enhance the image of both the Unit and the Wyoming Game and Fish Department in the public eye. In the future, some expansion of conservation education activities will be done at Sybille. A visitor's center and nature trail complex are planned in the future. Providing this increased public activity will not lead to conflict with the research programs. The current number of and the average harvest of about 50 head of deer are considered reasonable goals for the future in the area of sportsman recreation.

One of the original reasons for purchase of the Sybille Unit was to provide winter deer range in a then critical area. The maintenance of this deer range continues as a substantial objective of the overall program. The presence of a healthy deer population is actually an asset to overall research objectives in that it offers opportunities for closely controlled studies relating to harvest potential, competition with domestic livestock, etc.

The Johnson Creek area was incorporated into the region 3 habitat management unit in July 1987. It will be maintained as a deer winter range and public use area.

1. Capitol Improvements and Other Developments

- a. Provide and maintain experimental animals for use by research projects under the direction of the Department's Chief of Habitat and Technical Services.
- b. Provide and maintain personnel, corrals, paddocks, and other physical features to properly handle these animals.
- c. Develop, protect, and maintain the lands and buildings on the Unit.
- d. Provide land areas for ecological studies.
- e. Assist with research projects within the Unit.
- f. Provide hunting and fishing and other public recreation consistent with other functions of the Unit.
- g. Public relations and education activities will be continued whenever they do not interfere with research operations.

2. Use of Water and Agricultural Land

Meadows and parts of some pastures will continue to be irrigated to furnish forage. The fenced pastures, including the 60-acre one

north of the highway, will be used for confined animals. The rest of the land north of the highway will be managed for deer range (which may include periodic livestock grazing) and will serve as a wildlife ecological study area and for public hunting, fishing, and other recreational activities.

3. Personnel

A unit supervisor, biologist, ferret center biologist and an education assistant will be maintained at the unit. Other personnel will be determined by needs.

4. Unit Need

The pastures and paddock area south of the highway will be closed to hunting. With exception of the Unit Director's area, the land north of the highway will continue to be open to hunting with the surrounding area so long as this activity is compatible with the research conducted there.

5. Other Uses of the Land

Aside from compatible recreation, other uses will be limited to incidentals.

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APPENDIX A

Weather

Table 1. Average annual temperatures and precipitation at the Sybille Unit, 1964-1986.

Year	Temperature					Precipitation		
	Avg. Max.	Avg. Min.	Avg.	Avg. High	Avg. Low	Total	Snow-sleet Total	Avg. Max. depth
1964	57.4	32.1	44.8	73.5	17.4	11.51	80.6	3.5
1965	57.6	33.7	45.7	73.0	18.4	16.58	64.5	2.5
1966	59.6	33.7	46.7	73.3	15.6	11.40	38.1	1.6
1967	58.5	33.0	45.8	73.2	15.4	22.66	120.8	3.7
1968	57.7	34.0	45.5	71.9	16.6	14.35	93.0	4.5
1969	59.0	34.1	45.6	74.9	17.4	16.97	79.5	3.0
1970	58.0	33.2	45.6	73.3	17.8	18.01	120.5	6.4
1971	57.6	32.6	45.1	73.8	13.7	16.61	92.6	5.0
1972	57.9	32.4	45.2	71.3	13.6	18.39	99.4	3.9
1973	56.1	33.9	44.9	71.8	15.9	19.41	134.5	6.0
1974	59.4	33.3	46.4	74.0	16.4	13.28	55.7	2.7
1975	58.4	32.2	45.5	74.3	12.3	12.56	82.0	3.8
1976	59.8	33.4	46.6	72.8	14.2	11.49	53.5	1.7
1977	60.8	34.2	47.5	74.4	17.9	12.59	52.3	2.2
1978	58.2	31.7	50.0	72.4	15.0	17.25	110.1	4.2
1979	57.8	32.7	45.3	72.6	17.1	14.76	116.5	6.1
1980	59.6	33.9	46.7	75.0	17.0	12.87	113.0	9.4
1981	62.4	35.6	49.0	76.0	19.0	15.25	48.5	4.0
1982	57.9	32.4	45.2	74.0	15.0	16.49	68.0	5.6
1983	57.7	33.3	45.5	73.0	15.0	22.64	122.0	10.2
1984	56.8	32.6	44.8	71.8	17.0	16.03	102.0	4.3
1985	57.5	31.9	44.7	72.3	12.9	11.87	95.0	4.1
1986	59.9	34.5	47.2	73.4	20.0	15.70	81.0	2.8
23 Yr. Avg.	58.5	33.2	46.0	73.3	16.1	15.60	88.0	4.4

APPENDIX B

Cattle grazing on the Johnson Creek Area
of the Sybille Unit from 1969 through 1981

Table 2. Cattle grazing on the Johnson Creek area of the Sybille Unit from 1969 through 1981

Year and Stock	Animal Unit Months	Grazing Period	Average Gain (lbs) per Animal	Average Gain (lbs) per head per day	Lease Payment	Grazing Lessee
<u>1969</u>						
30 cows 108 heifers	400	11 June - 12 September	88 132	0.95 1.42	\$1,597.50	Don Cundall
<u>1970</u>						
133 cows	400	29 May - 31 August	178	1.89	\$1,437.00	Don Cundall and Von Forell Herefords
<u>1971</u>						
134 cows 49 heifers	600	28 May - 15 September	151	1.28	\$2,100.00	Bruce Von Forell
<u>1972</u>						
114 yearling steers	400	16 June - 15 September	169	1.60	\$1,200.00	Elwood Hanna
<u>1973</u>						
150 yearling heifers	600	25 May - 15 September	151	1.28	\$2,220.00	Fred McQuire
<u>1974</u>						
100 cows with calves	400	1 June - 30 September			\$2,600.00	Luke Cori
<u>1978</u>						
94 cows 42 calves 24 yearling heifers 2 bulls	400	1 June - 15 September			\$3,200.00	Dumbell Ranch Co. and Owen McGill

Table 2. Continued

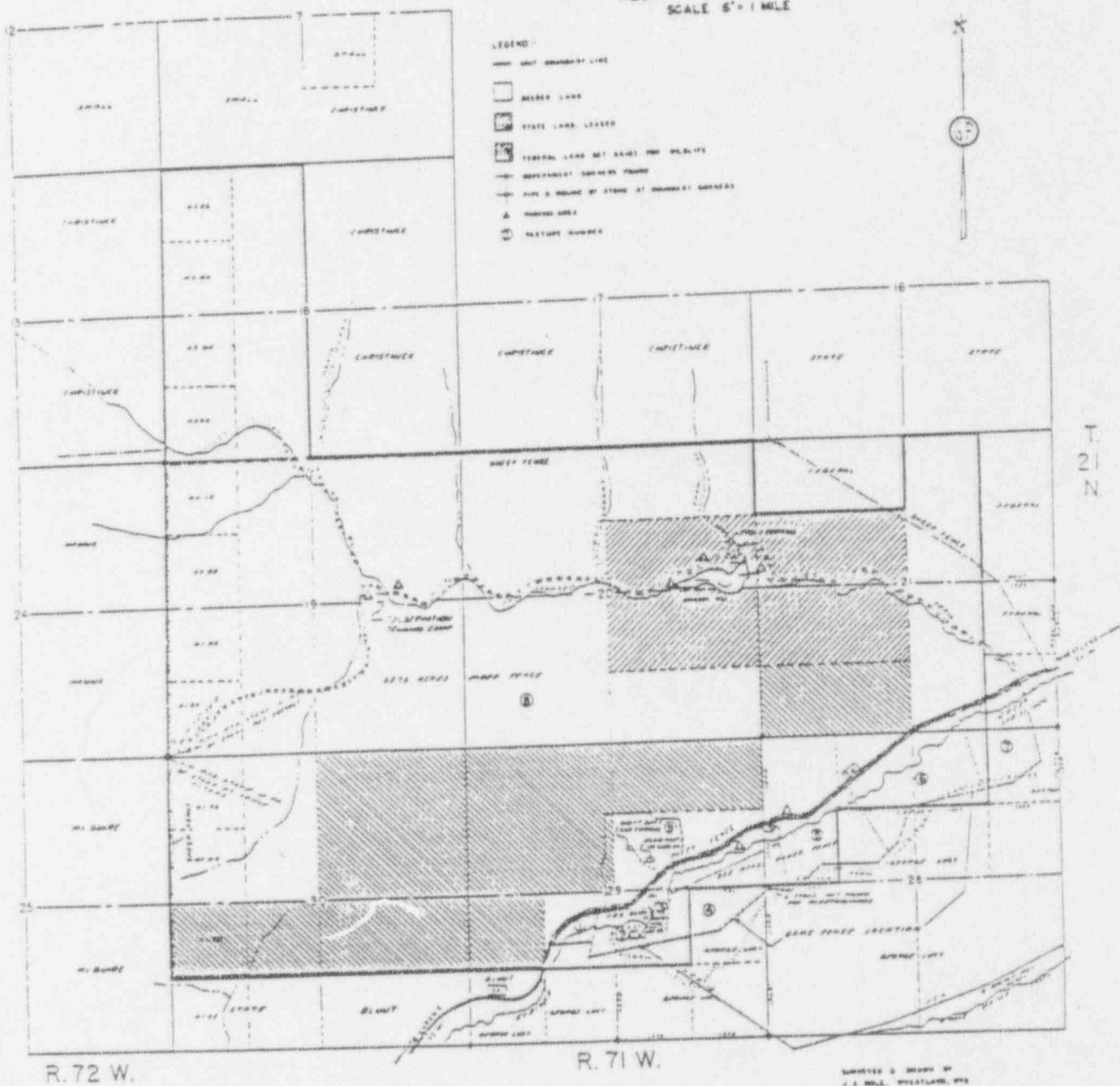
Year and Stock	Animal Unit Months	Grazing Period	Average Gain (lbs) per Animal	Average Gain (lbs) per head per day	Lease Payment	Grazing Lessee
<u>1979</u>						
110 cows 8 heifers 52 calves 2 bulls	400	1 June - 15 September			\$4,410.00	Dumbell Ranch Co. and Owen McGill
<u>1980</u>						
82 cows 31 calves 26 heifers 2 bulls 1 steer	400	1 June - 15 September			\$4,828.00	Dumbell Ranch Co. and Owen McGill
<u>1981</u>	400	1 June - 15 September				Dumbell Ranch Co. and Owen McGill

APPENDIX E

Base Map, Sybille Game and Fish Experimental Unit

SYBILLE GAME and FISH EXPERIMENTAL UNIT
 WYOMING GAME & FISH COMMISSION
 FEDERAL AID IN FISH AND WILDLIFE RESTORATION
 ALBANY COUNTY, WYOMING
 SCALE 6" = 1 MILE

- LEGEND
- UNIT BOUNDARY LINE
 - MEADOW LAND
 - ▨ STATE LAND, LESSED
 - ▩ FEDERAL LAND SET ASIDE FOR WILDLIFE
 - IMPROVEMENT SURVEY STAKE
 - PIPE & BOUNDARY STAKE AT NEAREST CORNER
 - △ MARKED AREA
 - ⊙ NATURAL NUMBER



R. 17, Eng. No. 2

T. 21 N.

R. 72 W.

R. 71 W.

DESIGNED & DRAWN BY
 J. A. MILL, WYOMING, 1924

APPENDIX F

Bibliography of Research completed on Sybille

APPENDIX F

Bibliography of Research completed on Sybille

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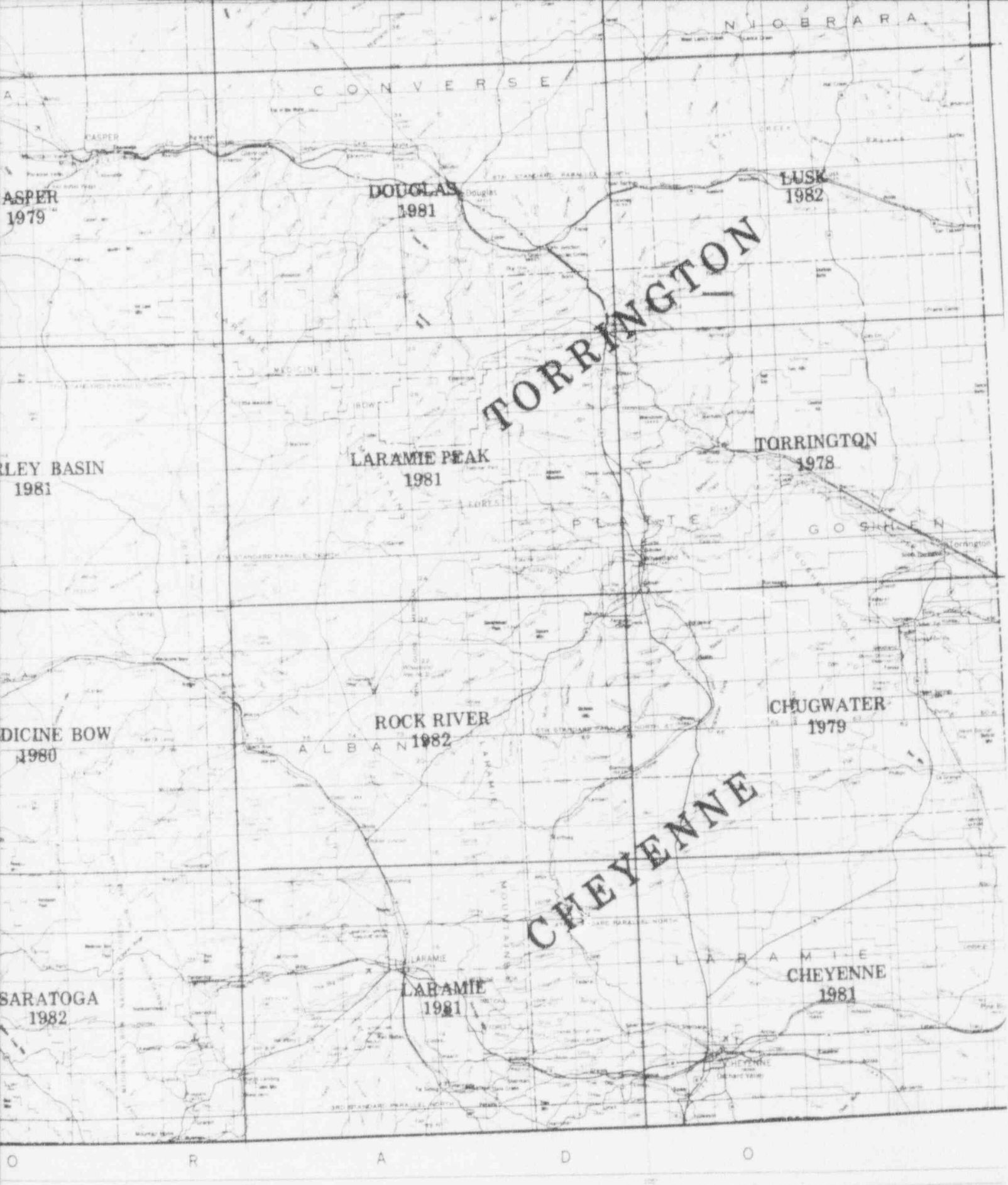
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Revised J.

TOPOGRAPHIC MAPS OF WYOMING

NATIONAL SURVEY OF WYOMING



4	13.1234	0°20'	13'	6	7	8
5	16.4042	6 MILS	231 MILS			
6	19.6850					
7	22.9659					
8	26.2467					
9	29.5276					
10	32.8084					

To convert meters to feet multiply by 3.2808

To convert feet to meters multiply by 0.3048

UTM grid convergence (GN) and 1982 magnetic declination (MN) at center of map
Diagram is approximate

- 1 Shirley Basin
- 2 Laramie Peak
- 3 Torrington
- 4 Medicine Bow
- 5 Chugwater
- 6 Saratoga
- 7 Laramie
- 8 Cheyenne

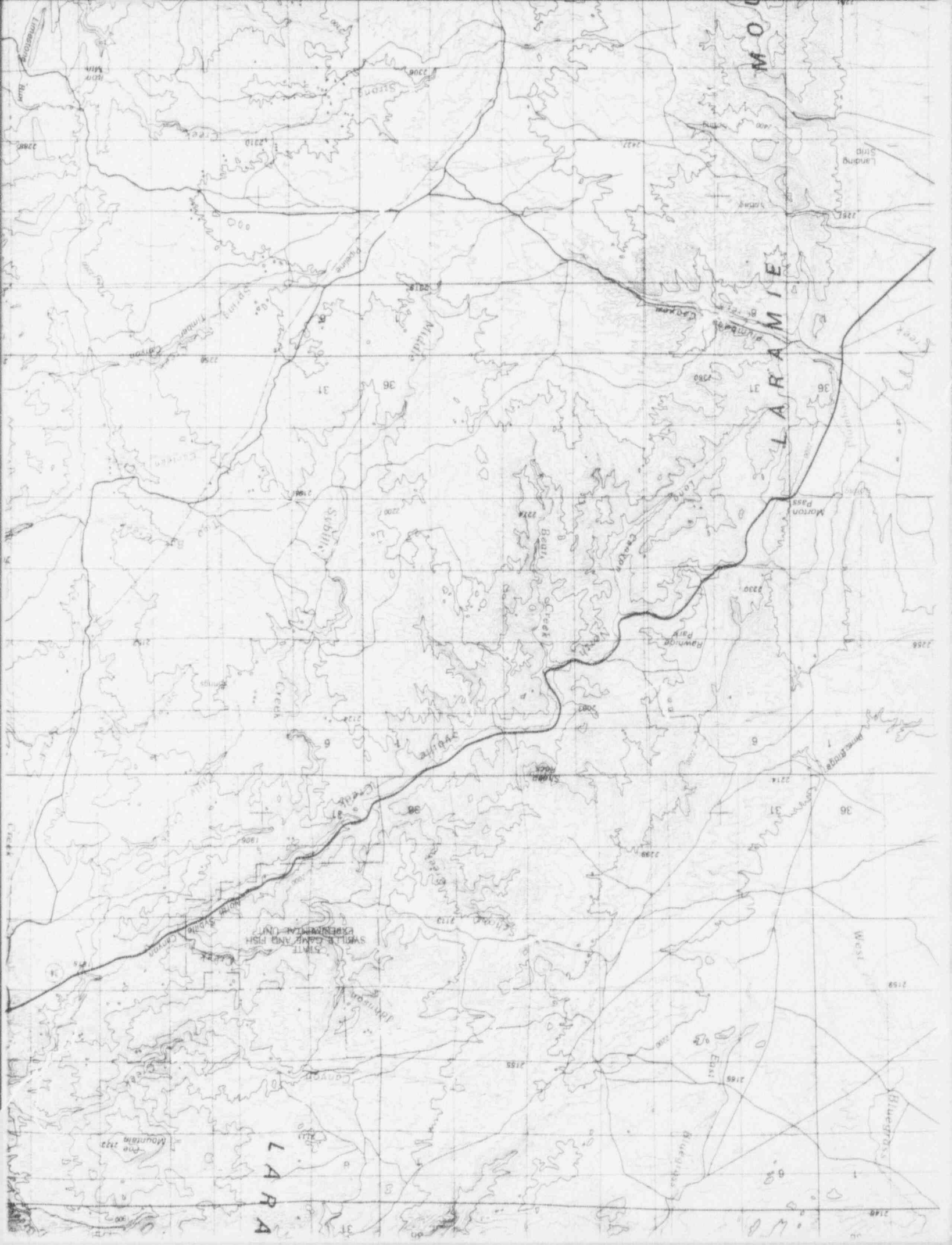
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225
OR RESTON, VIRGINIA 22092

Topographic Map Symbols

Primary highway, hard surface	
Secondary highway, hard surface	
Light duty road, principal street, hard or improved surface	
Other road or street; trail	
Route marker: Interstate; U. S.; State	
Railroad: standard gage; narrow gage	
Bridge; overpass; underpass	
Tunnel: road; railroad	
Built up area; locality; elevation	
Airport; landing field; landing strip	
National boundary	
State boundary	
County boundary	
National or State reservation boundary	
Land grant boundary	
U. S. public lands survey: range, township; section	
Range, township; section line: protracted	
Power transmission line; pipeline	
Dam; dam with lock	
Cemetery; building	
Windmill; water well; spring	
Mine shaft; adit or cave; mine, quarry; gravel pit	
Campground; picnic area; U. S. location monument	
Ruins; cliff dwelling	
Distorted surface: strip mine, lava; sand	
Contours: index; intermediate; supplementary	
Bathymetric contours: index; intermediate	
Stream, lake: perennial; intermittent	
Rapids, large and small; falls, large and small	
Area to be submerged; marsh; swamp	
Land subject to controlled inundation; woodland	
Scrub; mangrove	
Orchard; vineyard	

A pamphlet describing topographic maps is available on request

ROCK RIVER, WYOMING
N4130-W10500/30x60
1982



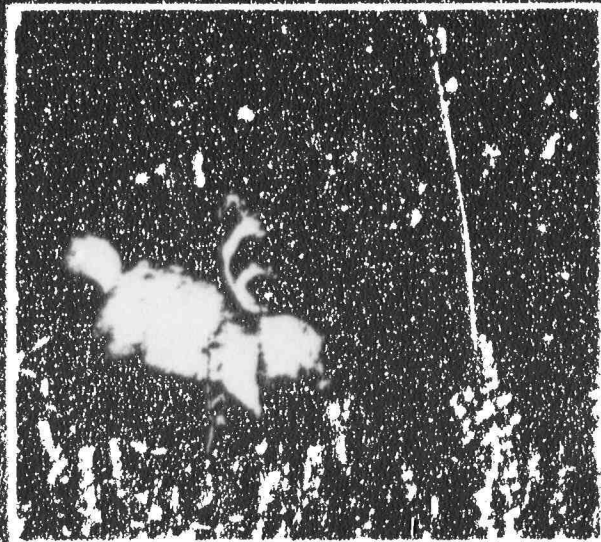


Black-footed ferrets once lived across the prairies of central and western North America. Their skins were used by American Indians for ceremonial decorations. Fur traders occasionally trapped them during the 1800s.



The ferret was found throughout the Great Plains from Texas to southern Saskatchewan, Canada. Its range stretched from the foothills of the Rocky Mountains eastward through the grasslands of Oklahoma, Texas, Kansas, Nebraska and the Dakotas.

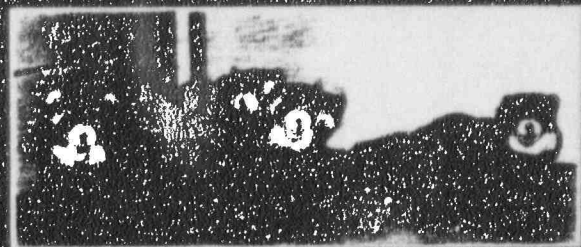
Historical range (shaded) and last known current range () of the black-footed ferret



The black-footed ferret has been found over a large portion of North America.



As the native prairie was converted to farmland, ferrets nearly disappeared.



Baby ferrets born in captivity.

As the prairie was settled, large stretches of native grassland were plowed into farmland eliminating prairie dog habitat. Prairie dogs are large burrowing rodents that serve as the ferrets' primary prey. In many areas, poisoning programs decimated large colonies leaving only small, isolated prairie dog towns. As prairie dog numbers declined, black-footed ferrets nearly disappeared.

By the 1950s, very few ferrets were left. A small group was discovered in South Dakota in 1964 and a few were taken into captivity beginning in 1971. Eventually, all were lost to old age and disease. None were successfully bred.

The ferret was officially listed as an endangered species in 1967. Many feared that by the mid-1970s, the species was either extinct or, if populations existed, they were so small that natural disasters or disease would eventually eliminate them.



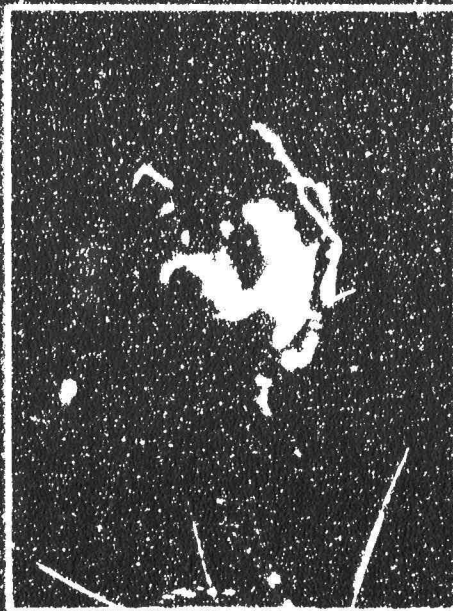
Ferrets usually hunt at night.

The discovery of a group of black-footed ferrets on a ranch near Meeteetse, Wyoming, in 1981 offered a ray of hope for the species. Over the next few years, research provided new information about the lifestyle of this secretive mammal. A 1985 outbreak of canine distemper killed nearly all of the ferrets. The remaining 18 were taken into captivity between 1985 and early 1987, launching a very successful captive breeding program. Efforts are now underway to reintroduce ferrets to parts of their historic range where adequate prairie dog populations exist.

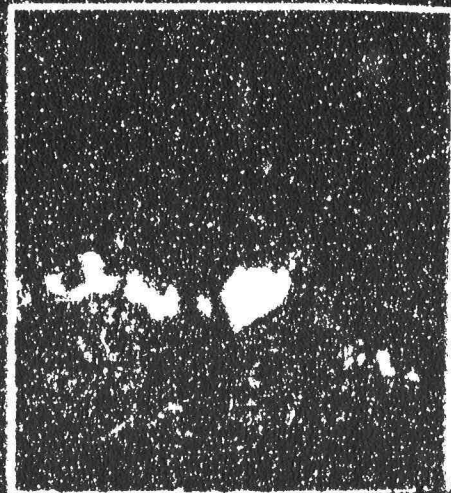
Black-footed ferrets are 20 to 24 inches long, including a 5- to 6-inch tail. They can weigh



Prairie dogs are the ferret's primary prey.



Radio collars allow biologists to track the movements of some ferrets.



Reintroduction plans protect existing land areas.

up to 2½ pounds. Ferrets are best known for their black face masks and feet. The tips of their tails are also black.

The ferret, along with the skunk, badger, fisher, marten, otter, mink, wolverine and weasel, is a member of the weasel family (Mustelidae). The European or domestic ferret, which is sold in pet stores, and the Siberian polecat from Asia are similar to the black-footed ferret but are different species.

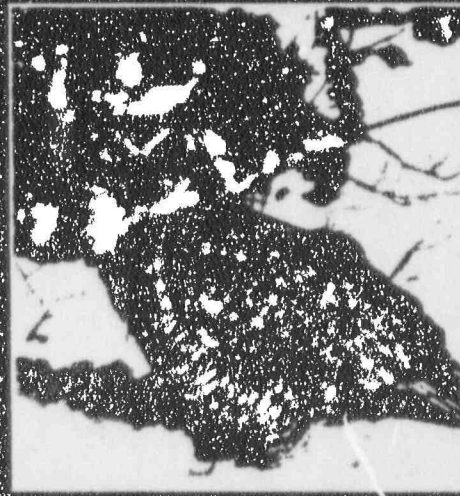
The ferret is a predator that kills and eats prairie dogs. Mice and other small animals are also taken occasionally, but the ferret lives in prairie dog burrows and cannot survive for extended periods without them.

The ferret hunts primarily at night, so it is rarely seen. They may be active during the day, especially females, who hunt to feed their young.

Few ferrets live beyond two or three years in the wild. In captivity, a female over four years old rarely produces young. Many things can kill a ferret. Some are lost to accidents, starvation or injuries. Diseases like canine distemper and various other infections and parasites also kill ferrets. Predators like owls, hawks, eagles, coyotes, badgers and bobcats are the main cause of death for wild ferrets. The *Mustelictor* ferrets, for example, were discovered when a dog killed one near a ranch house.



Research has answered many questions, but many remain.



Predators like the great horned owl are one of the many things that can kill ferrets.

The US Forest Service, in cooperation with private landowners and conservation groups, are planning to reintroduce black-footed ferrets to the wild, beginning in Wyoming in 1991. Reintroduction in other western states will follow. Ferrets will also be maintained at several zoos and other facilities around the country.

Research with captive ferrets is attempting to answer many questions, such as: Is hunting skill inherited or learned? If learned, at what age is it learned, and how pre- the young taught? Can captive raised animals be taught to avoid predators? Should they be? At what age are young ferrets able to feed for themselves? How important is early family experience to successful mating later in life?

The first releases are planned on public land and will be experimental. Mortality rates are expected to be high during the early learning stages so researchers look for the best ways to return ferrets to their native habitats.

Initially, food will be provided for the released ferrets. As they adjust to their new surroundings and learn to hunt on their own, supplemental feedings will be reduced, then eliminated. Over-winter survival and breeding the following spring will be measures of long-term success.

National recovery goals call for establishment of at least 10 free-ranging populations, spread over the widest possible area, with 2 or more breeding adults in each. By the year 2010, biologists hope to have 1,500 ferrets in the wild.

Reintroduction plans are tailored for each area to be compatible with existing land uses such as agriculture, livestock grazing, energy production, hunting and other recreation. As management plans are prepared for each area, they will be open to local and national public review, comment and modification.

If you see a black-footed ferret in the wild, report it to your state wildlife agency, the Bureau of Land Management or to the U.S. Fish and Wildlife Service.

Visit the *Sage-Grouse Wildlife Research and Conservation Education Center* 34 miles southwest of Wheatland, Wyoming, on State Highway 34, to learn more about ferrets and the efforts to save them from extinction.

If you would like to contribute to the black-footed ferret program, send your donation to the Black-footed Ferret Fund, National Fish and Wildlife Foundation, 18th and C Street NW, Room 2725, Washington, D.C. 20240.

Wyoming Game & Fish Dept.
5400 Bishop Boulevard
Cheyenne, Wyoming 82006
(307) 777-6600

Bureau of Land Management
2515 Warren Avenue
P.O. Box 1828
Cheyenne, Wyoming 82003
(307) 775-6256

U.S. Fish and Wildlife Service
P.O. Box 25406
Denver Federal Center
Denver, Colorado 80225
(303) 236-7396



WYOMING'S WILDLIFE
Watch the Watching



1993 Protocol for Wyoming Toad Reintroduction By Managed
Breeding Using Sybille Wildlife Research Unit
and Cheyenne Mountain Zoo Captive Animals

The Wyoming toad (Bufo hemiophrys baxteri) captive breeding program is a cooperative endeavor between the Wyoming Game and Fish Department, the Cheyenne Mountain Zoo, and the U.S. Fish and Wildlife Service. The toad population at Sybille is believed to consist of 1.1 (male:female) toads born in 1989, 8.5 toads born in 1990, 3.6 toads from the 1991, and 22 toads of unknown sex from the 1992 cohort. These captive toads should be used for the best possible advantage to the species by establishing a new population in former habitat. This may be accomplished in 1993 by encouraging managed breeding and egg laying under semi-protected conditions in natural habitat at Lake George, Hutton National Wildlife Refuge. There is risk to the captive toads associated with possible escape, predation, theft, and disease; but the risks are far outweighed by the benefits to the species if a new population is established at Lake George.

1. Three to five metal cages will be constructed.
 - a. Cages will have a wire top, but will not have a bottom.
 - b. Cages will measure 16 feet by 8 feet or 8 feet by 8 feet and will be 2 to 4 feet deep.
 - c. Cages will be constructed in portable panels framed with angle iron, with a double layer of wire mesh consisting of 1 inch by 2 inch welded wire outside 1/4 inch hardware cloth wire. Cages will include 1 or 2 inch PVC piping as an internal climbing barrier.
2. Cages will be set up at Lake George by May 10 in order to allow time for vegetation disturbed by installation to recover and to be sure all sides remain adequately buried and sealed.
3. An aggressive effort will be made at Mortenson Lake to locate and document calling males and egg masses.
4. Captive toads will not be brought out of hibernation until a few days after toads are known to emerge at Mortenson Lake or two days before being moved to the managed breeding site.

- c. Artificial shelters will be established inside cages.
 - d. Feasibility of establishing solar powered artificial heat sources will be explored and, if possible, artificial heat will be provided.
7. Initially, all captive toads will be placed in the same cage to simulate breeding congregation and competition conditions.
- a. Recordings of calling males will be played at night if it is demonstrated to encourage breeding activity.
 - b. Cages and toads will not be visually examined at night unless an emergency, e.g. predation attempt, is perceived.
 - c. Cages and toads will be carefully inspected at least once daily to account for toads, search for egg masses, and inspect cages for potential escape routes.
8. When an egg mass is discovered the female, if she can be identified, that produced the egg mass will be returned to Sybille, and remaining toads will be moved to a second cage after two or more egg masses are established
- a. The process of moving all remaining toads to a new cage will continue until the fourth and fifth cages are used.
9. Hormonal induction will be considered using the protocol of Bob Johnson on an apparent gravid female at Lake George after seven days of calling without apparent amplexus in the presence of calling males.
10. Toads will be placed into maintenance isolation upon return to Sybille and the Cheyenne Mountain Zoo.
11. If technician assistance and equipment are available, environmental variables will be monitored.
- a. Air temperature
 - b. Water temperature
 - c. Wind intensity

- a. Toads will be given an opportunity to become completely hydrated before transfer to the managed breeding site.
 - b. If captive toads emerge before toads at Mortenson Lake, they will be subjected to as near ambient temperatures as possible and they will not be managed in any way that encourages activity, including breeding activity.
 - 1) This may require holding the toads in their hibernacula within the environmental chamber.
5. Captive toads will be moved to Lake George after the first males are heard calling at Mortenson Lake and/or after ambient temperatures, as recorded in Laramie, have exceeded 70°F for four consecutive days and night time low temperatures generally exceed 32°F.
- a. All captive 1991 and older toads at Sybille will be used, except females that do not appear gravid.
 - b. The five largest male toads and female toads which have attained adult size and appear gravid at the Cheyenne Mountain Zoo will be moved to Lake George. These toads will be confined in a cage (or cages) separate from the Sybille toads. Prior to delivery, they will be maintained on a natural light cycle.
 - c. Males and females will be moved at the same time.
 - d. Captive toads will not be moved to Lake George during a period of unfavorable weather conditions.
 - e. All toads will be photographed and weighed immediately before being moved to Lake George.
6. Cages and toads will be examined at least daily in order to maximize safety of confined toads.
- a. Cages and toads will be examined for evidence of cage damage, vandalism, predation, cold stress, disease, and escape.
 - b. A cylindrical cage of 1/2 inch hardware cloth wire 24 inches in diameter will be available if it appears necessary to confine a male and female close together in order to facilitate amplexus.

EXECUTIVE SUMMARY

Current Status: The Wyoming toad (*Bufo hemiophrys baxteri*) was common into the early 1970's, but the populations crashed in the middle 1970's. The Wyoming toad was listed as endangered in January 1984. The only known population of this species is located southwest of Laramie, Wyoming. Surveys in 1987 and 1988 indicated that this population was healthy, reproducing, and maintaining itself. However, recent reproduction has been low and red leg bacteria was discovered in 1990 which caused a reduction in the adult population.

Habitat Requirements and Limiting Factors: The Wyoming toad is a glacial relic known only from Albany County, Wyoming. The Wyoming toad formerly inhabited floodplains, ponds, and small seepage lakes in the shortgrass communities of the Laramie Basin. The diet includes ants, beetles, and a variety of other arthropods. Adults emerge from hibernation in May after daytime maximum temperatures reach 70° F. Breeding congregations are not large, usually not more than six males with several females. Eggs, in gelatinous strings, are laid from mid-May to early June, and the larvae usually transform by mid-July. Spraying of insecticides to control mosquitoes, changes in agricultural practices, increased predation, disease, and climatic changes have been suggested as causes of the decline in the abundance of the species, but no definite cause has been identified.

Recovery Objectives: Downlisting

Recovery Criteria: To protect and maintain the existing population at a level of approximately 200 adults and to establish and maintain viable populations of approximately 100 adults each in five other locations.

Actions Needed: Major actions needed to achieve recovery include:

1. protect existing populations by monitoring, land acquisition/conservation easement, and implementing protective measures;
2. conduct research on the biology of the species;
3. conduct captive rearing to ensure against catastrophic loss of the wild population and to produce eggs to establish new populations;
4. survey suitable habitat for additional populations and reestablish five populations within historic range;
5. eliminate threats/habitat degradation through a combination of consultation, cooperative, and monetary programs; and
6. establish a management team, in affiliation with an advisory working group, to accomplish recovery tasks.

PART I

INTRODUCTION

The Wyoming toad (Bufo hemiophrys baxteri Porter) is a glacial relic found only in Albany County, Wyoming (Figure 1). This toad was discovered in 1946 by Dr. George T. Baxter, University of Wyoming zoology professor. Bufo hemiophrys (Canadian, Manitoba, Dakota toad) is still common in Manitoba, Alberta, Saskatchewan, Minnesota, North Dakota, and South Dakota (Stebbins 1984).

Known historical distribution of the Wyoming toad was restricted to within 30 miles of Laramie (Figure 2). Dr. Baxter visited known breeding sites for over 30 years. The toads were common from the 1950's through the early 1970's. Toad populations crashed in the middle 1970's and were extremely rare by 1980 (Baxter and Stromberg 1980, Stromberg 1981, Vankirk 1980, Baxter et al. 1982, Baxter and Stone 1985, Lewis et al. 1985). The Wyoming toad was federally listed as endangered in January 1984 (49 F.R. 1992, January 17, 1984).

The Wyoming toad has been given a recovery priority of 3 which indicates this is a subspecies with a high degree of threat and a high recovery potential. This priority number would be elevated to a 2 in the event the Wyoming toad is determined to be a full species rather than a subspecies.

A population of toads was located southwest of Laramie in 1987. Surveys in 1987 and 1988 revealed a healthy population of approximately 100 to 150 adults represented by all age groups, indicating successful reproduction. However, recent reproduction has been low and red leg bacteria was discovered in 1990 which caused a reduction in the adult population.

In September 1987, a recovery group was formed consisting of representatives from the Wyoming Game and Fish Department, U.S. Fish and Wildlife Service (Service) University of Wyoming, and The Nature Conservancy. This group has coordinated protective, research, and recovery efforts.

Description

Recent descriptions of the Wyoming toad are provided by Baxter and Stone (1985) and Stebbins (1984). Adult snout-vent length averages about 2.2 inches. Females grow slightly larger than males. The dorsal surface of the body has rounded warts intermediate in size between those of the Great Plains toad [Bufo cognatus (Say)] and the boreal toad [Bufo boreas (Baird and Girard)]. The cranial crests fuse medially to form an elongated boss, a ridge with a median groove, or paired ridges. The boss is often cornified. Postorbital ridges are indistinct or absent. The tympanum is round, smaller than the eye. Cutting tubercles on the hind foot are well developed.

Background color is dark brown, gray, or greenish with small dark blotches and a rather indistinct median line. Some individuals have well-defined light lateral stripes. The belly is spotted; males have a dark throat. Photographic analysis has shown that individual toads can be identified by the variation in their skin color and wart patterns.

This toad may be distinguished from other toad species present in Wyoming by the small adult size and by the fused cranial crests.

Wyoming toads are distinguished from spadefoots (genus Scaphiopus) by the presence of cranial crests, parotoid glands, and a round pupil. From frogs, it differs by the stocky body and glandular skin (Baxter and Stone 1985).

Taxonomy

Bufo hemiophrys is morphologically and genetically distinct from other Bufo species (Corn 1990). Medial displacement of the frontal ridges and the elevated crests forming a higher boss in the Wyoming toad (Bufo hemiophrys baxteri) further separates it from the Manitoba toad (Bufo hemiophrys). Some controversy surrounds the taxonomic status of the Wyoming toad and its near relative toads (Cook 1983, Green 1983, Packard 1971).

Termination of Wisconsinite glaciation some 10,000 to 12,000 years ago was initially suggested as the event separating the ancestral Wyoming toad from the Manitoba toad (Porter 1968, Blair 1965). Data from Kansas and southern Nebraska indicate that the Wyoming and Manitoba toads have been separated from 17,000 to 100,000 years. Paleontological data from Kansas indicates that Bufo hemiophrys has been morphologically distinct from Bufo americanus for more than 750,000 years (Rogers 1982). Additional clarification of Bufo hemiophrys taxonomy is needed to determine if the Wyoming toad should be recognized as a full species or subspecies as it is presently.

Distribution

Historic known distribution of the Wyoming toad is restricted to a portion of the 7,000- to 7,500-foot elevation intermountain Laramie Basin in Albany County, Wyoming (Figure 2). All collections and observations have been made within 30 miles of the city of Laramie, Wyoming. Until the early 1970's, the Wyoming toad inhabited the floodplains of the Big and Little Laramie Rivers and the margins of ponds and small seepage lakes in the Laramie Basin (Baxter and Stone 1985).

During the mid-1970's, declines in both range and abundance were noted. Since 1980, the present known distribution is limited to an area between 10 and 20 miles west of Laramie that extends approximately 20 miles to the north and south. Since 1983, all Wyoming toad observations have come from an area, approximately 30 square miles, located 10 to 15 miles southwest of Laramie. Recent sightings since 1987 have been confined to a 2-square-mile area within this general vicinity (Figure 3). This population, associated with a lake and surrounding wet meadows, contains individuals from several age classes and exhibits annual reproduction.

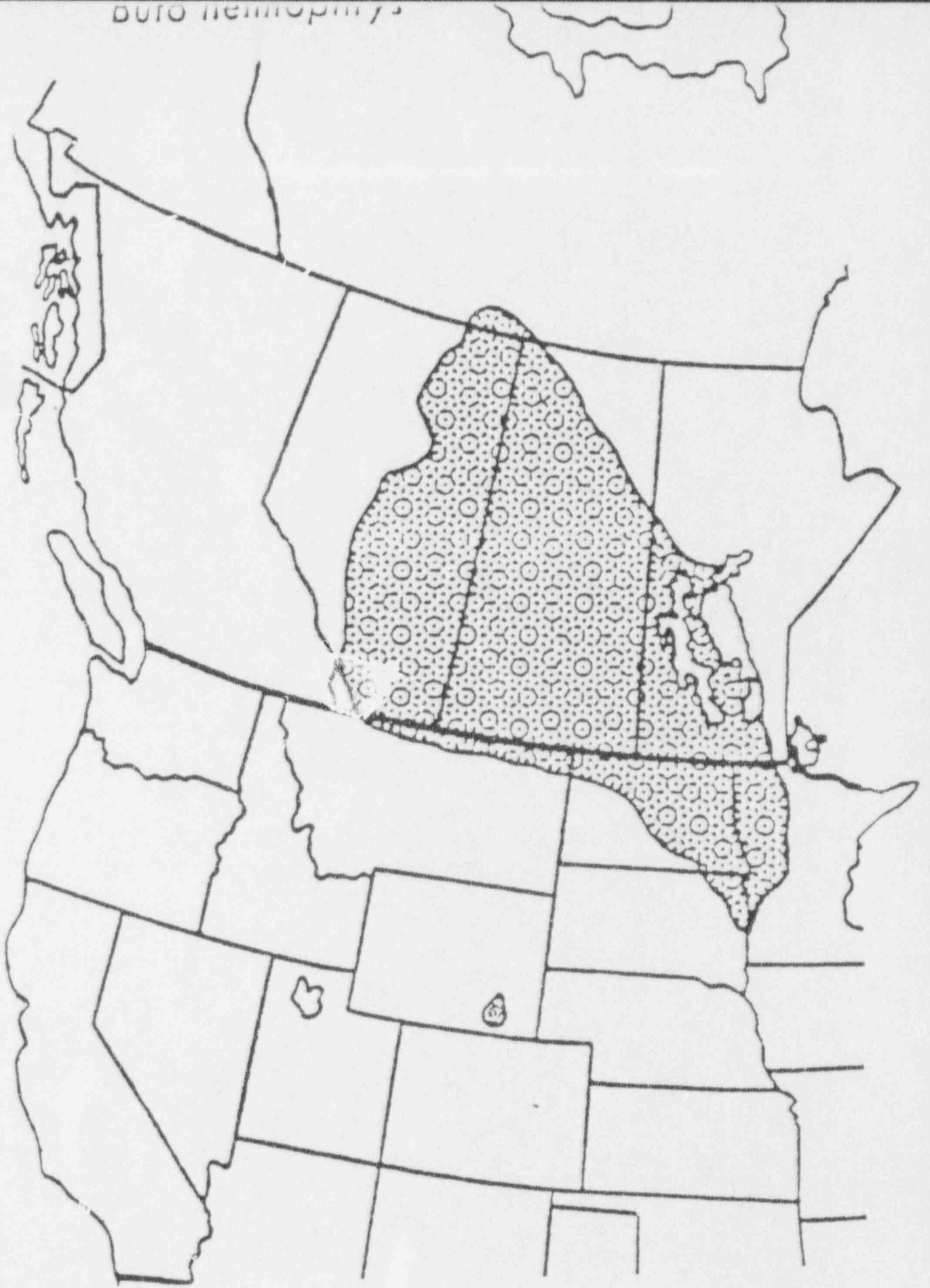


Figure 1. *Bufo hemiophrys* distribution (from Stebbins 1984).

WYOMING

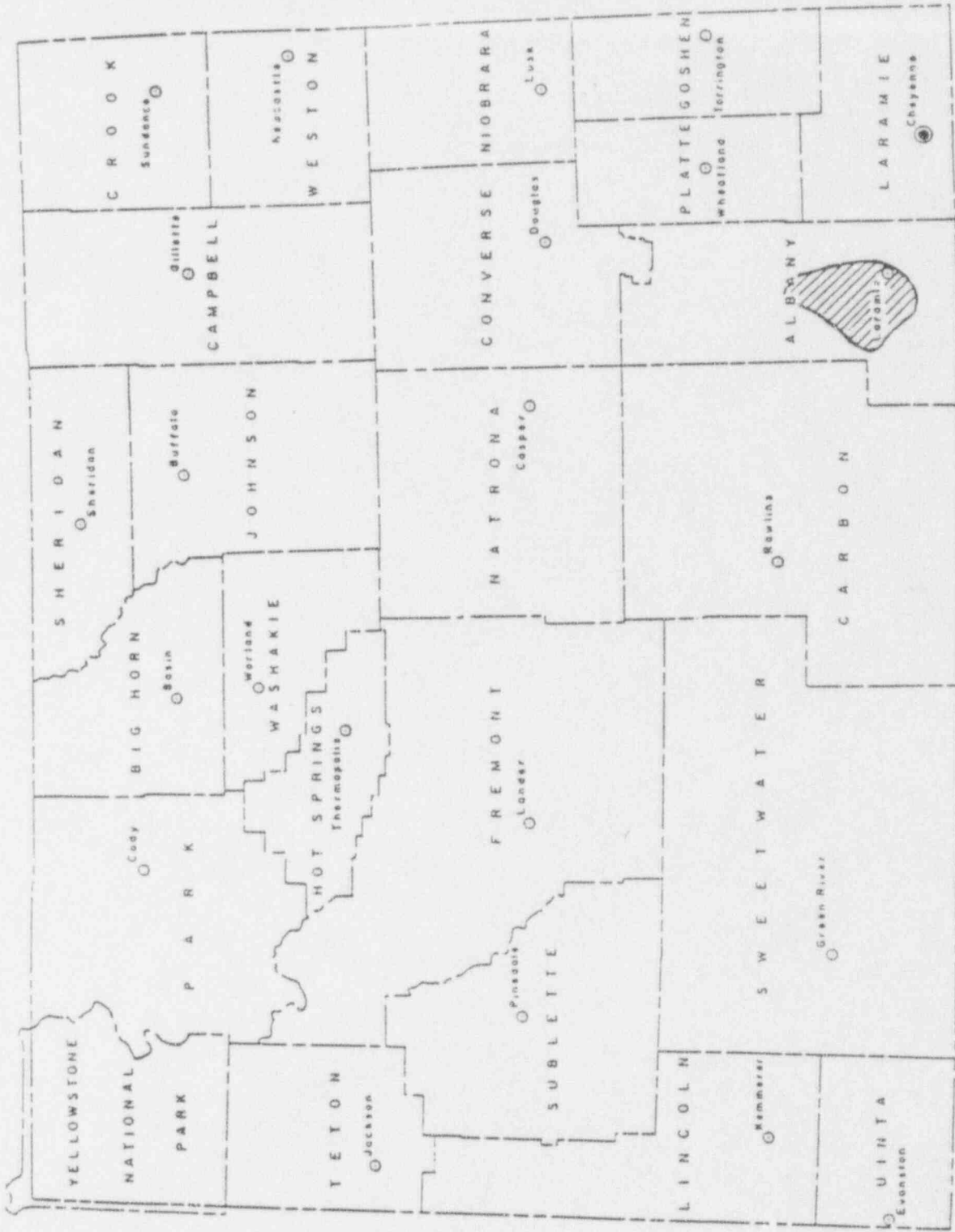


Figure 2. Wyoming map depicting Wyoming toad distribution. (Baxter and Stromberg 1985)



Figure 3. Known Wyoming toad population distribution.

R. 76W. R. 75W.

WYOMING
GAME AND FISH DEPARTMENT

Mike Sullivan, Governor



Francis Peters, Director

*April -
3/28/93*

Game and Fish Laboratory
University of Wyoming
P.O. Box 3312
Laramie, Wyoming 82071
(766-6313)

May 24, 1993

TO: Jay Lawson
FROM: Tom Thorne *Tom*
COPIES: H. Dawson, W. Jones
SUBJECT: Pronghorn antelope for Sybille

We have a need to acquire pronghorn antelope for use in two planned studies at Sybille and to increase slightly the size of our resident herd at Sybille. One study is Kathy Parker's research on lactation, and the other is an AML funded study by Dr. Merl Raisbeck, Toxicologist at the Wyoming State Veterinary Laboratory, on selenium toxicity.

I would like to make two separate requests which require your assistance. One request is to capture up to 10 newborn female fawns from the wild during the first two weeks of June. These animals will eventually be used in Kathy Parker's study, and to increase the number of pronghorns at Sybille, which now consists of four old females. If this is agreeable, we would need Game Division direction regarding where the fawns should be captured. If orphaned or confiscated female fawns are submitted to Sybille, the number to be captured would be reduced.

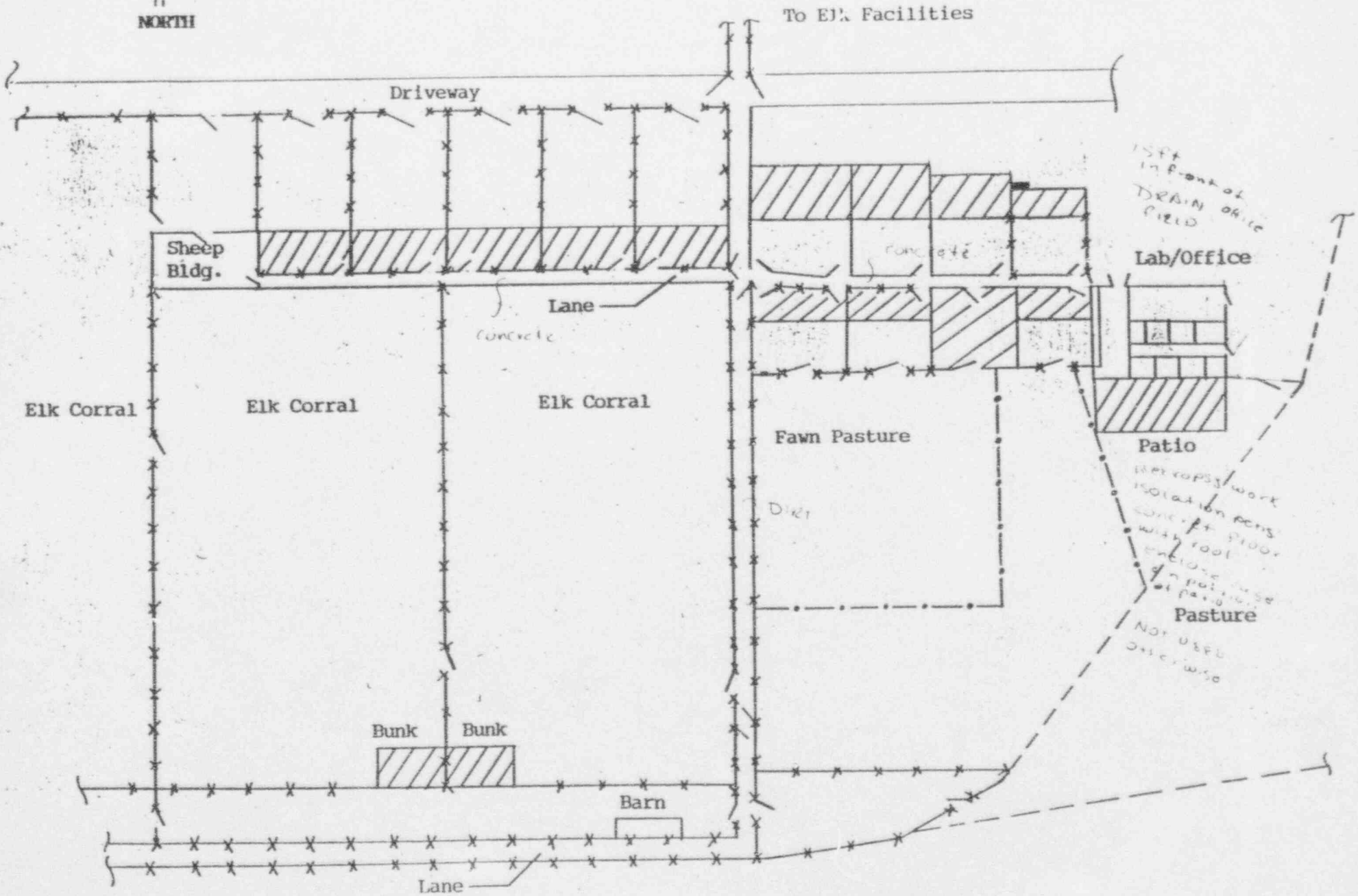
The second request is to import surplus pronghorns from the Colorado Division of Wildlife research facilities in Fort Collins. This would include three 2-year-old males, three 6-7-year-old castrated males imported in July or August 1993 for the selenium study, and up to six adult females imported in the spring of 1994 for the pronghorn lactation study. We would expect to comply with the provisions of Chapter X regulations for import of these pronghorns from Colorado.

Thanks, Jay, in advance for any help you can provide on these requests. If you have any questions, please give me a ring.








CALL Jay Tues.

*Up to
Gerald
Fawns for
Se*

Wildlife Holding/Handling Facilities




LEGEND:

-  4.5 foot solid wood wall
-  8 foot solid wood wall
-  9 gauge net wire 6.5 feet high with
3 strands of barbed wire on top and
2 strands on bottom (total height 8.5 feet)
-  pole/rail fence (12 foot panels)
5-6 inch diameter poles
3-4 inch diameter rails
-  covered pen/corral areas
-  buildings
-  gates/doors

SCALE: 1 inch = 40 feet

LEGAL DESCRIPTION: NW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 29 in T21N, R21N, 6th PM



Walker's
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4th Edition

Ronald M. Nowak • John L. Paradiso
Volume II

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Baltimore and London
1983

requires a series of valves to regulate the flow of blood to the head. Females have four mammae.

The giraffe dwells mainly on dry savannahs and in open woodland. It is usually associated with scattered acacia growth. In a study in Tsavo National Park, Kenya, Leuthold and Leuthold (1978) found animals to concentrate near rivers in the dry season and to disperse into deciduous woodland during the rains. Such seasonal movements generally covered 20 to 30 km. The giraffe is active mainly in the evening and early morning, and rests during the heat of the day. It usually sleeps standing up, but occasionally lies down. In real sleep, a giraffe rests its head on the lower part of one hind leg, its neck forming an impressive arch. While dozing, which is more common, it rests on its withdrawn legs, but the neck remains outstretched, the eyes are half closed, and the ears continue twitching. In order to drink or to pick food from the ground, the giraffe spreads its forelegs widely and well to the front, or bends at the knee until its head can reach the ground or water level.

The record running speed of *Giraffa* is 56 km per hr (Dagg and Foster 1976). Over moderate distances, it can scarcely be overtaken by a good horse. If not crowded, a giraffe can lope for long distances without tiring. While the giraffe is running, the hind feet are swung forward of the forefeet, the head and neck swing widely, almost in a figure eight, and the tail is raised over the back. While it is walking, however, both feet on one side are carried forward simultaneously. Although the giraffe has large feet, it is able to walk only on firm earth, since the long legs supporting such a heavy body would soon become bogged down in swampy terrain. As a result, large rivers are usually barriers.

The giraffe is shy, timid, and alert. It is especially vulnerable to lion predation when lying down, ground feeding, or drinking. A panicky movement indicates danger. When forced to defend itself, the giraffe kicks with its forefeet. In addition, it frequently uses the head to give blows, particularly to another giraffe. The senses of smell, hearing, and vision are acute. Probably this animal has the keenest sight of any African big game species, and its height gives it the greatest range of vision of any terrestrial creature. The giraffe is a browser, feeding almost entirely on leaves from acacia, mimosa, and wild apricot trees. It takes branches in its mouth and tears off the leaves by pulling its head away. It may chew its cud at any time of day. If water is available, it will take an occasional drink (about 7½ liters a week). However, it is able to go without water for many weeks, if not months, at a time.

Reported normal population density varies from about 0.1 to 3.4 individuals per sq km. Mean individual home range in different areas varies from about 23 to 163 sq km. The average range size is about the same for each sex; there is considerable overlap and no evidence of territoriality. *Giraffa* is usually observed alone or in small, loosely organized groups. When the genus was more common, herds of over 100 individuals were recorded, but most groups now contain 2 to 10 animals. There seems to be little evidence of a dominance hierarchy, except when several males are in the presence of an estrous female. At such times the males may fight one another by swinging their necks and striking with their heads from the side. Females with young sometimes aggregate, and one or two of the adults may remain with all of the calves, while the rest of the adults go off to browse or drink. *Giraffa* has a variety of sounds, but is rarely heard. It may grunt or snort when alarmed, a female may whistle to call its young, and calves bleat (Dagg and Foster 1976; Langman 1973, 1977; Leuthold 1979; Leuthold and Leuthold 1978; Berry 1978).

In at least some parts of Africa, such as Zambia, breeding may occur throughout the year (Berry 1973). Females give birth at a mean interval of about 20–23 months (Leuthold and

Leuthold 1978; Hall-Martin and Skinner 1978). The average gestation period is 457 days (Skinner and Hall-Martin 1975). The number of offspring is almost always one, though twins are known. At birth the young weigh 47 to 70 kg and are 1,700 to 2,000 mm tall. They are able to stand on their wobbly legs about 20 minutes after being born, and begin to suckle within an hour. Contrary to early reports, there appears to be a strong bond between mother and calf. The calf may nurse for up to 13 months and then remain with the mother for another 2 to 5 months (Langman 1977; Leuthold 1979). The age of sexual maturity is 3½ years in females and 4½ years in males. Full size is attained at 5 years by females and 7 years by males. Females are capable of reproduction until they are at least 20 years old, and maximum known longevity in the wild is 26 years (Dagg and Foster 1976). A captive giraffe lived for 36 years and 2 months (Marvin L. Jones, Zoological Society of San Diego, pers. comm.).

The native peoples of Africa sometimes take giraffes in snares and pitfalls. They use the strong sinews for bowstrings and musical instruments, and the thick hide as a covering for shields. The meat, although tough, has a good flavor. European settlers killed the animals in great numbers for their hides, which were used to make traces, long reins, whips, and other items. A combination of excessive hunting and climatic change has caused a great reduction in the distribution and numbers of *Giraffa* in historical time. The genus disappeared in Egypt about 2600 B.C., but may have survived in Morocco to 600 A.D. In the 20th century, it was wiped out in most of western and southern Africa. The only remaining large populations are in Tanzania and some adjacent areas (Dagg 1971; Dagg and Foster 1976).

ARTIODACTYLA; Family ANTILOCAPRIDAE; Genus ANTILOCAPRA Ord. 1818

Pronghorn

The single living genus and species, *Antilocapra americana*, originally occurred in open country from eastern Washington and southern Manitoba to Baja California and northeastern Mexico (Hall 1981). Most authorities continue to regard the Antilocapridae as a distinct family, but O'Gara and Matson (1975) suggested that the group be ranked only as a subfamily of the Bovidae.

Head and body length is 1,000 to 1,500 mm, tail length is 75 to 178 mm, shoulder height is 810 to 1,040 mm, and weight is 36 to 70 kg. Males average approximately 10 percent larger than females (Hall 1981). The woolly undercoat is overlaid with fairly long, straight, coarse, pithy, and brittle guard hairs. By flexing certain skin muscles, the pronghorn can maintain its pelage at different angles. Cold air is excluded when the hairs lie smooth and flat, but the hairs may be erected in the desert sun to allow air movement to cool the skin. The upper parts are reddish brown to tan, the neck has a black mane, and the underparts, the rump, and two bands across the neck are white. In the male, the face and a patch on the side of the neck are black, the horns are longer than the ears, and the nose is pointed downward slightly when running. In the female, the mask and patch are lacking, or nearly so; the horns, if present, seldom exceed the ears in length; and the nose is held more nearly horizontal when the animal is running. Females have four mammae.

Males, and most females, carry horns that consist of a permanent, laterally flattened bone core covered with a keratinous sheath that is shed annually after each breeding season. The new sheath grows upward under the old sheath. The shedding process is usually considered a major distinguish-



Pronghorn (*Antilocapra*)

ing feature between the Antilocapridae and Bovidae. O'Gara and Matson (1975) occurs in at least one species families. The horns of Antilocapra are curved at the tips. Those of males have a forward-directed prong. Those of females, if present, and seldom have prongs.

Antilocapra has large eyes (eter), and long, pointed ears. The third and the fourth hooves, especially those of males, have cartilaginous padding. The hind feet are 3/3, m 3/3) x 2 = 3/3. Habitats include grasslands. Range is sea level to 3,300 m. Pronghorn is the swiftest of all mammals. World Kitchen (1974) clocked a pronghorn at 48 km per hr, and observed a male pronghorn running at 48 km per hr. Such velocities can be maintained for approximately 48 km per hr, but then the animal shakes the body after a full minute, and the weight while running.

... (Sinner 1978). The average weight and Hall-Martin 1975) always one, though twins weigh 47 to 70 kg and are able to stand on their feet being born, and begin to graze early reports, there are mother and calf. The calf and then remain with the mother (Langman 1977; Leuthold is 3 1/2 years in females and 4 years in males by females capable of reproduction, and maximum known age (Jagg and Foster 1976). A and 2 months (Marvin L. Diego, pers. comm.). Sometimes take giraffes in long sinews for bowstrings and buck hide as a covering for their hides, has a good flavor. European great numbers for their races, long reins, whips, and of excessive hunting and reduction in the distributional time. The genus B.C., but may have survived the 20th century, it was southern Africa. The only one in Tanzania and some adjacent (Foster 1976).

OCAPRIDAE; Genus

... species, *Antilocapra americana* in country from eastern Utah to Baja California and Most authorities continue to place it in the same family, but O'Gara (1978) ranks the group as only

... 1,500 mm, tail length is 810 to 1,040 mm, and weight approximately 10 percent of body weight. The woolly undercoat is coarse, pithy, and brittle. In the muscles, the pronghorn is a powerful animal. Cold air is excluded, but the hairs may allow movement to cool the body. On the neck, the neck has a patch of hair, and two bands of hair on the face and a patch on the horns are longer than the ears. The horns are slightly curved when running and are lacking, or nearly lacking, when the animal is at rest.

... horns that consist of a core covered with a keratinous sheath. After each breeding season, the old sheath is shed. A major distinguishing



Pronghorn (*Antilocapra americana*), photo by Bernhard Grzimek.

... ing feature between the Antilocapridae and the Bovidae, but O'Gara and Matson (1975) observed that a similar process occurs in at least one species of each of the five bovid subfamilies. The horns of *Antilocapra* are erect, and backwardly curved at the tips. Those of males are about 250 mm long and have a forward-directed prong arising from the upper half. Those of females, if present, are seldom over 120 mm long and seldom have prongs.

Antilocapra has large eyes (approximately 50 mm in diameter), and long, pointed ears. Only two digits are developed: the third and the fourth; the lateral toes are lacking. The hooves, especially those of the forefeet, are supplied with cartilaginous padding. The dental formula is: (i 0/3, c 0/1, pm 3/3, m 3/3) $\times 2 = 32$. The high-crowned cheek teeth have crescentic ridges of enamel.

Habitats include grasslands and deserts. The elevational range is sea level to 3,353 meters (Yoakum, 1978). The pronghorn is the swiftest terrestrial mammal in the New World. Kitchen (1974) clocked herds moving at 64 to 72 km per hr, and observed a maximum speed of 86.5 km per hr. Such velocities can be attained only on hard ground and involve leaps of 3.5 to 6 meters. The cruising speed is approximately 48 km per hr. Fast runs of 5 to 6 km are common, but then exhaustion occurs rapidly. The pronghorn shakes the body after a fast run. The front feet carry most of the weight while running. The pronghorn is a good swimmer.

It can see objects several kilometers away, but apparently lacks visual acuity. A motionless person, only 10 to 15 meters away, may be ignored (Kitchen 1974). The pronghorn is a curious animal, and may approach a strange object if it does not cause alarm by scent or sudden movement.

Activity is both diurnal and nocturnal, with slight peaks just after sunset and before sunrise (Kitchen 1974). Daily movement is usually 0.1 to 0.8 km in spring and summer, and 3.2 to 9.7 km in fall and winter (Yoakum 1978). The range may shift several times in a year, for purposes of obtaining food and water. The distance between the summer and winter range may be as much as 160 km (O'Gara 1978). The pronghorn both browses and grazes on a wide variety of shrubs, forbs, grasses, cacti, and other plants. It uses its front feet to dig food buried under the snow, and also to scratch depressions for deposit of droppings. If water is available, it will drink freely, but, if necessary, it can derive sufficient moisture from plants.

According to O'Gara (1978), studies in Wyoming indicated that 48.6 ha. of desert could support 8 pronghorns year-round. Home range in Wyoming during the summer and early autumn was found to be 2.6 to 5.2 sq km. Yoakum (1978) stated that most herds have an overall range 8 to 16 km wide. During the fall and winter, *Antilocapra* forms large, loose aggregations of all age and sex classes. In the northern

part of the range; such groups contain up to 1,000 individuals (Yoakum 1978).

From late March to early October, groups are smaller and are segregated by sex (Kitchen 1974; O'Gara 1978). At this time, males over three years old compete with one another for possession of territories 0.23 to 4.34 sq km in size. A territory usually contains a permanent source of water, often has prominent physical borders, and may be separated by a no man's land of up to 0.8 km from other territories. An old male may return to the same territory each year after the herd breaks up and moves out of its winter range. He scent marks the area with urine, feces, and secretions from subauricular glands. He constantly attempts to keep groups of females within his territory and to keep other males out. When a territorial male spots a rival, he will first stare for a period. A stare is considered aggressive, and avoidance of a stare is considered submissive. If the other male holds his ground, there may be loud vocalization, an aggressive approach, a chase, and, occasionally, a fight. The sharp horns evidently often cause serious injury.

Old males that are not able to hold a territory may wander about alone. Younger males form bachelor herds with up to 36 members. These groups have a loose hierarchy, and move about on the edges of the areas controlled by the territorial males. Female groups contain up to 23 members, have a permanent linear hierarchy, and move about freely on the territories of the dominant males. A female group seldom remains on a single territory through the entire period from March to October. Females are pursued by bachelor herds, but try to avoid them. Individual does may separate from the group to give birth. Following the mating season, the horn sheaths are cast and social distinctions become obscured, though the female associations may persist as subgroupings of the main herd.

The pronghorn has a variety of vocalizations. Mothers call calves with individually recognizable grunts, fawns bleat, and males sometimes roar during agonistic encounters. Mature animals of both sexes reveal anger or anxiety by forcefully expelling air through their nostrils. The hairs of the white rump patch are raised when danger is sensed, a conspicuous warning signal to other pronghorns. The white flash can be seen by a human for a distance of at least 4 km.

Mating occurs during a period of about 3 weeks between July and early October, and births take place in the spring. The gestation period averages 252 days (O'Gara 1978). A female generally produces a single young in her first pregnancy, and thereafter usually gives birth to twins, rarely triplets. At birth a fawn usually weighs 2 to 4 kg and has a beautiful, wavy, grayish pelage. The mother's milk is extremely rich in solids. At the age of 4 days the fawn can outrun a human, at 3 weeks it is nibbling at vegetation, and before 3 months it has acquired its first adultlike pelage. Apparently, the young may separate at least temporarily from the mothers during the mating season and form small groups of their own, but there may subsequently be a reassociation with the mothers until the following spring or summer (Autenrieth and Fichter 1975; O'Gara 1978). Females usually reach sexual maturity when 15 or 16 months old. Males are capable of mating at this same age, but generally are not able to do so until they are 3 years old. A captive specimen lived for 11 years and 2 months (Marvin L. Jones, Zoological Society of San Diego, pers. comm.).

There are estimated to have been about 35,000,000 pronghorns in North America prior to the arrival of European explorers. Subsequent uncontrolled hunting for meat and sport, and human usurpation of habitat, resulted in a decline to fewer than 20,000 in the 1920s. Conservation efforts have since allowed numbers to expand to about 500,000 in the United States and Canada. The pronghorn is now subject to

limited sport hunting in most parts of its range, and the annual harvest is about 40,000. In Mexico, however, only about 1,200 individuals survive and the number is declining through illegal hunting and habitat modification (O'Gara 1978; Yoakum 1978). The subspecies *A. a. sonoriensis* of extreme southern Arizona and northwestern Mexico and *A. a. peninsularis* of Baja California are classified as endangered by the IUCN (1972, 1976) and the USDI (1980), and are on appendix 1 of the CITES. *A. a. mexicana* of Arizona, New Mexico, Texas, and northern Mexico is on appendix 2 of the CITES.

The geological range of the family Antilocapridae is middle Miocene to Recent in North America. Thirteen now-extinct genera were present during the Pliocene and Pleistocene (O'Gara 1978).

ARTIODACTYLA; Family BOVIDAE

Antelopes, Cattle, Bison, Buffalo, Goats, Sheep

This family of 45 Recent genera and 128 species has a natural distribution covering all of Africa, most of Eurasia and North America, and some islands of the Arctic and East Indies. The great majority of genera are native to Africa, and southern and Central Asia. Wild-living populations of some species have been introduced by human agency in New Guinea, New Zealand, Australia, and surrounding islands. Certain species have been domesticated and are now found throughout the world in association with people. The sequence of genera presented here follows basically that of Simpson (1945), who recognized five subfamilies:

	Subfamily Bovinae	
<i>Tragelaphus</i>	<i>Tetracerus</i>	<i>Bos</i>
<i>Taurotragus</i>	<i>Bubalus</i>	<i>Bison</i>
<i>Boselaphus</i>	<i>Syncerus</i>	
	Subfamily Cephalophinae	
<i>Cephalophus</i>	<i>Sylvicapra</i>	
	Subfamily Hippotraginae	
<i>Kobus</i>	<i>Hippotragus</i>	<i>Damaliscus</i>
<i>Redunca</i>	<i>Oryx</i>	<i>Alcelaphus</i>
<i>Pelea</i>	<i>Addax</i>	<i>Connochaetes</i>
	Subfamily Antilopinae	
<i>Oreotragus</i>	<i>Dorcatragus</i>	<i>Litocranius</i>
<i>Ourebia</i>	<i>Antilope</i>	<i>Gazella</i>
<i>Raphicerus</i>	<i>Aepyceros</i>	<i>Antidorcas</i>
<i>Neotragus</i>	<i>Ammodorcas</i>	<i>Procapra</i>
<i>Madoqua</i>		
	Subfamily Caprinae	
<i>Pantholops</i>	<i>Rupicapra</i>	<i>Capra</i>
<i>Saiga</i>	<i>Budorcas</i>	<i>Pseudois</i>
<i>Nemorhaedus</i>	<i>Ovibos</i>	<i>Ammotragus</i>
<i>Capricornis</i>	<i>Hemitragus</i>	<i>Ovis</i>
<i>Oreamnos</i>		

Simpson's list of genera has been modified extensively here, in accordance with various sources cited in the generic accounts that follow. There remains much controversy regarding the classification of the Bovidae. Ansell (in Meester and Setzer 1971), for example, recognized four additional subfamilies: Reduncinae, with the genera *Redunca* and *Kobus*; Alcelaphinae, with *Connochaetes*, *Alcelaphus*, and

Damaliscus; Aepycerotinae with *Pelea*.

Shoulder height ranges of pygmy antelope (*Neotragus* species of *Bos*). The pelage is rough and shaggy. The ulna and main foot bones are fused. The third and fourth digits are not the same. The fifth and sixth digits are either called dew hooves or dew hooves and ruminating, and Females have one or two horns.

Horns are carried by a females of most genera. The core, attached to the front sheath of horny material. 7 in having four horns; all dental formula is: (i 0/3, 30-32. The lower incisors the cheek teeth are low crecentic ridges of enamel or

Most bovids inhabit grassland but some live in forests, and sheep generally occur in rangeland or browse, and are ruminant. The food is brought to the stomach and chewed while being swallowed a second time. Bovid feed by twisting the tongue and cutting the vegetation.

According to Estes (1993) the subfamily Bovinae, with territorial or, in the case of *spekei*, solitary and nonterritorial. *Redunca*, *Oreotragus*, *C. madoqua*, and *Dorcatragus* are territorial. Three social classes of bovids: nursery herds of females and solitary adult males. The adult male usually defends the herd throughout the year. Glands on the face release a substance onto the ground that an isolated animal can detect.

Wild bovids have been hunted for meat, hides, and sport. Some have become rare or threatened. Sheep, and goats have all been domesticated in southwestern Asia 8,000 years ago.

The geological range of the family is Recent in Europe, early Pliocene in Africa, and Pleistocene to Recent in North America.

ARTIODACTYLA; BOVIDAE *De Blainville, 1816*

Bongo, Sitatunga, Bushbuck

There are two subgenera of *Bongo* (Setzer 1971; Harrison 1993). The subgenus *Tragelaphus* is represented by the following species:

T. buxtoni (mountain bongo), Ethiopia.

APHURUS

inally occurred in wild animals dis- ars ago, but a herd (ing Park, south of cended from that e world (Grzimek obroruka (1970b) an in 1869, appear

mm, tail length is t 1,150 mm, and The summer pel- much shorter than resent on the neck long, straight tine m extends almost ce. The antlers are id a new set begins take six months to id spreading, like

nhabited swampy, plern ts its grass esse tially a graz- where o large herd or hal of the year. it 2 months before ich begins in June. together in several group of females ngages in mock in fighting. *Ela-* but also rises on its manner as *Cervus*

elaphus. In a process that continues to the end of the rut in August, males are successively ousted and replaced by other stags. After leaving a harem, a male begins feeding again and quickly regains weight. The one or two spotted fawns are born in April or May, following a gestation period of 250 to 270 days. Sexual maturity is usually attained at an age of 2½ years (Grzimek 1975). Potential longevity is at least 20 years.

This deer is named for Abbé Armand David, who procured two skins in 1865 by bribing guards at the Imperial Hunting Park. Subsequently, a number of live animals were sent from China to various zoos in Europe. The imperial herd was largely destroyed by a flood in 1894, and by subsequent hunting during a famine and the Boxer Rebellion. The last member of this herd survived at the Peking Zoo until 1922. Meanwhile, however, the captives from several European zoos had been pooled at the Duke of Bedford's estate, Woburn Abbey, in England. The herd thus established increased in numbers, and individual deer were later distributed to other areas. In 1956, two pairs were sent to Peking, and in 1957 the first calf was born there (Bower 1979; Grzimek 1975). According to the "Census of Rare Animals in Captivity" in the 1980 *International Zoo Yearbook*, there are now 801 living Père David's deer in 94 collections.

ARTIODACTYLA: CERVIDAE: Genus *ODOCOILEUS*
Rafinesque, 1832

White-tailed and Mule Deer

There are two species (Hall 1981; Cabrera 1961):

- O. hemionus* (mule deer), southern Yukon and Manitoba to Baja California and northern Mexico;
- O. virginianus* (white-tailed deer), southern Canada, conterminous United States except parts of the Southwest, Mexico to Peru and northeastern Brazil.

Hall (1981) used the name *Dama* Zimmermann, 1780 for this genus.

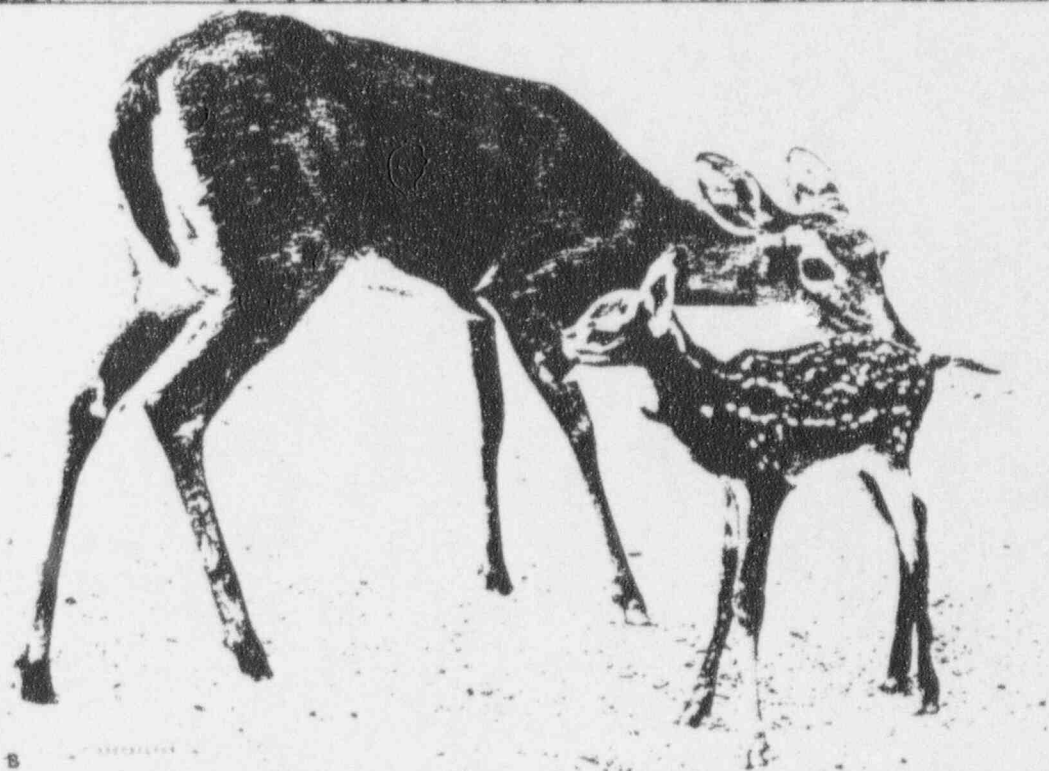
Head and body length is 850 to 2,100 mm, tail length is 100 to 350 mm, shoulder height is 550 to 1,100 mm, and weight is 22 to 215 kg. In winter the upper parts are brownish gray and the underparts are lighter. In summer the coat is reddish brown above and is spoken of as being "in the red." In *O. virginianus* the tail is brown above, and white laterally and below. In *O. hemionus* the tail is usually smaller, white or black above, and tipped with black. The hairs, especially those of the winter coat, are tubular and somewhat stiff and brittle. For this reason, the winter skins float in water and have at times been used as life preservers. In North America the antlers are shed from January to March and the new ones begin to grow about April or May, losing their velvet in August or September. The antlers attain full size by the fourth or fifth year of life. The antler of the mule deer branches into two nearly equal parts, whereas the antler of the white-tailed deer has one main beam with minor branches.

These deer occur in a great variety of habitats. They prefer areas with enough vegetation for concealment, but usually avoid dense forests. They walk about cautiously, flee from danger with a series of bounds, can run at speeds of up to 64 km per hr, and are excellent swimmers (Banfield 1974). They are generally most active at dawn and dusk. In some areas there is a fall migration to lower elevations or to the vicinity of favorable winter food supplies. The diet includes grass, weeds, shrubs, twigs, mushrooms, nuts, and lichens. Both species browse for part of the year, but *O. hemionus* is predominantly a grazer in the summer.

Hirth (1977) reported population densities of one *O. virginianus* per 4 ha, in a study area in Michigan, and one per 2 ha, in another area in Texas. Individual home range varies widely in this species, but most reported figures fall within the extremes of those found in Texas: 24.3 to 137.6 ha, for females, and 97.1 to 356.1 ha, for males (Halls 1978). Unlike *Cervus* and some other kinds of deer, *Odocoileus* does



Mule deer (*Odocoileus hemionus*): A. Photo by Leonard Lee Rue IV; B. Photo by Leonard Lee Rue III.



A. White-tailed deer (*Odocoileus virginianus*), male in velvet, photo by Earl W. Craven of U. S. Fish & Wildlife Service. B. White-tailed deer (*O. virginianus*), two-year-old doe with fawn, photo by Rex Gary Schmidt of U. S. Fish & Wildlife Service.

not usually gather in large groups. In the fall, an adult doe, her yearling daughter, and her mate may be seen together for most of the year. In the spring, males may associate temporarily with one another, through which they will attempt to gather a group, but associates with one doe and is usually displaced by another male. Such groups appear to be common in *O. hemionus* (Halls 1974; Halls 1978; Kucera 1978).

In Canada and the United States, mating takes place from April to September. Females are polyestrous, with an estrous cycle of 24 hours. The gestation period is 225 days (Banfield 1974; Halls 1978). Females usually bear a single fawn in their first birth, but occasionally three or four. The fawn is born at a few hours after midnight and is nursed by the doe. They nibble on vegetation at 3 weeks old, and are completely weaned at 3 months. Young females may breed at 1 year of age, but the males usually leave their natal range at 1 year of age. Most other *Odocoileus* do not usually breed until 2 years of age. Captives have lived up to 10 years in a hunted herd (Halls 1978).

These deer have long been used for their tender, juicy meat. The leather originally tanned from the skin of *Odocoileus*. Following the establishment of protection in North America, such measures were largely ineffective. The species had been exterminated in many areas. At the time, the number of individuals was estimated to have been about 1 million. Management efforts resulted in a great increase in their numbers, such as the Great Lakes region, where the deer population was favored by habitat, deer were more numerous than they had been. Currently in the United States, about 2,250,000 deer are killed by sport hunters annually (Halls 1978; Wallmo 1978; Vogt 1978).

Despite the general recovery of the species, several are listed as endangered. The Florida key deer (*O. virginianus*) is listed as endangered by the IUCN. It is found only on the Florida Keys. Because of its small range, fewer than 30 individuals remain. Full legal protection was granted in 1949. Allowed numbers to increase to 350-400. The Columbian deer (*O. columbianus*) is classified as endangered. It is found only in the Pacific Northwest, where it is considered to be recovering. It now exists only on a nearby island and in the Pacific Northwest. The Cedros Island deer (*O. columbianus*), also considered endangered,

not usually gather in large herds. A basic social unit is an adult doe, her yearling daughter, and the two fawns of the season. Adult males occur either alone or in small groups for most of the year. In the mating season, the males compete with one another, through ritualized combat, for the right to associate temporarily with the females. A male does not attempt to gather a group of females or to defend a territory, but associates with one doe until he mates with her or is displaced by another male. During the winter, animals of both sexes and all ages may aggregate in a favorable area. Such groups appear to be generally larger and more organized in *O. hemionus* (Hawkins and Klimstra 1970; Banfield 1974; Halls 1978; Kucera 1978).

In Canada and the United States, mating occurs from October to January, usually peaking in November, and births take place from April to September. Females are seasonally polyestrous, with an estrous cycle of about 28 days and an estrus of 24 hours. The gestation period is 195 to 212 days (Banfield 1974; Halls 1978). Females usually give birth to a single fawn in their first litter, and subsequently to two, or occasionally three or four. The offspring are beautifully spotted and weigh 1.5 to 3.5 kg at birth, and are able to stand after a few hours. They are left hidden in dense vegetation for 1 month or so and are nursed about every 4 hours by the mother. They nibble on vegetation after a few days, can run when 3 weeks old, and are completely weaned at an age of about 4 months. Young females may follow their mother for 2 years, but the males usually leave after 1 year. In a study of *O. virginianus* in Iowa, Haugen (1975) determined that 65 to 74 percent of young females successfully bred within their first year of life. Most other reports indicate that both sexes of *Odocoileus* do not usually mate until the second year. Some captives have lived up to 20 years; wild individuals seldom survive more than 10 years, or 4½ years if in a regularly hunted herd (Halls 1978).

These deer have long been hunted by people. The venison is said to be tender, juicy, and of excellent flavor. Buckskin, a leather originally tanned by the Indians, is made from the skin of *Odocoileus*. Following the arrival of European settlers in North America, hunting became so intense that legal protection was established in some areas in colonial times. Such measures were largely unsuccessful, and by 1900 both species had been exterminated in most of their range. At that time, the number of individuals remaining in each species is estimated to have been about 500,000. Subsequent regulations, management efforts, and environmental changes stimulated a great increase in numbers and distribution. In some places, such as the Great Lakes region, where logging created favorable habitat, deer apparently became far more numerous than they had been prior to European colonization. Currently in the United States there are about 12,450,000 *O. virginianus* and 2,250,000 *O. hemionus*. Respective annual kills by sport hunters are 2,000,000 and 500,000 (Halls 1978; Wallmo 1978; Vogt 1978; Banfield 1974).

Despite the general recovery of *Odocoileus*, three subspecies are listed as endangered by the USDI (1980). The tiny key deer (*O. virginianus clavium*), which is considered out of danger by the IUCN (1972), inhabits the western Florida Keys. Because of excessive hunting and loss of habitat, fewer than 30 individuals were estimated to survive by 1949. Full legal protection, and establishment of a refuge, allowed numbers to increase to a current estimate of 350–400. The Columbian white-tailed deer (*O. v. leucurus*), which is classified as endangered by the IUCN (1976), formerly occurred throughout western Washington and Oregon. It now exists only on a national wildlife refuge and some nearby islands and lowlands along the lower Columbia River. The Cedros Island mule deer (*O. hemionus cerrosensis*), also considered endangered by the IUCN (1973), is

confined to a small island off Baja California. Only a few animals are thought to survive, and they are subject to illegal hunting and repeated burning of their habitat.

ARTIODACTYLA; CERVIDAE; Genus *BLASTOCERUS*

Wagner, 1844

Marsh Deer

The single species, *B. dichotomus*, originally occurred in the southern half of Brazil, Bolivia, southeastern Peru, Paraguay, northeastern Argentina, and Uruguay (Cabrera 1961; IUCN 1976). Some authorities, such as Grzimek (1975), place this species in the genus *Odocoileus*.

This is the largest deer of South America. Head and body length is 1,800 to 1,950 mm, tail length is 100 to 150 mm, shoulder height is 1,100 to 1,200 mm, and weight is 100 to 150 kg (Grzimek 1975). The coat is long and coarse. In summer the coloration is bright rufous chestnut. In winter it is brownish red, becoming lighter on the flanks, neck, and chest. The lower legs are black. The tail is yellowish rusty red above and black below. The antlers of adult males are usually doubly forked, that is, each of the two branches has a single fork, for a total of four points. The hooves can be spread widely and are bound by a strong membrane in the inner part of the divergence point. This represents an adaptation against sinking into soft ground.

Blastocerus prefers marshes and wet savannahs with high grass and wooded islands, and damp forest edges. It enters water frequently. It remains in seclusion most of the day and comes out into the clearings to feed in the evening and through the night. The diet consists of grass, reeds, and numerous aquatic plants.

Schaller and Vasconcelos (1978) found population densities ranging from one deer per 3.8 sq km to one per 42 sq km in the Mato Grosso. According to Grzimek (1975), *Blastocerus* lives alone or in groups of up to six individuals, which usually include an older male, and two females and their young. It has been reported that the males do not fight for possession of the females, and that there is not a definite season in which the antlers are dropped. Newborn fawns have been noted at various times of the year. In the Mato Grosso the birth season extends at least from May to September (Schaller and Vasconcelos 1978). The gestation period is about nine months, and a single young is usually born.

The marsh deer is classified as vulnerable by the IUCN (1976) and endangered by the USDI (1980), and is on appendix 1 of the CITES. Numbers and distribution have declined substantially through loss of habitat to agriculture, marsh drainage, and uncontrolled hunting. During the wet season, when the grasslands are flooded, the deer are forced onto a limited amount of high ground with livestock. There is resultant competition, and thus persecution by stockmen. A survey by Schaller and Vasconcelos (1978) indicated that deer populations in the Mato Grosso are declining, perhaps in part because of disease contracted from cattle.

ARTIODACTYLA; CERVIDAE; Genus *OZOTOCEROS*

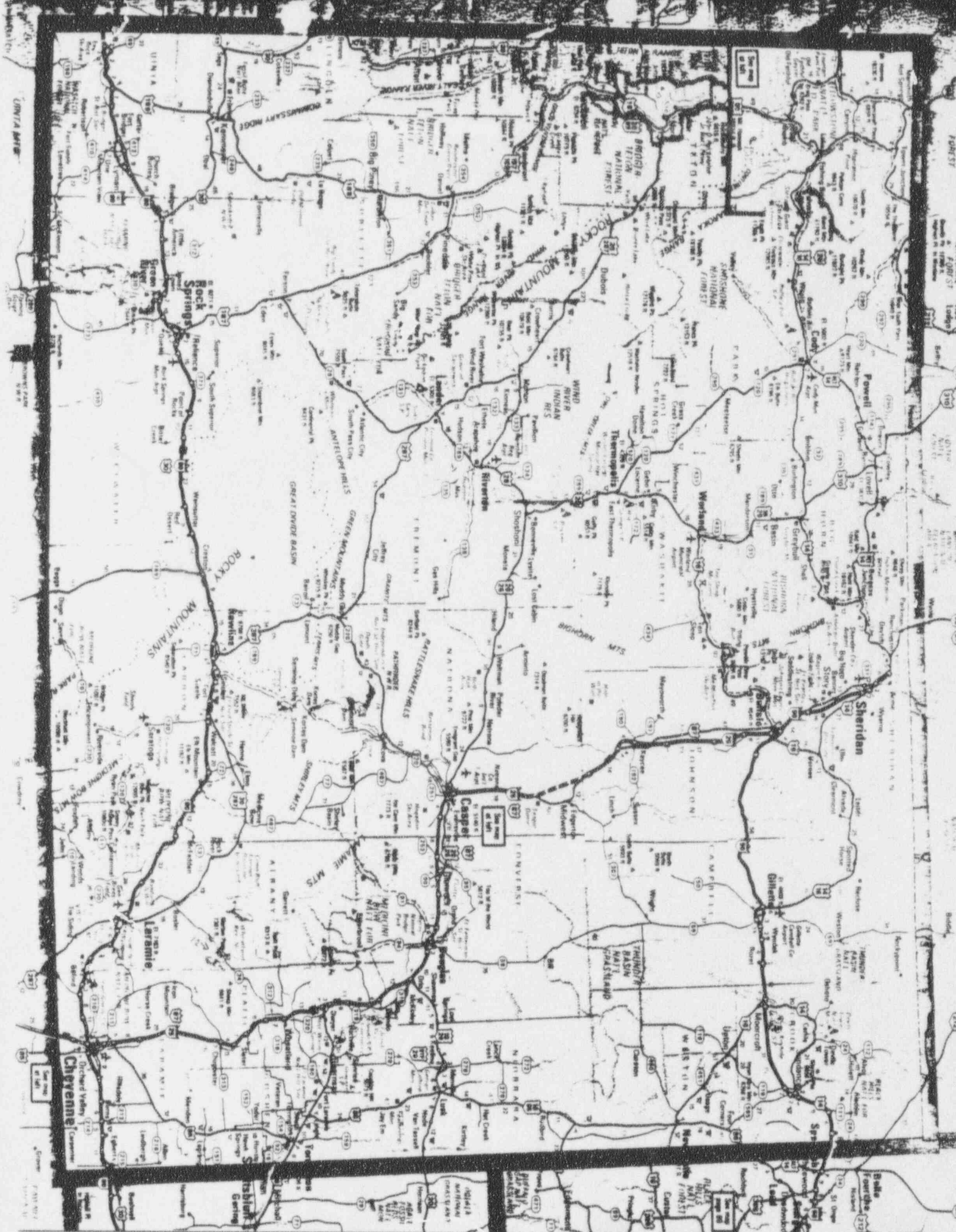
Ameghino, 1891

Pampas Deer

The single species, *O. bezoarticus*, is found in Brazil to the south of the Amazon, eastern Bolivia, Paraguay, Uru-



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